Configuring Spine Switches in a BGP EVPN VXLAN Fabric

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Information About Spine Switches in a BGP EVPN VXLAN Fabric

Spine switches in a BGP EVPN VXLAN fabric act as the connecting nodes between all the leaf switches or VTEPs. They form the backbone of the EVPN VXLAN network and forward traffic between the leaf switches. Each leaf switch is connected to each spine switch in the network. Spine switches enable redundancy within the network and provide multiple paths for VTEPs to forward traffic to each other.

Spine switches in an EVPN VXLAN network are part of the underlay network and transport the VXLAN-encapsulated packets. When deployed as border nodes, spine switches connect the network with an external network and allow movement of traffic. In a BGP EVPN VXLAN fabric, spine switces can also be deployed as route reflectors.

Deployment Scenarios for Spine Switches and Leaf Switches in a BGP EVPN VXLAN Fabric

Spine switches and leaf switches in a BGP EVPN VXLAN fabric can be deployed in the following ways:

- Spine Switches and Leaf Switches in the Same Autonomous System
- Spine Switches in One Autonomous System and the Leaf Switches in a Different Autonomous System
- Spine Switches in One Autonomous System and Each Leaf Switch in a Different Autonomous System

Spine Switches and Leaf Switches in the Same Autonomous System

In this scenario, all the devices in the EVPN VXLAN network are in the same autonomous system. The spine switches function as BGP route reflectors and anycast rendezvouz points (RPs). Internal Border Gateway Protocol (iBGP) is used to establish peering between the spine switches, and between the spine and leaf switches.

See Configuration Example-Spine and Leaf Switches in the Same Autonomous System, on page 2 for a sample topology and configuration.

Spine Switches in One Autonomous System and the Leaf Switches in a Different Autonomous System

In this scenario, all the leaf switches are in a single autonomous system that is different from the autonomous system of the spine switches. The spine switches function as BGP route servers. iBGP is used to establish peering between the spine switches. eBGP is used to establish peering between the spine and leaf switches.

See Configuration Example-Spine and Leaf Switches are in Different Autonomous Systems, on page 19 for a sample topology and configuration.

Spine Switches in One Autonomous System and Each Leaf Switch in a Different Autonomous System

In this scenario, each leaf switch is in its own individual autonomous system that is different from the autonomous system of the spine switches. The spine switches function as BGP route servers. iBGP is used to establish peering between the spine switches. eBGP is used to establish peering between the spine and leaf switches.

See Configuration Example-Each Leaf Switch in a Different Autonomous System, on page 37 for a sample topology and configuration.

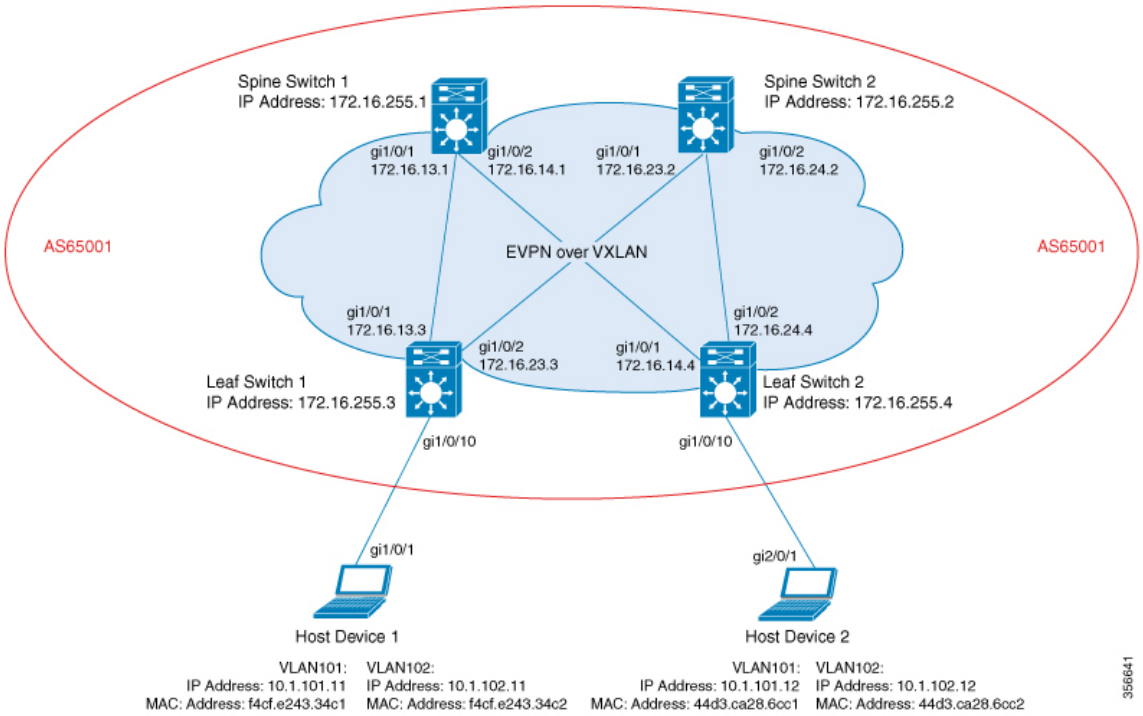
Configuration Examples for Spine Switches in a BGP EVPN VXLAN Network

This section provides configuration examples for spine switches for the different deployments of spine and leaf switches in a BGP EVPN VXLAN fabric.

Configuration Example-Spine and Leaf Switches in the Same Autonomous System

This section provides an example to show how spine switches are configured in a BGP EVPN VXLAN fabric using iBGP when the spine switches and leaf switches are in the same autonomous system. The example shows how to configure spine switches and verify the configuration for the topology shown below:

Figure 1: BGP EVPN VXLAN Fabric with the Spine Switches and Leaf Switches in the Same Autonomous System



The topology shows an EVPN VXLAN network with two leaf switches (VTEP 1 and VTEP 2) and two spine switches (Spine Switch 1 and Spine Switch 2). The entire BGP EVPN VXLAN fabric (which includes Spine Switch 1, Spine Switch 2, Leaf Switch 1, and Leaf Switch 2) is in autonomous system AS65001. Anycast RP is configured on both the spine switches. Spine Switch 1 and Spine Switch 2 are not route reflector clients to each other. Multicast Source Discovery Protocol (MSDP) is configured between Spine Switch 1 and Spine Switch 2 for source synchronization. Protocol Independent Multicast (PIM) is enabled on the interfaces that connect leaf switches and spine switches. Static RP is configured in the network and the underlay network uses multicast forwarding mechanism to forward BUM traffic.

The following tables provide sample configurations for the devices in the topology above.

Table 1: Configuring Spine Switch 1 and Spine Switch 2 using iBGP when the Spine Switches and the Leaf Switches are in the same Autonomous System

Spine Switch 1	Spine Switch 2
Spine-01# **show running-config** hostname Spine-01 ! ip routing ! ip multicast-routing ! interface Loopback0 ip address 172.16.255.1 255.255.255.255 ip ospf 1 area 0 ! interface Loopback1 ip address 172.16.254.1 255.255.255.255 ip ospf 1 area 0 ! interface Loopback2 ip address 172.16.255.255 255.255.255.255 ip pim sparse-mode ip ospf 1 area 0 ! interface GigabitEthernet1/0/1 no switchport ip address 172.16.13.1 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! interface GigabitEthernet1/0/2 no switchport ip address 172.16.14.1 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! router ospf 1 router-id 172.16.255.1 ! router bgp 65001 template peer-policy RR-PP route-reflector-client send-community both exit-peer-policy ! template peer-session RR-PS remote-as 65001 update-source Loopback0 exit-peer-session ! bgp router-id 172.16.255.1 bgp log-neighbor-changes no bgp default ipv4-unicast neighbor 172.16.255.3 inherit peer-session RR-PS neighbor 172.16.255.4 inherit peer-session RR-PS ! address-family ipv4 exit-address-family !	Spine-02# **show running-config** hostname Spine-02 ! ip routing ! ip multicast-routing ! interface Loopback0 ip address 172.16.255.2 255.255.255.255 ip ospf 1 area 0 ! interface Loopback1 ip address 172.16.254.2 255.255.255.255 ip ospf 1 area 0 ! interface Loopback2 ip address 172.16.255.255 255.255.255.255 ip pim sparse-mode ip ospf 1 area 0 ! interface GigabitEthernet1/0/1 no switchport ip address 172.16.23.2 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! interface GigabitEthernet1/0/2 no switchport ip address 172.16.24.2 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! router ospf 1 router-id 172.16.255.2 ! router bgp 65001 template peer-policy RR-PP route-reflector-client send-community both exit-peer-policy ! template peer-session RR-PS remote-as 65001 update-source Loopback0 exit-peer-session ! bgp router-id 172.16.255.2 bgp log-neighbor-changes no bgp default ipv4-unicast neighbor 172.16.255.3 inherit peer-session RR-PS neighbor 172.16.255.4 inherit peer-session RR-PS ! address-family ipv4 exit-address-family !

Spine Switch 1	Spine Switch 2
address-family l2vpn evpn neighbor 172.16.255.3 activate neighbor 172.16.255.3 send-community extended neighbor 172.16.255.3 inherit peer-policy RR-PP neighbor 172.16.255.4 activate neighbor 172.16.255.4 send-community extended neighbor 172.16.255.4 inherit peer-policy RR-PP exit-address-family ! ip pim rp-address 172.16.255.255 ip msdp peer 172.16.254.2 connect-source Loopback1 remote-as 65001 ip msdp cache-sa-state ! end Spine-01#	address-family l2vpn evpn neighbor 172.16.255.3 activate neighbor 172.16.255.3 send-community extended neighbor 172.16.255.3 inherit peer-policy RR-PP neighbor 172.16.255.4 activate neighbor 172.16.255.4 send-community extended neighbor 172.16.255.4 inherit peer-policy RR-PP exit-address-family ! ip pim rp-address 172.16.255.255 ip msdp peer 172.16.254.1 connect-source Loopback1 remote-as 65001 ip msdp cache-sa-state ! end Spine-02#

Table 2: Configuring Leaf Switch 1 and Leaf Switch 2 using iBGP when the Spine Switches and the Leaf Switches are in the same Autonomous System

Leaf Switch 1

```
Leaf-01# show running-config
hostname Leaf-01
!
vrf definition green
rd 1:1
!
address-family ipv4
route-target export 1:1
route-target import 1:1
route-target export 1:1 stitching
route-target import 1:1 stitching
exit-address-family
!
address-family ipv6
route-target export 1:1
route-target import 1:1
route-target export 1:1 stitching
route-target import 1:1 stitching
exit-address-family
!
ip routing
!
ip multicast-routing
!
l2vpn evpn
replication-type static
router-id Loopback1
default-gateway advertise
!
l2vpn evpn instance 101 vlan-based
encapsulation vxlan
replication-type static
!
l2vpn evpn instance 102 vlan-based
encapsulation vxlan
replication-type ingress
!
vlan configuration 101
member evpn-instance 101 vni 10101
vlan configuration 102
member evpn-instance 102 vni 10102
vlan configuration 901
member vni 50901
!
interface Loopback0
ip address 172.16.255.3 255.255.255.255
ip ospf 1 area 0
!
interface Loopback1
ip address 172.16.254.3 255.255.255.255
ip pim sparse-mode
ip ospf 1 area 0
!
interface GigabitEthernet1/0/1
no switchport
ip address 172.16.13.3 255.255.255.0
ip pim sparse-mode
ip ospf network point-to-point
ip ospf 1 area 0
!
```

Leaf Switch 2

```
Leaf-02# show running-config
hostname Leaf-02
!
vrf definition green
rd 1:1
!
address-family ipv4
route-target export 1:1
route-target import 1:1
route-target export 1:1 stitching
route-target import 1:1 stitching
exit-address-family
!
address-family ipv6
route-target export 1:1
route-target import 1:1
route-target export 1:1 stitching
route-target import 1:1 stitching
exit-address-family
!
ip routing
!
ip multicast-routing
!
l2vpn evpn
replication-type static
router-id Loopback1
default-gateway advertise
!
l2vpn evpn instance 101 vlan-based
encapsulation vxlan
!
l2vpn evpn instance 102 vlan-based
encapsulation vxlan
replication-type ingress
!
vlan configuration 101
member evpn-instance 101 vni 10101
vlan configuration 102
member evpn-instance 102 vni 10102
vlan configuration 901
member vni 50901
!
interface Loopback0
ip address 172.16.255.4 255.255.255.255
ip ospf 1 area 0
!
interface Loopback1
ip address 172.16.254.4 255.255.255.255
ip pim sparse-mode
ip ospf 1 area 0
!
interface GigabitEthernet1/0/1
no switchport
ip address 172.16.14.4 255.255.255.0
ip pim sparse-mode
ip ospf network point-to-point
ip ospf 1 area 0
!
```

Leaf Switch 1	Leaf Switch 2
interface GigabitEthernet1/0/2 no switchport ip address 172.16.23.3 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! interface GigabitEthernet1/0/10 switchport mode trunk ! interface Vlan101 vrf forwarding green ip address 10.1.101.1 255.255.255.0 ! interface Vlan102 vrf forwarding green ip address 10.1.102.1 255.255.255.0 ! interface Vlan901 vrf forwarding green ip unnumbered Loopback1 ipv6 enable no autostate ! interface nve1 no ip address source-interface Loopback1 host-reachability protocol bgp member vni 10101 mcast-group 225.0.0.101 member vni 10102 ingress-replication member vni 50901 vrf green ! router ospf 1 router-id 172.16.255.3 ! router bgp 65001 bgp log-neighbor-changes no bgp default ipv4-unicast neighbor 172.16.255.1 remote-as 65001 neighbor 172.16.255.1 update-source Loopback0 neighbor 172.16.255.2 remote-as 65001 neighbor 172.16.255.2 update-source Loopback0 ! address-family ipv4 exit-address-family ! address-family l2vpn evpn neighbor 172.16.255.1 activate neighbor 172.16.255.1 send-community both neighbor 172.16.255.2 activate neighbor 172.16.255.2 send-community both exit-address-family ! address-family ipv4 vrf green advertise l2vpn evpn redistribute connected redistribute static exit-address-family !	interface GigabitEthernet1/0/2 no switchport ip address 172.16.24.4 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! interface GigabitEthernet1/0/10 switchport mode trunk ! interface Vlan101 vrf forwarding green ip address 10.1.101.1 255.255.255.0 ! interface Vlan102 vrf forwarding green ip address 10.1.102.1 255.255.255.0 ! interface Vlan901 vrf forwarding green ip unnumbered Loopback1 ipv6 enable no autostate ! interface nve1 no ip address source-interface Loopback1 host-reachability protocol bgp member vni 10101 mcast-group 225.0.0.101 member vni 50901 vrf green member vni 10102 ingress-replication ! router ospf 1 router-id 172.16.255.4 ! router bgp 65001 bgp log-neighbor-changes no bgp default ipv4-unicast neighbor 172.16.255.1 remote-as 65001 neighbor 172.16.255.1 update-source Loopback0 neighbor 172.16.255.2 remote-as 65001 neighbor 172.16.255.2 update-source Loopback0 ! address-family ipv4 exit-address-family ! address-family l2vpn evpn neighbor 172.16.255.1 activate neighbor 172.16.255.1 send-community both neighbor 172.16.255.2 activate neighbor 172.16.255.2 send-community both exit-address-family ! address-family ipv4 vrf green advertise l2vpn evpn redistribute connected redistribute static exit-address-family !

Leaf Switch 1	Leaf Switch 2
address-family ipv6 vrf green redistribute connected redistribute static advertise l2vpn evpn exit-address-family ! ip pim rp-address 172.16.255.255 ! end Leaf-01#	address-family ipv6 vrf green redistribute connected redistribute static advertise l2vpn evpn exit-address-family ! ip pim rp-address 172.16.255.255 ! end Leaf-02#

The following examples provide sample outputs for **show** commands on the devices in the topology configured in the preceding tables:

Spine Switch 1

The following example shows the output for the **show ip ospf neighbor** command on spine switch 1:

```
Spine-01# show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
172.16.255.4      0   FULL/  -        00:00:39    172.16.14.4     GigabitEthernet1/0/2
172.16.255.3      0   FULL/  -        00:00:30    172.16.13.3     GigabitEthernet1/0/1
```

The following example shows the output for the **show bgp l2vpn evpn summary** command on spine switch 1:

```
Spine-01# show bgp l2vpn evpn summary
BGP router identifier 172.16.255.1, local AS number 65001
BGP table version is 46, main routing table version 46
18 network entries using 6192 bytes of memory
38 path entries using 7904 bytes of memory
14/13 BGP path/bestpath attribute entries using 4032 bytes of memory
2 BGP rrinfo entries using 80 bytes of memory
12 BGP extended community entries using 640 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 18848 total bytes of memory
BGP activity 27/9 prefixes, 49/11 paths, scan interval 60 secs
18 networks peaked at 17:16:59 May 24 2020 UTC (22:49:24.588 ago)

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
172.16.255.3    4        65001    1517    1536       46    0    0 22:49:32        9
172.16.255.4    4        65001    1297    1310       46    0    0 19:23:05       11
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on spine switch 1 for route type 2 and the IP address of host device 1:

```
Spine-01# show bgp l2vpn evpn route-type 2 0 f4cfe24334c1 10.1.101.11
BGP routing table entry for [2][172.16.254.3:101][0][48][F4CFE24334C1][32][10.1.101.11]/24,
 version 4
Paths: (2 available, best #2, table EVPN-BGP-Table)
  Advertised to update-groups:
     1          2
```

```
  Refresh Epoch 1
  Local
    172.16.254.3 (metric 2) (via default) from 172.16.255.2 (172.16.255.2)
      Origin incomplete, metric 0, localpref 100, valid, internal
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      Originator: 172.16.255.3, Cluster list: 172.16.255.2
      rx pathid: 0, tx pathid: 0
      net: 0x7F54CCA547D0, path: 0x7F54CCA63D70, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on May 24 2020 20:42:55 UTC
  Refresh Epoch 2
  Local, (Received from a RR-client)
    172.16.254.3 (metric 2) (via default) from 172.16.255.3 (172.16.255.3)
      Origin incomplete, metric 0, localpref 100, valid, internal, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F54CCA547D0, path: 0x7F54CCA64AF0, pathext: 0x7F54CA789BA8
      flags: net: 0x0, path: 0x3, pathext: 0x81
      Updated on May 24 2020 17:16:50 UTC
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on spine switch 1 for route type 2 and the IP address of host device 2:

```
Spine-01# show bgp l2vpn evpn route-type 2 0 44d3ca286cc1 10.1.101.12
BGP routing table entry for [2][172.16.254.4:101][0][48][44D3CA286CC1][32][10.1.101.12]/24,
 version 42
Paths: (2 available, best #1, table EVPN-BGP-Table)
  Advertised to update-groups:
     1          2
  Refresh Epoch 2
  Local, (Received from a RR-client)
    172.16.254.4 (metric 2) (via default) from 172.16.255.4 (172.16.255.4)
      Origin incomplete, metric 0, localpref 100, valid, internal, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F54CCA53E30, path: 0x7F54CCA63428, pathext: 0x7F54CA7898A8
      flags: net: 0x0, path: 0x3, pathext: 0x81
      Updated on May 24 2020 20:43:18 UTC
  Refresh Epoch 1
  Local
    172.16.254.4 (metric 2) (via default) from 172.16.255.2 (172.16.255.2)
      Origin incomplete, metric 0, localpref 100, valid, internal
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      Originator: 172.16.255.4, Cluster list: 172.16.255.2
      rx pathid: 0, tx pathid: 0
      net: 0x7F54CCA53E30, path: 0x7F54CCA64280, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on May 24 2020 20:28:04 UTC
```

The following example shows the output for the **show ip pim neighbor** command on spine switch 1:

```
Spine-01# 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
172.16.13.3       GigabitEthernet1/0/1     1d22h/00:01:41    v2    1 / DR S P G
172.16.14.4       GigabitEthernet1/0/2     4w5d/00:01:24     v2    1 / DR S P G
```

The following example shows the output for the **show ip pim rp map** command on spine switch 1:

```
Spine-01# show ip pim rp map
PIM Group-to-RP Mappings

Group(s): 224.0.0.0/4, Static
    RP: 172.16.255.255 (?)
```

The following example shows the output for the **show ip rpf** command on spine switch 1:

```
Spine-01# show ip rpf 172.16.255.255
RPF information for ? (172.16.255.255)
  RPF interface: Loopback2
  RPF neighbor: ? (172.16.255.255) - directly connected
  RPF route/mask: 172.16.255.255/32
  RPF type: multicast (connected)
  Doing distance-preferred lookups across tables
  RPF topology: ipv4 multicast base
```

The following example shows the output for the **show ip msdp summary** command on spine switch 1:

```
Spine-01# show ip msdp summary
MSDP Peer Status Summary
Peer Address     AS    State    Uptime/  Reset SA    Peer Name
                                Downtime Count Count
172.16.254.2     65001 Up       22:37:35 0     2     ?
```

The following example shows the output for the **show ip msdp sa-cache** command on spine switch 1:

```
Spine-01# show ip msdp sa-cache
MSDP Source-Active Cache - 2 entries
(172.16.254.3, 225.0.0.101), RP 172.16.255.255, BGP/AS 0, 00:00:29/00:05:30, Peer 172.16.254.2
(172.16.254.4, 225.0.0.101), RP 172.16.255.255, BGP/AS 0, 00:00:17/00:05:43, Peer 172.16.254.2
```

The following example shows the output for the **show ip mroute** command on spine switch 1:

```
Spine-01# show ip mroute 225.0.0.10
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
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 225.0.0.101), 00:01:04/stopped, RP 172.16.255.255, flags: SP
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list: Null

(172.16.254.4, 225.0.0.101), 00:00:51/00:02:08, flags: PA
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.14.4
  Outgoing interface list: Null

(172.16.254.3, 225.0.0.101), 00:01:04/00:01:55, flags: PA
  Incoming interface: GigabitEthernet1/0/1, RPF nbr 172.16.13.3
  Outgoing interface list: Null
```

Spine Switch 2

The following example shows the output for the **show ip ospf neighbor** command on spine switch 2:

```
Spine-02# show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
172.16.255.4      0   FULL/  -        00:00:39    172.16.24.4     GigabitEthernet1/0/2
172.16.255.3      0   FULL/  -        00:00:35    172.16.23.3     GigabitEthernet1/0/1
```

The following example shows the output for the **show bgp l2vpn evpn summary** command on spine switch 2:

```
Spine-02# show bgp l2vpn evpn summary
BGP router identifier 172.16.255.2, local AS number 65001
BGP table version is 28, main routing table version 28
18 network entries using 6192 bytes of memory
38 path entries using 7904 bytes of memory
14/13 BGP path/bestpath attribute entries using 4032 bytes of memory
2 BGP rrinfo entries using 80 bytes of memory
12 BGP extended community entries using 640 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 18848 total bytes of memory
BGP activity 36/18 prefixes, 58/20 paths, scan interval 60 secs
18 networks peaked at 16:03:20 May 24 2020 UTC (1d00h ago)

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
172.16.255.3    4        65001    1307    1322       28    0    0 19:35:35        9
172.16.255.4    4        65001    1316    1334       28    0    0 19:51:36       11
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on spine switch 2 for route type 2 and the IP address of host device 1:

```
Spine-02# show bgp l2vpn evpn route-type 2 0 f4cfe24334c1 10.1.101.11
BGP routing table entry for [2][172.16.254.3:101][0][48][F4CFE24334C1][32][10.1.101.11]/24,
 version 24
Paths: (2 available, best #1, table EVPN-BGP-Table)
```

```
  Advertised to update-groups:
     2          3
  Refresh Epoch 2
  Local, (Received from a RR-client)
    172.16.254.3 (metric 2) (via default) from 172.16.255.3 (172.16.255.3)
      Origin incomplete, metric 0, localpref 100, valid, internal, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      rx pathid: 0, tx pathid: 0x0
      net: 0x7FEFE69D6638, path: 0x7FEFE45FED18, pathext: 0x7FEFE6645CC0
      flags: net: 0x0, path: 0x3, pathext: 0x81
      Updated on May 24 2020 20:43:24 UTC
  Refresh Epoch 1
  Local
    172.16.254.3 (metric 2) (via default) from 172.16.255.1 (172.16.255.1)
      Origin incomplete, metric 0, localpref 100, valid, internal
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      Originator: 172.16.255.3, Cluster list: 172.16.255.1
      rx pathid: 0, tx pathid: 0
      net: 0x7FEFE69D6638, path: 0x7FEFE45FF738, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on May 24 2020 20:27:33 UTC
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on spine switch 2 for route type 2 and the IP address of host device 2:

```
Spine-02# show bgp l2vpn evpn route-type 2 0 44d3ca286cc1 10.1.101.12
BGP routing table entry for [2][172.16.254.4:101][0][48][44D3CA286CC1][32][10.1.101.12]/24,
 version 10
Paths: (2 available, best #2, table EVPN-BGP-Table)
  Advertised to update-groups:
     2          3
  Refresh Epoch 1
  Local
    172.16.254.4 (metric 2) (via default) from 172.16.255.1 (172.16.255.1)
      Origin incomplete, metric 0, localpref 100, valid, internal
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      Originator: 172.16.255.4, Cluster list: 172.16.255.1
      rx pathid: 0, tx pathid: 0
      net: 0x7FEFE69D64D8, path: 0x7FEFE45FE730, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on May 24 2020 20:43:46 UTC
  Refresh Epoch 1
  Local, (Received from a RR-client)
    172.16.254.4 (metric 2) (via default) from 172.16.255.4 (172.16.255.4)
      Origin incomplete, metric 0, localpref 100, valid, internal, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      rx pathid: 0, tx pathid: 0x0
      net: 0x7FEFE69D64D8, path: 0x7FEFE45FF660, pathext: 0x7FEFE6645B40
      flags: net: 0x0, path: 0x3, pathext: 0x81
      Updated on May 24 2020 20:27:22 UTC
```

The following example shows the output for the **show ip pim neighbor** command on spine switch 2:

```
Spine-02# 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
172.16.23.3       GigabitEthernet1/0/1    6w3d/00:01:21     v2    1 / DR S P G
172.16.24.4       GigabitEthernet1/0/2    1d22h/00:01:18    v2    1 / DR S P G
```

The following example shows the output for the **show ip pim rp map** command on spine switch 2:

```
Spine-02# show ip pim rp map
PIM Group-to-RP Mappings

Group(s): 224.0.0.0/4, Static
    RP: 172.16.255.255 (?)
```

The following example shows the output for the **show ip rpf** command on spine switch 2:

```
Spine-02# show ip rpf 172.16.255.255
RPF information for ? (172.16.255.255)
  RPF interface: Loopback2
  RPF neighbor: ? (172.16.255.255) - directly connected
  RPF route/mask: 172.16.255.255/32
  RPF type: multicast (connected)
  Doing distance-preferred lookups across tables
  RPF topology: ipv4 multicast base
```

The following example shows the output for the **show ip msdp summary** command on spine switch 2:

```
Spine-02# show ip msdp summary
MSDP Peer Status Summary
Peer Address     AS    State    Uptime/  Reset SA    Peer Name
                                Downtime Count Count
172.16.254.1     65001 Up       22:41:13 3     2     ?
```

The following example shows the output for the **show ip msdp sa-cache** command on spine switch 2:

```
Spine-02# show ip msdp sa-cache
MSDP Source-Active Cache - 2 entries
(172.16.254.3, 225.0.0.101), RP 172.16.255.255, BGP/AS 0, 00:04:09/00:05:57, Peer 172.16.254.1
(172.16.254.4, 225.0.0.101), RP 172.16.255.255, BGP/AS 0, 00:03:56/00:05:57, Peer 172.16.254.1
```

The following example shows the output for the **show ip mroute** command on spine switch 2:

```
Spine-02# show ip mroute 225.0.0.101
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
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 225.0.0.101), 5w6d/00:03:16, RP 172.16.255.255, flags: S
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    GigabitEthernet1/0/2, Forward/Sparse, 1d22h/00:03:10
    GigabitEthernet1/0/1, Forward/Sparse, 5w6d/00:02:55

(172.16.254.4, 225.0.0.101), 00:00:13/00:02:46, flags: TA
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.24.4
  Outgoing interface list:
    GigabitEthernet1/0/1, Forward/Sparse, 00:00:13/00:03:16

(172.16.254.3, 225.0.0.101), 00:00:23/00:02:36, flags: A
  Incoming interface: GigabitEthernet1/0/1, RPF nbr 172.16.23.3
  Outgoing interface list:
    GigabitEthernet1/0/2, Forward/Sparse, 00:00:23/00:03:10
```

Leaf Switch 1

The following example shows the output for the **show ip ospf neighbor** command on leaf switch 1:

```
Leaf-01# show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
172.16.255.2      0   FULL/  -        00:00:34    172.16.23.2     GigabitEthernet1/0/2
172.16.255.1      0   FULL/  -        00:00:30    172.16.13.1     GigabitEthernet1/0/1
```

The following example shows the output for the **show bgp l2vpn evpn summary** command on leaf switch 1:

```
Leaf-01# show bgp l2vpn evpn summary
BGP router identifier 172.16.255.3, local AS number 65001
BGP table version is 11429, main routing table version 11429
27 network entries using 9288 bytes of memory
36 path entries using 7488 bytes of memory
15/15 BGP path/bestpath attribute entries using 4320 bytes of memory
2 BGP rrinfo entries using 80 bytes of memory
12 BGP extended community entries using 624 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 21800 total bytes of memory
BGP activity 398/365 prefixes, 4243/4201 paths, scan interval 60 secs
89 networks peaked at 20:32:14 Apr 21 2020 UTC (4w5d ago)

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
172.16.255.1    4        65001     261     242    11429    0    0 03:28:13        9
172.16.255.2    4        65001      31      16    11429    0    0 00:02:08        9
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on leaf switch 1 for route type 2 and the IP address of host device 2:

```
Leaf-01# show bgp l2vpn evpn route-type 2 0 44d3ca286cc1 10.1.101.12
BGP routing table entry for [2][172.16.254.3:101][0][48][44D3CA286CC1][32][10.1.101.12]/24,
 version 11423
Paths: (1 available, best #1, table evi_101)
  Not advertised to any peer
  Refresh Epoch 1
  Local, imported path from [2][172.16.254.4:101][0][48][44D3CA286CC1][32][10.1.101.12]/24
 (global)
    172.16.254.4 (metric 3) (via default) from 172.16.255.1 (172.16.255.1)
      Origin incomplete, metric 0, localpref 100, valid, internal, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      Originator: 172.16.255.4, Cluster list: 172.16.255.1
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F575DB9FAB0, path: 0x7F575FD77698, pathext: 0x7F575DBD5B48, exp_net:
0x7F575DBA3B50
      flags: net: 0x0, path: 0x4000000000003, pathext: 0x81
      Updated on May 24 2020 20:40:59 UTC
BGP routing table entry for [2][172.16.254.4:101][0][48][44D3CA286CC1][32][10.1.101.12]/24,
 version 11414
Paths: (2 available, best #2, table EVPN-BGP-Table)
  Not advertised to any peer
  Refresh Epoch 2
  Local
    172.16.254.4 (metric 3) (via default) from 172.16.255.2 (172.16.255.2)
      Origin incomplete, metric 0, localpref 100, valid, internal
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      Originator: 172.16.255.4, Cluster list: 172.16.255.2
      rx pathid: 0, tx pathid: 0
      net: 0x7F575DBA3B50, path: 0x7F575FD77E30, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on May 24 2020 20:40:37 UTC
  Refresh Epoch 1
  Local
    172.16.254.4 (metric 3) (via default) from 172.16.255.1 (172.16.255.1)
      Origin incomplete, metric 0, localpref 100, valid, internal, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      Originator: 172.16.255.4, Cluster list: 172.16.255.1
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F575DBA3B50, path: 0x7F575FD769F0, pathext: 0x7F575DBD5D88
      flags: net: 0x0, path: 0x3, pathext: 0x81
      Updated on May 24 2020 20:40:59 UTC
```

The following example shows the output for the **show ip pim neighbor** command on leaf switch 1:

```
Leaf-01# 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
172.16.13.1       GigabitEthernet1/0/1     1d03h/00:01:21    v2    1 / S P G
172.16.23.2       GigabitEthernet1/0/2     6w2d/00:01:25     v2    1 / S P G
```

The following example shows the output for the **show ip pim rp mapping** command on leaf switch 1:

```
Leaf-01# show ip pim rp mapping
PIM Group-to-RP Mappings

Group(s): 224.0.0.0/4, Static
    RP: 172.16.255.255 (?)
```

The following example shows the output for the **show ip ro** command on leaf switch 1:

```
Leaf-01# show ip ro 172.16.255.255
Routing entry for 172.16.255.255/32
  Known via "ospf 1", distance 110, metric 2, type intra area
  Last update from 172.16.13.1 on GigabitEthernet1/0/1, 1d03h ago
  Routing Descriptor Blocks:
  * 172.16.23.2, from 172.16.255.2, 4w5d ago, via GigabitEthernet1/0/2
      Route metric is 2, traffic share count is 1
    172.16.13.1, from 172.16.255.1, 1d03h ago, via GigabitEthernet1/0/1
      Route metric is 2, traffic share count is 1
```

The following example shows the output for the **show ip rpf** command on leaf switch 1:

```
Leaf-01# show ip rpf 172.16.255.255
RPF information for ? (172.16.255.255)
  RPF interface: GigabitEthernet1/0/2
  RPF neighbor: ? (172.16.23.2)
  RPF route/mask: 172.16.255.255/32
  RPF type: unicast (ospf 1)
  Doing distance-preferred lookups across tables
  RPF topology: ipv4 multicast base, originated from ipv4 unicast base
```

The following example shows the output for the **show ip mroute** command on leaf switch 1:

```
Leaf-01# show ip mroute 225.0.0.101
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
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 225.0.0.101), 6w2d/stopped, RP 172.16.255.255, flags: SJCFx
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.23.2
  Outgoing interface list:
    Tunnel0, Forward/Sparse-Dense, 6w2d/00:01:57

(172.16.254.4, 225.0.0.101), 00:00:49/00:02:10, flags: JTx
```

```
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.23.2
  Outgoing interface list:
    Tunnel0, Forward/Sparse-Dense, 00:00:49/00:02:10

(172.16.254.3, 225.0.0.101), 00:01:01/00:01:58, flags: FTx
  Incoming interface: Loopback1, RPF nbr 0.0.0.0
  Outgoing interface list:
    GigabitEthernet1/0/2, Forward/Sparse, 00:01:01/00:03:27
```

Leaf Switch 2

The following example shows the output for the **show ip ospf neighbor** command on leaf switch 2:

```
Leaf-02# show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
172.16.255.2      0   FULL/  -        00:00:34    172.16.24.2     GigabitEthernet1/0/2
172.16.255.1      0   FULL/  -        00:00:35    172.16.14.1     GigabitEthernet1/0/1
```

The following example shows the output for the **show bgp l2vpn evpn summary** command on leaf switch 2:

```
Leaf-02# show bgp l2vpn evpn summary
BGP router identifier 172.16.255.4, local AS number 65001
BGP table version is 168, main routing table version 168
25 network entries using 8600 bytes of memory
36 path entries using 7488 bytes of memory
16/15 BGP path/bestpath attribute entries using 4608 bytes of memory
2 BGP rrinfo entries using 80 bytes of memory
13 BGP extended community entries using 664 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 21440 total bytes of memory
BGP activity 70/39 prefixes, 168/124 paths, scan interval 60 secs
31 networks peaked at 15:56:08 May 24 2020 UTC (05:05:36.264 ago)

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
172.16.255.1    4        65001      45      31      168    0    0 00:16:18        9
172.16.255.2    4        65001      54      48      168    0    0 00:32:42        9
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on leaf switch 2 for route type 2 and the IP address of host device 1:

```
Leaf-02# show bgp l2vpn evpn route-type 2 0 f4cfe24334c1 10.1.101.11
BGP routing table entry for [2][172.16.254.3:101][0][48][F4CFE24334C1][32][10.1.101.11]/24,
 version 163
Paths: (2 available, best #1, table EVPN-BGP-Table)
  Not advertised to any peer
  Refresh Epoch 2
  Local
    172.16.254.3 (metric 3) (via default) from 172.16.255.1 (172.16.255.1)
      Origin incomplete, metric 0, localpref 100, valid, internal, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      Originator: 172.16.255.3, Cluster list: 172.16.255.1
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F84B9145020, path: 0x7F84BB3355F8, pathext: 0x7F84BB5B4318
```

```
      flags: net: 0x0, path: 0x3, pathext: 0x81
      Updated on May 24 2020 20:45:25 UTC
  Refresh Epoch 1
  Local
    172.16.254.3 (metric 3) (via default) from 172.16.255.2 (172.16.255.2)
      Origin incomplete, metric 0, localpref 100, valid, internal
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      Originator: 172.16.255.3, Cluster list: 172.16.255.2
      rx pathid: 0, tx pathid: 0
      net: 0x7F84B9145020, path: 0x7F84BB333948, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on May 24 2020 20:45:03 UTC
BGP routing table entry for [2][172.16.254.4:101][0][48][F4CFE24334C1][32][10.1.101.11]/24,
 version 166
Paths: (1 available, best #1, table evi_101)
  Not advertised to any peer
  Refresh Epoch 2
  Local, imported path from [2][172.16.254.3:101][0][48][F4CFE24334C1][32][10.1.101.11]/24
 (global)
    172.16.254.3 (metric 3) (via default) from 172.16.255.1 (172.16.255.1)
      Origin incomplete, metric 0, localpref 100, valid, internal, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      Originator: 172.16.255.3, Cluster list: 172.16.255.1
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F84B9145700, path: 0x7F84BB334008, pathext: 0x7F84BB5B3A18, exp_net:
0x7F84B9145020
      flags: net: 0x0, path: 0x4000000000003, pathext: 0x81
      Updated on May 24 2020 20:45:25 UTC
```

The following example shows the output for the **show ip pim neighbor** command on leaf switch 2:

```
Leaf-02# 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
172.16.14.1       GigabitEthernet1/0/1     4w5d/00:01:26     v2    1 / S P G
172.16.24.2       GigabitEthernet1/0/2     1d03h/00:01:20    v2    1 / S P G
```

The following example shows the output for the **show ip pim rp map** command on leaf switch 2:

```
Leaf-02# show ip pim rp map
PIM Group-to-RP Mappings

Group(s): 224.0.0.0/4, Static
    RP: 172.16.255.255 (?)
```

The following example shows the output for the **show ip ro** command on leaf switch 2:

```
Leaf-02# show ip ro 172.16.255.255
Routing entry for 172.16.255.255/32
  Known via "ospf 1", distance 110, metric 2, type intra area
  Last update from 172.16.14.1 on GigabitEthernet1/0/1, 05:12:11 ago
```

```
  Routing Descriptor Blocks:
  * 172.16.24.2, from 172.16.255.2, 05:12:11 ago, via GigabitEthernet1/0/2
      Route metric is 2, traffic share count is 1
    172.16.14.1, from 172.16.255.1, 05:12:11 ago, via GigabitEthernet1/0/1
      Route metric is 2, traffic share count is 1
```

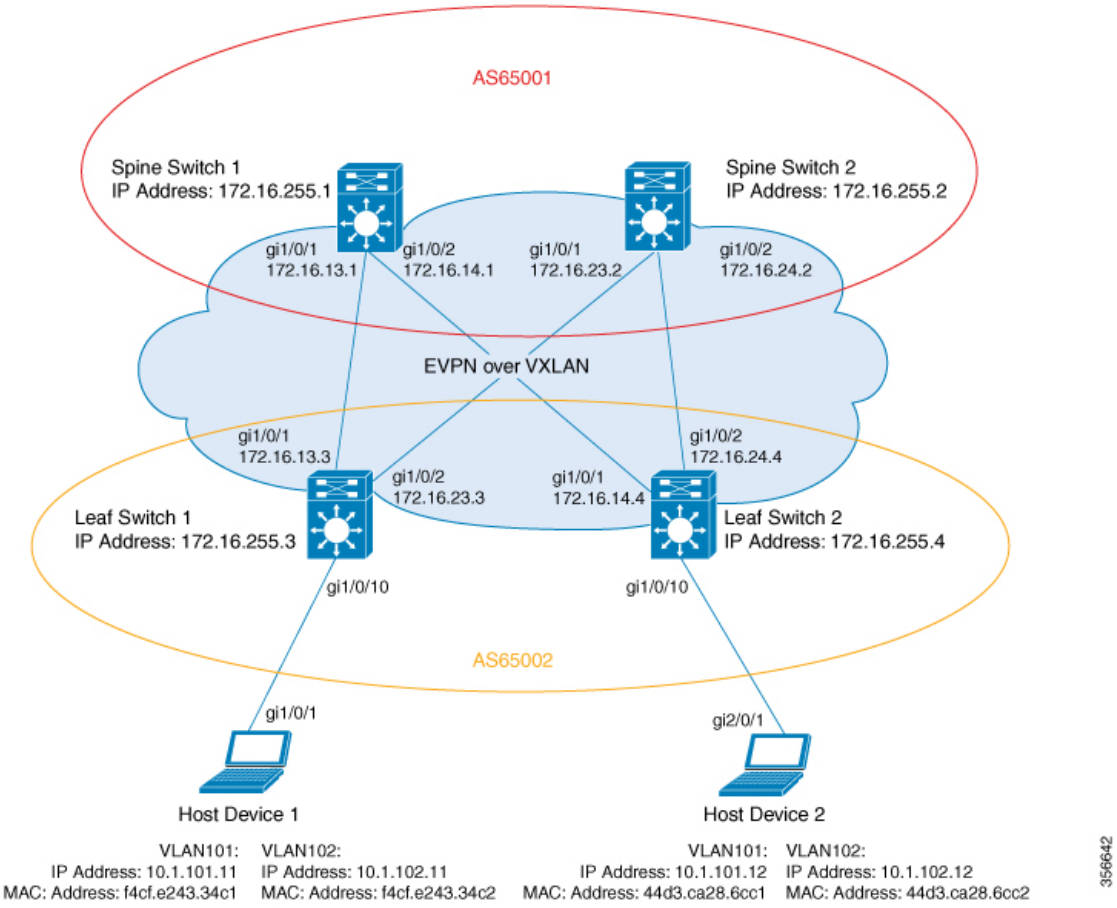
The following example shows the output for the **show ip mroute** command on leaf switch 2:

```
Leaf-02# show ip mroute 225.0.0.101
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
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 225.0.0.101), 3d07h/stopped, RP 172.16.255.255, flags: SJCFx
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.24.2
  Outgoing interface list:
    Tunnel0, Forward/Sparse-Dense, 3d07h/00:00:38

(172.16.254.4, 225.0.0.101), 00:00:09/00:02:50, flags: FTx
  Incoming interface: Loopback1, RPF nbr 0.0.0.0
  Outgoing interface list:
    GigabitEthernet1/0/2, Forward/Sparse, 00:00:09/00:03:20

(172.16.254.3, 225.0.0.101), 00:00:28/00:02:31, flags: JTx
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.24.2
  Outgoing interface list:
    Tunnel0, Forward/Sparse-Dense, 00:00:28/00:02:31
```

Configuration Example-Spine and Leaf Switches are in Different Autonomous Systems

This section provides an example to show how spine switches are configured in a BGP EVPN VXLAN fabric using eBGP when the spine switches are in one autonomous system and the leaf switches are in a different autonomous system. The example shows how to configure spine switches and verify the configuration for the topology shown below:

Figure 2: BGP EVPN VXLAN Fabric with the Spine Switches in One Autonomous System and the Leaf Switches in a Different Autonomous System



The topology shows an EVPN VXLAN network with two leaf switches (Leaf Switch 1 and Leaf Switch 2) and two spine switches (Spine Switch 1 and Spine Switch 2).Spine Switch 1 and Spine Switch 2 are in autonomous system AS65001. Leaf Switch 1 and Leaf Switch 2 are in autonomous system AS65002. Spine Switch 1 and Spine Switch 2 are BGP route servers and are not route reflector clients to each other. Multicast Source Discovery Protocol (MSDP) is configured between Spine Switch 1 and Spine Switch 2 for source synchronization. Protocol Independent Multicast (PIM) is enabled on the interfaces that connect leaf switches and spine switches. Static RP is configured in the network and the underlay network uses multicast forwarding mechanism to forward BUM traffic.

Note

- You must run the **neighbor** *ip-address* **allowas-in** command in the L2VPN EVPN address family configuration mode on the leaf switches to allow processing of BGP updates that have a different autonomous system number.
- You must manually run the **no bgp default route-target filter** command in router configuration mode on the spine switches.
- You must configure eBGP multihop on the leaf and spine switches for the fabric to function.

The following tables provide sample configurations for the devices in the topology above.

Table 3: Configuring Spine Switch 1 and Spine Switch 2 using eBGP when the Spine Switches are in one Autonomous System and the Leaf Switches are in a Different Autonomous System

Spine Switch 1	Spine Switch 2
Spine-01# **show running-config** hostname Spine-01 ! ip routing ! ip multicast-routing ! interface Loopback0 ip address 172.16.255.1 255.255.255.255 ip ospf 1 area 0 ! interface Loopback1 ip address 172.16.254.1 255.255.255.255 ip ospf 1 area 0 ! interface Loopback2 ip address 172.16.255.255 255.255.255.255 ip pim sparse-mode ip ospf 1 area 0 ! interface GigabitEthernet1/0/1 no switchport ip address 172.16.13.1 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! interface GigabitEthernet1/0/2 no switchport ip address 172.16.14.1 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! router ospf 1 router-id 172.16.255.1 ! router bgp 65001 bgp router-id 172.16.255.1 bgp log-neighbor-changes no bgp default ipv4-unicast no bgp default route-target filter neighbor 172.16.255.3 remote-as 65002 neighbor 172.16.255.3 ebgp-multihop 255 neighbor 172.16.255.3 update-source Loopback0 neighbor 172.16.255.4 remote-as 65002 neighbor 172.16.255.4 ebgp-multihop 255 neighbor 172.16.255.4 update-source Loopback0 ! address-family ipv4 exit-address-family !	Spine-02# **show running-config** hostname Spine-02 ! ip routing ! ip multicast-routing ! interface Loopback0 ip address 172.16.255.2 255.255.255.255 ip ospf 1 area 0 ! interface Loopback1 ip address 172.16.254.2 255.255.255.255 ip ospf 1 area 0 ! interface Loopback2 ip address 172.16.255.255 255.255.255.255 ip pim sparse-mode ip ospf 1 area 0 ! interface GigabitEthernet1/0/1 no switchport ip address 172.16.23.2 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! interface GigabitEthernet1/0/2 no switchport ip address 172.16.24.2 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! router ospf 1 router-id 172.16.255.2 ! router bgp 65001 bgp router-id 172.16.255.2 bgp log-neighbor-changes no bgp default ipv4-unicast no bgp default route-target filter neighbor 172.16.255.3 remote-as 65002 neighbor 172.16.255.3 ebgp-multihop 255 neighbor 172.16.255.3 update-source Loopback0 neighbor 172.16.255.4 remote-as 65002 neighbor 172.16.255.4 ebgp-multihop 255 neighbor 172.16.255.4 update-source Loopback0 ! address-family ipv4 exit-address-family !

Spine Switch 1	Spine Switch 2
address-family l2vpn evpn neighbor 172.16.255.3 activate neighbor 172.16.255.3 send-community extended neighbor 172.16.255.3 route-map BGP-NHU out neighbor 172.16.255.4 activate neighbor 172.16.255.4 send-community both neighbor 172.16.255.4 route-map BGP-NHU out exit-address-family ! ip pim rp-address 172.16.255.255 ip msdp peer 172.16.254.2 connect-source Loopback1 remote-as 65001 ip msdp cache-sa-state ! route-map BGP-NHU permit 10 set ip next-hop unchanged ! end Spine-01#	address-family l2vpn evpn neighbor 172.16.255.3 activate neighbor 172.16.255.3 send-community both neighbor 172.16.255.3 route-map BGP-NHU out neighbor 172.16.255.4 activate neighbor 172.16.255.4 send-community both neighbor 172.16.255.4 route-map BGP-NHU out exit-address-family ! ip pim rp-address 172.16.255.255 ip msdp peer 172.16.254.1 connect-source Loopback1 remote-as 65001 ip msdp cache-sa-state ! route-map BGP-NHU permit 10 set ip next-hop unchanged ! end Spine-02#

Table 4: Configuring Leaf Switch 1 and Leaf Switch 2 using eBGP when the Spine Switches are in one Autonomous System and the Leaf Switches are in a Different Autonomous System

Leaf Switch 1	Leaf Switch 2
Leaf-01# **show running-config** hostname Leaf-01 ! vrf definition green rd 1:1 ! address-family ipv4 route-target export 1:1 route-target import 1:1 route-target export 1:1 stitching route-target import 1:1 stitching exit-address-family ! address-family ipv6 route-target export 1:1 route-target import 1:1 route-target export 1:1 stitching route-target import 1:1 stitching exit-address-family ! ip routing ! ip multicast-routing ! l2vpn evpn replication-type static router-id Loopback1 default-gateway advertise ! l2vpn evpn instance 101 vlan-based encapsulation vxlan replication-type static ! l2vpn evpn instance 102 vlan-based encapsulation vxlan replication-type ingress ! vlan configuration 101 member evpn-instance 101 vni 10101 vlan configuration 102 member evpn-instance 102 vni 10102 vlan configuration 901 member vni 50901 ! interface Loopback0 ip address 172.16.255.3 255.255.255.255 ip ospf 1 area 0 ! interface Loopback1 ip address 172.16.254.3 255.255.255.255 ip pim sparse-mode ip ospf 1 area 0 ! interface GigabitEthernet1/0/1 no switchport ip address 172.16.13.3 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0	Leaf-02# **show running-config** hostname Leaf-02 ! vrf definition green rd 1:1 ! address-family ipv4 route-target export 1:1 route-target import 1:1 route-target export 1:1 stitching route-target import 1:1 stitching exit-address-family ! address-family ipv6 route-target export 1:1 route-target import 1:1 route-target export 1:1 stitching route-target import 1:1 stitching exit-address-family ! ip routing ! ip multicast-routing ! l2vpn evpn replication-type static router-id Loopback1 default-gateway advertise ! l2vpn evpn instance 101 vlan-based encapsulation vxlan ! l2vpn evpn instance 102 vlan-based encapsulation vxlan replication-type ingress ! vlan configuration 101 member evpn-instance 101 vni 10101 vlan configuration 102 member evpn-instance 102 vni 10102 vlan configuration 901 member vni 50901 ! interface Loopback0 ip address 172.16.255.4 255.255.255.255 ip ospf 1 area 0 ! interface Loopback1 ip address 172.16.254.4 255.255.255.255 ip pim sparse-mode ip ospf 1 area 0 ! interface GigabitEthernet1/0/1 no switchport ip address 172.16.14.4 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 !

Leaf Switch 1	Leaf Switch 2
interface GigabitEthernet1/0/2 no switchport ip address 172.16.23.3 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! interface GigabitEthernet1/0/10 switchport mode trunk ! interface Vlan101 vrf forwarding green ip address 10.1.101.1 255.255.255.0 ! interface Vlan102 vrf forwarding green ip address 10.1.102.1 255.255.255.0 ! interface Vlan901 vrf forwarding green ip unnumbered Loopback1 ipv6 enable no autostate ! interface nve1 no ip address source-interface Loopback1 host-reachability protocol bgp member vni 10101 mcast-group 225.0.0.101 member vni 10102 ingress-replication member vni 50901 vrf green ! router ospf 1 router-id 172.16.255.3 ! router bgp 65002 bgp log-neighbor-changes no bgp default ipv4-unicast neighbor 172.16.255.1 remote-as 65001 neighbor 172.16.255.1 ebgp-multihop 255 neighbor 172.16.255.1 update-source Loopback0 neighbor 172.16.255.2 remote-as 65001 neighbor 172.16.255.2 ebgp-multihop 255 neighbor 172.16.255.2 update-source Loopback0 ! address-family ipv4 exit-address-family ! address-family l2vpn evpn neighbor 172.16.255.1 activate neighbor 172.16.255.1 send-community both neighbor 172.16.255.1 allowas-in neighbor 172.16.255.2 activate neighbor 172.16.255.2 send-community both neighbor 172.16.255.2 allowas-in exit-address-family ! address-family ipv4 vrf green advertise l2vpn evpn redistribute connected redistribute static exit-address-family	interface GigabitEthernet1/0/2 no switchport ip address 172.16.24.4 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! interface GigabitEthernet1/0/10 switchport mode trunk ! interface Vlan101 vrf forwarding green ip address 10.1.101.1 255.255.255.0 ! interface Vlan102 vrf forwarding green ip address 10.1.102.1 255.255.255.0 ! interface Vlan901 vrf forwarding green ip unnumbered Loopback1 ipv6 enable no autostate ! interface nve1 no ip address source-interface Loopback1 host-reachability protocol bgp member vni 10101 mcast-group 225.0.0.101 member vni 50901 vrf green member vni 10102 ingress-replication ! router ospf 1 router-id 172.16.255.4 ! router bgp 65002 bgp log-neighbor-changes no bgp default ipv4-unicast neighbor 172.16.255.1 remote-as 65001 neighbor 172.16.255.1 ebgp-multihop 255 neighbor 172.16.255.1 update-source Loopback0 neighbor 172.16.255.2 remote-as 65001 neighbor 172.16.255.2 ebgp-multihop 255 neighbor 172.16.255.2 update-source Loopback0 ! address-family ipv4 exit-address-family ! address-family l2vpn evpn neighbor 172.16.255.1 activate neighbor 172.16.255.1 send-community both neighbor 172.16.255.1 allowas-in neighbor 172.16.255.2 activate neighbor 172.16.255.2 send-community both neighbor 172.16.255.2 allowas-in exit-address-family ! address-family ipv4 vrf green advertise l2vpn evpn redistribute connected redistribute static exit-address-family

Leaf Switch 1	Leaf Switch 2
!	!
address-family ipv6 vrf green	address-family ipv6 vrf green
redistribute connected	redistribute connected
redistribute static	redistribute static
advertise l2vpn evpn	advertise l2vpn evpn
exit-address-family	exit-address-family
!	!
ip pim rp-address 172.16.255.255	ip pim rp-address 172.16.255.255
!	!
end	end
Leaf-01#	Leaf-02#

The following examples provide sample outputs for **show** commands on the devices in the topology configured in the preceding tables:

Spine Switch 1

The following example shows the output for the **show ip ospf neighbor** command on spine switch 1:

```
Spine-01# show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
172.16.255.4      0   FULL/  -        00:00:33    172.16.14.4     GigabitEthernet1/0/2
172.16.255.3      0   FULL/  -        00:00:34    172.16.13.3     GigabitEthernet1/0/1
```

The following example shows the output for the **show bgp l2vpn evpn summary** command on spine switch 1:

```
Spine-01# show bgp l2vpn evpn summary
BGP router identifier 172.16.255.1, local AS number 65001
BGP table version is 75, main routing table version 75
18 network entries using 6192 bytes of memory
38 path entries using 7904 bytes of memory
27/13 BGP path/bestpath attribute entries using 7776 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
12 BGP extended community entries using 640 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 22536 total bytes of memory
BGP activity 18/0 prefixes, 76/38 paths, scan interval 60 secs
18 networks peaked at 20:34:25 May 27 2020 UTC (5d18h ago)

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
172.16.255.3    4        65002    8446    8456       75    0    0 5d07h           9
172.16.255.4    4        65002    8446    8447       75    0    0 5d07h          11
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on spine switch 1 for route type 2 and the IP address of host device 2:

```
Spine-01# show bgp l2vpn evpn route-type 2 0 44d3ca286cc1 10.1.101.12
BGP routing table entry for [2][172.16.254.4:101][0][48][44D3CA286CC1][32][10.1.101.12]/24,
 version 72
Paths: (2 available, best #1, table EVPN-BGP-Table)
  Advertised to update-groups:
     4          5
```

```
  Refresh Epoch 2
  65002
    172.16.254.4 (metric 2) (via default) from 172.16.255.4 (172.16.255.4)
      Origin incomplete, metric 0, localpref 100, valid, external, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F789AD67240, path: 0x7F789AD76820, pathext: 0x7F789AD88298
      flags: net: 0x0, path: 0x3, pathext: 0x81
      Updated on May 28 2020 07:29:30 UTC
  Refresh Epoch 1
  65002
    172.16.254.4 (metric 2) (via default) from 172.16.255.2 (172.16.255.2)
      Origin incomplete, metric 0, localpref 100, valid, internal
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      rx pathid: 0, tx pathid: 0
      net: 0x7F789AD67240, path: 0x7F789AD76EE0, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on May 28 2020 07:27:54 UTC
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on spine switch 1 for route type 2 and the IP address of host device 2:

```
Spine-01# show bgp l2vpn evpn route-type 2 0 f4cfe24334c1 10.1.101.11
BGP routing table entry for [2][172.16.254.3:101][0][48][F4CFE24334C1][32][10.1.101.11]/24,
 version 40
Paths: (2 available, best #2, table EVPN-BGP-Table)
  Advertised to update-groups:
     4          5
  Refresh Epoch 1
  65002
    172.16.254.3 (metric 2) (via default) from 172.16.255.2 (172.16.255.2)
      Origin incomplete, metric 0, localpref 100, valid, internal
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      rx pathid: 0, tx pathid: 0
      net: 0x7F789AD67EA0, path: 0x7F789AD77678, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on May 28 2020 07:29:03 UTC
  Refresh Epoch 1
  65002
    172.16.254.3 (metric 2) (via default) from 172.16.255.3 (172.16.255.3)
      Origin incomplete, metric 0, localpref 100, valid, external, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F789AD67EA0, path: 0x7F789AD77FC0, pathext: 0x7F789AD88598
      flags: net: 0x0, path: 0x3, pathext: 0x81
      Updated on May 28 2020 07:27:47 UTC
```

The following example shows the output for the **show ip pim neighbor** command on spine switch 1:

```
Spine-01# 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
172.16.13.3       GigabitEthernet1/0/1    5d19h/00:01:44    v2    1 / DR S P G
172.16.14.4       GigabitEthernet1/0/2    5d19h/00:01:36    v2    1 / DR S P G
```

The following example shows the output for the **show ip pim rp mapping** command on spine switch 1:

```
Spine-01# show ip pim rp mapping
PIM Group-to-RP Mappings

Group(s): 224.0.0.0/4, Static
    RP: 172.16.255.255 (?)
```

The following example shows the output for the **show ip ro** command on spine switch 1:

```
Spine-01# show ip ro 172.16.255.255
Routing entry for 172.16.255.255/32
  Known via "connected", distance 0, metric 0 (connected, via interface)
  Routing Descriptor Blocks:
  * directly connected, via Loopback2
      Route metric is 0, traffic share count is 1
```

The following example shows the output for the **show ip msdp summary** command on spine switch 1:

```
Spine-01# show ip msdp summary
MSDP Peer Status Summary
Peer Address     AS    State    Uptime/  Reset SA    Peer Name
                                Downtime Count Count
172.16.254.2     65001 Up       5d19h    0     2     ?
```

The following example shows the output for the **show ip msdp sa-cache** command on spine switch 1:

```
Spine-01# show ip msdp sa-cache
MSDP Source-Active Cache - 2 entries
(172.16.254.3, 225.0.0.101), RP 172.16.255.255, BGP/AS 0, 00:04:01/00:05:23, Peer 172.16.254.2
(172.16.254.4, 225.0.0.101), RP 172.16.255.255, BGP/AS 0, 00:03:39/00:05:26, Peer 172.16.254.2
```

The following example shows the output for the **show ip mroute** command on spine switch 1:

```
Spine-01# show  ip mroute 225.0.0.101
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
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 225.0.0.101), 00:04:02/stopped, RP 172.16.255.255, flags: SP
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list: Null

(172.16.254.4, 225.0.0.101), 00:00:34/00:02:25, flags: PA
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.14.4
  Outgoing interface list: Null

(172.16.254.3, 225.0.0.101), 00:00:46/00:02:13, flags: PA
  Incoming interface: GigabitEthernet1/0/1, RPF nbr 172.16.13.3
  Outgoing interface list: Null
```

Spine Switch 2

The following example shows the output for the **show ip ospf neighbor** command on spine switch 2:

```
Spine-02# show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
172.16.255.4      0   FULL/  -        00:00:37    172.16.24.4     GigabitEthernet1/0/2
172.16.255.3      0   FULL/  -        00:00:32    172.16.23.3     GigabitEthernet1/0/1
```

The following example shows the output for the **show bgp l2vpn evpn summary** command on spine switch 2:

```
Spine-02# show bgp l2vpn evpn summary
BGP router identifier 172.16.255.2, local AS number 65001
BGP table version is 91, main routing table version 91
18 network entries using 6192 bytes of memory
38 path entries using 7904 bytes of memory
27/13 BGP path/bestpath attribute entries using 7776 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
12 BGP extended community entries using 640 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 22536 total bytes of memory
BGP activity 20/2 prefixes, 76/38 paths, scan interval 60 secs
18 networks peaked at 20:36:02 May 27 2020 UTC (5d18h ago)

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
172.16.255.3    4        65002    8443    8442       91    0    0 5d07h           9
172.16.255.4    4        65002    8442    8446       91    0    0 5d07h          11
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on spine switch 2 for host device 1:

```
Spine-02# bgp l2vpn evpn route-type 2 0 44d3ca286cc1 10.1.101.12
BGP routing table entry for [2][172.16.254.4:101][0][48][44D3CA286CC1][32][10.1.101.12]/24,
 version 74
Paths: (2 available, best #2, table EVPN-BGP-Table)
```

```
  Advertised to update-groups:
     3          4
  Refresh Epoch 1
  65002
    172.16.254.4 (metric 2) (via default) from 172.16.255.1 (172.16.255.1)
      Origin incomplete, metric 0, localpref 100, valid, internal
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      rx pathid: 0, tx pathid: 0
      net: 0x7FB64B5D07C0, path: 0x7FB64B5DFA08, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on May 28 2020 07:30:01 UTC
  Refresh Epoch 1
  65002
    172.16.254.4 (metric 2) (via default) from 172.16.255.4 (172.16.255.4)
      Origin incomplete, metric 0, localpref 100, valid, external, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      rx pathid: 0, tx pathid: 0x0
      net: 0x7FB64B5D07C0, path: 0x7FB64B5E01A0, pathext: 0x7FB64B5F1498
      flags: net: 0x0, path: 0x3, pathext: 0x81
      Updated on May 28 2020 07:28:25 UTC
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on spine switch 2 for host device 2:

```
Spine-02# show bgp l2vpn evpn route-type 2 0 f4cfe24334c1 10.1.101.11
BGP routing table entry for [2][172.16.254.3:101][0][48][F4CFE24334C1][32][10.1.101.11]/24,
 version 88
Paths: (2 available, best #1, table EVPN-BGP-Table)
  Advertised to update-groups:
     3          4
  Refresh Epoch 2
  65002
    172.16.254.3 (metric 2) (via default) from 172.16.255.3 (172.16.255.3)
      Origin incomplete, metric 0, localpref 100, valid, external, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      rx pathid: 0, tx pathid: 0x0
      net: 0x7FB64B5D1580, path: 0x7FB64B5E0D70, pathext: 0x7FB64B5F19D8
      flags: net: 0x0, path: 0x3, pathext: 0x81
      Updated on May 28 2020 07:29:33 UTC
  Refresh Epoch 1
  65002
    172.16.254.3 (metric 2) (via default) from 172.16.255.1 (172.16.255.1)
      Origin incomplete, metric 0, localpref 100, valid, internal
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      rx pathid: 0, tx pathid: 0
      net: 0x7FB64B5D1580, path: 0x7FB64B5E0AE8, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on May 28 2020 07:28:18 UTC
```

The following example shows the output for the **show ip pim neighbor** command on spine switch 2:

```
Spine-02# 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
172.16.23.3       GigabitEthernet1/0/1     5d19h/00:01:33    v2    1 / DR S P G
172.16.24.4       GigabitEthernet1/0/2     5d19h/00:01:18    v2    1 / DR S P G
```

The following example shows the output for the **show ip pim rp mapping** command on spine switch 2:

```
Spine-02# show ip pim rp mapping
PIM Group-to-RP Mappings

Group(s): 224.0.0.0/4, Static
    RP: 172.16.255.255 (?)
```

The following example shows the output for the **show ip ro** command on spine switch 2:

```
Spine-02# show ip ro 172.16.255.255
Routing entry for 172.16.255.255/32
  Known via "connected", distance 0, metric 0 (connected, via interface)
  Routing Descriptor Blocks:
  * directly connected, via Loopback2
      Route metric is 0, traffic share count is 1
```

The following example shows the output for the **show ip msdp summary** command on spine switch 2:

```
Spine-02# show ip msdp summary
MSDP Peer Status Summary
Peer Address     AS    State    Uptime/  Reset SA    Peer Name
                                Downtime Count Count
172.16.254.1     65001 Up       5d19h    0     2     ?
```

The following example shows the output for the **show ip msdp sa-cache** command on spine switch 2:

```
Spine-02# show ip msdp sa-cache
MSDP Source-Active Cache - 2 entries
(172.16.254.3, 225.0.0.101), RP 172.16.255.255, BGP/AS 0, 00:04:07/00:05:17, Peer 172.16.254.1
(172.16.254.4, 225.0.0.101), RP 172.16.255.255, BGP/AS 0, 00:03:45/00:05:20, Peer 172.16.254.1
```

The following example shows the output for the **show ip mroute** command on spine switch 2:

```
Spine-02# show ip mroute 225.0.0.101
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
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 225.0.0.101), 5d19h/00:03:21, RP 172.16.255.255, flags: S
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    GigabitEthernet1/0/2, Forward/Sparse, 5d19h/00:03:15
    GigabitEthernet1/0/1, Forward/Sparse, 5d19h/00:03:21

(172.16.254.4, 225.0.0.101), 00:00:40/00:02:19, flags: A
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.24.4
  Outgoing interface list:
    GigabitEthernet1/0/1, Forward/Sparse, 00:00:40/00:03:21

(172.16.254.3, 225.0.0.101), 00:00:52/00:02:07, flags: A
  Incoming interface: GigabitEthernet1/0/1, RPF nbr 172.16.23.3
  Outgoing interface list:
    GigabitEthernet1/0/2, Forward/Sparse, 00:00:52/00:03:15
```

Leaf Switch 1

The following example shows the output for the **show ip ospf neighbor** command on leaf switch 1:

```
Leaf-01# show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
172.16.255.2      0   FULL/  -        00:00:38    172.16.23.2     GigabitEthernet1/0/2
172.16.255.1      0   FULL/  -        00:00:32    172.16.13.1     GigabitEthernet1/0/1
```

The following example shows the output for the **show bgp l2vpn evpn summary** command on leaf switch 1:

```
Leaf-01# show bgp l2vpn evpn summary
BGP router identifier 172.16.255.3, local AS number 65002
BGP table version is 32, main routing table version 32
27 network entries using 9288 bytes of memory
38 path entries using 7904 bytes of memory
16/15 BGP path/bestpath attribute entries using 4608 bytes of memory
1 BGP AS-PATH entries using 40 bytes of memory
13 BGP extended community entries using 664 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 22504 total bytes of memory
BGP activity 395/362 prefixes, 918/872 paths, scan interval 60 secs
27 networks peaked at 13:15:47 May 26 2020 UTC (1w0d ago)

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
172.16.255.1    4        65001    8457    8446       32    0    0 5d07h           9
172.16.255.2    4        65001    8443    8444       32    0    0 5d07h          11
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on leaf switch 1 for route type 2 and the IP address of host device 2:

```
Leaf-01# show bgp l2vpn evpn route-type 2 0 44d3ca286cc1 10.1.101.12
BGP routing table entry for [2][172.16.254.3:101][0][48][44D3CA286CC1][32][10.1.101.12]/24,
 version 22
```

```
Paths: (1 available, best #1, table evi_101)
  Not advertised to any peer
  Refresh Epoch 1
  65001 65002, imported path from
[2][172.16.254.4:101][0][48][44D3CA286CC1][32][10.1.101.12]/24 (global)
    172.16.254.4 (metric 3) (via default) from 172.16.255.1 (172.16.255.1)
      Origin incomplete, localpref 100, valid, external, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F575E47B150, path: 0x7F575E1EF800, pathext: 0x7F575E201C08, exp_net:
0x7F575E479470
      flags: net: 0x0, path: 0x4000000000003, pathext: 0x81
      Updated on May 28 2020 07:25:32 UTC
BGP routing table entry for [2][172.16.254.4:101][0][48][44D3CA286CC1][32][10.1.101.12]/24,
 version 10
Paths: (2 available, best #2, table EVPN-BGP-Table)
  Advertised to update-groups:
     19
  Refresh Epoch 2
  65001 65002
    172.16.254.4 (metric 3) (via default) from 172.16.255.2 (172.16.255.2)
      Origin incomplete, localpref 100, valid, external
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      rx pathid: 0, tx pathid: 0
      net: 0x7F575E479470, path: 0x7F575E1EFD10, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on May 28 2020 07:26:48 UTC
  Refresh Epoch 1
  65001 65002
    172.16.254.4 (metric 3) (via default) from 172.16.255.1 (172.16.255.1)
      Origin incomplete, localpref 100, valid, external, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on leaf switch 1 for route type 2 and the IP address of host device 1:

```
Leaf-01# show bgp l2vpn evpn route-type 2 0 f4cfe24334c1 10.1.101.11
BGP routing table entry for [2][172.16.254.3:101][0][48][F4CFE24334C1][32][10.1.101.11]/24,
 version 4
Paths: (1 available, best #1, table evi_101)
  Advertised to update-groups:
     19
  Refresh Epoch 1
  Local
    :: (via default) from 0.0.0.0 (172.16.255.3)
      Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      Local irb vxlan vtep:
        vrf:green, l3-vni:50901
        local router mac:10B3.D56A.8FC8
        core-irb interface:Vlan901
        vtep-ip:172.16.254.3
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F575E479B50, path: 0x7F575E1F0580, pathext: 0x7F575E201CC8
```

```
      flags: net: 0x0, path: 0x4000028000003, pathext: 0x81
      Updated on May 28 2020 07:25:30 UTC
```

The following example shows the output for the **show ip pim neighbor** command on leaf switch 1:

```
Leaf-01# 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
172.16.13.1       GigabitEthernet1/0/1    5d19h/00:01:38    v2    1 / S P G
172.16.23.2       GigabitEthernet1/0/2    5d19h/00:01:17    v2    1 / S P G
```

The following example shows the output for the **show ip pim rp mapping** command on leaf switch 1:

```
Leaf-01# show ip pim rp mapping
PIM Group-to-RP Mappings

Group(s): 224.0.0.0/4, Static
    RP: 172.16.255.255 (?)
```

The following example shows the output for the **show ip ro** command on leaf switch 1:

```
Leaf-01# show ip ro 172.16.255.255Routing entry for 172.16.255.255/32
  Known via "ospf 1", distance 110, metric 2, type intra area
  Last update from 172.16.23.2 on GigabitEthernet1/0/2, 5d19h ago
  Routing Descriptor Blocks:
    172.16.23.2, from 172.16.255.2, 5d19h ago, via GigabitEthernet1/0/2
      Route metric is 2, traffic share count is 1
  * 172.16.13.1, from 172.16.255.1, 5d19h ago, via GigabitEthernet1/0/1
      Route metric is 2, traffic share count is 1
```

The following example shows the output for the **show ip rpf** command on leaf switch 1:

```
Leaf-01# show ip rpf 172.16.255.255
RPF information for ? (172.16.255.255)
  RPF interface: GigabitEthernet1/0/2
  RPF neighbor: ? (172.16.23.2)
  RPF route/mask: 172.16.255.255/32
  RPF type: unicast (ospf 1)
  Doing distance-preferred lookups across tables
  RPF topology: ipv4 multicast base, originated from ipv4 unicast base
```

The following example shows the output for the **show ip mroute** command on leaf switch 1:

```
Leaf-01# show ip mroute 225.0.0.101
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
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 225.0.0.101), 7w4d/stopped, RP 172.16.255.255, flags: SJCFx
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.23.2
  Outgoing interface list:
    Tunnel0, Forward/Sparse-Dense, 1w0d/00:00:40

(172.16.254.4, 225.0.0.101), 00:01:22/00:01:37, flags: JTx
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.23.2
  Outgoing interface list:
    Tunnel0, Forward/Sparse-Dense, 00:01:22/00:01:37

(172.16.254.3, 225.0.0.101), 00:01:35/00:01:24, flags: FTx
  Incoming interface: Loopback1, RPF nbr 0.0.0.0
  Outgoing interface list:
    GigabitEthernet1/0/2, Forward/Sparse, 00:01:35/00:02:53
```

Leaf Switch 2

The following example shows the output for the **show ip ospf neighbor** command on leaf switch 2:

```
Leaf-02# show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
172.16.255.2      0   FULL/  -        00:00:34    172.16.24.2     GigabitEthernet1/0/2
172.16.255.1      0   FULL/  -        00:00:31    172.16.14.1     GigabitEthernet1/0/1
```

The following example shows the output for the **show bgp l2vpn evpn summary** command on leaf switch 2:

```
Leaf-02# show bgp l2vpn evpn summary
BGP router identifier 172.16.255.4, local AS number 65002
BGP table version is 28, main routing table version 28
25 network entries using 8600 bytes of memory
34 path entries using 7072 bytes of memory
16/15 BGP path/bestpath attribute entries using 4608 bytes of memory
1 BGP AS-PATH entries using 40 bytes of memory
13 BGP extended community entries using 664 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 20984 total bytes of memory
BGP activity 199/168 prefixes, 638/596 paths, scan interval 60 secs
25 networks peaked at 13:20:44 May 26 2020 UTC (1w0d ago)

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
172.16.255.1    4        65001    8449    8447       28    0    0 5d07h           9
172.16.255.2    4        65001    8448    8443       28    0    0 5d07h           7
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on leaf switch 2 for route type 2 and the IP address of host device 1:

```
Leaf-02# show bgp l2vpn evpn route-type 2 0 f4cfe24334c1 10.1.101.11
BGP routing table entry for [2][172.16.254.3:101][0][48][F4CFE24334C1][32][10.1.101.11]/24,
 version 4
```

```
Paths: (2 available, best #2, table EVPN-BGP-Table)
  Advertised to update-groups:
     7
  Refresh Epoch 2
  65001 65002
    172.16.254.3 (metric 3) (via default) from 172.16.255.1 (172.16.255.1)
      Origin incomplete, localpref 100, valid, external
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      rx pathid: 0, tx pathid: 0
      net: 0x7F84BB3C4290, path: 0x7F84BB49BF98, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on May 28 2020 07:31:42 UTC
  Refresh Epoch 1
  65001 65002
    172.16.254.3 (metric 3) (via default) from 172.16.255.2 (172.16.255.2)
      Origin incomplete, localpref 100, valid, external, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F84BB3C4290, path: 0x7F84BB49D9C0, pathext: 0x7F84BB594138
      flags: net: 0x0, path: 0x3, pathext: 0x81
      Updated on May 28 2020 07:31:37 UTC
BGP routing table entry for [2][172.16.254.4:101][0][48][F4CFE24334C1][32][10.1.101.11]/24,
 version 20
Paths: (1 available, best #1, table evi_101)
  Not advertised to any peer
  Refresh Epoch 1
  65001 65002, imported path from
[2][172.16.254.3:101][0][48][F4CFE24334C1][32][10.1.101.11]/24 (global)
    172.16.254.3 (metric 3) (via default) from 172.16.255.2 (172.16.255.2)
      Origin incomplete, localpref 100, valid, external, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on leaf switch 2 for route type 2 and the IP address of host device 2:

```
Leaf-02# show bgp l2vpn evpn route-type 2 0 44d3ca286cc1 10.1.101.12
BGP routing table entry for [2][172.16.254.4:101][0][48][44D3CA286CC1][32][10.1.101.12]/24,
 version 10
Paths: (1 available, best #1, table evi_101)
  Advertised to update-groups:
     7
  Refresh Epoch 1
  Local
    :: (via default) from 0.0.0.0 (172.16.255.4)
      Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      Local irb vxlan vtep:
        vrf:green, l3-vni:50901
        local router mac:7C21.0DBD.9548
        core-irb interface:Vlan901
        vtep-ip:172.16.254.4
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F84BB3C4970, path: 0x7F84BB49CDF0, pathext: 0x7F84BB593CB8
      flags: net: 0x0, path: 0x4000028000003, pathext: 0x81
      Updated on May 28 2020 07:30:04 UTC
```

The following example shows the output for the **show ip pim neighbor** command on leaf switch 2:

```
Leaf-02# 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
172.16.14.1       GigabitEthernet1/0/1     5d19h/00:01:22    v2    1 / S P G
172.16.24.2       GigabitEthernet1/0/2     5d19h/00:01:27    v2    1 / S P G
```

The following example shows the output for the command on leaf switch 2:

```
Leaf-02# show ip pim rp mapping
PIM Group-to-RP Mappings

Group(s): 224.0.0.0/4, Static
    RP: 172.16.255.255 (?)
```

The following example shows the output for the **show ip ro** command on leaf switch 2:

```
Leaf-02# show ip ro 172.16.255.255
Routing entry for 172.16.255.255/32
  Known via "ospf 1", distance 110, metric 2, type intra area
  Last update from 172.16.24.2 on GigabitEthernet1/0/2, 5d19h ago
  Routing Descriptor Blocks:
    172.16.24.2, from 172.16.255.2, 5d19h ago, via GigabitEthernet1/0/2
      Route metric is 2, traffic share count is 1
  * 172.16.14.1, from 172.16.255.1, 5d19h ago, via GigabitEthernet1/0/1
      Route metric is 2, traffic share count is 1
```

The following example shows the output for the **show ip rpf** command on leaf switch 2:

```
Leaf-02# show ip rpf 172.16.255.255
RPF information for ? (172.16.255.255)
  RPF interface: GigabitEthernet1/0/2
  RPF neighbor: ? (172.16.24.2)
  RPF route/mask: 172.16.255.255/32
  RPF type: unicast (ospf 1)
  Doing distance-preferred lookups across tables
  RPF topology: ipv4 multicast base, originated from ipv4 unicast base
```

The following example shows the output for the **show ip mroute** command on leaf switch 2:

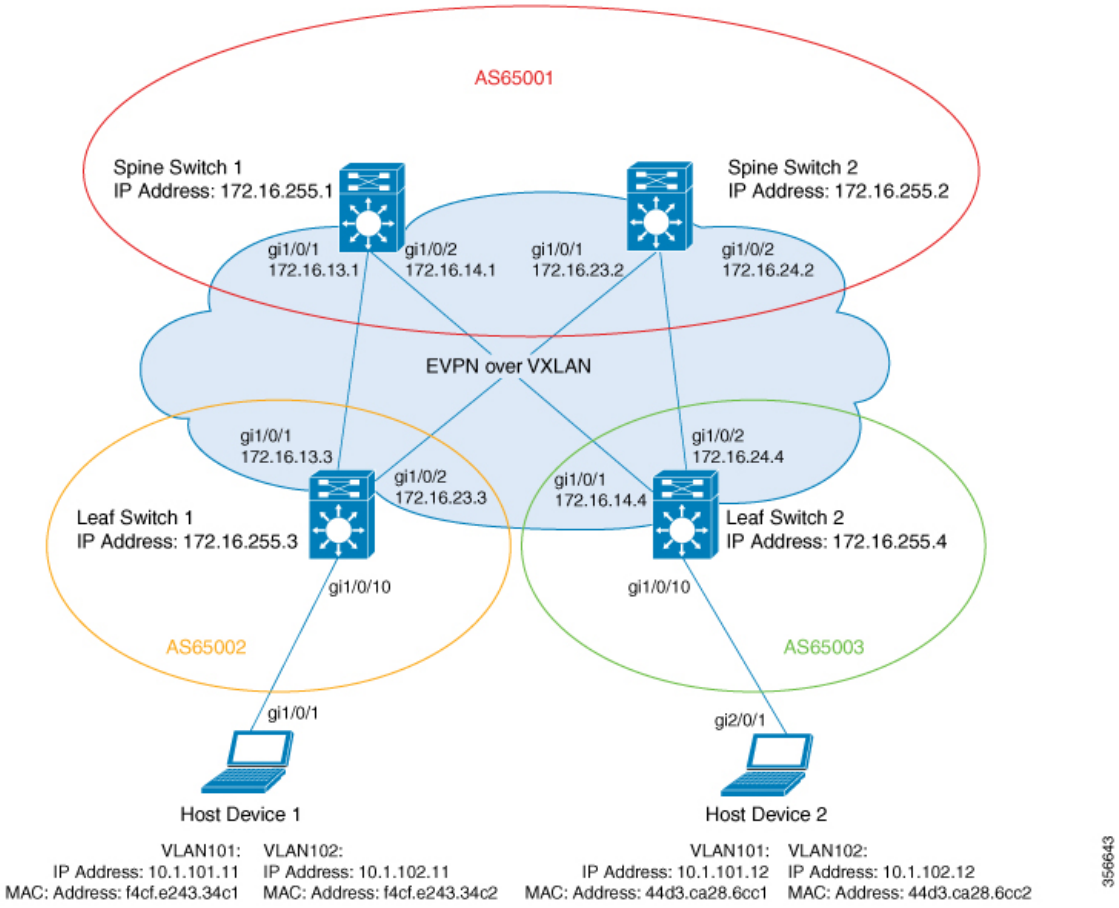
```
Leaf-02# show ip mroute 225.0.0.101
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy 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
```

```
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 225.0.0.101), 1w5d/stopped, RP 172.16.255.255, flags: SJCFx
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.24.2
  Outgoing interface list:
    Tunnel0, Forward/Sparse-Dense, 1w5d/00:00:06

(172.16.254.4, 225.0.0.101), 00:01:56/00:01:03, flags: FTx
  Incoming interface: Loopback1, RPF nbr 0.0.0.0
  Outgoing interface list:
    GigabitEthernet1/0/2, Forward/Sparse, 00:01:56/00:02:32

(172.16.254.3, 225.0.0.101), 00:02:09/00:00:50, flags: JTx
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.24.2
  Outgoing interface list:
    Tunnel0, Forward/Sparse-Dense, 00:02:09/00:00:50
```

Configuration Example-Each Leaf Switch in a Different Autonomous System

This section provides an example to show how spine switches are configured in a BGP EVPN VXLAN fabric using eBGP when the spine switches are in one autonomous system and each leaf switch is in a different autonomous system. The example shows how to configure spine switches and verify the configuration for the topology shown below:

Figure 3: BGP EVPN VXLAN Fabric with the Spine Switches in one Autonomous System and each Leaf Switch in a Different Autonomous System



The topology shows an EVPN VXLAN network with two leaf switches (Leaf Switch 1 and Leaf Switch 2) and two spine switches (Spine Switch 1 and Spine Switch 2). Spine Switch 1 and Spine Switch 2 are in autonomous system AS65001. Leaf Switch 1 is in autonomous system AS65002. Leaf Switch 2 is in autonomous system AS65003. Spine Switch 1 and Spine Switch 2 are BGP route servers and are not route reflector clients to each other. Multicast Source Discovery Protocol (MSDP) is configured between Spine Switch 1 and Spine Switch 2 for source synchronization. Protocol Independent Multicast (PIM) is enabled on the interfaces that connect leaf switches and spine switches. Static RP is configured in the network and the underlay network uses multicast forwarding mechanism to forward BUM traffic.

Note

- You must run the **rewrite-evpn-rt-asn** command in the L2VPN EVPN address family configuration mode on the leaf switches to allow processing of BGP updates that have a different autonomous system number.
- You must manually run the **no bgp default route-target filter** command in router configuration mode on the spine switches.
- You must configure eBGP multihop on the leaf and spine switches for the fabric to function.

The following tables provide sample configurations for the devices in the topology above.

Table 5: Configuring Spine Switch 1 and Spine Switch 2 using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

Spine Switch 1	Spine Switch 2
Spine-01# **show running-config** hostname Spine-01 ! ip routing ! ip multicast-routing ! interface Loopback0 ip address 172.16.255.1 255.255.255.255 ip ospf 1 area 0 ! interface Loopback1 ip address 172.16.254.1 255.255.255.255 ip ospf 1 area 0 ! interface Loopback2 ip address 172.16.255.255 255.255.255.255 ip pim sparse-mode ip ospf 1 area 0 ! interface GigabitEthernet1/0/1 no switchport ip address 172.16.13.1 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! interface GigabitEthernet1/0/2 no switchport ip address 172.16.14.1 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! router ospf 1 router-id 172.16.255.1 ! router bgp 65001 bgp router-id 172.16.255.1 bgp log-neighbor-changes no bgp default ipv4-unicast no bgp default route-target filter neighbor 172.16.255.3 remote-as 65002 neighbor 172.16.255.3 ebgp-multihop 255 neighbor 172.16.255.3 update-source Loopback0 neighbor 172.16.255.4 remote-as 65003 neighbor 172.16.255.4 ebgp-multihop 255 neighbor 172.16.255.4 update-source Loopback0 ! address-family ipv4 exit-address-family !	Spine-02# **show running-config** hostname Spine-02 ! ip routing ! ip multicast-routing ! interface Loopback0 ip address 172.16.255.2 255.255.255.255 ip ospf 1 area 0 ! interface Loopback1 ip address 172.16.254.2 255.255.255.255 ip ospf 1 area 0 ! interface Loopback2 ip address 172.16.255.255 255.255.255.255 ip pim sparse-mode ip ospf 1 area 0 ! interface GigabitEthernet1/0/1 no switchport ip address 172.16.23.2 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! interface GigabitEthernet1/0/2 no switchport ip address 172.16.24.2 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! router ospf 1 router-id 172.16.255.2 ! router bgp 65001 bgp router-id 172.16.255.2 bgp log-neighbor-changes no bgp default ipv4-unicast no bgp default route-target filter neighbor 172.16.255.3 remote-as 65002 neighbor 172.16.255.3 ebgp-multihop 255 neighbor 172.16.255.3 update-source Loopback0 neighbor 172.16.255.4 remote-as 65003 neighbor 172.16.255.4 ebgp-multihop 255 neighbor 172.16.255.4 update-source Loopback0 ! address-family ipv4 exit-address-family !

Spine Switch 1	Spine Switch 2
address-family l2vpn evpn rewrite-evpn-rt-asn neighbor 172.16.255.3 activate neighbor 172.16.255.3 send-community both neighbor 172.16.255.3 route-map BGP-NHU out neighbor 172.16.255.4 activate neighbor 172.16.255.4 send-community both neighbor 172.16.255.4 route-map BGP-NHU out exit-address-family ! ip pim rp-address 172.16.255.255 ip pim ssm default ip msdp peer 172.16.254.2 connect-source Loopback1 remote-as 65001 ip msdp cache-sa-state ! route-map BGP-NHU permit 10 set ip next-hop unchanged ! end Spine-01#	address-family l2vpn evpn rewrite-evpn-rt-asn neighbor 172.16.255.3 activate neighbor 172.16.255.3 send-community both neighbor 172.16.255.3 route-map BGP-NHU out neighbor 172.16.255.4 activate neighbor 172.16.255.4 send-community both neighbor 172.16.255.4 route-map BGP-NHU out exit-address-family ! ip pim rp-address 172.16.255.255 ip pim ssm default ip msdp peer 172.16.254.1 connect-source Loopback1 remote-as 65001 ip msdp cache-sa-state ! route-map BGP-NHU permit 10 set ip next-hop unchanged ! end Spine-02#

Table 6: Configuring Leaf Switch 1 and Leaf Switch 2 using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

Leaf Switch 1	Leaf Switch 2
Leaf-01# **show running-config** hostname Leaf-01 ! vrf definition green rd 1:1 ! address-family ipv4 route-target export 1:1 route-target import 1:1 route-target export 1:1 stitching route-target import 1:1 stitching exit-address-family ! address-family ipv6 route-target export 1:1 route-target import 1:1 route-target export 1:1 stitching route-target import 1:1 stitching exit-address-family ! ip routing ! ip multicast-routing ! l2vpn evpn replication-type static router-id Loopback1 default-gateway advertise ! l2vpn evpn instance 101 vlan-based encapsulation vxlan replication-type static ! l2vpn evpn instance 102 vlan-based encapsulation vxlan replication-type ingress ! vlan configuration 101 member evpn-instance 101 vni 10101 vlan configuration 102 member evpn-instance 102 vni 10102 vlan configuration 901 member vni 50901 ! interface Loopback0 ip address 172.16.255.3 255.255.255.255 ip ospf 1 area 0 ! interface Loopback1 ip address 172.16.254.3 255.255.255.255 ip pim sparse-mode ip ospf 1 area 0 ! interface GigabitEthernet1/0/1 no switchport ip address 172.16.13.3 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0	Leaf-02# **show running-config** hostname Leaf-02 ! vrf definition green rd 1:1 ! address-family ipv4 route-target export 1:1 route-target import 1:1 route-target export 1:1 stitching route-target import 1:1 stitching exit-address-family ! address-family ipv6 route-target export 1:1 route-target import 1:1 route-target export 1:1 stitching route-target import 1:1 stitching exit-address-family ! ip routing ! ip multicast-routing ! l2vpn evpn replication-type static router-id Loopback1 default-gateway advertise ! l2vpn evpn instance 101 vlan-based encapsulation vxlan ! l2vpn evpn instance 102 vlan-based encapsulation vxlan replication-type ingress ! vlan configuration 101 member evpn-instance 101 vni 10101 vlan configuration 102 member evpn-instance 102 vni 10102 vlan configuration 901 member vni 50901 ! interface Loopback0 ip address 172.16.255.4 255.255.255.255 ip ospf 1 area 0 ! interface Loopback1 ip address 172.16.254.4 255.255.255.255 ip pim sparse-mode ip ospf 1 area 0 ! interface GigabitEthernet1/0/1 no switchport ip address 172.16.14.4 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 !

Leaf Switch 1	Leaf Switch 2
interface GigabitEthernet1/0/2 no switchport ip address 172.16.23.3 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! interface Vlan101 vrf forwarding green ip address 10.1.101.1 255.255.255.0 ! interface Vlan102 vrf forwarding green ip address 10.1.102.1 255.255.255.0 ! interface Vlan901 vrf forwarding green ip unnumbered Loopback1 ipv6 enable no autostate ! interface nve1 no ip address source-interface Loopback1 host-reachability protocol bgp member vni 10101 mcast-group 225.0.0.101 member vni 10102 ingress-replication member vni 50901 vrf green ! router ospf 1 router-id 172.16.255.3 ! router bgp 65002 bgp log-neighbor-changes no bgp default ipv4-unicast neighbor 172.16.255.1 remote-as 65001 neighbor 172.16.255.1 ebgp-multihop 255 neighbor 172.16.255.1 update-source Loopback0 neighbor 172.16.255.2 remote-as 65001 neighbor 172.16.255.2 ebgp-multihop 255 neighbor 172.16.255.2 update-source Loopback0 ! address-family ipv4 exit-address-family ! address-family l2vpn evpn rewrite-evpn-rt-asn neighbor 172.16.255.1 activate neighbor 172.16.255.1 send-community both neighbor 172.16.255.2 activate neighbor 172.16.255.2 send-community both exit-address-family ! address-family ipv4 vrf green advertise l2vpn evpn redistribute connected redistribute static exit-address-family !	interface GigabitEthernet1/0/2 no switchport ip address 172.16.24.4 255.255.255.0 ip pim sparse-mode ip ospf network point-to-point ip ospf 1 area 0 ! interface Vlan101 vrf forwarding green ip address 10.1.101.1 255.255.255.0 ! interface Vlan102 vrf forwarding green ip address 10.1.102.1 255.255.255.0 ! interface Vlan901 vrf forwarding green ip unnumbered Loopback1 ipv6 enable no autostate ! interface nve1 no ip address source-interface Loopback1 host-reachability protocol bgp member vni 10101 mcast-group 225.0.0.101 member vni 50901 vrf green member vni 10102 ingress-replication ! router ospf 1 router-id 172.16.255.4 ! router bgp 65003 bgp log-neighbor-changes no bgp default ipv4-unicast neighbor 172.16.255.1 remote-as 65001 neighbor 172.16.255.1 ebgp-multihop 255 neighbor 172.16.255.1 update-source Loopback0 neighbor 172.16.255.2 remote-as 65001 neighbor 172.16.255.2 ebgp-multihop 255 neighbor 172.16.255.2 update-source Loopback0 ! address-family ipv4 exit-address-family ! address-family l2vpn evpn rewrite-evpn-rt-asn neighbor 172.16.255.1 activate neighbor 172.16.255.1 send-community both neighbor 172.16.255.2 activate neighbor 172.16.255.2 send-community both exit-address-family ! address-family ipv4 vrf green advertise l2vpn evpn redistribute connected redistribute static exit-address-family !

Leaf Switch 1	Leaf Switch 2
address-family ipv6 vrf green redistribute connected redistribute static advertise l2vpn evpn exit-address-family ! ip pim rp-address 172.16.255.255 ip pim ssm default ! end Leaf-01#	address-family ipv6 vrf green redistribute connected redistribute static advertise l2vpn evpn exit-address-family ! ip pim rp-address 172.16.255.255 ! end Leaf-02#

The following examples provide sample outputs for **show** commands on the devices in the topology configured in the preceding tables:

Spine Switch 1

The following example shows the output for the **show ip ospf neighbor** command on spine switch 1:

```
Spine-01# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
172.16.255.4      0   FULL/  -        00:00:34    172.16.14.4     GigabitEthernet1/0/2
172.16.255.3      0   FULL/  -        00:00:38    172.16.13.3     GigabitEthernet1/0/1
```

The following example shows the output for the **show bgp l2vpn evpn summary** command on spine switch 1:

```
Spine-01# show bgp l2vpn evpn summary
BGP router identifier 172.16.255.1, local AS number 65001
BGP table version is 19, main routing table version 19
18 network entries using 6192 bytes of memory
38 path entries using 7904 bytes of memory
45/15 BGP path/bestpath attribute entries using 12960 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
24 BGP extended community entries using 1280 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 28384 total bytes of memory
BGP activity 94/76 prefixes, 293/255 paths, scan interval 60 secs
18 networks peaked at 21:10:53 Jun 4 2020 UTC (2d23h ago)

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
172.16.255.3    4        65002      35      27       19    0    0 00:08:54        9
172.16.255.4    4        65003      34      27       19    0    0 00:08:54       11
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on spine switch 1 for route type 2 and the IP address of host device 2:

```
Spine-01# show bgp l2vpn evpn route-type 2 0 44d3ca286cc1 10.1.101.12
BGP routing table entry for [2][172.16.254.4:101][0][48][44D3CA286CC1][32][10.1.101.12]/24,
 version 10
Paths: (2 available, best #2, table EVPN-BGP-Table)
  Advertised to update-groups:
```

```
    11         13
  Refresh Epoch 1
  65003
    172.16.254.4 (metric 2) (via default) from 172.16.255.2 (172.16.255.2)
      Origin incomplete, metric 0, localpref 100, valid, internal
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      rx pathid: 0, tx pathid: 0
      net: 0x7F7898C7FEF0, path: 0x7F7898C8E578, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on Jun 7 2020 20:42:32 UTC
  Refresh Epoch 2
  65003
    172.16.254.4 (metric 2) (via default) from 172.16.255.4 (172.16.255.4)
      Origin incomplete, metric 0, localpref 100, valid, external, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F7898C7FEF0, path: 0x7F7898C8E728, pathext: 0x7F7898CAE8E0
      flags: net: 0x0, path: 0x3, pathext: 0x81
      Updated on Jun 7 2020 20:41:30 UTC
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on spine switch 1 for route type 2 and the IP address of host device 1:

```
Spine-01# show bgp l2vpn evpn route-type 2 0 f4cfe24334c1 10.1.101.11
BGP routing table entry for [2][172.16.254.3:101][0][48][F4CFE24334C1][32][10.1.101.11]/24,
 version 4
Paths: (2 available, best #2, table EVPN-BGP-Table)
  Advertised to update-groups:
     11         13
  Refresh Epoch 1
  65002
    172.16.254.3 (metric 2) (via default) from 172.16.255.2 (172.16.255.2)
      Origin incomplete, metric 0, localpref 100, valid, internal
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      rx pathid: 0, tx pathid: 0
      net: 0x7F7898C7F290, path: 0x7F7898C8FEC8, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on Jun 7 2020 20:42:32 UTC
  Refresh Epoch 2
  65002
    172.16.254.3 (metric 2) (via default) from 172.16.255.3 (172.16.255.3)
      Origin incomplete, metric 0, localpref 100, valid, external, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F7898C7F290, path: 0x7F7898C8E218, pathext: 0x7F7898CAEE20
      flags: net: 0x0, path: 0x3, pathext: 0x81
      Updated on Jun 7 2020 20:41:30 UTC
```

The following example shows the output for the **show ip pim neighbor** command on spine switch 1:

```
Spine-01# 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
172.16.13.3       GigabitEthernet1/0/1     1w4d/00:01:37     v2    1 / DR S P G
172.16.14.4       GigabitEthernet1/0/2     1w4d/00:01:39     v2    1 / DR S P G
```

The following example shows the output for the **show ip pim rp mapping** command on spine switch 1:

```
Spine-01# show ip pim rp mapping
PIM Group-to-RP Mappings

Group(s): 224.0.0.0/4, Static
    RP: 172.16.255.255 (?)
```

The following example shows the output for the **show ip ro** command on spine switch 1:

```
Spine-01# show ip ro 172.16.255.255
Routing entry for 172.16.255.255/32
  Known via "connected", distance 0, metric 0 (connected, via interface)
  Routing Descriptor Blocks:
  * directly connected, via Loopback2
      Route metric is 0, traffic share count is 1
```

The following example shows the output for the **show ip msdp summary** command on spine switch 1:

```
Spine-01# show ip msdp summary
MSDP Peer Status Summary
Peer Address     AS    State    Uptime/  Reset SA    Peer Name
                                Downtime Count Count
172.16.254.2     65001 Up       1w4d     0     2     ?
```

The following example shows the output for the **show ip msdp sa-cache** command on spine switch 1:

```
Spine-01# show ip msdp sa-cache
MSDP Source-Active Cache - 2 entries
(172.16.254.3, 225.0.0.101), RP 172.16.255.255, BGP/AS 0, 00:01:07/00:05:06, Peer 172.16.254.2
(172.16.254.4, 225.0.0.101), RP 172.16.255.255, BGP/AS 0, 00:00:45/00:05:14, Peer 172.16.254.2
```

The following example shows the output for the **show ip rpf** command on spine switch 1:

```
Spine-01# show ip rpf 172.16.255.255
RPF information for ? (172.16.255.255)
  RPF interface: Loopback2
  RPF neighbor: ? (172.16.255.255) - directly connected
  RPF route/mask: 172.16.255.255/32
  RPF type: multicast (connected)
  Doing distance-preferred lookups across tables
  RPF topology: ipv4 multicast base
```

The following example shows the output for the **show ip mroute** command on spine switch 1:

```
Spine-01# show ip mroute 225.0.0.101
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
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 225.0.0.101), 00:01:07/stopped, RP 172.16.255.255, flags: SP
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list: Null

(172.16.254.4, 225.0.0.101), 00:00:45/00:02:14, flags: PA
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.14.4
  Outgoing interface list: Null

(172.16.254.3, 225.0.0.101), 00:01:07/00:01:52, flags: PA
  Incoming interface: GigabitEthernet1/0/1, RPF nbr 172.16.13.3
  Outgoing interface list: Null
```

Spine Switch 2

The following example shows the output for the **show ip ospf neighbor** command on spine switch 2:

```
Spine-02# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
172.16.255.4      0   FULL/  -        00:00:32    172.16.24.4     GigabitEthernet1/0/2
172.16.255.3      0   FULL/  -        00:00:34    172.16.23.3     GigabitEthernet1/0/1
```

The following example shows the output for the **show bgp l2vpn evpn summary** command on spine switch 2:

```
Spine-02# show bgp l2vpn evpn summary
BGP router identifier 172.16.255.2, local AS number 65001
BGP table version is 19, main routing table version 19
18 network entries using 6192 bytes of memory
38 path entries using 7904 bytes of memory
45/15 BGP path/bestpath attribute entries using 12960 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
24 BGP extended community entries using 1280 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 28384 total bytes of memory
BGP activity 56/38 prefixes, 244/206 paths, scan interval 60 secs
18 networks peaked at 21:11:25 Jun 4 2020 UTC (2d23h ago)

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
```

```
172.16.255.3    4        65002      30      27       19    0    0 00:08:54        9
172.16.255.4    4        65003      30      27       19    0    0 00:08:54       11
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on spine switch 2 for route type 2 and the IP address of host device 2:

```
Spine-02# show bgp l2vpn evpn route-type 2 0 44d3ca286cc1 10.1.101.12
BGP routing table entry for [2][172.16.254.4:101][0][48][44D3CA286CC1][32][10.1.101.12]/24,
 version 10
Paths: (2 available, best #2, table EVPN-BGP-Table)
  Advertised to update-groups:
     9          10
  Refresh Epoch 1
  65003
    172.16.254.4 (metric 2) (via default) from 172.16.255.1 (172.16.255.1)
      Origin incomplete, metric 0, localpref 100, valid, internal
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      rx pathid: 0, tx pathid: 0
      net: 0x7FB6494C8550, path: 0x7FB64B6D21A8, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on Jun 7 2020 20:43:06 UTC
  Refresh Epoch 2
  65003
    172.16.254.4 (metric 2) (via default) from 172.16.255.4 (172.16.255.4)
      Origin incomplete, metric 0, localpref 100, valid, external, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      rx pathid: 0, tx pathid: 0x0
      net: 0x7FB6494C8550, path: 0x7FB64B6D3870, pathext: 0x7FB6494D8788
      flags: net: 0x0, path: 0x3, pathext: 0x81
      Updated on Jun 7 2020 20:42:08 UTC
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on spine switch 2 for route type 2 and the IP address of host device 1:

```
Spine-02# show bgp l2vpn evpn route-type 2 0 f4cfe24334c1 10.1.101.11
BGP routing table entry for [2][172.16.254.3:101][0][48][F4CFE24334C1][32][10.1.101.11]/24,
 version 4
Paths: (2 available, best #2, table EVPN-BGP-Table)
  Advertised to update-groups:
     9          10
  Refresh Epoch 1
  65002
    172.16.254.3 (metric 2) (via default) from 172.16.255.1 (172.16.255.1)
      Origin incomplete, metric 0, localpref 100, valid, internal
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      rx pathid: 0, tx pathid: 0
      net: 0x7FB6494C86B0, path: 0x7FB64B6D25E0, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on Jun 7 2020 20:43:06 UTC
  Refresh Epoch 2
  65002
    172.16.254.3 (metric 2) (via default) from 172.16.255.3 (172.16.255.3)
      Origin incomplete, metric 0, localpref 100, valid, external, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65001:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
```

```
      rx pathid: 0, tx pathid: 0x0
      net: 0x7FB6494C86B0, path: 0x7FB64B6D31B0, pathext: 0x7FB6494D8CC8
      flags: net: 0x0, path: 0x3, pathext: 0x81
      Updated on Jun 7 2020 20:42:08 UTC
```

The following example shows the output for the **show ip pim neighbor** command on spine switch 2:

```
Spine-02# 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
172.16.23.3       GigabitEthernet1/0/1     00:34:48/00:01:27 v2    1 / DR S P G
172.16.24.4       GigabitEthernet1/0/2     1w4d/00:01:36     v2    1 / DR S P G
```

The following example shows the output for the **show ip pim rp mapping** command on spine switch 2:

```
Spine-02# show ip pim rp mapping
PIM Group-to-RP Mappings

Group(s): 224.0.0.0/4, Static
    RP: 172.16.255.255 (?)
```

The following example shows the output for the **show ip ro** command on spine switch 2:

```
Spine-02# show ip ro 172.16.255.255
Routing entry for 172.16.255.255/32
  Known via "connected", distance 0, metric 0 (connected, via interface)
  Routing Descriptor Blocks:
  * directly connected, via Loopback2
      Route metric is 0, traffic share count is 1
```

The following example shows the output for the **show ip msdp summary** command on spine switch 2:

```
Spine-02# show ip msdp summary
MSDP Peer Status Summary
Peer Address     AS    State    Uptime/  Reset SA    Peer Name
                                Downtime Count Count
172.16.254.1     65001 Up       1w4d     0     2     ?
```

The following example shows the output for the **show ip msdp sa-cache** command on spine switch 2:

```
Spine-02# show ip msdp sa-cache
RPF information for ? (172.16.255.255)
  RPF interface: Loopback2
  RPF neighbor: ? (172.16.255.255) - directly connected
  RPF route/mask: 172.16.255.255/32
  RPF type: multicast (connected)
  Doing distance-preferred lookups across tables
  RPF topology: ipv4 multicast base
```

The following example shows the output for the **show ip mroute** command on spine switch 2:

```
Spine-02# show ip mroute 225.0.0.101
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
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 225.0.0.101), 1w4d/00:03:27, RP 172.16.255.255, flags: S
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    GigabitEthernet1/0/1, Forward/Sparse, 00:34:36/00:03:22
    GigabitEthernet1/0/2, Forward/Sparse, 2d23h/00:03:27

(172.16.254.4, 225.0.0.101), 00:00:50/00:02:09, flags: A
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.24.4
  Outgoing interface list:
    GigabitEthernet1/0/1, Forward/Sparse, 00:00:50/00:03:22

(172.16.254.3, 225.0.0.101), 00:01:11/00:01:47, flags: A
  Incoming interface: GigabitEthernet1/0/1, RPF nbr 172.16.23.3
  Outgoing interface list:
    GigabitEthernet1/0/2, Forward/Sparse, 00:01:11/00:03:27
```

Leaf Switch 1

The following example shows the output for the **show ip ospf neighbor** command on leaf switch 1:

```
Leaf-01# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
172.16.255.2      0   FULL/  -        00:00:31    172.16.23.2     GigabitEthernet1/0/2
172.16.255.1      0   FULL/  -        00:00:34    172.16.13.1     GigabitEthernet1/0/1
```

The following example shows the output for the **show bgp l2vpn evpn summary** command on leaf switch 1:

```
Leaf-01# show bgp l2vpn evpn summary
BGP router identifier 172.16.255.3, local AS number 65002
BGP table version is 99, main routing table version 99
27 network entries using 9288 bytes of memory
36 path entries using 7488 bytes of memory
22/15 BGP path/bestpath attribute entries using 6336 bytes of memory
1 BGP AS-PATH entries using 40 bytes of memory
18 BGP extended community entries using 944 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 24096 total bytes of memory
BGP activity 483/450 prefixes, 1123/1081 paths, scan interval 60 secs
```

```
27 networks peaked at 13:15:47 May 26 2020 UTC (1w5d ago)

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
172.16.255.1    4        65001      27      34       99    0    0 00:08:30        9
172.16.255.2    4        65001      27      29       99    0    0 00:08:25        9
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on leaf switch 1 for route type 2 and the IP address of host device 2:

```
Leaf-01# show bgp l2vpn evpn route-type 2 0 44d3ca286cc1 10.1.101.12
BGP routing table entry for [2][172.16.254.3:101][0][48][44D3CA286CC1][32][10.1.101.12]/24,
 version 93
Paths: (1 available, best #1, table evi_101)
  Not advertised to any peer
  Refresh Epoch 1
  65001 65003, imported path from
[2][172.16.254.4:101][0][48][44D3CA286CC1][32][10.1.101.12]/24 (global)
    172.16.254.4 (metric 3) (via default) from 172.16.255.2 (172.16.255.2)
      Origin incomplete, localpref 100, valid, external, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F575E4795D0, path: 0x7F575E1EFC38, pathext: 0x7F575E201308, exp_net:
0x7F575E47AA70
      flags: net: 0x0, path: 0x4000000000003, pathext: 0x81
      Updated on Jun 7 2020 20:40:17 UTC
BGP routing table entry for [2][172.16.254.4:101][0][48][44D3CA286CC1][32][10.1.101.12]/24,
 version 84
Paths: (2 available, best #2, table EVPN-BGP-Table)
  Advertised to update-groups:
     21
  Refresh Epoch 1
  65001 65003
    172.16.254.4 (metric 3) (via default) from 172.16.255.1 (172.16.255.1)
      Origin incomplete, localpref 100, valid, external
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on leaf switch 1 for route type 2 and the IP address of host device 1:

```
Leaf-01# show bgp l2vpn evpn route-type 2 0 f4cfe24334c1 10.1.101.11
BGP routing table entry for [2][172.16.254.3:101][0][48][F4CFE24334C1][32][10.1.101.11]/24,
 version 4
Paths: (1 available, best #1, table evi_101)
  Advertised to update-groups:
     21
  Refresh Epoch 1
  Local
    :: (via default) from 0.0.0.0 (172.16.255.3)
      Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65002:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      Local irb vxlan vtep:
        vrf:green, l3-vni:50901
        local router mac:10B3.D56A.8FC8
        core-irb interface:Vlan901
        vtep-ip:172.16.254.3
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F575E47ABD0, path: 0x7F575E1F13D8, pathext: 0x7F575E201968
```

```
      flags: net: 0x0, path: 0x4000028000003, pathext: 0x81
      Updated on Jun 4 2020 21:26:02 UTC
```

The following example shows the output for the **show l2vpn evpn mac ip** command on leaf switch 1:

```
Leaf-01# show l2vpn evpn mac ip
IP Address                EVI   VLAN  MAC Address    Next Hop(s)
------------------------- ----- ----- -------------- -------------------------
10.1.101.11               101   101   f4cf.e243.34c1 Gi1/0/10:101
10.1.101.12               101   101   44d3.ca28.6cc1 172.16.254.4
10.1.102.11               102   102   f4cf.e243.34c2 Gi1/0/10:102
10.1.102.12               102   102   44d3.ca28.6cc2 172.16.254.4
```

The following example shows the output for the **show ip pim neighbor** command on leaf switch 1:

```
Leaf-01# 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
172.16.13.1       GigabitEthernet1/0/1     1w4d/00:01:17     v2    1 / S P G
172.16.23.2       GigabitEthernet1/0/2     00:34:19/00:01:24 v2    1 / S P G
```

The following example shows the output for the **show ip pim rp mapping** command on leaf switch 1:

```
Leaf-01# show ip pim rp mapping
PIM Group-to-RP Mappings

Group(s): 224.0.0.0/4, Static
    RP: 172.16.255.255 (?)
```

The following example shows the output for the **show ip ro** command on leaf switch 1:

```
Leaf-01# show ip ro 172.16.255.255
Routing entry for 172.16.255.255/32
  Known via "ospf 1", distance 110, metric 2, type intra area
  Last update from 172.16.23.2 on GigabitEthernet1/0/2, 00:34:08 ago
  Routing Descriptor Blocks:
    172.16.23.2, from 172.16.255.2, 00:34:08 ago, via GigabitEthernet1/0/2
      Route metric is 2, traffic share count is 1
  * 172.16.13.1, from 172.16.255.1, 1w4d ago, via GigabitEthernet1/0/1
      Route metric is 2, traffic share count is 1
```

The following example shows the output for the **show ip rpf** command on leaf switch 1:

```
Leaf-01# show ip rpf 172.16.255.255
RPF information for ? (172.16.255.255)
  RPF interface: GigabitEthernet1/0/2
  RPF neighbor: ? (172.16.23.2)
  RPF route/mask: 172.16.255.255/32
  RPF type: unicast (ospf 1)
  Doing distance-preferred lookups across tables
  RPF topology: ipv4 multicast base, originated from ipv4 unicast base
```

The following example shows the output for the **show ip mroute** command on leaf switch 1:

```
Leaf-01# show ip mroute 225.0.0.101
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
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 225.0.0.101), 8w2d/stopped, RP 172.16.255.255, flags: SJCFx
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.23.2
  Outgoing interface list:
    Tunnel0, Forward/Sparse-Dense, 1w5d/00:01:01

(172.16.254.4, 225.0.0.101), 00:00:21/00:02:38, flags: JTx
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.23.2
  Outgoing interface list:
    Tunnel0, Forward/Sparse-Dense, 00:00:21/00:02:38

(172.16.254.3, 225.0.0.101), 00:00:43/00:02:46, flags: FTx
  Incoming interface: Loopback1, RPF nbr 0.0.0.0
  Outgoing interface list:
    GigabitEthernet1/0/2, Forward/Sparse, 00:00:43/00:02:46
```

Leaf Switch 2

The following example shows the output for the **show ip ospf neighbor** command on leaf switch 2:

```
Leaf-02# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
172.16.255.2      0   FULL/  -        00:00:36    172.16.24.2     GigabitEthernet1/0/2
172.16.255.1      0   FULL/  -        00:00:31    172.16.14.1     GigabitEthernet1/0/1
```

The following example shows the output for the **show bgp l2vpn evpn summary** command on leaf switch 2:

```
Leaf-02# show bgp l2vpn evpn summary
BGP router identifier 172.16.255.4, local AS number 65003
BGP table version is 83, main routing table version 83
25 network entries using 8600 bytes of memory
36 path entries using 7488 bytes of memory
23/15 BGP path/bestpath attribute entries using 6624 bytes of memory
1 BGP AS-PATH entries using 40 bytes of memory
19 BGP extended community entries using 984 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 23736 total bytes of memory
BGP activity 95/64 prefixes, 207/163 paths, scan interval 60 secs
25 networks peaked at 21:31:21 Jun 4 2020 UTC (2d23h ago)
```

```
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
172.16.255.1    4        65001      27      34       83    0    0 00:08:40        9
172.16.255.2    4        65001      27      29       83    0    0 00:08:35        9
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on leaf switch 2 for route type 2 and the IP address of host device 2:

```
Leaf-02# show bgp l2vpn evpn route-type 2 0 44d3ca286cc1 10.1.101.12
BGP routing table entry for [2][172.16.254.4:101][0][48][44D3CA286CC1][32][10.1.101.12]/24,
 version 4
Paths: (1 available, best #1, table evi_101)
  Advertised to update-groups:
     2
  Refresh Epoch 1
  Local
    :: (via default) from 0.0.0.0 (172.16.255.4)
      Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65003:101 ENCAP:8
        Router MAC:7C21.0DBD.9548
      Local irb vxlan vtep:
        vrf:green, l3-vni:50901
        local router mac:7C21.0DBD.9548
        core-irb interface:Vlan901
        vtep-ip:172.16.254.4
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F84B8F2D778, path: 0x7F84BB3149F0, pathext: 0x7F84BB526788
      flags: net: 0x0, path: 0x4000028000003, pathext: 0x81
      Updated on Jun 4 2020 21:30:20 UTC
```

The following example shows the output for the **show bgp l2vpn evpn route-type** command on leaf switch 2 for route type 2 and the IP address of host device 1:

```
Leaf-02# show bgp l2vpn evpn route-type 2 0 f4cfe24334c1 10.1.101.11
BGP routing table entry for [2][172.16.254.3:101][0][48][F4CFE24334C1][32][10.1.101.11]/24,
 version 72
Paths: (2 available, best #2, table EVPN-BGP-Table)
  Advertised to update-groups:
     2
  Refresh Epoch 1
  65001 65002
    172.16.254.3 (metric 3) (via default) from 172.16.255.1 (172.16.255.1)
      Origin incomplete, localpref 100, valid, external
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65003:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      rx pathid: 0, tx pathid: 0
      net: 0x7F84B8F2E958, path: 0x7F84BB313FD0, pathext: 0x0
      flags: net: 0x0, path: 0x3, pathext: 0x0
      Updated on Jun 7 2020 20:44:45 UTC
  Refresh Epoch 1
  65001 65002
    172.16.254.3 (metric 3) (via default) from 172.16.255.2 (172.16.255.2)
      Origin incomplete, localpref 100, valid, external, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65003:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F84B8F2E958, path: 0x7F84BB313178, pathext: 0x7F84BB526548
      flags: net: 0x0, path: 0x3, pathext: 0x81
      Updated on Jun 7 2020 20:44:44 UTC
```

```
BGP routing table entry for [2][172.16.254.4:101][0][48][F4CFE24334C1][32][10.1.101.11]/24,
 version 78
Paths: (1 available, best #1, table evi_101)
  Not advertised to any peer
  Refresh Epoch 1
  65001 65002, imported path from
[2][172.16.254.3:101][0][48][F4CFE24334C1][32][10.1.101.11]/24 (global)
    172.16.254.3 (metric 3) (via default) from 172.16.255.2 (172.16.255.2)
      Origin incomplete, localpref 100, valid, external, best
      EVPN ESI: 00000000000000000000, Label1 10101, Label2 50901
      Extended Community: RT:1:1 RT:65003:101 ENCAP:8
        Router MAC:10B3.D56A.8FC8
      rx pathid: 0, tx pathid: 0x0
      net: 0x7F84B8F2D358, path: 0x7F84BB314258, pathext: 0x7F84BB5265A8, exp_net:
0x7F84B8F2E958
      flags: net: 0x0, path: 0x4000000000003, pathext: 0x81
      Updated on Jun 7 2020 20:44:44 UTC
```

The following example shows the output for the **show l2vpn evpn mac ip** command on leaf switch 2:

```
Leaf-02# show l2vpn evpn mac ip
IP Address                EVI   VLAN  MAC Address    Next Hop(s)
------------------------- ----- ----- -------------- -------------------------
10.1.101.11               101   101   f4cf.e243.34c1 172.16.254.3
10.1.101.12               101   101   44d3.ca28.6cc1 Gi1/0/10:101
10.1.102.11               102   102   f4cf.e243.34c2 172.16.254.3
10.1.102.12               102   102   44d3.ca28.6cc2 Gi1/0/10:102
```

The following example shows the output for the **show ip pim neighbor** command on leaf switch 2:

```
Leaf-02# 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
172.16.14.1       GigabitEthernet1/0/1     1w4d/00:01:42     v2    1 / S P G
172.16.24.2       GigabitEthernet1/0/2     1w4d/00:01:19     v2    1 / S P G
```

The following example shows the output for the **show ip pim rp mapping** command on leaf switch 2:

```
Leaf-02# show ip pim rp mapping
PIM Group-to-RP Mappings

Group(s): 224.0.0.0/4, Static
    RP: 172.16.255.255 (?)
```

The following example shows the output for the **show ip ro** command on leaf switch 2:

```
Leaf-02# show ip ro 172.16.255.255
Routing entry for 172.16.255.255/32
  Known via "ospf 1", distance 110, metric 2, type intra area
  Last update from 172.16.14.1 on GigabitEthernet1/0/1, 3d00h ago
  Routing Descriptor Blocks:
  * 172.16.24.2, from 172.16.255.2, 3d00h ago, via GigabitEthernet1/0/2
      Route metric is 2, traffic share count is 1
```

```
    172.16.14.1, from 172.16.255.1, 3d00h ago, via GigabitEthernet1/0/1
      Route metric is 2, traffic share count is 1
```

The following example shows the output for the **show ip rpf** command on leaf switch 2:

```
Leaf-02# show ip rpf 172.16.255.255
RPF information for ? (172.16.255.255)
  RPF interface: GigabitEthernet1/0/2
  RPF neighbor: ? (172.16.24.2)
  RPF route/mask: 172.16.255.255/32
  RPF type: unicast (ospf 1)
  Doing distance-preferred lookups across tables
  RPF topology: ipv4 multicast base, originated from ipv4 unicast base
```

The following example shows the output for the **show ip mroute** command on leaf switch 2:

```
Leaf-02# show ip mroute 225.0.0.101
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
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 225.0.0.101), 2w3d/stopped, RP 172.16.255.255, flags: SJCFx
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.24.2
  Outgoing interface list:
    Tunnel0, Forward/Sparse-Dense, 2d23h/00:01:40

(172.16.254.4, 225.0.0.101), 00:00:31/00:02:58, flags: FTx
  Incoming interface: Loopback1, RPF nbr 0.0.0.0
  Outgoing interface list:
    GigabitEthernet1/0/2, Forward/Sparse, 00:00:31/00:02:58

(172.16.254.3, 225.0.0.101), 00:00:52/00:02:07, flags: JTx
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 172.16.24.2
  Outgoing interface list:
    Tunnel0, Forward/Sparse-Dense, 00:00:52/00:02:07
```