

Lab 3: Intra-domain ASM

Answers

Goal: Enable intra-domain ASM multicast between hosts Q and R. Verify R -> Q operation with packet dumps and router state inspection. View traffic on shared tree and shortest path tree.

- Choose ASM address (cannot start with 232) and port for your pod.

- Configure PIM Sparse Mode on all internal Pod interfaces. Do not enable PIM-SM on external interfaces (i.e. Border-A fe-0/0/0 and fe-0/0/3 and Border-B FastEthernet0/0 and Serial0/0).

Border-A

```
protocols {
  pim {
    interface fe-0/0/1 {
      mode sparse;
      version 2;
    }
  }
}
```

Border-B

```
int FastEthernet0/0
  ip pim sparse-mode
int FastEthernet0/1
  ip pim sparse-mode
```

Core-C

```
ip multicast-routing
ip pim ssm default
int FastEthernet0/0
  ip pim sparse-mode
int FastEthernet0/1
  ip pim sparse-mode
int FastEthernet1/0
  ip pim sparse-mode
int FastEthernet2/0
  ip pim sparse-mode
```

- Verify PIM neighbor relationships.

Border-A

```
ws@P3A> show pim neighbors
Instance: PIM.master

Interface          IP V Mode      Option      Uptime Neighbor addr
fe-0/0/1.0         4 2           HP          00:09:03 199.109.203.26

ws@P3A>
```

Border-B

```
P3B#show ip pim neighbor
PIM Neighbor Table
Neighbor          Interface          Uptime/Expires    Ver    DR
Address                                     Prio/Mode
199.109.203.29    FastEthernet0/1    00:08:39/00:01:35 v2      1 / S
P3B#
```

Core-C

```
P3C#show ip pim neighbor
PIM Neighbor Table
Neighbor          Interface          Uptime/Expires    Ver    DR
Address                                     Prio/Mode
199.109.203.25    FastEthernet0/0    00:16:13/00:01:42 v2      1 /
199.109.203.30    FastEthernet0/1    00:14:24/00:01:21 v2      1 / DR S
199.109.203.34    FastEthernet1/0    00:16:11/00:01:34 v2      1 / DR S
199.109.203.38    FastEthernet2/0    00:15:24/00:01:21 v2      1 / DR S
P3C#
```

- Configure additional loopback (199.109.x.6/32) on Border-A, Border-B, or Core-C for use as a RP address. Core-C is recommended.

Core-C

```
int loopback 1
 ip address 199.109.202.6 255.255.255.255
```

- Configure RP address statically on each router in the pod.

Border-A

```
protocols {
  pim {
    rp {
      static {
        address 199.109.202.6
      }
    }
  }
}
```

Border-B

```
ip pim rp-address 199.109.202.6 override
```

Core-C

```
ip pim rp-address 199.109.202.6 override
```

```
ws@P3A> show pim rps
Instance: PIM.master

Family: INET
RP address      Type      Holdtime  Timeout  Active groups  Group prefixes
199.109.203.6   static    0         None     0              224.0.0.0/4
```

```
ws@P3A>
```

```
P3B#show ip pim rp mapping
PIM Group-to-RP Mappings
```

```
Group(s): 224.0.0.0/4, Static-Override
RP: 199.109.203.6 (?)
P3B#
```

- **Configure Core-C, Customer-D, and Customer-E to prevent switchover from shared tree to shortest path tree.**

```
ip pim spt-threshold infinity
```

- **Start source on Host-Q and configure stream using ASM group address.**

```
iperf -u -c <group> -p <port> -b 1 -i 5 -T 10 -t 1000
```

- **Capture and decode packets on Host-Q to verify source operation.**

```
IGMP behavior of source applications
```

- **On Customer-D verify (*,G) and (S,G) state.**

```
P3D# show ip mroute 233.1.1.1
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,
X - Proxy Join Timer Running, A - Candidate MSDP Advertisement,
U - URD, I - Received Source Specific Host Report, Z - Multicast Tunnel
Y - Joined MDT-data group, y - Sending to MDT-data group
Outgoing interface flags: H - Hardware switched
Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 233.1.1.1), 00:27:26/stopped, RP 199.109.203.6, flags: SCF
Incoming interface: FastEthernet0/0, RPF nbr 199.109.203.33
Outgoing interface list:
FastEthernet0/1, Forward/Sparse, 00:27:26/00:02:29

(199.109.203.130, 233.1.1.1), 00:27:26/00:03:22, flags: FT
Incoming interface: FastEthernet0/1, RPF nbr 0.0.0.0
Outgoing interface list:
FastEthernet0/0, Forward/Sparse, 00:27:26/00:02:50

P3D#
```

- **Capture and decode packets on Host-Q to verify that the IGMP Group Membership Reports are being sent when requested.**

- **Start receiver on Host-R.**

```
rtpqual <group> <port>
```

- On Customer-E verify IGMP reports received from Host-R.

```
P3E#show ip igmp groups 233.1.1.1
IGMP Connected Group Membership
Group Address      Interface          Uptime    Expires    Last Reporter
233.1.1.1         FastEthernet0/1   00:28:52  00:02:38  199.109.203.162
P3E#
```

- Verify (via packet capture) that Receiver on Host-R is receiving traffic.

- Diagram path of multicast traffic flow from Host-Q to Host-R for multicast group <group>.

Customer-D

```
P3D#show ip mroute 233.1.1.1
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,
X - Proxy Join Timer Running, A - Candidate MSDP Advertisement,
U - URD, I - Received Source Specific Host Report, Z - Multicast Tunnel
Y - Joined MDT-data group, y - Sending to MDT-data group
Outgoing interface flags: H - Hardware switched
Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 233.1.1.1), 00:32:31/stopped, RP 199.109.203.6, flags: SCF
  Incoming interface: FastEthernet0/0, RPF nbr 199.109.203.33
  Outgoing interface list:
    FastEthernet0/1, Forward/Sparse, 00:32:31/00:02:21

(199.109.203.130, 233.1.1.1), 00:32:31/00:03:27, flags: FT
  Incoming interface: FastEthernet0/1, RPF nbr 0.0.0.0
  Outgoing interface list:
    FastEthernet0/0, Forward/Sparse, 00:32:31/00:03:25

P3D#show ip rpf 199.109.203.130
RPF information for ? (199.109.203.130)
  RPF interface: FastEthernet0/1
  RPF neighbor: ? (0.0.0.0) - directly connected
  RPF route/mask: 199.109.203.128/27
  RPF type: unicast (connected)
  RPF recursion count: 0
  Doing distance-preferred lookups across tables
P3D#
```

Core-C

```
P3C#show ip rpf 199.109.203.130
RPF information for ? (199.109.203.130)
  RPF interface: FastEthernet1/0
  RPF neighbor: ? (199.109.203.34)
  RPF route/mask: 199.109.203.128/27
```

```

RPF type: unicast (ospf 65503)
RPF recursion count: 0
Doing distance-preferred lookups across tables
P3C#
P3C#show ip mroute 233.1.1.1
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,
X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
U - URD, I - Received Source Specific Host Report, s - SSM
Outgoing interface flags: H - Hardware switched
Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 233.1.1.1), 00:34:05/00:03:10, RP 199.109.203.6, flags: S
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
FastEthernet1/0, Forward/Sparse, 00:33:03/00:02:53
FastEthernet2/0, Forward/Sparse, 00:34:05/00:03:10

(199.109.203.130, 233.1.1.1), 00:33:03/00:03:29, flags: T
Incoming interface: FastEthernet1/0, RPF nbr 199.109.203.34
Outgoing interface list:
FastEthernet2/0, Forward/Sparse, 00:33:03/00:03:10

(199.109.203.162, 233.1.1.1), 00:34:03/00:03:25, flags: T
Incoming interface: FastEthernet2/0, RPF nbr 199.109.203.38
Outgoing interface list:
FastEthernet1/0, Forward/Sparse, 00:33:04/00:02:52

P3C#

```

Customer-E

```

P3E#show ip rpf 199.109.203.130
RPF information for ? (199.109.203.130)
RPF interface: Serial0/0
RPF neighbor: ? (199.109.203.4)
RPF route/mask: 199.109.203.128/27
RPF type: unicast (ospf 65503)
RPF recursion count: 0
Doing distance-preferred lookups across tables
P3E#show ip mroute 233.1.1.1
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,
X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
U - URD, I - Received Source Specific Host Report, s - SSM
Outgoing interface flags: H - Hardware switched
Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 233.1.1.1), 00:32:22/00:02:59, RP 199.109.203.6, flags: SCF
Incoming interface: FastEthernet0/0, RPF nbr 199.109.203.37
Outgoing interface list:
FastEthernet0/1, Forward/Sparse, 00:30:34/00:02:01

(199.109.203.162, 233.1.1.1), 00:32:20/00:03:29, flags: CFT
Incoming interface: FastEthernet0/1, RPF nbr 0.0.0.0
Outgoing interface list:
FastEthernet0/0, Forward/Sparse, 00:32:20/00:02:54

```

```
P3E#
```

- Configure Core-C, Customer-D, and Customer-E to switch to shortest path tree.

```
no ip pim spt-threshold infinity
```

- Diagram path of multicast traffic flow from Host-Q to Host-R for multicast group <group>.

Customer-D

```
P3D#
P3D#show ip mroute 233.1.1.1
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,
       X - Proxy Join Timer Running, A - Candidate MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report, Z - Multicast Tunnel
       Y - Joined MDT-data group, y - Sending to MDT-data group
Outgoing interface flags: H - Hardware switched
Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 233.1.1.1), 00:17:42/stopped, RP 199.109.203.6, flags: SJCF
  Incoming interface: FastEthernet0/0, RPF nbr 199.109.203.33
  Outgoing interface list:
    FastEthernet0/1, Forward/Sparse, 00:17:42/00:02:26

(199.109.203.130, 233.1.1.1), 00:17:41/00:03:29, flags: FT
  Incoming interface: FastEthernet0/1, RPF nbr 0.0.0.0
  Outgoing interface list:
    Serial0/0, Forward/Sparse, 00:17:18/00:03:05
    FastEthernet0/0, Forward/Sparse, 00:17:41/00:02:55

(199.109.203.162, 233.1.1.1), 00:17:23/00:02:59, flags: JT
  Incoming interface: Serial0/0, RPF nbr 199.109.203.5
  Outgoing interface list:
    FastEthernet0/1, Forward/Sparse, 00:17:23/00:02:26

P3D#
```

Core-C

```
P3C#show ip mroute 233.1.1.1
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,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report, s - SSM
Outgoing interface flags: H - Hardware switched
Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 233.1.1.1), 00:19:12/00:02:59, RP 199.109.203.6, flags: S
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    FastEthernet2/0, Forward/Sparse, 00:18:56/00:02:35
```

```
FastEthernet1/0, Forward/Sparse, 00:19:12/00:02:59
(199.109.203.130, 233.1.1.1), 00:19:11/00:02:59, flags: T
  Incoming interface: FastEthernet1/0, RPF nbr 199.109.203.34
  Outgoing interface list:
    FastEthernet2/0, Forward/Sparse, 00:18:56/00:00:00
(199.109.203.162, 233.1.1.1), 00:18:54/00:02:55, flags: T
  Incoming interface: FastEthernet2/0, RPF nbr 199.109.203.38
  Outgoing interface list:
    FastEthernet1/0, Forward/Sparse, 00:18:56/00:00:00
P3C#
```

Customer-E

```
P3E#show ip mroute 233.1.1.1
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,
  X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
  U - URD, I - Received Source Specific Host Report, s - SSM
Outgoing interface flags: H - Hardware switched
Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 233.1.1.1), 00:19:44/00:02:59, RP 199.109.203.6, flags: SJCF
  Incoming interface: FastEthernet0/0, RPF nbr 199.109.203.37
  Outgoing interface list:
    FastEthernet0/1, Forward/Sparse, 00:19:36/00:02:50
(199.109.203.130, 233.1.1.1), 00:19:43/00:02:59, flags: CJT
  Incoming interface: Serial0/0, RPF nbr 199.109.203.4
  Outgoing interface list:
    FastEthernet0/1, Forward/Sparse, 00:19:37/00:02:50
(199.109.203.162, 233.1.1.1), 00:19:41/00:03:26, flags: CFT
  Incoming interface: FastEthernet0/1, RPF nbr 0.0.0.0
  Outgoing interface list:
    Serial0/0, Forward/Sparse, 00:19:41/00:03:10
    FastEthernet0/0, Forward/Sparse, 00:19:44/00:02:33
P3E#
```

- Stop source and receiver.