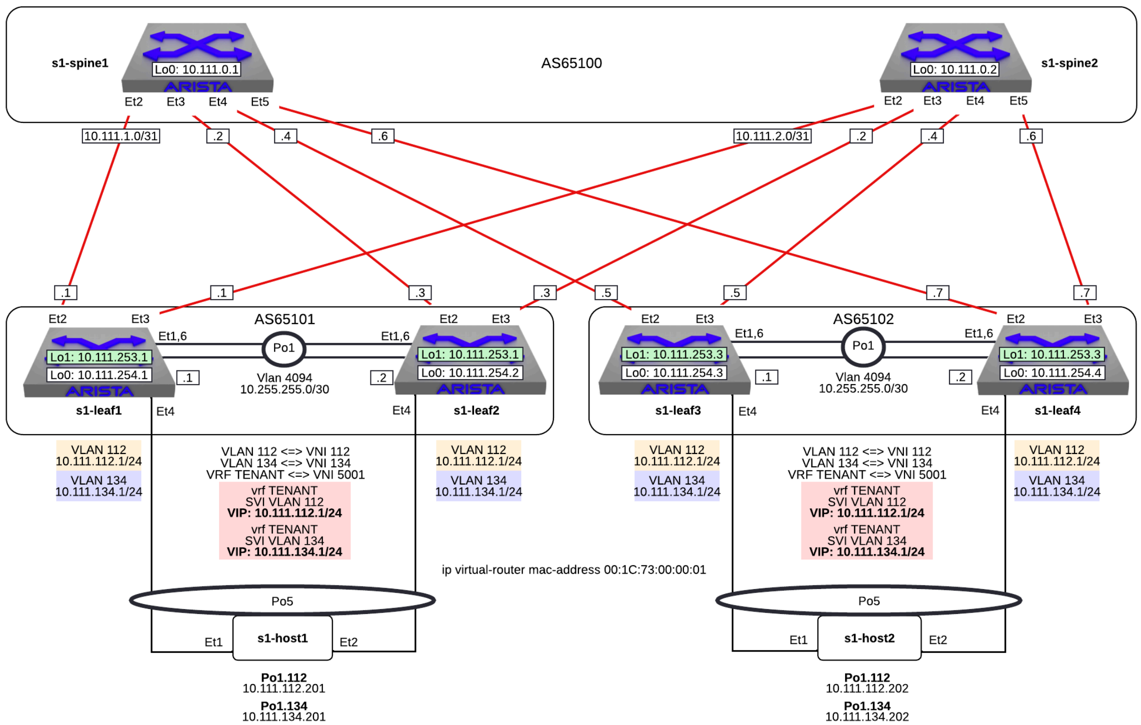
L2 and L3 EVPN - Symmetric IRB with MLAG



(_images/nested_l2l3evpn_topo_dual_dc.png)

> **Note**
>
> This lab exercise is focused on the VXLAN EVPN configuration. IP addresses, MLAG and BGP Underlay are already configured.

1. Log into the **LabAccess** jumpserver:

   a. Type `97` to access additional lab, then `evpn-labs` at the prompt to access the EVPN VXLAN content. Then type `l2l3evpn` for the Layer 2 and 3 EVPN lab. The script will configure the datacenter with the exception of **s1-leaf4**.

Note

Did you know the “l2l3evpn” script is composed of Python code that uses the CloudVision Portal REST API to automate the provisioning of CVP Configlets. The configlets that are configured via the REST API are `L2L3EVPN_s1-spine1`, `L2L3EVPN_s1-spine2`, `L2L3EVPN_s1-leaf1`, `L2L3EVPN_s1-leaf2`, `L2L3EVPN_s1-leaf3`, `L2L3EVPN_s1-leaf4`.

2. On **s1-leaf4**, check if Multi-Agent Routing Protocols are enabled.

```
s1-leaf4#show run section service
service routing protocols model multi-agent
s1-leaf4#show ip route summary

Operating routing protocol model: multi-agent
Configured routing protocol model: multi-agent

VRF: default
   Route Source                                Number Of Routes
------------------------------------- -------------------------
   connected                                                  4
   static (persistent)                                        0
   static (non-persistent)                                    0
   VXLAN Control Service                                      0
   static nexthop-group                                       0
   ospf                                                       0
     Intra-area: 0 Inter-area: 0 External-1: 0 External-2: 0
     NSSA External-1: 0 NSSA External-2: 0
   ospfv3                                                     0
   bgp                                                        9
     External: 7 Internal: 2
   isis                                                       0
     Level-1: 0 Level-2: 0
   rip                                                        0
   internal                                                  11
   attached                                                   3
   aggregate                                                  0
   dynamic policy                                             0
   gribi                                                      0

   Total Routes                                              27

Number of routes per mask-length:
   /8: 2         /24: 3        /30: 1        /31: 2        /32: 19
```

Note

By default, EOS is using the GateD routing process. Activating (ArBGP) is requiring a reboot. This has been done prior to the lab buildout so no reboot is required here.

3. On **s1-leaf4**, check the following operational states before configuring EVPN constructs:

   a. Verify EOS MLAG operational details.

   > **Note**
   >
   > The MLAG state between **s1-leaf4** and its peer **s1-leaf3** will be inconsistent. This is expected as **s1-leaf3** is fully configured and **s1-leaf4** is not as of yet.

```
s1-leaf4#show mlag
MLAG Configuration:
domain-id                          :                MLAG
local-interface                    :            Vlan4094
peer-address                       :        10.255.255.1
peer-link                          :        Port-Channel1
peer-config                        :        inconsistent

MLAG Status:
state                              :              Active
negotiation status                 :           Connected
peer-link status                   :                  Up
local-int status                   :                  Up
system-id                          :   02:1c:73:c0:c6:14
dual-primary detection             :            Disabled
dual-primary interface errdisabled :               False

MLAG Ports:
Disabled                           :                   0
Configured                         :                   0
Inactive                           :                   0
Active-partial                     :                   0
Active-full                        :                   0
```

   b. Verify BGP operational details for Underlay:

   > **Note**
   >
   > You should see 3 underlay sessions; one to each spine and one to the MLAG peer for redundancy.

```
s1-leaf4#show ip bgp summary
BGP summary information for VRF default
Router identifier 10.111.254.4, local AS number 65102
Neighbor Status Codes: m - Under maintenance
Neighbor      V AS           MsgRcvd   MsgSent  InQ OutQ  Up/Down State   PfxRcd PfxAcc
10.111.1.6    4 65100              9        12    0    0 00:00:07 Estab   5      5
10.111.2.6    4 65100              9        12    0    0 00:00:07 Estab   5      5
10.255.255.1 4 65102              8        10    0    0 00:00:07 Estab   10     10
```

c. Check the IP routing table:

> **Note**
>
> Notice that **s1-leaf4** has 2 ECMP paths for reaching **s1-leaf1** or **s1-leaf2** loopacks.

```
s1-leaf4#show ip route

VRF: default
Codes: C - connected, S - static, K - kernel,
       O - OSPF, IA - OSPF inter area, E1 - OSPF external type 1,
       E2 - OSPF external type 2, N1 - OSPF NSSA external type 1,
       N2 - OSPF NSSA external type2, B - Other BGP Routes,
       B I - iBGP, B E - eBGP, R - RIP, I L1 - IS-IS level 1,
       I L2 - IS-IS level 2, O3 - OSPFv3, A B - BGP Aggregate,
       A O - OSPF Summary, NG - Nexthop Group Static Route,
       V - VXLAN Control Service, M - Martian,
       DH - DHCP client installed default route,
       DP - Dynamic Policy Route, L - VRF Leaked,
       G  - gRIBI, RC - Route Cache Route

Gateway of last resort is not set

B E      10.111.0.1/32 [200/0] via 10.111.1.6, Ethernet2
B E      10.111.0.2/32 [200/0] via 10.111.2.6, Ethernet3
C        10.111.1.6/31 is directly connected, Ethernet2
B E      10.111.1.0/24 [200/0] via 10.111.1.6, Ethernet2
C        10.111.2.6/31 is directly connected, Ethernet3
B E      10.111.2.0/24 [200/0] via 10.111.2.6, Ethernet3
B I      10.111.112.0/24 [200/0] via 10.255.255.1, Vlan4094
B E      10.111.253.1/32 [200/0] via 10.111.1.6, Ethernet2
                                 via 10.111.2.6, Ethernet3
B I      10.111.253.3/32 [200/0] via 10.255.255.1, Vlan4094
B E      10.111.254.1/32 [200/0] via 10.111.1.6, Ethernet2
                                 via 10.111.2.6, Ethernet3
B E      10.111.254.2/32 [200/0] via 10.111.1.6, Ethernet2
                                 via 10.111.2.6, Ethernet3
B I      10.111.254.3/32 [200/0] via 10.255.255.1, Vlan4094
C        10.111.254.4/32 is directly connected, Loopback0
C        10.255.255.0/30 is directly connected, Vlan4094
C        192.168.0.0/24 is directly connected, Management0
```

4. On **s1-leaf4**, configure the BGP EVPN control-plane.

a. Configure the EVPN control plane.

> **Note**
>
> In this lab, the Spines serve as EVPN Route Servers. They receive the EVPN Routes from each leaf and, due to our eBGP setup, will naturally pass them along the other leaves.
>
> Also note that BGP standard and extended communities are explicitly enabled on the peering. EVPN makes use of extended BGP communities for route signaling and standard communities allow for various other functions such as BGP maintenance mode.

Lastly, note in this setup we use eBGP-multihop peerings with the Loopback0 interfaces of each switch. This follows Arista best-practice designs for separation of Underlay (peerings done using physical Ethernet interfaces) and Overlay (peerings done using Loopbacks) when leveraging eBGP. Other options exist and can be discussed with your Arista SE.

```
router bgp 65102
    neighbor SPINE-EVPN peer group
    neighbor SPINE-EVPN remote-as 65100
    neighbor SPINE-EVPN update-source Loopback0
    neighbor SPINE-EVPN ebgp-multihop 3
    neighbor SPINE-EVPN send-community standard extended
    neighbor 10.111.0.1 peer group SPINE-EVPN
    neighbor 10.111.0.2 peer group SPINE-EVPN
    !
    address-family evpn
       neighbor SPINE-EVPN activate
```

b. Verify the EVPN Control-Plane is established to both Spine peers.

```
s1-leaf4(config-router-bgp-af)#show bgp evpn summary
BGP summary information for VRF default
Router identifier 10.111.254.4, local AS number 65102
Neighbor Status Codes: m - Under maintenance
  Neighbor   V AS           MsgRcvd   MsgSent  InQ OutQ  Up/Down State   PfxRcd PfxAcc
  10.111.0.1 4 65100             10         4    0    0 00:00:04 Estab   8      8
  10.111.0.2 4 65100             10         7    0    0 00:00:04 Estab   8      8
```

5. On **s1-leaf4**, configure the VXLAN data-plane for transport.

a. Configure Loopback1 with the shared IP of **s1-leaf3**.

Note

This is referred to as an MLAG VTEP. The MLAG peer leafs provide redundancy by sharing the Loopback1 IP and jointly advertising reachability for it. Route redistribution has already been configured for the underlay.

```
interface Loopback1
   description VTEP
   ip address 10.111.253.3/32
```

b. Configure the Vxlan1 interface with the Loopback1 as the source.

Note

This is the logical interface that will provide VXLAN header encap and decap functions. In this lab, since we are leveraging VXLAN routing, we can able the use of a virtual-router MAC address. This instructs the device to use the shared MLAG System ID as the router MAC when performing VXLAN routing operations and ensures that whichever switch in the MLAG receives the VXLAN Routed packet can provide forwarding of that traffic without shunting it over the MLAG peer-link.

```
interface Vxlan1
   vxlan source-interface Loopback1
   vxlan virtual-router encapsulation mac-address mlag-system-id
```

6. Configure Layer 2 EVPN services on **s1-leaf4**.

   a. Add the local Layer 2 VLANs with an IDs of 112 and 134.

   ```
   vlan 112
      name Host_Network_112
   !
   vlan 134
      name Host_Network_134
   ```

   b. Map the local Layer 2 VLANs with a matching VNIs.

   Note

   This is how the switch understands which local Layer 2 VLAN maps to which VNI in the overlay. The example shows matching them one to one, but any scheme or method is valid, such as adding 10000 to the VLAN ID.

   ```
   interface Vxlan1
      vxlan vlan 112 vni 112
      vxlan vlan 134 vni 134
   ```

   c. Add the mac-vrf EVPN configuration for VLAN 112 and 134.

   Note

   Here we configure a VLAN-based service with EVPN. It has two components. The first is a route-distinguisher, or **RD** to identify the router (or leaf switch) that is originating the EVPN routes. This can be manually defined in the format of **Number** : **Number**, such as **Loopback0** : **VLAN ID** or as we do in this case, let EOS automatically allocate one.

   Second is the route-target, or **RT**. The **RT** is used by the leaf switches in the network to determine if they should import the advertised route into their local table(s). If they receive an EVPN route, they check the **RT** value and see if they have a matching **RT** configured in BGP. If they do, they import the route into the associated mac-vrf (or VLAN). If they do not, they ignore the route.

```
router bgp 65102
   !
   vlan 112
      rd auto
      route-target both 112:112
      redistribute learned
   !
   vlan 134
      rd auto
      route-target both 134:134
      redistribute learned
```

7. Configure Layer 3 EVPN services on **s1-leaf4**.

   a. Create the VRF, or logical routing instance, for the Tenant Layer 3 Network.

   > **Note**
   >
   > In EOS, by default, VRFs are created with inter-subnet routing disabled. Always be sure to enable IP routing in user-defined VRFs.

```
vrf instance TENANT
!
ip routing vrf TENANT
```

   b. Create the SVI for default gateway function for the host network as an Anycast Gateway.

   > **Note**
   >
   > With VXLAN, we can leverage a shared IP using Anycast Gateway. This allows a single IP to be shared without any other dedicated IPs per switch.

```
ip virtual-router mac-address 00:1C:73:00:00:01
!
interface Vlan112
   description Host Network 112
   vrf TENANT
   ip address virtual 10.111.112.1/24
!
interface Vlan134
   description Host Network 134
   vrf TENANT
   ip address virtual 10.111.134.1/24
```

   c. Map the local Layer 3 VRF with a matching VNI.

   > **Note**
   >
   > For the Layer 3 Service, the VRF requires what is referred to as the Layer 3 VNI, which is used for VXLAN Routing in a Symmetric IRB deployment between VTEPs. Any unique ID number will serve here.

```
interface Vxlan1
   vxlan vrf TENANT vni 5001
```

d. Add the IP VRF EVPN configuration for the TENANT VRF.

> **Note**
>
> Here we configure a Layer 3 VRF service with EVPN. It also leverage a unique **RD** and **RT**. They are used by the leaf switches for the same purpose as the Layer 2 service. The difference is simply the routes are imported. If they receive a Type 5 EVPN route, they check the **RT** value and see if they have a matching **RT** configured for the VRF. If so, they import the route into the associated VRF routing table. If they do not, they ignore the route.

```
router bgp 65102
   rd auto
   !
   vrf TENANT
      route-target import evpn 5001:5001
      route-target export evpn 5001:5001
      redistribute connected
```

e. Configure the host-facing MLAG port.

```
interface Port-Channel5
   description MLAG Downlink - s1-host2
   switchport trunk allowed vlan 112,134
   switchport mode trunk
   mlag 5
!
interface Ethernet4
   description MLAG Downlink - s1-host2
   channel-group 5 mode active
```

8. With the Layer 2 and 3 EVPN Services configured, verify the operational state.

a. Check the VXLAN data-plane configuration.

> **Note**
>
> Here we can see some useful commands for VXLAN verification. `show vxlan config-sanity detail` verifies a number of standard things locally and with the MLAG peer to ensure all basic criteria are met. `show interfaces Vxlan1` provides a consolidated series of outputs of operational VXLAN data such as control-plane mode (EVPN in this case), VLAN to VNI mappings and discovered VTEPs.

```
s1-leaf4#show vxlan config-sanity detail
Category                            Result  Detail
---------------------------------- -------- ------------------------------------------
Local VTEP Configuration Check        OK
  Loopback IP Address                 OK
  VLAN-VNI Map                        OK
  Routing                             OK
  VNI VRF ACL                         OK
  Decap VRF-VNI Map                   OK
  VRF-VNI Dynamic VLAN                OK
Remote VTEP Configuration Check       OK
  Remote VTEP                         OK
Platform Dependent Check              OK
  VXLAN Bridging                      OK
  VXLAN Routing                       OK
CVX Configuration Check               OK
  CVX Server                          OK    Not in controller client mode
MLAG Configuration Check              OK    Run 'show mlag config-sanity' to verify MLA
  Peer VTEP IP                        OK
  MLAG VTEP IP                        OK
  Peer VLAN-VNI                       OK
  Virtual VTEP IP                     OK
  MLAG Inactive State                 OK

s1-leaf4#show interfaces Vxlan1
Vxlan1 is up, line protocol is up (connected)
  Hardware is Vxlan
  Source interface is Loopback1 and is active with 10.111.253.3
  Replication/Flood Mode is headend with Flood List Source: EVPN
  Remote MAC learning via EVPN
  VNI mapping to VLANs
  Static VLAN to VNI mapping is
    [112, 112]        [134, 134]
  Dynamic VLAN to VNI mapping for 'evpn' is
    [4093, 5001]
  Note: All Dynamic VLANs used by VCS are internal VLANs.
        Use 'show vxlan vni' for details.
  Static VRF to VNI mapping is
   [TENANT, 5001]
  Headend replication flood vtep list is:
   112 10.111.253.1
   134 10.111.253.1
  MLAG Shared Router MAC is 021c.73c0.c614
```

b. On **s1-leaf1** (and/or **s1-leaf2**) verify the IMET table to ensure **s1-leaf4** has been discovered in the overlay.

Note

The Inclusive Multicast Ethernet Tag, or **IMET**, route is how a VTEP advertises membership in a given Layer 2 service, or VXLAN segment. This is also known as the EVPN Type 3 Route. Other leaves receive this route, evaluate the **RT** to see if they have a matching configuration and, if so, import the advertising VTEP into their flood list for BUM traffic. Note that these are done on a per VLAN basis based on the MAC-VRF configuration. Highlighted below are the EVPN Type 3 Routes from **s1-leaf4** which we identify based on the **RD** value. The detail outputs show **RT** and **VNI** information as well as the **Tunnel ID** which in our case is the VTEP address to flood BUM traffic to.

```
s1-leaf1#show bgp evpn route-type imet
BGP routing table information for VRF default
Router identifier 10.111.254.1, local AS number 65101
Route status codes: * - valid, > - active, S - Stale, E - ECMP head, e - ECMP
                    c - Contributing to ECMP, % - Pending BGP convergence
Origin codes: i - IGP, e - EGP, ? - incomplete
AS Path Attributes: Or-ID - Originator ID, C-LST - Cluster List, LL Nexthop - Link Loca

          Network                Next Hop              Metric  LocPref Weight  Path
 * >Ec    RD: 10.111.254.3:112 imet 10.111.253.3
                                 10.111.253.3          -       100     0       65100 65
 *  ec    RD: 10.111.254.3:112 imet 10.111.253.3
                                 10.111.253.3          -       100     0       65100 65
 * >Ec    RD: 10.111.254.3:134 imet 10.111.253.3
                                 10.111.253.3          -       100     0       65100 65
 *  ec    RD: 10.111.254.3:134 imet 10.111.253.3
                                 10.111.253.3          -       100     0       65100 65
 * >Ec    RD: 10.111.254.4:112 imet 10.111.253.3
                                 10.111.253.3          -       100     0       65100 65
 *  ec    RD: 10.111.254.4:112 imet 10.111.253.3
                                 10.111.253.3          -       100     0       65100 65
 * >Ec    RD: 10.111.254.4:134 imet 10.111.253.3
                                 10.111.253.3          -       100     0       65100 65
 *  ec    RD: 10.111.254.4:134 imet 10.111.253.3
                                 10.111.253.3          -       100     0       65100 65
 * >      RD: 10.111.254.1:112 imet 10.111.253.1
                                 -                     -       -       0       i
 * >      RD: 10.111.254.1:134 imet 10.111.253.1
                                 -                     -       -       0       i
s1-leaf1#show bgp evpn route-type imet rd 10.111.254.4:112 detail
BGP routing table information for VRF default
Router identifier 10.111.254.1, local AS number 65101
BGP routing table entry for imet 10.111.253.3, Route Distinguisher: 10.111.254.4:112
 Paths: 2 available
  65100 65102
    10.111.253.3 from 10.111.0.1 (10.111.0.1)
      Origin IGP, metric -, localpref 100, weight 0, valid, external, ECMP head, ECMP,
      Extended Community: Route-Target-AS:112:112 TunnelEncap:tunnelTypeVxlan
      VNI: 112
      PMSI Tunnel: Ingress Replication, MPLS Label: 112, Leaf Information Required: fal
  65100 65102
    10.111.253.3 from 10.111.0.2 (10.111.0.2)
      Origin IGP, metric -, localpref 100, weight 0, valid, external, ECMP, ECMP contri
      Extended Community: Route-Target-AS:112:112 TunnelEncap:tunnelTypeVxlan
      VNI: 112
      PMSI Tunnel: Ingress Replication, MPLS Label: 112, Leaf Information Required: fal
s1-leaf4#show interfaces Vxlan1
Vxlan1 is up, line protocol is up (connected)
  Hardware is Vxlan
  Source interface is Loopback1 and is active with 10.111.253.3
  Replication/Flood Mode is headend with Flood List Source: EVPN
  Remote MAC learning via EVPN
```

```
  VNI mapping to VLANs
  Static VLAN to VNI mapping is
    [112, 112]        [134, 134]
  Dynamic VLAN to VNI mapping for 'evpn' is
    [4093, 5001]
  Note: All Dynamic VLANs used by VCS are internal VLANs.
        Use 'show vxlan vni' for details.
  Static VRF to VNI mapping is
   [TENANT, 5001]
  Headend replication flood vtep list is:
   112 10.111.253.1
   134 10.111.253.1
  MLAG Shared Router MAC is 021c.73c0.c614
```

c. Log into **s1-host1** and ping **s2-host2** in both VLANs to populate the network's MAC and ARP tables.

> **Note**
>
> Since we are hosting multiple networks on the simulated Hosts, we have separated the networks by VRFs. These are not related to the VRFs in the network fabric.

```
s1-host1#ping vrf 112 10.111.112.202
PING 10.111.112.202 (10.111.112.202) 72(100) bytes of data.
80 bytes from 10.111.112.202: icmp_seq=1 ttl=64 time=21.3 ms
80 bytes from 10.111.112.202: icmp_seq=2 ttl=64 time=17.6 ms
80 bytes from 10.111.112.202: icmp_seq=3 ttl=64 time=22.2 ms
80 bytes from 10.111.112.202: icmp_seq=4 ttl=64 time=22.3 ms
80 bytes from 10.111.112.202: icmp_seq=5 ttl=64 time=23.8 ms

--- 10.111.112.202 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 64ms
rtt min/avg/max/mdev = 17.698/21.491/23.822/2.059 ms, pipe 3, ipg/ewma 16.095/21.549 ms
s1-host1#ping vrf 134 10.111.134.202
PING 10.111.134.202 (10.111.134.202) 72(100) bytes of data.
80 bytes from 10.111.134.202: icmp_seq=1 ttl=64 time=138 ms
80 bytes from 10.111.134.202: icmp_seq=2 ttl=64 time=132 ms
80 bytes from 10.111.134.202: icmp_seq=3 ttl=64 time=124 ms
80 bytes from 10.111.134.202: icmp_seq=4 ttl=64 time=111 ms
80 bytes from 10.111.134.202: icmp_seq=5 ttl=64 time=103 ms

--- 10.111.134.202 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 46ms
rtt min/avg/max/mdev = 103.152/122.104/138.805/13.201 ms, pipe 5, ipg/ewma 11.627/129.4
```

d. On **s1-leaf1**, check the EVPN control-plane for the associated host MAC/IP.

> **Note**

We see the MAC of **s1-host2** multiple times in the control-plane due to our redundant MLAG and ECMP design. Both **s1-leaf3** and **s1-leaf4** are attached to **s1-host2** in VLANs 112 and 134 and therefore will generate these Type 2 EVPN route for its MAC. They each then send this route up to the redundant Spines (or EVPN Route Servers) which provides an ECMP path to the host. The highlighting below is focusing on **s1-leaf4**.

Also notice that since we have configured our network for VXLAN Routing functionality we also see the host MAC-IP route that advertises the ARP binding of **s1-host2**. By looking at the detailed output of the command specifically for the host in VNI (VLAN) 112, we can see details about the **RT** and **VNIs**, both Layer 2 (112) and Layer 3 (5001) which we see in further outputs later.

```
s1-leaf1#show bgp evpn route-type mac-ip
BGP routing table information for VRF default
Router identifier 10.111.254.1, local AS number 65101
Route status codes: * - valid, > - active, S - Stale, E - ECMP head, e - ECMP
                    c - Contributing to ECMP, % - Pending BGP convergence
Origin codes: i - IGP, e - EGP, ? - incomplete
AS Path Attributes: Or-ID - Originator ID, C-LST - Cluster List, LL Nexthop - Link Loca

          Network                Next Hop              Metric  LocPref Weight  Path
<Output Truncated for Space>
 * >Ec    RD: 10.111.254.4:112 mac-ip 001c.73c0.c617
                                 10.111.253.3          -       100     0       65100 65
 *  ec    RD: 10.111.254.4:112 mac-ip 001c.73c0.c617
                                 10.111.253.3          -       100     0       65100 65
 * >Ec    RD: 10.111.254.4:134 mac-ip 001c.73c0.c617
                                 10.111.253.3          -       100     0       65100 65
 *  ec    RD: 10.111.254.4:134 mac-ip 001c.73c0.c617
                                 10.111.253.3          -       100     0       65100 65
 * >Ec    RD: 10.111.254.3:112 mac-ip 001c.73c0.c617 10.111.112.202
                                 10.111.253.3          -       100     0       65100 65
 *  ec    RD: 10.111.254.3:112 mac-ip 001c.73c0.c617 10.111.112.202
                                 10.111.253.3          -       100     0       65100 65
 * >Ec    RD: 10.111.254.4:112 mac-ip 001c.73c0.c617 10.111.112.202
                                 10.111.253.3          -       100     0       65100 65
 *  ec    RD: 10.111.254.4:112 mac-ip 001c.73c0.c617 10.111.112.202
                                 10.111.253.3          -       100     0       65100 65
 * >Ec    RD: 10.111.254.3:134 mac-ip 001c.73c0.c617 10.111.134.202
                                 10.111.253.3          -       100     0       65100 65
 *  ec    RD: 10.111.254.3:134 mac-ip 001c.73c0.c617 10.111.134.202
                                 10.111.253.3          -       100     0       65100 65
 * >Ec    RD: 10.111.254.4:134 mac-ip 001c.73c0.c617 10.111.134.202
                                 10.111.253.3          -       100     0       65100 65
 *  ec    RD: 10.111.254.4:134 mac-ip 001c.73c0.c617 10.111.134.202
                                 10.111.253.3          -       100     0       65100 65
s1-leaf1#show bgp evpn route-type mac-ip 001c.73c0.c617 vni 112 detail
<Output Truncated for Space>
BGP routing table entry for mac-ip 001c.73c0.c617, Route Distinguisher: 10.111.254.4:11
 Paths: 2 available
  65100 65102
    10.111.253.3 from 10.111.0.2 (10.111.0.2)
      Origin IGP, metric -, localpref 100, weight 0, valid, external, ECMP head, ECMP,
      Extended Community: Route-Target-AS:112:112 TunnelEncap:tunnelTypeVxlan
      VNI: 112 ESI: 0000:0000:0000:0000:0000
  65100 65102
    10.111.253.3 from 10.111.0.1 (10.111.0.1)
      Origin IGP, metric -, localpref 100, weight 0, valid, external, ECMP, ECMP contri
      Extended Community: Route-Target-AS:112:112 TunnelEncap:tunnelTypeVxlan
      VNI: 112 ESI: 0000:0000:0000:0000:0000
<Output Truncated for Space>
BGP routing table entry for mac-ip 001c.73c0.c617 10.111.112.202, Route Distinguisher:
 Paths: 2 available
  65100 65102
```

```
    10.111.253.3 from 10.111.0.2 (10.111.0.2)
      Origin IGP, metric -, localpref 100, weight 0, valid, external, ECMP head, ECMP,
      Extended Community: Route-Target-AS:112:112 Route-Target-AS:5001:5001 TunnelEncap
      VNI: 112 L3 VNI: 5001 ESI: 0000:0000:0000:0000:0000
  65100 65102
    10.111.253.3 from 10.111.0.1 (10.111.0.1)
      Origin IGP, metric -, localpref 100, weight 0, valid, external, ECMP, ECMP contri
      Extended Community: Route-Target-AS:112:112 Route-Target-AS:5001:5001 TunnelEncap
      VNI: 112 L3 VNI: 5001 ESI: 0000:0000:0000:0000:0000
```

e. On **s1-leaf1**, verify the BGP table to ensure the Tenant networks on **s1-leaf4** has been learned in the overlay.

Note

The output below shows learned **IP Prefix** routes from EVPN. These are referred to as EVPN Type 5 routes. Similar to the Type 2 and 3 Routes, other VTEPs evaluate the **RT** to see if they have a matching configuration and, if so, import the contained prefix into their VRF Route Table. Note that IPv4 and IPv6 are supported.

In the detailed output, we can see the specific routes from **s1-leaf4** by filtering based on the **RD** value. We can see information about the **RT**, EVPN Router MAC (shared with **s1-leaf3**) and the L3 VNI. The highlights below focus on the 10.111.112.0/24 network.

```
s1-leaf1#show bgp evpn route-type ip-prefix ipv4
BGP routing table information for VRF default
Router identifier 10.111.254.1, local AS number 65101
Route status codes: * - valid, > - active, S - Stale, E - ECMP head, e - ECMP
                    c - Contributing to ECMP, % - Pending BGP convergence
Origin codes: i - IGP, e - EGP, ? - incomplete
AS Path Attributes: Or-ID - Originator ID, C-LST - Cluster List, LL Nexthop - Link Loca

          Network                Next Hop              Metric  LocPref Weight  Path
 * >      RD: 10.111.254.1:1 ip-prefix 10.111.112.0/24
                                 -                     -       -       0       i
 * >Ec    RD: 10.111.254.3:1 ip-prefix 10.111.112.0/24
                                 10.111.253.3          -       100     0       65100 65
 *  ec    RD: 10.111.254.3:1 ip-prefix 10.111.112.0/24
                                 10.111.253.3          -       100     0       65100 65
 * >Ec    RD: 10.111.254.4:1 ip-prefix 10.111.112.0/24
                                 10.111.253.3          -       100     0       65100 65
 *  ec    RD: 10.111.254.4:1 ip-prefix 10.111.112.0/24
                                 10.111.253.3          -       100     0       65100 65
 * >      RD: 10.111.254.1:1 ip-prefix 10.111.134.0/24
                                 -                     -       -       0       i
 * >Ec    RD: 10.111.254.3:1 ip-prefix 10.111.134.0/24
                                 10.111.253.3          -       100     0       65100 65
 *  ec    RD: 10.111.254.3:1 ip-prefix 10.111.134.0/24
                                 10.111.253.3          -       100     0       65100 65
 * >Ec    RD: 10.111.254.4:1 ip-prefix 10.111.134.0/24
                                 10.111.253.3          -       100     0       65100 65
 *  ec    RD: 10.111.254.4:1 ip-prefix 10.111.134.0/24
                                 10.111.253.3          -       100     0       65100 65
s1-leaf1#show bgp evpn route-type ip-prefix ipv4 rd 10.111.254.4:1 detail
BGP routing table information for VRF default
Router identifier 10.111.254.1, local AS number 65101
BGP routing table entry for ip-prefix 10.111.112.0/24, Route Distinguisher: 10.111.254.
 Paths: 2 available
  65100 65102
    10.111.253.3 from 10.111.0.1 (10.111.0.1)
      Origin IGP, metric -, localpref 100, weight 0, valid, external, ECMP head, ECMP,
      Extended Community: Route-Target-AS:5001:5001 TunnelEncap:tunnelTypeVxlan EvpnRou
      VNI: 5001
  65100 65102
    10.111.253.3 from 10.111.0.2 (10.111.0.2)
      Origin IGP, metric -, localpref 100, weight 0, valid, external, ECMP, ECMP contri
      Extended Community: Route-Target-AS:5001:5001 TunnelEncap:tunnelTypeVxlan EvpnRou
      VNI: 5001
```

f. On **s1-leaf1**, check the local ARP and MAC address-table.

Note

The MAC addresses in your lab may differ as they are randomly generated during the lab build. We see here that the ARP and MAC entry of **s1-host2** has been learned and imported via the Vxlan1 interface on **s1-leaf1** in both Host VLANs.

We also see the remote MAC for the shared MLAG System ID of **s1-leaf3** and **s1-leaf4** associated with VLAN 4093 and the Vxlan1 interface. This is how the local VTEP knows where to send routed (ie inter-subnet) traffic when destined to the remote MLAG pair. We can see this VLAN is dynamically created in the VLAN database and is mapped to our Layer 3 VNI (5001) in our VXLAN interface output. Be aware that since this VLAN is dynamic, the ID used in your lab may be different.

```
s1-leaf1#show ip arp vrf TENANT
Address         Age (sec)  Hardware Addr   Interface
10.111.112.201    0:17:56  001c.73c0.c616  Vlan112, Port-Channel5
10.111.112.202          -  001c.73c0.c617  Vlan112, Vxlan1
10.111.134.201    0:17:56  001c.73c0.c616  Vlan134, Port-Channel5
10.111.134.202          -  001c.73c0.c617  Vlan134, Vxlan1
s1-leaf1#show mac address-table dynamic
          Mac Address Table
------------------------------------------------------------------

Vlan    Mac Address       Type        Ports      Moves   Last Move
----    -----------       ----        -----      -----   ---------
 112    001c.73c0.c616    DYNAMIC     Po5        1       0:01:44 ago
 112    001c.73c0.c617    DYNAMIC     Vx1        1       0:01:44 ago
 134    001c.73c0.c616    DYNAMIC     Po5        1       0:01:32 ago
 134    001c.73c0.c617    DYNAMIC     Vx1        1       0:01:32 ago
4093    021c.73c0.c614    DYNAMIC     Vx1        1       0:54:31 ago
Total Mac Addresses for this criterion: 5

          Multicast Mac Address Table
------------------------------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       ----        -----
Total Mac Addresses for this criterion: 0
s1-leaf1#show vlan 4093
VLAN  Name                             Status    Ports
----- -------------------------------- --------- -------------------------------
4093* VLAN4093                         active    Cpu, Po1, Vx1

* indicates a Dynamic VLAN
s1-leaf1#show interfaces Vxlan1
Vxlan1 is up, line protocol is up (connected)
  Hardware is Vxlan
  Source interface is Loopback1 and is active with 10.111.253.1
  Replication/Flood Mode is headend with Flood List Source: EVPN
  Remote MAC learning via EVPN
  VNI mapping to VLANs
  Static VLAN to VNI mapping is
    [112, 112]        [134, 134]
  Dynamic VLAN to VNI mapping for 'evpn' is
    [4093, 5001]
  Note: All Dynamic VLANs used by VCS are internal VLANs.
        Use 'show vxlan vni' for details.
  Static VRF to VNI mapping is
   [TENANT, 5001]
  Headend replication flood vtep list is:
   112 10.111.253.3
   134 10.111.253.3
  MLAG Shared Router MAC is 021c.73c0.c612
```

g. On **s1-leaf1**, check the VXLAN data-plane for MAC address.

Note

Though both **s1-leaf3** and **s1-leaf4** are advertising the MAC of **s1-host2** recall that they have a shared MLAG VTEP IP for VXLAN reachability. Therefore we only see one possible destination for this host MAC. The `show l2rib output mac <MAC of remote host>` command then allows us to see the VTEP info in the hardware. Finally we can verify the ECMP path to the remote MLAG VTEP via **s1-spine1** and **s1-spine2** with a simple `show ip route 10.111.253.3` command.

```
s1-leaf1#show vxlan address-table evpn
  Vxlan Mac Address Table
----------------------------------------------------------------------

VLAN  Mac Address     Type      Prt  VTEP             Moves   Last Move
----  -----------     ----      ---  ----             -----   ---------
112  001c.73c0.c617  EVPN      Vx1  10.111.253.3     1       0:00:57 ago
Total Remote Mac Addresses for this criterion: 1
s1-leaf1#show l2rib output mac 001c.73c0.c617
001c.73c0.c617, VLAN 112, seq 1, pref 16, evpnDynamicRemoteMac, source: BGP
   VTEP 10.111.253.3
s1-leaf1#show ip route 10.111.253.3

VRF: default
Codes: C - connected, S - static, K - kernel,
       O - OSPF, IA - OSPF inter area, E1 - OSPF external type 1,
       E2 - OSPF external type 2, N1 - OSPF NSSA external type 1,
       N2 - OSPF NSSA external type2, B - Other BGP Routes,
       B I - iBGP, B E - eBGP, R - RIP, I L1 - IS-IS level 1,
       I L2 - IS-IS level 2, O3 - OSPFv3, A B - BGP Aggregate,
       A O - OSPF Summary, NG - Nexthop Group Static Route,
       V - VXLAN Control Service, M - Martian,
       DH - DHCP client installed default route,
       DP - Dynamic Policy Route, L - VRF Leaked,
       G  - gRIBI, RC - Route Cache Route

 B E      10.111.253.3/32 [200/0] via 10.111.1.0, Ethernet2
                                  via 10.111.2.0, Ethernet3
```

h. On **s1-leaf1**, verify the Tenant Route table to ensure the Tenant networks on **s1-leaf4** has been installed in the overlay.

Note

Note on the route table for the TENANT VRF, we see a single route entry for the tenant subnets since they are both locally attached.

Also note that the Type 2 MAC-IP Routes, which correspond to the ARP entry of **s1-host2** have also been installed as /32 host routes. This ensures that in a distributed VXLAN fabric, Layer 3 routed traffic is always directed to the VTEP where the host currently resides. This route is directed to the shared MLAG VTEP IP and EVPN Router MAC. It will be ECMPed via the Spines providing a dual path for load-balancing and redundancy.

```
s1-leaf1#show ip route vrf TENANT

VRF: TENANT
Codes: C - connected, S - static, K - kernel,
       O - OSPF, IA - OSPF inter area, E1 - OSPF external type 1,
       E2 - OSPF external type 2, N1 - OSPF NSSA external type 1,
       N2 - OSPF NSSA external type2, B - Other BGP Routes,
       B I - iBGP, B E - eBGP, R - RIP, I L1 - IS-IS level 1,
       I L2 - IS-IS level 2, O3 - OSPFv3, A B - BGP Aggregate,
       A O - OSPF Summary, NG - Nexthop Group Static Route,
       V - VXLAN Control Service, M - Martian,
       DH - DHCP client installed default route,
       DP - Dynamic Policy Route, L - VRF Leaked,
       G  - gRIBI, RC - Route Cache Route

Gateway of last resort is not set

 B E      10.111.112.202/32 [200/0] via VTEP 10.111.253.3 VNI 5001 router-mac 02:1c:73:
 C        10.111.112.0/24 is directly connected, Vlan112
 B E      10.111.134.202/32 [200/0] via VTEP 10.111.253.3 VNI 5001 router-mac 02:1c:73:
 C        10.111.134.0/24 is directly connected, Vlan134
```

LAB COMPLETE!

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