Configuring Spine Switches in a BGP EVPN VXLAN Fabric

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 for Spine Switches Using iBGP when the Spine Switches and Leaf Switches are 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 for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different Autonomous System, 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 for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System, on page 38 for a sample topology and configuration.
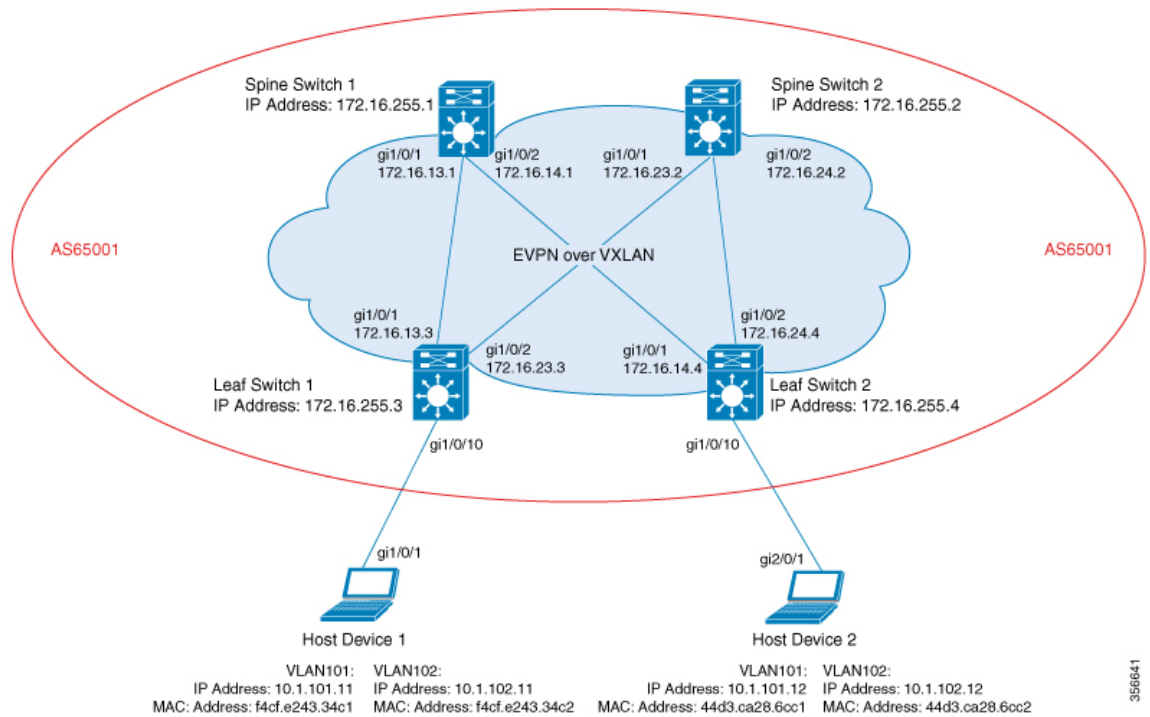
Configuration Examples for Spine Switches in a BGP EVPN VXLAN Network

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 for Spine Switches Using iBGP when the Spine Switches and Leaf Switches are 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:

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using iBGP when the Spine Switches and Leaf Switches are in the Same Autonomous System

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 boths 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 synchronisation. 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.

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using iBGP when the Spine Switches and Leaf Switches are in the Same Autonomous System

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

<pre>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 172.16.255.2 remote-as 65001
neighbor 172.16.255.2 update-source Loopback0
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
!</pre>
	<pre>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 172.16.255.1 remote-as 65001
	neighbor 172.16.255.1 update-source Loopback0
	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
	!</pre>

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using iBGP when the Spine Switches and Leaf Switches are in the Same Autonomous System

Spine Switch 1	Spine Switch 2
| ```
address-family l2vpn evpn
neighbor 172.16.255.2 activate
neighbor 172.16.255.2 send-community both
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 172.16.255.1 activate
neighbor 172.16.255.1 send-community both
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#
``` |

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using iBGP when the Spine Switches and Leaf Switches are in the Same Autonomous System

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 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
!
``` |

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using iBGP when the Spine Switches and Leaf Switches are in the Same Autonomous System

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
!
``` |

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using iBGP when the Spine Switches and Leaf Switches are in the Same Autonomous System

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
172.16.255.2    4        65001    1318    1314       46    0    0 19:39:19        18
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:
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using iBGP when the Spine Switches and Leaf Switches are in the Same Autonomous System

```
      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:

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using iBGP when the Spine Switches and Leaf Switches are in the Same Autonomous System

```
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,
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using iBGP when the Spine Switches and Leaf Switches are in the Same Autonomous System ■

```
                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
172.16.255.1    4      65001    1327    1331       28    0    0 19:51:26        18
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:

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```
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
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using iBGP when the Spine Switches and Leaf Switches are in the Same Autonomous System ▪

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,
```

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Configuration Example for Spine Switches Using iBGP when the Spine Switches and Leaf Switches are in the Same Autonomous System

```
                    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
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using iBGP when the Spine Switches and Leaf Switches are in the Same Autonomous System

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
```

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Configuration Example for Spine Switches Using iBGP when the Spine Switches and Leaf Switches are in the Same Autonomous System

```
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
```

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```
  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
```

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Configuration Example for Spine Switches Using iBGP when the Spine Switches and Leaf Switches are in the Same Autonomous System

```
            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:

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different Autonomous System

```
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
```
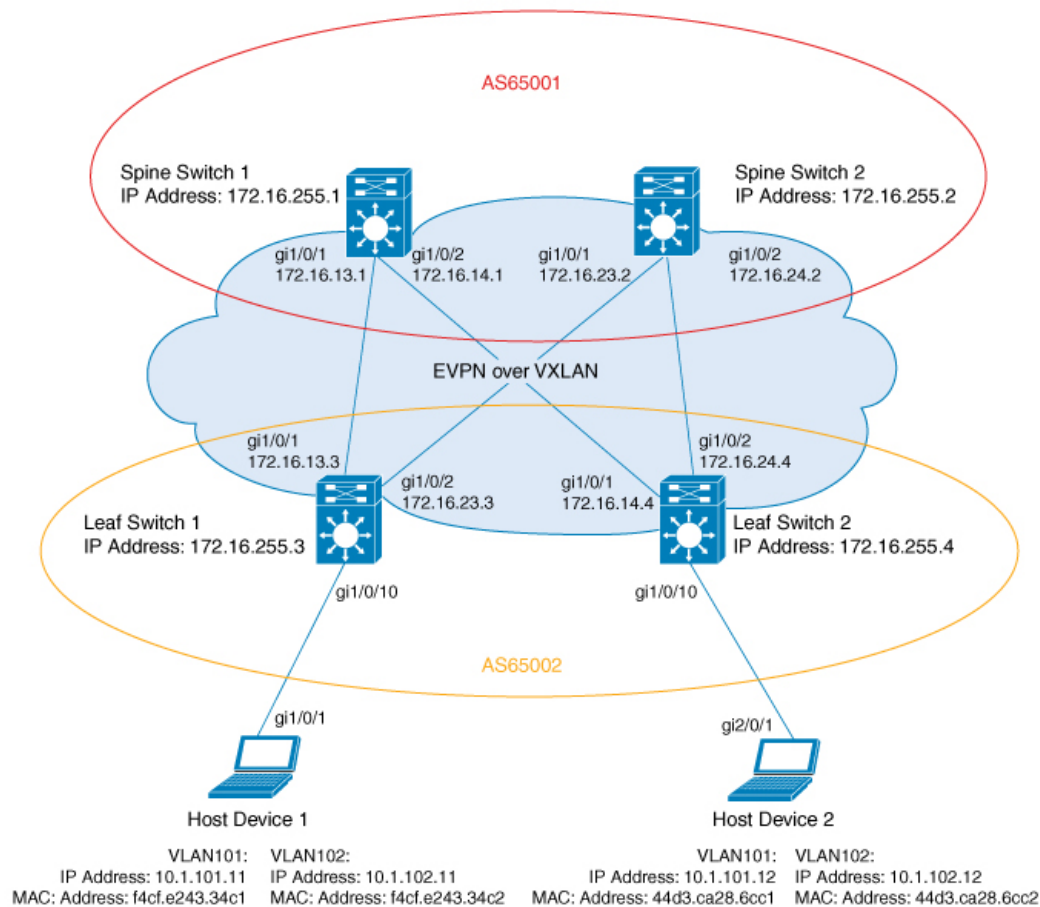
Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different Autonomous System

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 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:

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different Autonomous System

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 synchronisation. 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.

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different Autonomous System

Note   You must manually run the **no bgp default route-target filter** command in router configuration mode on the spine switches.

Note   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.

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different Autonomous System

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 172.16.255.2 remote-as 65001
neighbor 172.16.255.2 update-source Loopback0
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 172.16.255.1 remote-as 65001
neighbor 172.16.255.1 update-source Loopback0
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
!
``` |

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches 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
| ```
address-family l2vpn evpn
neighbor 172.16.255.2 activate
neighbor 172.16.255.2 send-community both
neighbor 172.16.255.2 route-map BGP-NHU out
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 172.16.255.1 activate
neighbor 172.16.255.1 send-community both
neighbor 172.16.255.1 route-map BGP-NHU out
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#
``` |

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different
Autonomous System

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
!
``` |

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches 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
| ```
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
``` |

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches 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

`!`
`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/  -        00:00:33    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
172.16.255.2    4        65001    9196    9183       75    0    0 5d18h          18
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:
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different Autonomous System

```
        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,
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different Autonomous System

```
           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,
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different
Autonomous System

```
        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
172.16.255.1    4      65001    9183    9196       91    0    0 5d18h          18
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,
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different Autonomous System

```
  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:

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different Autonomous System

```
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,
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different Autonomous System

```
             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:

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different Autonomous System

```
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
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different Autonomous System

```
          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,
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different Autonomous System

```
           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:

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different Autonomous System

```
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
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in One Autonomous System and the Leaf Switches are in a Different Autonomous System

```
                       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,
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different
Autonomous System

```
            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
```
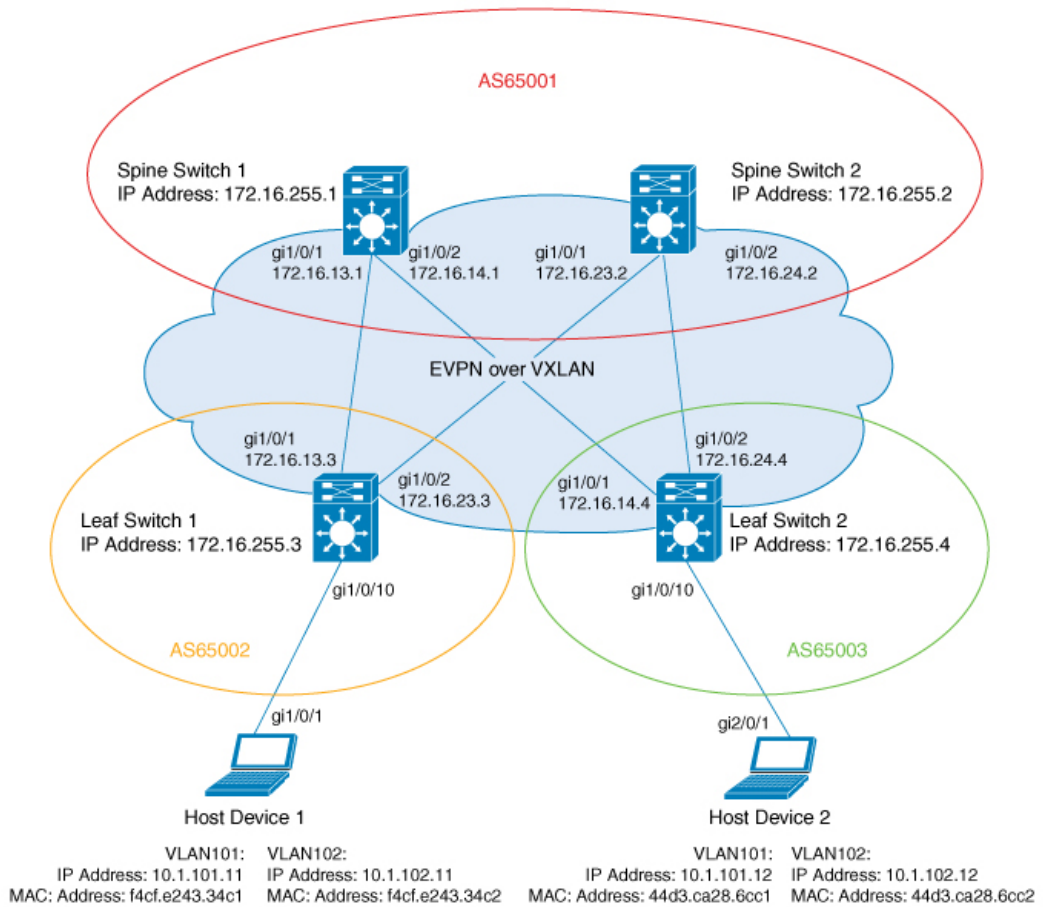
Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

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 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:

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

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 synchronisation. 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.

Note   You must manually run the **no bgp default route-target filter** command in router configuration mode on the spine switches.

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

✎

| **Note** | 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.

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

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

<pre>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 172.16.255.2 remote-as 65001
neighbor 172.16.255.2 update-source Loopback0
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
!</pre>
	<pre>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 172.16.255.1 remote-as 65001
	neighbor 172.16.255.1 update-source Loopback0
	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
	!</pre>

Configuration Example for Spine Switches 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
| ```
address-family l2vpn evpn
rewrite-evpn-rt-asn
neighbor 172.16.255.2 activate
neighbor 172.16.255.2 send-community both
neighbor 172.16.255.2 route-map BGP-NHU out
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 172.16.255.1 activate
neighbor 172.16.255.1 send-community both
neighbor 172.16.255.1 route-map BGP-NHU out
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#
``` |

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

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

<pre>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</pre>
	<pre>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
	!</pre>

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches 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
| ```
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
!
``` |

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches 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

<pre>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#</pre>
	<pre>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#</pre>

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
172.16.255.2    4        65001      28      27       19    0    0 00:08:49         18
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)
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

```
      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
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

```
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:

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different
Autonomous System

```
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
172.16.255.1    4        65001      27      28       19    0    0 00:08:54        18
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

```
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
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

```
                        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
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

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
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

```
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
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

```
                    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
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

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
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

```
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
```

Configuring Spine Switches in a BGP EVPN VXLAN Fabric

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System

```
        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
```

Configuration Example for Spine Switches Using eBGP when the Spine Switches are in one Autonomous System and each Leaf Switch is in a Different Autonomous System