Configure and Troubleshoot Multicast Service Reflection on Catalyst 8000

Contents

Introduction

This document describes the process to troubleshoot Multicast Service Reflection feature on Catalyst 8000.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- Knowledge of Basic Multicast Routing
- Knowledge of Cisco IOS® XE command line

Components Used

The information in this document is based on these software and hardware versions:

- Router Catalyst 8500
- Cisco IOS XE 17.9.4

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, ensure that you understand the potential impact of any command.

Background Information

The purpose of this document is to demonstrate the basic configuration and troubleshooting of the Multicast Service Reflection feature to validate a Multicast-to-Multicast destination translation scenario with a Cisco Catalyst 8000.

Multicast Service Reflection is a versatile feature that can be deployed at various points within a network to

meet specific multicast requirements. It helps enhance the efficiency and reliability of multicast services in complex network environments as it allows users to translate received multicast or unicast destination addresses to multicast or unicast addresses that conform to their internal addressing policy.

Multicast Service Reflection has the ability to translate both source and destination addresses in the IPv4 header. It identifies the multicast traffic streams (associated with specific multicast groups and sources) that need to be translated (based on the predefined configuration) and when the traffic reaches the reflection point, the router doing the translation selectively reflects these packets.

One of the core components of this feature is the Virtual Interface (Vif). This Vif interface is a logical interface that can statically join the group that needs to be reflected in order to build the multicast tree. In other words, this Vif interface acts as multicast receiver for the original stream and once the traffic is forwarded to the Vif interface, the packets are reflected and the source/destination addresses are translated to the new desired IPv4 addresses.
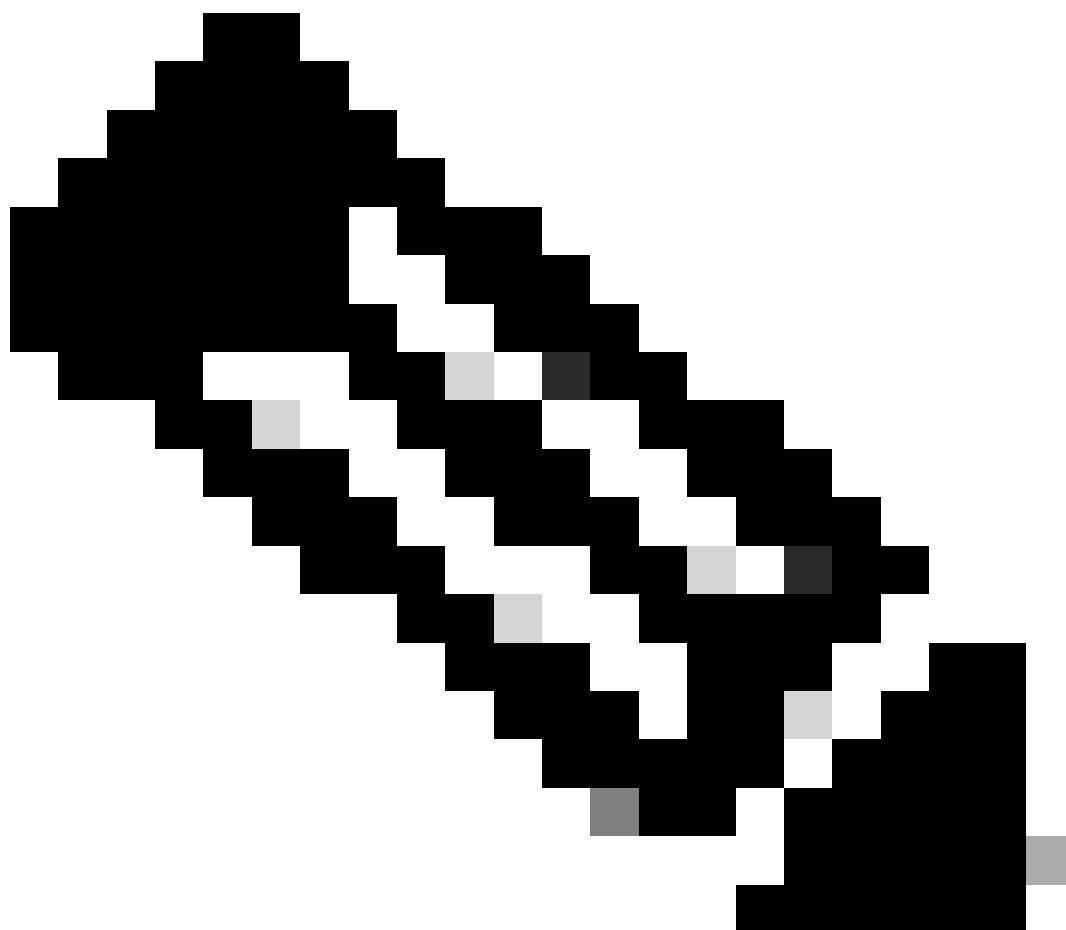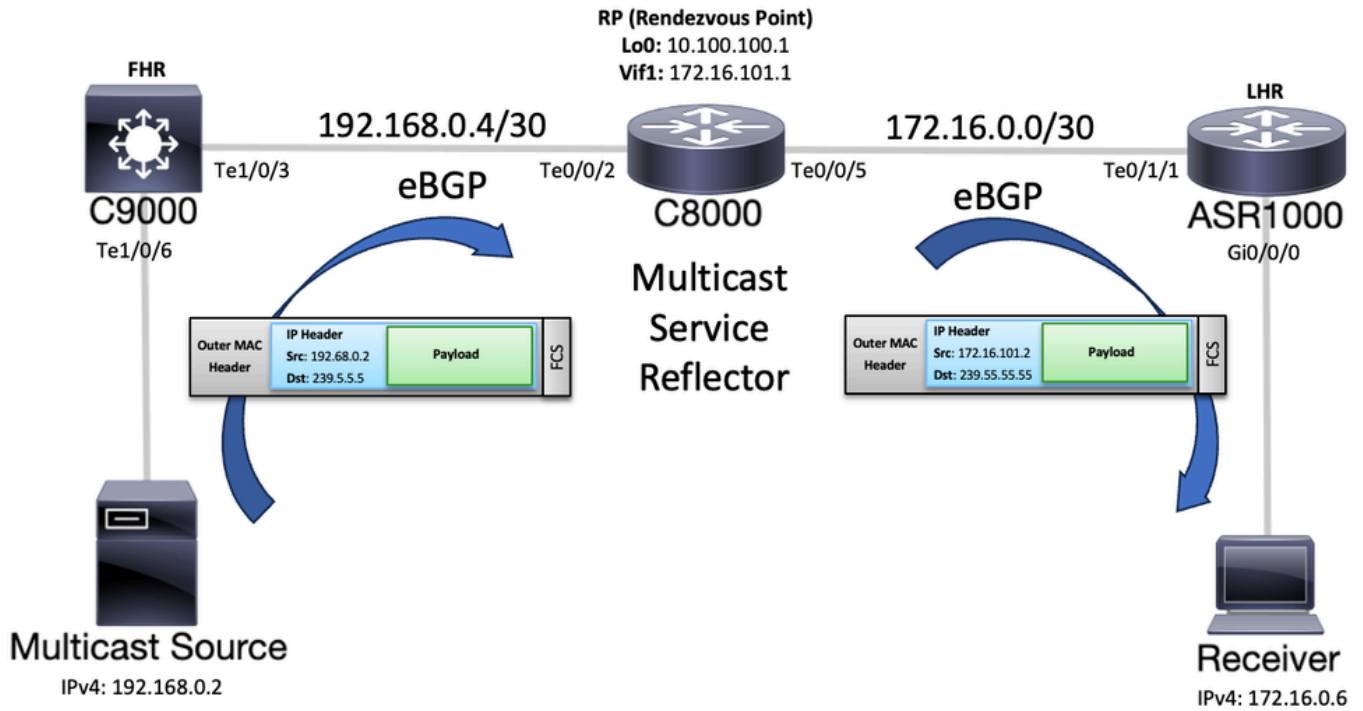

Note: To implement this feature your router must have at least a **network-advantage** license installed, otherwise an error can be seen when trying to configure the Vif interface.

Topology

Topology Diagram

Configuration

To configure the feature in this setup multicast routing needs to be enabled across the path and basic IPv4 connectivity between the Multicast Source and the Receiver is required as well. In this scenario, there is a Catalyst 9K switch (C9000) acting as a First Hop Router (FHR), then the Catalyst 8K router (C8000) that is the Multicast Service Reflector and also the Rendezvous Point (RP) for the different multicast groups and an ASR1K router (ASR1000) is the Last Hop Router (LHR) where the receiver is connected. For this example, external Border Gateway Protocol (eBGP) is used to interconnect these devices, however there is no requirement to implement a particular routing protocol.

> **Note**: This example makes use of only one RP for the various multicast streams, for more information on scenarios where different RPs are used for the multicast domains review the section [Configuration Examples for Multicast Service Reflection](#) from the IP Multicast Configuration Guide, Cisco IOS XE 17.x

FHR (C9000)

To start the configuration at the FHR, enable multicast routing, add the RP IPv4 address and configure Protocol Independent Multicast Sparse Mode (PIM-SM) on interfaces connected to the Multicast Source and to the Multicast Service Reflector router (C8000).

<#root>

C9000#

show run | i multicast|rp-address

ip multicast-routing

class-map match-any system-cpp-police-multicast-end-station

```
class-map match-any system-cpp-police-multicast

ip pim rp-address 10.100.100.1


C9000#

show run interface Ten 1/0/6

Building configuration...

Current configuration : 116 bytes
!
interface TenGigabitEthernet1/0/6
 no switchport
 ip address 192.168.0.1 255.255.255.252


ip pim sparse-mode

end

C9000#

show run interface Ten 1/0/3

Building configuration...

Current configuration : 116 bytes
!
interface TenGigabitEthernet1/0/3
 no switchport
 ip address 192.168.0.5 255.255.255.252


ip pim sparse-mode

end
```

The C9000 switch is doing an eBGP adjacency to the C8000 router to advertise the connected routes.

<#root>

C9000#

show run | section router bgp

```
router bgp 65003
 bgp log-neighbor-changes
```

redistribute connected

```
 neighbor 192.168.0.6 remote-as 65001
```


Multicast Service Reflector Router (C8000)

At the Catalyst 8K router, for the initial configuration enable multicast routing, add the appropriate RP IPv4 address and also configure PIM-SM on the interfaces connected to C9000 and ASR1000 devices as well as

in the Loopback0 interface.

<#root>

Mcast_SR#

show run | i multicast|rp-address
ip multicast-routing distributed
ip pim rp-address 10.100.100.1

Mcast_SR#

show run interface Ten 0/0/2

Building configuration...

Current configuration : 156 bytes
!
interface TenGigabitEthernet0/0/2
 description to C9000
 ip address 192.168.0.6 255.255.255.252

ip pim sparse-mode

 no negotiation auto
 cdp enable
end

Mcast_SR#

show run interface Ten 0/0/5

Building configuration...

Current configuration : 157 bytes
!
interface TenGigabitEthernet0/0/5
 description to ASR1000
 ip address 172.16.0.1 255.255.255.252

ip pim sparse-mode

 no negotiation auto
 cdp enable
end

Mcast_SR#

show run interface loopback 0

Building configuration...

Current configuration : 88 bytes
!
interface Loopback0
 ip address 10.100.100.1 255.255.255.255

ip pim sparse-mode

end

This router has two eBGP neighbors, 192.168.0.5 neighbor is the C9000 switch sending the prefixes to reach the Multicast Source and the second neighbor is the ASR1000 router used to reach the Receiver. Notice that this router is advertising its local Loopback0 and also advertisies the Vif subnet.

<#root>

Mcast_SR#

show run | section router bgp

```
router bgp 65001
 bgp log-neighbor-changes
```

network 10.100.100.1 mask 255.255.255.255
 network 172.16.101.0 mask 255.255.255.252

 neighbor 172.16.0.2 remote-as 65002
 neighbor 192.168.0.5 remote-as 65003

Now, it is time to configure the Vif interface, which is the one that helps to translate the multicast group from 239.5.5.5 to 239.55.55.55. This logical interface needs to have an IP address and this subnet needs to be routable, additonally PIM-SM must be configured. To enable the Multicast Service Reflection feature, the command **ip service reflect <interface_id> destination <destination_ip1> to <destination_ip2> mask-len <subnet_mask_length> source <source_ip>** is used, where the *interface_id* is the interface receiving the original multicast traffic, the *destination_ip1* is the original IPv4 address that needs to be translated (239.5.5.5), and *destination_ip2* is the new IPv4 address that is expected after the translation (239.55.55.55). Last but not least, the command **ip igmp static-group <group-address>** is required in order to make this interface a statically connected member of the original multicast group.

<#root>

Mcast_SR#

configure terminal

```
Enter configuration commands, one per line.  End with CNTL/Z.
Mcast_SR(config)#
```

interface Vif1

Mcast_SR(config-if)#

ip address 172.16.101.1 255.255.255.252

Mcast_SR(config-if)#

ip pim sparse-mode

Mcast_SR(config-if)#

ip service reflect TenGigabitEthernet0/0/2 destination 239.5.5.5 to 239.55.55.55 mask-len 32 source 172.

Mcast_SR(config-if)#

ip igmp static-group 239.5.5.5

```
Mcast_SR(config-if)#

end
```
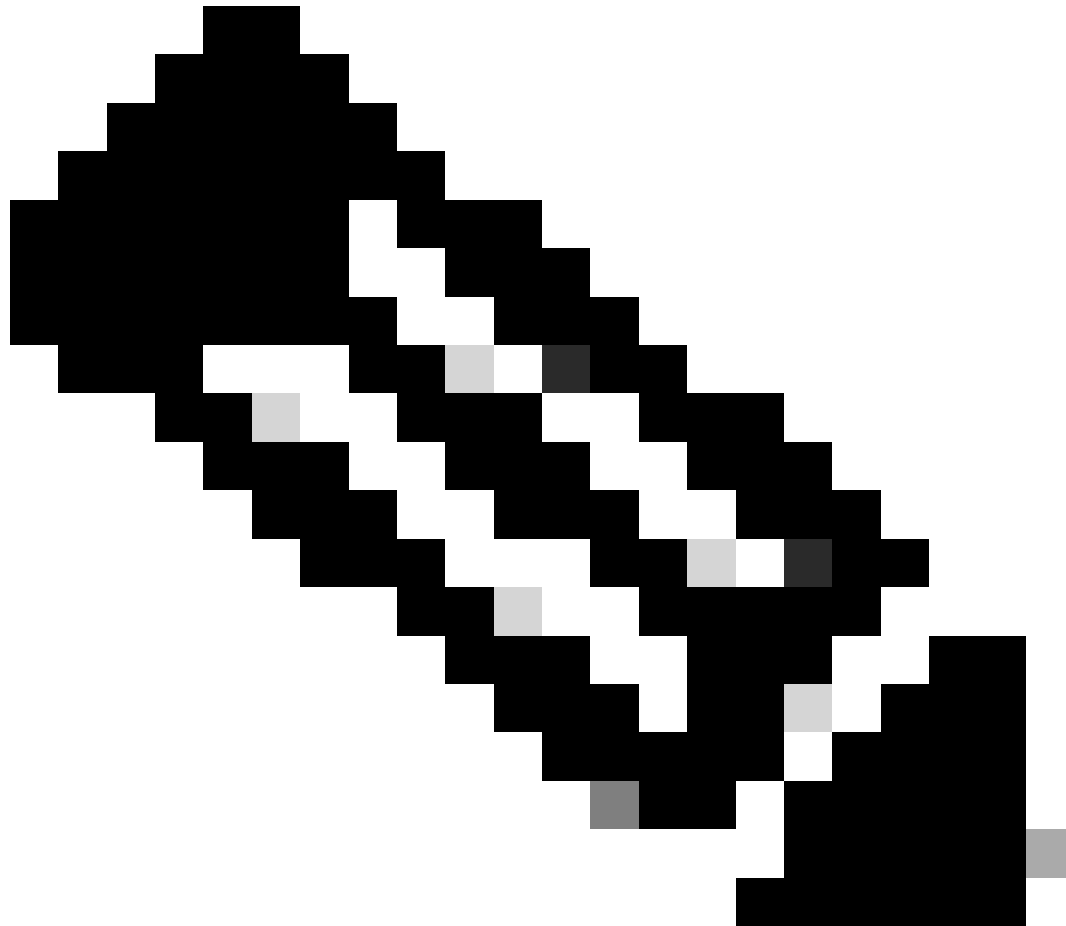

> **Note**: Interface "Vif1" is strictly associated with the default Virtual Route Forwarding (VRF) for the Multicast Service Reflection feature, if a different number for this interface is selected a message can be displayed into the console similar to "Only Vif1 can be used for Service Reflect in global table".

The next output shows the Vif interface after the configuration has been applied, notice that the interface operation becomes UP/UP and the output feature is SERVICE REFLECT with the help of the **show ip interface <interface>** command:

<#root>

Mcast_SR#

show run interface Vif1

```
Building configuration...

Current configuration : 229 bytes
!
interface Vif1
 ip address 172.16.101.1 255.255.255.252
 ip pim sparse-mode
 ip service reflect TenGigabitEthernet0/0/2 destination 239.5.5.5 to 239.55.55.55 mask-len 32 source 17
 ip igmp static-group 239.5.5.5
end
```

Mcast_SR#

show ip interface vif1

Vif1 is up, line protocol is up

```
  Internet address is 172.16.101.1/30
  Broadcast address is 255.255.255.255
  Address determined by non-volatile memory
  MTU is 1514 bytes
  Helper address is not set
  Directed broadcast forwarding is disabled
  Multicast reserved groups joined: 224.0.0.1 224.0.0.2 224.0.0.22 224.0.0.13
  Outgoing Common access list is not set
  Outgoing access list is not set
  Inbound Common access list is not set
  Inbound  access list is not set
  Proxy ARP is enabled
  Local Proxy ARP is disabled
  Security level is default
  Split horizon is enabled
  ICMP redirects are always sent
  ICMP unreachables are always sent
  ICMP mask replies are never sent
  IP fast switching is enabled
  IP Flow switching is disabled
  IP CEF switching is enabled
  IP CEF switching turbo vector
  IP Null turbo vector
  Associated unicast routing topologies:
        Topology "base", operation state is UP
  Associated multicast routing topologies:
        Topology "base", operation state is UP
  IP multicast fast switching is enabled
  IP multicast distributed fast switching is disabled
  IP route-cache flags are Fast, CEF
  Router Discovery is disabled
  IP output packet accounting is disabled
  IP access violation accounting is disabled
  TCP/IP header compression is disabled
  RTP/IP header compression is disabled
  Probe proxy name replies are disabled
  Policy routing is disabled
  Network address translation is disabled
  BGP Policy Mapping is disabled
  Input features: MCI Check
```

Output features: SERVICE REFLECT

```
  IPv4 WCCP Redirect outbound is disabled
  IPv4 WCCP Redirect inbound is disabled
```

```
IPv4 WCCP Redirect exclude is disabled
IP Clear Dont Fragment is disabled
```

LHR (ASR1000)

For the configuration at the LHR, in the same way, enable multicast routing and PIM-SM on the interfaces connected to Multicast Service Reflector router and towards the Receiver and also make sure to configure the RP IPv4 address:

<#root>

ASR1000#

show run | i multicast|rp-address

ip multicast-routing distributed
ip pim rp-address 10.100.100.1

ASR1000#

show run interface Ten 0/1/1

Building configuration...

Current configuration : 133 bytes
!
interface TenGigabitEthernet0/1/1
 ip address 172.16.0.2 255.255.255.252

ip pim sparse-mode

 no negotiation auto
 cdp enable
end

ASR1000#

show run interface GigabitEthernet0/0/0

Building configuration...

Current configuration : 127 bytes
!
interface GigabitEthernet0/0/0
 ip address 172.16.0.5 255.255.255.252

ip pim sparse-mode

 negotiation auto
 cdp enable
end

For the IP connectivity, this router is also using BGP to exchange the connected prefixes:

<#root>

```
ASR1000#
```

show run | section router bgp

```
router bgp 65002
 bgp log-neighbor-changes
```

redistribute connected

```
 neighbor 172.16.0.1 remote-as 65001
```

Initial Verification

As an initial verification, you can start checking the basic IP connectivity, route exchange between devices and PIM status. The next output was taken from the Catalyst 9K and shows the routes installed towards the Receiver (172.16.0.6), RP Loopback0 (10.100.100.1), and Vif (172.16.101.1). It can also be seen that there is a PIM adjacency with the C8000 router and that the RP mapping is also pointing to the 10.100.100.1 address.

<#root>

C9000#

show ip route 172.16.0.6

```
Routing entry for 172.16.0.4/30
  Known via "bgp 65003", distance 20, metric 0
  Tag 65001, type external
  Last update from 192.168.0.6 2d22h ago
  Routing Descriptor Blocks:
  * 192.168.0.6, from 192.168.0.6, 2d22h ago
      opaque_ptr 0x7FD797D4BA18
      Route metric is 0, traffic share count is 1
      AS Hops 2
      Route tag 65001
      MPLS label: none
```

C9000#

ping 172.16.0.6

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.0.6, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

C9000#

show ip route 10.100.100.1

```
Routing entry for 10.100.100.1/32
  Known via "bgp 65003", distance 20, metric 0
  Tag 65001, type external
  Last update from 192.168.0.6 2d22h ago
  Routing Descriptor Blocks:
  * 192.168.0.6, from 192.168.0.6, 2d22h ago
      opaque_ptr 0x7FD797D4B8D8
      Route metric is 0, traffic share count is 1
      AS Hops 1
```

```
      Route tag 65001
      MPLS label: none

C9000#

ping 10.100.100.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.100.100.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms

C9000#

show ip route 172.16.101.1


Routing entry for 172.16.101.0/30
  Known via "bgp 65003", distance 20, metric 0
  Tag 65001, type external
  Last update from 192.168.0.6 2d00h ago
  Routing Descriptor Blocks:
  * 192.168.0.6, from 192.168.0.6, 2d00h ago
      opaque_ptr 0x7FD797D4B8D8
      Route metric is 0, traffic share count is 1
      AS Hops 1
      Route tag 65001
      MPLS label: none

C9000#

ping 172.16.101.1


Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.101.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms

C9000#

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,
      L - DR Load-balancing Capable
Neighbor          Interface              Uptime/Expires    Ver   DR
Address                                                         Prio/Mode
192.168.0.6       TenGigabitEthernet1/0/3  2d22h/00:01:29   v2    1 / DR S P G

C9000#

show ip pim interface



Address           Interface              Ver/  Nbr   Query  DR        DR
                                         Mode  Count Intvl  Prior
192.168.0.5       TenGigabitEthernet1/0/3  v2/S  1     30     1         192.168.0.6
192.168.0.1       TenGigabitEthernet1/0/6  v2/S  0     30     1         192.168.0.1

C9000#
```

show ip pim rp mapping

PIM Group-to-RP Mappings

Group(s): 224.0.0.0/4, Static

RP: 10.100.100.1

  (?)

The Multicast Service Reflector shows both addresses 172.16.101.1 (Vif) and 10.100.100.1 (Loopback0) as directly connected, and routes to Source and Receiver being learned through BGP:

<#root>

Mcast_SR#

show ip route 10.100.100.1

Routing entry for 10.100.100.1/32
  Known via "connected", distance 0, metric 0 (connected, via interface)
  Advertised by bgp 65001
  Routing Descriptor Blocks:

* directly connected, via Loopback0

      Route metric is 0, traffic share count is 1

Mcast_SR#

show ip route 172.16.101.1

Routing entry for 172.16.101.1/32
  Known via "connected", distance 0, metric 0 (connected)
  Routing Descriptor Blocks:

* directly connected, via Vif1

      Route metric is 0, traffic share count is 1

Mcast_SR#

show ip route 172.16.0.6

Routing entry for 172.16.0.4/30
  Known via "bgp 65001", distance 20, metric 0
  Tag 65002, type external
  Last update from 172.16.0.2 5d20h ago
  Routing Descriptor Blocks:
  * 172.16.0.2, from 172.16.0.2, 5d20h ago
      opaque_ptr 0x7F841CBD53D0
      Route metric is 0, traffic share count is 1
      AS Hops 1
      Route tag 65002
      MPLS label: none

Mcast_SR#

show ip route 192.168.0.2

```
Routing entry for 192.168.0.0/30
  Known via "bgp 65001", distance 20, metric 0
  Tag 65003, type external
  Last update from 192.168.0.5 5d20h ago
  Routing Descriptor Blocks:
  * 192.168.0.5, from 192.168.0.5, 5d20h ago
      opaque_ptr 0x7F841CBD5290
      Route metric is 0, traffic share count is 1
      AS Hops 1
      Route tag 65003
      MPLS label: none
```

Router C8000 is also showing two PIM neighbors with four interfaces enabled with PIM-SM (including Vif and Loopback0), the correct RP mapping is also displayed and with the use of command **show ip multicast** you can verify the Multicast Service Reflect capabilities of the device:

```
<#root>

Mcast_SR#

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,
      L - DR Load-balancing Capable
Neighbor         Interface              Uptime/Expires     Ver   DR
Address                                                         Prio/Mode

192.168.0.5      TenGigabitEthernet0/0/2  5d20h/00:01:34   v2    1 / S P G
172.16.0.2       TenGigabitEthernet0/0/5  5d20h/00:01:15   v2    1 / DR S P G


Mcast_SR#

show ip pim interface



Address         Interface               Ver/   Nbr    Query  DR         DR
                                        Mode   Count  Intvl  Prior
10.100.100.1    Loopback0               v2/S   0      30     1          10.100.100.1
192.168.0.6     TenGigabitEthernet0/0/2 v2/S   1      30     1          192.168.0.6
172.16.0.1      TenGigabitEthernet0/0/5 v2/S   1      30     1          172.16.0.2
172.16.101.1    Vif1                    v2/S   0      30     1          0.0.0.0

Mcast_SR#

show ip pim rp mapping


PIM Group-to-RP Mappings

Group(s): 224.0.0.0/4, Static


RP: 10.100.100.1

 (?)
```

```
Mcast_SR#
```

show ip multicast

```
   Multicast Routing: enabled
   Multicast Multipath: disabled
   Multicast Route limit: No limit
   Multicast Fallback group mode: Sparse
   Number of multicast boundaries configured with filter-autorp option: 0
   MoFRR: Disabled
```

Multicast Service-Reflect Capabilities:
```
         Multicast to Multicast  Unicast to Multicast     Multicast to Unicast
```

At the LHR, similar verifications are completed. The next output taken from the ASR1000 router shows the routes installed for the translated Multicast Source 172.16.101.2 (this is important to note as at this point the multicast stream packet is received with a new source and destination IPv4 header) and for the RP IPv4 address 10.100.100.1. Notice that LHR also has reachability to the original Multicast Source 192.168.0.2, however at this point in the topology is more important to have reachability to the Vif subnet (172.16.101.0/30):

<#root>

```
ASR1000#
```

show ip route 10.100.100.1

```
Routing entry for 10.100.100.1/32
  Known via "bgp 65002", distance 20, metric 0
  Tag 65001, type external
  Last update from 172.16.0.1 2d22h ago
  Routing Descriptor Blocks:
  * 172.16.0.1, from 172.16.0.1, 2d22h ago
      opaque_ptr 0x7F2BFA855B80
      Route metric is 0, traffic share count is 1
      AS Hops 1
      Route tag 65001
      MPLS label: none

ASR1000#
```

ping 10.100.100.1

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.100.100.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms

ASR1000#
```

show ip route 172.16.101.1

```
Routing entry for 172.16.101.0/30
  Known via "bgp 65002", distance 20, metric 0
  Tag 65001, type external
  Last update from 172.16.0.1 2d00h ago
  Routing Descriptor Blocks:
  * 172.16.0.1, from 172.16.0.1, 2d00h ago
```

```
      opaque_ptr 0x7F2BFA855B80
      Route metric is 0, traffic share count is 1
      AS Hops 1
      Route tag 65001
      MPLS label: none

ASR1000#

ping 172.16.101.1


Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.101.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms

ASR1000#

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,
      L - DR Load-balancing Capable
Neighbor          Interface            Uptime/Expires    Ver    DR
Address                                                         Prio/Mode
172.16.0.1        TenGigabitEthernet0/1/1  2d22h/00:01:24    v2     1 / S P G

ASR1000#

show ip pim interface



Address           Interface            Ver/   Nbr   Query  DR        DR
                                       Mode   Count Intvl  Prior
172.16.0.5        GigabitEthernet0/0/0     v2/S   0     30     1         172.16.0.5
172.16.0.2        TenGigabitEthernet0/1/1  v2/S   1     30     1         172.16.0.2

ASR1000#

show ip route 192.168.0.2

Routing entry for 192.168.0.0/30
  Known via "bgp 65002", distance 20, metric 0
  Tag 65001, type external
  Last update from 172.16.0.1 5d21h ago
  Routing Descriptor Blocks:
  * 172.16.0.1, from 172.16.0.1, 5d21h ago
      opaque_ptr 0x7F2BFA855E00
      Route metric is 0, traffic share count is 1
      AS Hops 2
      Route tag 65001
      MPLS label: none

ASR1000#

ping 192.168.0.2 source 172.16.0.5

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.2, timeout is 2 seconds:
Packet sent with a source address of 172.16.0.5
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

Troubleshooting

After the Multicast Source start sending the stream for group 239.5.5.5, and while enabling **debug ip pim** on the different devices across the topology, it can be confirmed that the FHR registers the Multicast Source 192.168.0.2 to the RP and adds the interface TenGigabitEthernet1/0/3 into the Outgoing Interface List (OIL).

<#root>

C9000#
Oct 16 16:23:01.817: PIM(0)[default]: Re-check RP 10.100.100.1 into the (, 239.5.5.5) entry
Oct 16 16:23:01.817: PIM(0)[default]: Building Triggered (,G) Join / (S,G,RP-bit) Prune message for 239.5.5.5

*Oct 16 16:23:01.817: PIM(0)[default]: Adding register encap tunnel (Tunnel0) as forwarding interface of

*Oct 16 16:23:01.839: PIM(0)[default]: Received v2 Join/Prune on TenGigabitEthernet1/0/3 from 192.168.0
*Oct 16 16:23:01.839: PIM(0)[default]: Join-list: (192.168.0.2/32, 239.5.5.5), S-bit set

*Oct 16 16:23:01.839: PIM(0)[default]: MIDB Add TenGigabitEthernet1/0/3/192.168.0.6 to (192.168.0.2, 239

*Oct 16 16:23:01.839: PIM(0)[default]: Join to 0.0.0.0 on TenGigabitEthernet1/0/6 for (192.168.0.2, 239
*Oct 16 16:23:03.869: PIM(0)[default]: Received v2 Join/Prune on TenGigabitEthernet1/0/3 from 192.168.0
*Oct 16 16:23:03.869: PIM(0)[default]: Join-list: (192.168.0.2/32, 239.5.5.5), S-bit set
*Oct 16 16:23:03.869: PIM(0)[default]: MIDB Update TenGigabitEthernet1/0/3/192.168.0.6 to (192.168.0.2,

*Oct 16 16:23:05.818: PIM(0)[default]: Received v2 Register-Stop on TenGigabitEthernet1/0/3 from 10.100.
*Oct 16 16:23:05.818: PIM(0)[default]:   for source 192.168.0.2, group 239.5.5.5

*Oct 16 16:23:05.818: PIM(0)[default]: Removing register encap tunnel (Tunnel0) as forwarding interface
*Oct 16 16:23:05.818: PIM(0)[default]: Clear Registering flag to 10.100.100.1 for (192.168.0.2/32, 239.
*Oct 16 16:23:11.997: PIM(0)[default]: Send v2 join/prune to 192.168.0.6 (TenGigabitEthernet1/0/3)

C9000#

show ip mroute 239.5.5.5

IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       G - Received BGP C-Mroute, g - Sent BGP C-Mroute,
       N - Received BGP Shared-Tree Prune, n - BGP C-Mroute suppressed,
       Q - Received BGP S-A Route, q - Sent BGP S-A Route,
       V - RD & Vector, v - Vector, p - PIM Joins on route,
       x - VxLAN group, c - PFP-SA cache created entry,
       * - determined by Assert, # - iif-starg configured on rpf intf,
       e - encap-helper tunnel flag, l - LISP decap ref count contributor
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
                          t - LISP transit group
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 239.5.5.5), 00:24:22/stopped, RP 10.100.100.1, flags: SPF
  Incoming interface: TenGigabitEthernet1/0/3, RPF nbr 192.168.0.6
  Outgoing interface list: Null

```
(192.168.0.2, 239.5.5.5), 00:24:22/00:03:11, flags: FT

  Incoming interface: TenGigabitEthernet1/0/6, RPF nbr 0.0.0.0
  Outgoing interface list:


TenGigabitEthernet1/0/3, Forward/Sparse, 00:24:22/00:02:47, flags:
```

At the same time, the Multicast Service Reflector router (that is also the RP for both groups) receives the registration for the S,G (192.168.0.2, 239.5.5.5) and immediately detects that this group falls under the reflection rule previously defined. It then adds the TenGigabitEhternet0/0/2 as the incoming interface for the 239.5.5.5 stream, and later registers the new S,G (172.16.101.2, 239.55.55.55) to itself. The router adds Vif1 as the incoming interface for the 239.55.55.55 stream and places TenGigabitEthernet0/0/5 (connecting to ASR1000) into the OIL as shown in the debug and the **show ip mroute** command output:

<#root>

Mcast_SR#

```
*Oct 16 15:46:11.758: PIM(0)[default]: Received v2 Register on TenGigabitEthernet0/0/2 from 192.168.0.5
*Oct 16 15:46:11.758:       for 192.168.0.2, group 239.5.5.5

*Oct 16 15:46:11.758: PIM(0)[default]: Adding register decap tunnel (Tunnel1) as accepting interface of
*Oct 16 15:46:11.758: MSR(0)[default]: Add 239.5.5.5 to all the SR rules
*Oct 16 15:46:11.758: MSR: Found Grp idx 553648130 for rule 239.5.5.5->239.55.55.55
*Oct 16 15:46:11.758: MSR: Found Grp idx 553648130 for rule 239.5.5.5->239.55.55.55

*Oct 16 15:46:11.758: PIM(0)[default]: Insert (192.168.0.2,239.5.5.5) join in nbr 192.168.0.5's queue
*Oct 16 15:46:11.758: PIM(0)[default]: Building Join/Prune packet for nbr 192.168.0.5
*Oct 16 15:46:11.758: PIM(0)[default]:  Adding v2 (192.168.0.2/32, 239.5.5.5), S-bit Join
*Oct 16 15:46:11.758: PIM(0)[default]: Send v2 join/prune to 192.168.0.5 (TenGigabitEthernet0/0/2)
*Oct 16 15:46:12.929: PIM(0)[default]: Building Periodic (*,G) Join / (S,G,RP-bit) Prune message for 239
*Oct 16 15:46:12.929: PIM(0)[default]: rp our address for group 239.55.55.55
*Oct 16 15:46:13.251: PIM(0)[default]: Received v2 Join/Prune on TenGigabitEthernet0/0/5 from 172.16.0.2
*Oct 16 15:46:13.251: PIM(0)[default]: Join-list: (*, 239.55.55.55), RPT-bit set, WC-bit set, S-bit set
*Oct 16 15:46:13.252: PIM(0)[default]: MIDB Update TenGigabitEthernet0/0/5/172.16.0.2 to (*, 239.55.55.
*Oct 16 15:46:13.732: PIM(0)[default]: Received v2 Register on TenGigabitEthernet0/0/2 from 192.168.0.5
*Oct 16 15:46:13.732:       for 192.168.0.2, group 239.5.5.5
*Oct 16 15:46:13.732: PIM(0)[default]: Removing register decap tunnel (Tunnel1) as accepting interface

*Oct 16 15:46:13.732: PIM(0)[default]: Installing TenGigabitEthernet0/0/2 as accepting interface for (19

*Oct 16 15:46:13.732: PIM(0)[default]:  Prune to 0.0.0.0 on  for (192.168.0.2, 239.5.5.5), Ignored.

*Oct 16 15:46:13.773: PIM(0)[default]: Adding register decap tunnel (Tunnel1) as accepting interface of
*Oct 16 15:46:13.773: PIM(0)[default]: Adding register encap tunnel (Tunnel0) as forwarding interface of

*Oct 16 15:46:13.773: PIM(0)[default]: Removing register decap tunnel (Tunnel1) as accepting interface

*Oct 16 15:46:13.773: PIM(0)[default]: Installing Vif1 as accepting interface for (172.16.101.2, 239.55.

*Oct 16 15:46:13.788: PIM(0)[default]: Insert (192.168.0.2,239.5.5.5) join in nbr 192.168.0.5's queue
*Oct 16 15:46:13.788: PIM(0)[default]: Building Join/Prune packet for nbr 192.168.0.5
*Oct 16 15:46:13.788: PIM(0)[default]:  Adding v2 (192.168.0.2/32, 239.5.5.5), S-bit Join
*Oct 16 15:46:13.788: PIM(0)[default]: Send v2 join/prune to 192.168.0.5 (TenGigabitEthernet0/0/2)
*Oct 16 15:46:13.794: PIM(0)[default]: Received v2 Register on Vif1 from 10.100.100.1
*Oct 16 15:46:13.794:       for 172.16.101.2, group 239.55.55.55
*Oct 16 15:46:13.794: PIM(0)[default]: Send v2 Register-Stop to 10.100.100.1 for 172.16.101.2, group 239
*Oct 16 15:46:13.794: PIM(0)[default]: Received v2 Register-Stop on Loopback0 from 10.100.100.1
```

```
*Oct 16 15:46:13.794: PIM(0)[default]:   for source 172.16.101.2, group 239.55.55.55
*Oct 16 15:46:13.794: PIM(0)[default]: Removing register encap tunnel (Tunnel0) as forwarding interface
*Oct 16 15:46:13.794: PIM(0)[default]: Clear Registering flag to 10.100.100.1 for (172.16.101.2/32, 239
*Oct 16 15:46:13.809: PIM(0)[default]: Received v2 Join/Prune on TenGigabitEthernet0/0/5 from 172.16.0.2
*Oct 16 15:46:13.809: PIM(0)[default]: Join-list: (172.16.101.2/32, 239.55.55.55), S-bit set

*Oct 16 15:46:13.809: PIM(0)[default]: MIDB Update TenGigabitEthernet0/0/5/172.16.0.2 to (172.16.101.2,
```

Mcast_SR#

show ip mroute

```
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       G - Received BGP C-Mroute, g - Sent BGP C-Mroute,
       N - Received BGP Shared-Tree Prune, n - BGP C-Mroute suppressed,
       Q - Received BGP S-A Route, q - Sent BGP S-A Route,
       V - RD & Vector, v - Vector, p - PIM Joins on route,
       x - VxLAN group, c - PFP-SA cache created entry,
       * - determined by Assert, # - iif-starg configured on rpf intf,
       e - encap-helper tunnel flag, l - LISP decap ref count contributor
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
                          t - LISP transit group
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 239.5.5.5), 00:50:36/stopped, RP 10.100.100.1, flags: SJC
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    Vif1, Forward/Sparse, 00:50:36/00:00:23, flags:


(192.168.0.2, 239.5.5.5), 00:10:08/00:02:36, flags: T
  Incoming interface: TenGigabitEthernet0/0/2, RPF nbr 192.168.0.5
  Outgoing interface list:
    Vif1, Forward/Sparse, 00:10:08/00:01:51, flags:



(*, 239.55.55.55), 00:50:21/00:03:11, RP 10.100.100.1, flags: SF
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    TenGigabitEthernet0/0/5, Forward/Sparse, 00:50:21/00:03:11, flags:


(172.16.101.2, 239.55.55.55), 00:10:06/00:03:23, flags: FT
  Incoming interface: Vif1, RPF nbr 0.0.0.0
  Outgoing interface list:
    TenGigabitEthernet0/0/5, Forward/Sparse, 00:10:06/00:03:16, flags:



(*, 224.0.1.40), 00:50:36/00:03:28, RP 10.100.100.1, flags: SJCL
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    TenGigabitEthernet0/0/2, Forward/Sparse, 00:50:13/00:03:28, flags:
    TenGigabitEthernet0/0/5, Forward/Sparse, 00:50:28/00:03:10, flags:
```

```
    Loopback0, Forward/Sparse, 00:50:36/00:02:17, flags:
```
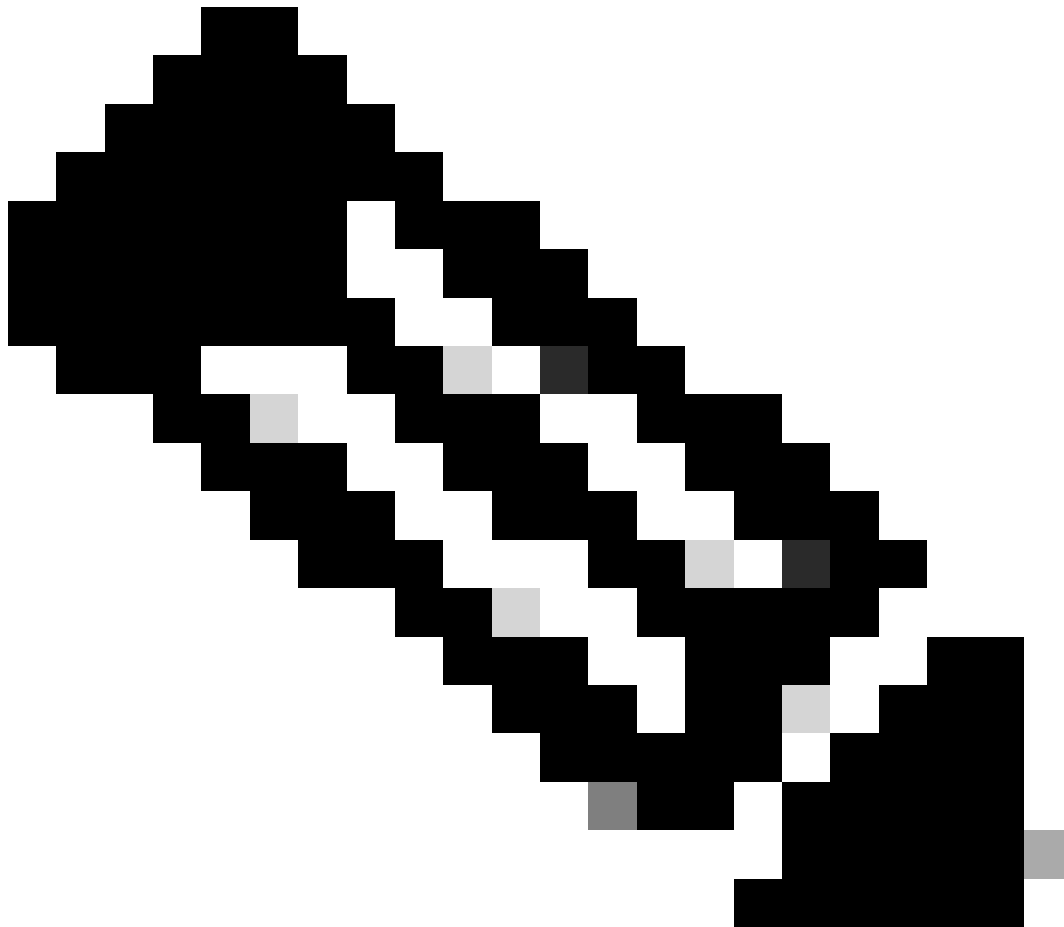
From the previous **show ip mroute** output it can be seen that there are *,G and S,G entries for both the original and new multicast groups. Additionally, the use of the **show ip mroute <group> count** command can give an idea of the packets received and forwarded for each multicast stream, this output is also useful as it helps to identify the traffic forwarding by the confirmation of the incrementing counters:

<#root>

Mcast_SR#

show ip mroute 239.5.5.5 count

Use "show ip mfib count" to get better response time for a large number of mroutes.

IP Multicast Statistics
5 routes using 5796 bytes of memory
3 groups, 0.66 average sources per group
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second
Other counts: Total/RPF failed/Other drops(OIF-null, rate-limit etc)

Group: 239.5.5.5, Source count: 1, Packets forwarded: 4053, Packets received: 4056

  RP-tree: Forwarding: 11/0/100/0, Other: 12/1/0
  Source: 192.168.0.2/32, Forwarding: 4042/0/113/0, Other: 4044/2/0

Mcast_SR#

show ip mroute 239.5.5.5 count

Use "show ip mfib count" to get better response time for a large number of mroutes.

IP Multicast Statistics
5 routes using 5796 bytes of memory
3 groups, 0.66 average sources per group
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second
Other counts: Total/RPF failed/Other drops(OIF-null, rate-limit etc)

Group: 239.5.5.5, Source count: 1, Packets forwarded: 4058, Packets received: 4061

  RP-tree: Forwarding: 11/0/100/0, Other: 12/1/0
  Source: 192.168.0.2/32, Forwarding: 4047/0/113/0, Other: 4049/2/0

Mcast_SR#

show ip mroute 239.55.55.55 count

Use "show ip mfib count" to get better response time for a large number of mroutes.

IP Multicast Statistics
5 routes using 5796 bytes of memory
3 groups, 0.66 average sources per group
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second
Other counts: Total/RPF failed/Other drops(OIF-null, rate-limit etc)

Group: 239.55.55.55, Source count: 1, Packets forwarded: 4046, Packets received: 4046

  RP-tree: Forwarding: 0/0/0/0, Other: 0/0/0
  Source: 172.16.101.2/32, Forwarding: 4046/0/114/0, Other: 4046/0/0

Mcast_SR#

show ip mroute 239.55.55.55 count

Use "show ip mfib count" to get better response time for a large number of mroutes.

IP Multicast Statistics
5 routes using 5796 bytes of memory
3 groups, 0.66 average sources per group
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second
Other counts: Total/RPF failed/Other drops(OIF-null, rate-limit etc)

Group: 239.55.55.55, Source count: 1, Packets forwarded: 4051, Packets received: 4051

```
  RP-tree: Forwarding: 0/0/0/0, Other: 0/0/0
  Source: 172.16.101.2/32, Forwarding: 4051/0/114/0, Other: 4051/0/0
```

If the S,G entries are not being created, it is important to determine if the multicast packets are being received at expected interface. A couple of options to confirm this situation is with use of an Embedded Packet Capture (EPC) or with a Packet Trace, in the next output an EPC was taken in the incoming (Te0/0/2) and outgoing (Te0/0/5) interfaces from the C8000 router. In this working scenario you can observe the original multicast stream 239.5.5.5 incoming and the new 239.55.55.55 stream egressing the router:

<#root>

Mcast_SR#

monitor capture msr buffer size 10 match any interface tenGigabitEthernet 0/0/2 in

Mcast_SR#

monitor capture msr start

```
Started capture point : msr
*Oct 16 17:59:06.986: %BUFCAP-6-ENABLE: Capture Point msr enabled.
Mcast_SR#
```

monitor capture msr stop

```
Stopped capture point : msr
Mcast_SR#s
*Oct 16 17:59:25.699: %BUFCAP-6-DISABLE: Capture Point msr disabled
Mcast_SR#
```

show monitor capture msr buffer brief

```
 -------------------------------------------------------------------------
 #    size   timestamp      source            destination      dscp   protocol
 -------------------------------------------------------------------------


 0   114    0.000000    192.168.0.2       ->  239.5.5.5         0  BE    ICMP


 1   114    2.000000    192.168.0.2       ->  239.5.5.5         0  BE    ICMP
   2    68    2.979961    192.168.0.5       ->  224.0.0.13      48 CS6   PIM
   3   114    4.000000    192.168.0.2       ->  239.5.5.5         0  BE    ICMP
   4   114    6.000000    192.168.0.2       ->  239.5.5.5         0  BE    ICMP
   5   114    8.000000    192.168.0.2       ->  239.5.5.5         0  BE    ICMP
   6   114   10.000000    192.168.0.2       ->  239.5.5.5         0  BE    ICMP
   7   114   12.000000    192.168.0.2       ->  239.5.5.5         0  BE    ICMP
   8   114   14.001007    192.168.0.2       ->  239.5.5.5         0  BE    ICMP
   9   114   16.001999    192.168.0.2       ->  239.5.5.5         0  BE    ICMP
  10   114   18.001007    192.168.0.2       ->  239.5.5.5         0  BE    ICMP
```

Mcast_SR#

monitor capture msr buffer size 10 match any interface tenGigabitEthernet0/0/5 out

Mcast_SR#

```
monitor capture msr start

Started capture point : msr
*Oct 16 18:07:26.846: %BUFCAP-6-ENABLE: Capture Point msr enabled.
Mcast_SR#

monitor capture msr stop


Stopped capture point : msr
*Oct 16 18:07:50.360: %BUFCAP-6-DISABLE: Capture Point msr disabled.
Mcast_SR#

show monitor capture msr buffer brief

 -------------------------------------------------------------------------
 #   size   timestamp      source              destination       dscp    protocol
 -------------------------------------------------------------------------
  0   73    0.000000   172.16.0.1      ->  172.16.0.2       48 CS6   TCP


  1  114    0.172040   172.16.101.2    ->  239.55.55.55     0   BE    ICMP
  2  114    2.173047   172.16.101.2    ->  239.55.55.55     0   BE    ICMP

  3  114    4.172040   172.16.101.2    ->  239.55.55.55     0   BE    ICMP
  4  114    6.173047   172.16.101.2    ->  239.55.55.55     0   BE    ICMP
  5  114    8.172040   172.16.101.2    ->  239.55.55.55     0   BE    ICMP
  6  114   10.172040   172.16.101.2    ->  239.55.55.55     0   BE    ICMP
  7  114   12.173047   172.16.101.2    ->  239.55.55.55     0   BE    ICMP
  8  114   14.175046   172.16.101.2    ->  239.55.55.55     0   BE    ICMP
  9  114   16.176038   172.16.101.2    ->  239.55.55.55     0   BE    ICMP
 10  114   18.176038   172.16.101.2    ->  239.55.55.55     0   BE    ICMP
 11   46   19.318029   172.16.0.1      ->  224.0.0.1        48 CS6   IGMP
 12  114   20.177045   172.16.101.2    ->  239.55.55.55     0   BE    ICMP
 13   72   20.629017   172.16.0.1      ->  224.0.0.13       48 CS6   PIM
 14  114   22.178037   172.16.101.2    ->  239.55.55.55     0   BE    ICMP
 15  430   23.273033   90:77:EE:3C:80:05 -> 01:00:0C:CC:CC:CC  --     LLC
```

A Packet Trace with an extended Access Control List (ACL) filtering on the 239.5.5.5 was also implemented. From the next output it can be observed that the packets are being received at the interface Te0/0/2 and initially consumed and copied internally to later be used as input packets into Vif1 interface and then forwarded out translated throughout interface Te0/0/5:

<#root>

Mcast_SR#

```
configure terminal
```

Enter configuration commands, one per line. End with CNTL/Z.
Mcast_SR(config)#

```
ip access-list extended original-mcast
```

Mcast_SR(config-ext-nacl)#

```
permit ip any host 239.5.5.5
```

Mcast_SR(config-ext-nacl)#

```
end
```

```
Mcast_SR#
*Oct 16 18:31:49.187: %SYS-5-CONFIG_I: Configured from console by console

Mcast_SR#

debug platform packet-trace packet 16

 Please remember to turn on 'debug platform condition start' for packet-trace to work
Mcast_SR#

debug platform condition ipv4 access-list original-mcast ingress


Mcast_SR#

debug platform condition start

Mcast_SR#

show platform packet-trace packet all

Packet: 0           CBUG ID: 0
Summary
  Input       : TenGigabitEthernet0/0/2
  Output      : <none>
  State       : CONS Packet Consumed Silently
  Timestamp
    Start     : 521286121898055 ns (10/16/2023 18:33:39.36879 UTC)
    Stop      : 521286122522268 ns (10/16/2023 18:33:39.37503 UTC)
Path Trace
  Feature: IPV4(Input)
    Input       : TenGigabitEthernet0/0/2
    Output      : <unknown>
    Source      : 192.168.0.2
    Destination : 239.5.5.5
    Protocol    : 1 (ICMP)
Packet: 1           CBUG ID: 0
Summary


Input      : TenGigabitEthernet0/0/2

  Output     : <none>


State      : CONS Packet Consumed Silently

  Timestamp
    Start    : 521286121980895 ns (10/16/2023 18:33:39.36962 UTC)
    Stop     : 521286122618968 ns (10/16/2023 18:33:39.37600 UTC)
Path Trace
  Feature: PACKET_COPY

    Original packet number: 0
  Feature: IPV4(Input)
    Input       : TenGigabitEthernet0/0/2
    Output      : <unknown>


 Source       : 192.168.0.2
   Destination : 239.5.5.5

    Protocol    : 1 (ICMP)
Packet: 2           CBUG ID: 0
Summary
```

```
  Input      : Vif1
  Output     : TenGigabitEthernet0/0/5


 State     : FWD


  Timestamp
    Start   : 521286122038938 ns (10/16/2023 18:33:39.37020 UTC)
    Stop    : 521286122694795 ns (10/16/2023 18:33:39.37676 UTC)
Path Trace
  Feature: PACKET_COPY
    Original packet number: 1
  Feature: IPV4(Input)
    Input        : Vif1
    Output       : <unknown>


 Source      : 172.16.101.2
    Destination : 239.55.55.55

    Protocol    : 1 (ICMP)
```

It is relevant to also check the Multicast Routing Information Base (MRIB) and Multicast Forwarding Information Base (MFIB) at the Catalyst 8K. Notice the hardware installed (HW) flags as well as the hardware forwarding counters incrementing with ideally very few Reverse Path Forwarding (RPF) failures or drops seen. Also note the forward (F) flag associated to the egress interface (Te0/0/5) towards ASR1000 router:

<#root>

Mcast_SR#

show ip mrib route

```
IP Multicast Routing Information Base
Entry flags: L - Domain-Local Source, E - External Source to the Domain,
    C - Directly-Connected Check, S - Signal, IA - Inherit Accept, D - Drop
    ET - Data Rate Exceeds Threshold,K - Keepalive,DDE - Data Driven Event
    ME - MoFRR ECMP Flow based, MNE - MoFRR Non-ECMP Flow based,
    MP - Primary MoFRR Non-ECMP Flow based entry,
    e - Encap helper tunnel flag
Interface flags: F - Forward, A - Accept, IC - Internal Copy,
    NS - Negate Signal, DP - Don't Preserve, SP - Signal Present,
    II - Internal Interest, ID - Internal Disinterest, LI - Local Interest,
    LD - Local Disinterest, MD - mCAC Denied, MI - mLDP Interest
    A2 - MoFRR ECMP Backup Accept

(*,224.0.0.0/4) Flags: C

(*,224.0.1.40) RPF nbr: 0.0.0.0 Flags: C
  TenGigabitEthernet0/0/2 Flags: F NS
  TenGigabitEthernet0/0/5 Flags: F NS
  Loopback0 Flags: F IC NS
  Tunnel1 Flags: A

(*,239.5.5.5) RPF nbr: 0.0.0.0 Flags: C
  Vif1 Flags: F NS  SR(172.16.101.2, 239.55.55.55)       Index(2, 2)
```

```
   Tunnel1 Flags: A

(*,239.55.55.55) RPF nbr: 0.0.0.0 Flags: C
   TenGigabitEthernet0/0/5 Flags: F NS
   Tunnel1 Flags: A


(172.16.101.2,239.55.55.55) RPF nbr: 0.0.0.0 Flags:
   Vif1 Flags: A
   TenGigabitEthernet0/0/5 Flags: F NS

(192.168.0.2,239.5.5.5) RPF nbr: 192.168.0.5 Flags:
   TenGigabitEthernet0/0/2 Flags: A NS
   Vif1 Flags: F NS   SR(172.16.101.2, 239.55.55.55)       Index(2, 2)



Mcast_SR#

show ip mfib 192.168.0.2 239.5.5.5

Entry Flags:    C - Directly Connected, S - Signal, IA - Inherit A flag,
                ET - Data Rate Exceeds Threshold, K - Keepalive
                DDE - Data Driven Event, HW - Hardware Installed
                ME - MoFRR ECMP entry, MNE - MoFRR Non-ECMP entry, MP - MFIB
                MoFRR Primary, RP - MRIB MoFRR Primary, P - MoFRR Primary
                MS  - MoFRR  Entry in Sync, MC - MoFRR entry in MoFRR Client,
                e   - Encap helper tunnel flag.
I/O Item Flags: IC - Internal Copy, NP - Not platform switched,
                NS - Negate Signalling, SP - Signal Present,
                A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB Forward,
                MA - MFIB Accept, A2 - Accept backup,
                RA2 - MRIB Accept backup, MA2 - MFIB Accept backup

Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts:      Total/RPF failed/Other drops
I/O Item Counts:   HW Pkt Count/FS Pkt Count/PS Pkt Count   Egress Rate in pps
Default


(192.168.0.2,239.5.5.5) Flags: HW

   SW Forwarding: 1/0/100/0, Other: 0/0/0


HW Forwarding:   6530/0/114/0, Other: 2/2/0



TenGigabitEthernet0/0/2 Flags: A



Vif1, SR/(172.16.101.2,239.55.55.55):553648130 Flags: F NS

     Pkts: 0/0/1    Rate: 0 pps

Mcast_SR#

show ip mfib 172.16.101.2 239.55.55.55

Entry Flags:    C - Directly Connected, S - Signal, IA - Inherit A flag,
                ET - Data Rate Exceeds Threshold, K - Keepalive
                DDE - Data Driven Event, HW - Hardware Installed
                ME - MoFRR ECMP entry, MNE - MoFRR Non-ECMP entry, MP - MFIB
                MoFRR Primary, RP - MRIB MoFRR Primary, P - MoFRR Primary
```

```
                MS  - MoFRR  Entry in Sync, MC - MoFRR entry in MoFRR Client,
                e   - Encap helper tunnel flag.
I/O Item Flags: IC - Internal Copy, NP - Not platform switched,
                NS - Negate Signalling, SP - Signal Present,
                A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB Forward,
                MA - MFIB Accept, A2 - Accept backup,
                RA2 - MRIB Accept backup, MA2 - MFIB Accept backup

Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts:      Total/RPF failed/Other drops
I/O Item Counts:   HW Pkt Count/FS Pkt Count/PS Pkt Count   Egress Rate in pps
Default


(172.16.101.2,239.55.55.55) Flags: HW

   SW Forwarding: 0/0/0/0, Other: 0/0/0


HW Forwarding:   6550/0/114/0, Other: 0/0/0



 Vif1 Flags: A
   TenGigabitEthernet0/0/5 Flags: F NS

      Pkts: 0/0/0    Rate: 0 pps

Mcast_SR#

show adjacency vif1 detail


Protocol Interface            Address
IP       Vif1                 point2point(8)
                              13270 packets, 657502 bytes
                              epoch 0
                              sourced in sev-epoch 0
                              empty encap string
                              P2P-ADJ

Mcast_SR#

show platform software ip rp active mfib group 239.5.5.5/32


Route flags:
S - Signal;          C - Directly connected;
IA - Inherit A Flag;    L - Local;
BR - Bidir route

*, 239.5.5.5/32 --> OBJ_INTF_LIST (0x15)

              Obj id: 0x15, Flags: C
              OM handle: 0x3480200a50

Mcast_SR#

show platform software ip rp active mfib group 239.55.55.55/32


Route flags:
S - Signal;          C - Directly connected;
IA - Inherit A Flag;    L - Local;
BR - Bidir route
```

```
*, 239.55.55.55/32 --> OBJ_INTF_LIST (0x36)

                 Obj id: 0x36, Flags: C
                 OM handle: 0x34801fa988


Mcast_SR#

show platform software mlist rp active index 0x15

Multicast List entries

OCE Flags:
NS - Negate Signalling; IC - Internal copy;
A - Accept;              F - Forward;

OCE              Type            OCE Flags        Interface
---------------------------------------------------------------------------------

0xf8000029       OBJ_ADJACENCY   NS, F            Vif1


0xf8000186       OBJ_ADJACENCY   A                Tunnel1

Mcast_SR#

show platform software mlist rp active index 0x36


Multicast List entries

OCE Flags:
NS - Negate Signalling; IC - Internal copy;
A - Accept;              F - Forward;

OCE              Type            OCE Flags        Interface
---------------------------------------------------------------------------------

0xf80000d1       OBJ_ADJACENCY   NS, F            TenGigabitEthernet0/0/5


0xf8000186       OBJ_ADJACENCY   A                Tunnel1
```

For the RPF check, it is important to verify this across the different devices in the multicast path.

<#root>

C9000#

show ip rpf 192.168.0.2

RPF information for ? (192.168.0.2)

RPF interface: TenGigabitEthernet1/0/6

  RPF neighbor: ? (192.168.0.2) -

directly connected

  RPF route/mask: 192.168.0.0/30
  RPF type: multicast (connected)
  Doing distance-preferred lookups across tables

RPF topology: ipv4 multicast base

Mcast_SR#

show ip rpf 192.168.0.2

RPF information for ? (192.168.0.2)

RPF interface: TenGigabitEthernet0/0/2

  RPF neighbor: ? (192.168.0.5)
  RPF route/mask: 192.168.0.0/30
  RPF type: unicast (bgp 65001)
  Doing distance-preferred lookups across tables

RPF topology: ipv4 multicast base, originated from ipv4 unicast base

Mcast_SR#

show ip rpf 172.16.101.2

RPF information for ? (172.16.101.2)

RPF interface: Vif1

  RPF neighbor: ? (172.16.101.2) -

directly connected

  RPF route/mask: 172.16.101.0/30
  RPF type: multicast (connected)
  Doing distance-preferred lookups across tables

RPF topology: ipv4 multicast base

ASR1000#

show ip rpf 172.16.101.2

RPF information for ? (172.16.101.2)

RPF interface: TenGigabitEthernet0/1/1

  RPF neighbor: ? (172.16.0.1)
  RPF route/mask: 172.16.101.0/30
  RPF type: unicast (bgp 65002)
  Doing distance-preferred lookups across tables

RPF topology: ipv4 multicast base, originated from ipv4 unicast base

Finally, you can confirm the traffic being received and forwarded at the LHR, the first capture shows how
ASR1000 received the packets from the new stream (172.16.101.2, 239.55.55.55) where the IPv4 addresses
were translated as expected. The second capture shows the traffic being forwarded to the Receiver.

<#root>

```
ASR1000#

monitor capture LHR buffer size 10 match any interface TenGigabitEthernet 0/1/1 in

ASR1000#

monitor capture LHR start


Started capture point : LHR
*Oct 17 15:16:06.192: %BUFCAP-6-ENABLE: Capture Point LHR enabled.show moni

ASR1000#

show monitor capture LHR buffer brief


  -----------------------------------------------------------------------------
  #   size   timestamp      source                destination      dscp    protocol
  -----------------------------------------------------------------------------
   0   73    0.000000    172.16.0.1        ->  172.16.0.2        48 CS6   TCP


 1  114    0.050992   172.16.101.2     ->  239.55.55.55     0   BE    ICMP
   2  114    2.051984   172.16.101.2     ->  239.55.55.55     0   BE    ICMP

   3   54    2.896993   172.16.0.1       ->  172.16.0.2       48 CS6   TCP
   4  114    4.051984   172.16.101.2     ->  239.55.55.55     0   BE    ICMP
   5   72    4.967989   172.16.0.1       ->  224.0.0.13       48 CS6   PIM
   6  114    6.052991   172.16.101.2     ->  239.55.55.55     0   BE    ICMP
   7  114    8.053983   172.16.101.2     ->  239.55.55.55     0   BE    ICMP
   8  114   10.053983   172.16.101.2     ->  239.55.55.55     0   BE    ICMP
   9  114   12.053983   172.16.101.2     ->  239.55.55.55     0   BE    ICMP
  10  114   14.055997   172.16.101.2     ->  239.55.55.55     0   BE    ICMP
  11  114   16.056989   172.16.101.2     ->  239.55.55.55     0   BE    ICMP
  12  114   18.055997   172.16.101.2     ->  239.55.55.55     0   BE    ICMP

ASR1000#

monitor capture LHR stop


Stopped capture point : LHR
ASR1000#
*Oct 17 15:16:32.029: %BUFCAP-6-DISABLE: Capture Point LHR disabled.

ASR1000#

monitor capture TO_RECEIVER buffer size 10 match any interface GigabitEthernet 0/0/0 out


ASR1000#

monitor capture TO_RECEIVER start


Started capture point : TO_RECEIVER
*Oct 17 15:19:00.309: %BUFCAP-6-ENABLE: Capture Point TO_RECEIVER enabled.ni

ASR1000#

show monitor capture TO_RECEIVER buffer brief


  -----------------------------------------------------------------------------
  #   size   timestamp      source                destination      dscp    protocol
```

```
     ----------------------------------------------------------------------
  0  114    0.000000   172.16.101.2    ->  239.55.55.55     0  BE   ICMP
  1   46    0.276994   172.16.0.5      ->  224.0.0.1       48 CS6   IGMP

  2  114    1.999009   172.16.101.2    ->  239.55.55.55     0  BE   ICMP
  3  114    4.000000   172.16.101.2    ->  239.55.55.55     0  BE   ICMP

  4   46    5.550027   172.16.0.5      ->  224.0.1.40      48 CS6   IGMP
  5  114    5.999009   172.16.101.2    ->  239.55.55.55     0  BE   ICMP
  6  114    8.000000   172.16.101.2    ->  239.55.55.55     0  BE   ICMP
  7  114   10.001007   172.16.101.2    ->  239.55.55.55     0  BE   ICMP
  8  114   12.001999   172.16.101.2    ->  239.55.55.55     0  BE   ICMP
  9  114   14.003006   172.16.101.2    ->  239.55.55.55     0  BE   ICMP
 10  114   16.003998   172.16.101.2    ->  239.55.55.55     0  BE   ICMP

ASR1000#
```

monitor capture TO_RECEIVER stop

```
Stopped capture point : TO_RECEIVER
*Oct 17 15:19:24.938: %BUFCAP-6-DISABLE: Capture Point TO_RECEIVER disabled.
```

If for some reason the *,G is missing at some point, you can validate the Internet Group Management Protocol (IGMP) status with the commands **show ip igmp membership <group>** and **show ip igmp groups <group>.** In this scenario, it is expected to see an entry for the translated multicast group 239.55.55.55**.**

<#root>

ASR1000#

show ip igmp membership 239.55.55.55

```
Flags: A  - aggregate, T - tracked
       L  - Local, S - static, V - virtual, R - Reported through v3
       I - v3lite, U - Urd, M - SSM (S,G) channel
       1,2,3 - The version of IGMP, the group is in
Channel/Group-Flags:
       / - Filtering entry (Exclude mode (S,G), Include mode (G))
Reporter:
       <mac-or-ip-address> - last reporter if group is not explicitly tracked
       <n>/<m>      - <n> reporter in include mode, <m> reporter in exclude

 Channel/Group                  Reporter        Uptime   Exp.  Flags  Interface

 *,239.55.55.55                 172.16.0.6      1w0d     02:40 2A     Gi0/0/0
```

ASR1000#

show ip igmp groups 239.55.55.55

```
IGMP Connected Group Membership
Group Address     Interface               Uptime    Expires   Last Reporter   Group Accounted

239.55.55.55      GigabitEthernet0/0/0    01:11:56  00:02:49  172.16.0.6
```

In addition, at the LHR a verification of the mroute can be used to confirm that the interface towards the Receiver is added into the OIL and the use of an mtrace to confirm the reverse path to both sources.

<#root>

ASR1000#

show ip mroute 239.55.55.55

```
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       G - Received BGP C-Mroute, g - Sent BGP C-Mroute,
       N - Received BGP Shared-Tree Prune, n - BGP C-Mroute suppressed,
       Q - Received BGP S-A Route, q - Sent BGP S-A Route,
       V - RD & Vector, v - Vector, p - PIM Joins on route,
       x - VxLAN group, c - PFP-SA cache created entry,
       * - determined by Assert, # - iif-starg configured on rpf intf,
       e - encap-helper tunnel flag, l - LISP Decap Refcnt Contributor
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 239.55.55.55), 23:28:12/stopped, RP 10.100.100.1, flags: SJC
  Incoming interface: TenGigabitEthernet0/1/1, RPF nbr 172.16.0.1
  Outgoing interface list:
    GigabitEthernet0/0/0, Forward/Sparse, 00:01:52/00:02:48
```

(172.16.101.2, 239.55.55.55), 00:10:11/00:02:40, flags: JT

```
  Incoming interface: TenGigabitEthernet0/1/1, RPF nbr 172.16.0.1
  Outgoing interface list:
```

GigabitEthernet0/0/0, Forward/Sparse, 00:01:52/00:02:48

ASR1000#

mtrace 172.16.101.2

```
Type escape sequence to abort.
Mtrace from 172.16.101.2 to 172.16.0.2 via RPF
From source (?) to destination (?)
Querying full reverse path...
 0  172.16.0.2
-1  172.16.0.2 ==> 172.16.0.2 PIM/MBGP  [172.16.101.0/30]
-2  172.16.0.1 ==> 172.16.101.1 PIM_MT  [172.16.101.0/30]
-3  172.16.101.2
```

ASR1000#

mtrace 192.168.0.2

```
Type escape sequence to abort.
Mtrace from 192.168.0.2 to 172.16.0.2 via RPF
```

```
From source (?) to destination (?)
Querying full reverse path...
 0  172.16.0.2
-1  172.16.0.2 ==> 172.16.0.2 PIM/MBGP  [192.168.0.0/30]
-2  172.16.0.1 ==> 192.168.0.6 PIM/MBGP  [192.168.0.0/30]
-3  192.168.0.5 ==> 192.168.0.1 PIM_MT  [192.168.0.0/30]
-4  192.168.0.2
```

Related Information

- **Implementing Multicast Service Reflection**
- **Multicast Service Reflection using PIM-SM on IOS-XE : Multicast to Unicast**