Determine Packet Flow Through an ACI Fabric

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Introduction

This document describes how to determine the packet flow through an Application Centric Infrastructure (ACI) Fabric in various situations.

Note: All of the situations that are described in this document involve an operational ACI Fabric so that the packet flow in the hardware can be traced.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

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

- An ACI Fabric that consists of two Spine switches and two Leaf switches
- An ESXi host with two uplinks that go to each of the Leaf switches
- An Application Policy Infrastructure Controller (APIC) that is used for initial setup

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Determine ACI Fabric Packet Flow

This section describes the various situations in which an ACI Fabric might be used and how to determine the packet flow.

Single BD/Single EPG with Two Endpoints on the Same Leaf

This section describes how to verify the hardware programming and packet flow for two endpoints within the same Endpoint Group (EPG)/Bridge Domain (BD) on the same Leaf switch. If the Virtual Machines (VMs) run on the same host, since they are in the same EPG, the traffic is isolated to the Virtual Switch (VS) on the host, and the traffic never has to leave the host. If the VMs run on different hosts, then the information that follows applies.

The first thing that you should verify is whether the Media Access Control (MAC) address information for both the source and destination IP addresses on the Leaf switch is learned. This is the MAC and IP address information that is used in this example:

- Source MAC address: ***0050.5695.17b7***
- Source IP address: ***192.168.3.2***
- Destination MAC address: ***0050.5695.248f***
- Destination IP address: ***192.168.3.3***

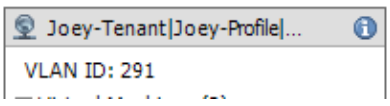
Enter the ***show mac address−table*** command in order to verify this information:

```
leaf2# show mac address-table
Legend:
        * - primary entry, G - Gateway MAC, (R) - Routed MAC, O - Overlay MAC
        age - seconds since last seen,+ - primary entry using vPC Peer-Link,
        (T) - True, (F) - False
   VLAN     MAC Address      Type      age     Secure NTFY Ports/SWID.SSID.LID
---------+-----------------+--------+---------+------+----+------------------
  16       0050.5695.248f    dynamic      -       F    F    tunnel4
* 19       0050.5695.17b7    dynamic      -       F    F    eth1/31
* 19       0050.5695.248f    dynamic      -       F    F    eth1/31
```

As shown, the system learns the MAC addresses for both of the endpoints on the same VLAN. This VLAN is the Platform Independent (PI) VLAN and is locally significant to each switch. In order to verify that this is the correct PI VLAN, connect to the ***vsh_lc*** and enter this command into the CLI:

```
module-1# show system internal eltmc info vlan brief
VLAN-Info
VlanId  HW_VlanId Type            Access_enc Access_enc Fabric_enc Fabric_enc BDVlan
                                  Type                  Type
================================================================================
     9       11         BD_VLAN   Unknown          0     VXLAN  16613250       9
    10       12         BD_VLAN   Unknown          0     VXLAN  15990734      10
    13       13         FD_VLAN    802.1q        299     VXLAN      8507      10
    16       14         BD_VLAN   Unknown          0     VXLAN  16449431      16
    17       15         FD_VLAN    802.1q        285     VXLAN      8493      16
    18       16         BD_VLAN   Unknown          0     VXLAN  15761386      18
    19       17         FD_VLAN    802.1q        291     VXLAN      8499      18
```

The ***HW_VlanId*** is the VLAN that is used by the Broadcom. The ***VlanId*** is the PI VLAN, which maps to the ***Access_enc*** VLAN 291 that is derived from the VLAN pool and is the VLAN that is propagated to the Distributed Virtual Switch (DVS) Port Group:



Since this traffic flow is in the same BD and the same VLAN, the traffic should be switched locally on the Broadcom ASIC. In order to verify that the Broadcom has the correct entries in the hardware, connect to the Broadcom shell and view the Layer 2 (L2) table:

```
leaf2# bcm-shell-hw
unit is 0
Available Unit Numbers: 0
bcm-shell.0> l2 show
mac=00:22:bd:f8:19:ff vlan=19 GPORT=0x7f modid=2 port=127   Static
mac=00:50:56:95:68:c4 vlan=25 GPORT=0x5f modid=0 port=95/xe94 Hit
mac=00:22:bd:f8:19:ff vlan=16 GPORT=0x7f modid=2 port=127   Static
mac=00:22:bd:f8:19:ff vlan=29 GPORT=0x7f modid=2 port=127   Static
mac=00:22:bd:f8:19:ff vlan=32 GPORT=0x7f modid=2 port=127   Static
mac=00:22:bd:f8:19:ff vlan=26 GPORT=0x7f modid=2 port=127   Static
mac=00:50:56:95:24:8f vlan=17 GPORT=0x1f modid=0 port=31/xe30 Hit
mac=00:22:bd:f8:19:ff vlan=18 GPORT=0x7f modid=2 port=127   Static
mac=00:22:bd:f8:19:ff vlan=21 GPORT=0x7f modid=2 port=127   Static
mac=00:22:bd:f8:19:ff vlan=34 GPORT=0x7f modid=2 port=127   Static
mac=00:50:56:95:26:5e vlan=25 GPORT=0x5f modid=0 port=95/xe94 Hit
mac=00:50:56:95:c3:6f vlan=24 GPORT=0x5f modid=0 port=95/xe94 Hit
mac=00:50:56:95:5c:4d vlan=28 GPORT=0x1e modid=0 port=30/xe29 Hit
mac=00:22:bd:f8:19:ff vlan=12 GPORT=0x7f modid=2 port=127   Static Hit
mac=00:22:bd:f8:19:ff vlan=11 GPORT=0x7f modid=2 port=127   Static
mac=00:50:56:95:17:b7 vlan=17 GPORT=0x1f modid=0 port=31/xe30 Hit
mac=00:50:56:95:4e:d3 vlan=30 GPORT=0x1e modid=0 port=30/xe29 Hit
mac=00:22:bd:f8:19:ff vlan=14 GPORT=0x7f modid=2 port=127   Static
```

The output shows that the Broadcom ASIC programming is correct and that the traffic should switch locally in VLAN 17.

Single BD/Single EPG with Two Endpoints on Different Leafs

This section describes how to verify the hardware programming and packet flow for two endpoints within the same EPG/BD but on different Leaf switches.

The first thing that you should verify is whether the MAC address information for both the source and destination IP addresses on the Leaf switches is learned. This is the MAC and IP address information that is used in this example:

- Source MAC address: ***0050.5695.17b7***
- Source IP address: ***192.168.3.2***
- Destination MAC address: ***0050.5695.bd89***
- Destination IP address: ***192.168.3.11***

Enter the ***show mac address-table*** command into the CLI of both Leaf switches in order to verify this information:

```
leaf2# show mac address-table
Legend:
        * - primary entry, G - Gateway MAC, (R) - Routed MAC, O - Overlay MAC
        age - seconds since last seen,+ - primary entry using vPC Peer-Link,
        (T) - True, (F) - False
   VLAN     MAC Address      Type      age     Secure NTFY Ports/SWID.SSID.LID
---------+-----------------+--------+---------+------+----+------------------
* 19       0050.5695.17b7    dynamic      -       F    F    eth1/31
* 19       0050.5695.248f    dynamic      -       F    F    eth1/31

leaf_1# show mac address-table
Legend:
        * - primary entry, G - Gateway MAC, (R) - Routed MAC, O - Overlay MAC
        age - seconds since last seen,+ - primary entry using vPC Peer-Link,
        (T) - True, (F) - False
   VLAN     MAC Address      Type      age     Secure NTFY Ports/SWID.SSID.LID
---------+-----------------+--------+---------+------+----+------------------
  27       0050.5695.248f    dynamic      -       F    F    tunnel7
```

```
  27       0050.5695.17b7    dynamic      -       F    F    tunnel7
* 28       0050.5695.bd89    dynamic      -       F    F    eth1/25
```

As shown in the outputs, the source IP address is learned on the second Leaf switch (***leaf2***), while the destination IP address is learned on the first Leaf switch (***leaf_1***). Since these are on different Leaf switches, the traffic must be sent to the NorthStar ASIC on the second Leaf switch so that it can be sent upstream to the Spine switches. In order to follow the NorthStar logic, connect to the linecard ***vsh***.

Enter this command in order to view a list of local entries:

```
leaf2# vsh_lc
module-1# show platform internal ns forwarding lst-l2
error opening file
: No such file or directory

==============================================================================
TABLE INSTANCE : 0
==============================================================================
Legend:
POS: Entry Position             O: Overlay Instance
V: Valid Bit                    MD/PT: Mod/Port
PT: Pointer Type(A=Adj, E=ECMP, D=DstEncap N=Invalid)
PTR: ECMP/Adj/DstEncap/MET pointer
ML: MET Last
ST: Static                      PTH: Num Paths
BN: Bounce                      CP: Copy To CPU
PA: Policy Applied              PI: Policy Incomplete
DL: Dst Local                   SP: Spine Proxy
------------------------------------------------------------------------------
MO       SRC  P      M S     B C P P D S
POS   O VNID   Address           V DE MD/PT CLSS T PTR  L T PTH N P A I L P
------------------------------------------------------------------------------
111 0 fd7f82 00:22:bd:f8:19:ff 1  0 00/00    1 A    0 0 1   1 0 0 0 1 0 0
131 0 f1ffde 00:22:bd:f8:19:ff 1  0 00/00    1 A    0 0 1   1 0 0 0 1 0 0
169 0 f37fd3 00:50:56:95:26:5e 1  0 00/24 4002 A    0 0 0   1 0 0 0 1 0 0
331 0 f37fd2 00:50:56:95:5c:4d 1  0 00/2e 8003 A    0 0 0   1 0 0 0 1 0 0
719 0 f3ffce 00:22:bd:f8:19:ff 1  0 00/00    1 A    0 0 1   1 0 0 0 1 0 0
945 0 f7ffae 00:22:bd:f8:19:ff 1  0 00/00    1 A    0 0 1   1 0 0 0 1 0 0
1390 0 fa7f9a 00:22:bd:f8:19:ff 1  0 00/00    1 A    0 0 1   1 0 0 0 1 0 0
1454 0 efffee 00:22:bd:f8:19:ff 1  0 00/00    1 A    0 0 1   1 0 0 0 1 0 0
1690 0 f37fd3 00:22:bd:f8:19:ff 1  0 00/00    1 A    0 0 1   1 0 0 0 1 0 0
1720 0 f37fd3 00:50:56:95:c3:6f 1  0 00/24 c002 A    0 0 0   1 0 0 0 1 0 0
1902 0 f1ffde 00:50:56:95:4e:d3 1  0 00/2e 8006 A    0 0 0   1 0 0 0 1 0 0
2176 0 f07fea 00:50:56:95:17:b7 1  0 00/0f 8004 A    0 0 0   1 0 0 0 0 0 0
2819 0 faff97 00:22:bd:f8:19:ff 1  0 00/00    1 A    0 0 1   1 0 0 0 1 0 0
3297 0 f07fea 00:22:bd:f8:19:ff 1  0 00/00    1 A    0 0 1   1 0 0 0 1 0 0

==============================================================================
TABLE INSTANCE : 1
==============================================================================
Legend:
POS: Entry Position             O: Overlay Instance
V: Valid Bit                    MD/PT: Mod/Port
PT: Pointer Type(A=Adj, E=ECMP, D=DstEncap N=Invalid)
PTR: ECMP/Adj/DstEncap/MET pointer
ML: MET Last
ST: Static                      PTH: Num Paths
BN: Bounce                      CP: Copy To CPU
PA: Policy Applied              PI: Policy Incomplete
DL: Dst Local                   SP: Spine Proxy
------------------------------------------------------------------------------
MO       SRC  P      M S     B C P P D S
POS   O VNID   Address           V DE MD/PT CLSS T PTR  L T PTH N P A I L P
------------------------------------------------------------------------------
169 0 f37fd3 00:50:56:95:26:5e 1  0 00/24 4002 A    e 0 0   1 0 0 0 0 1 0
```

```
331 0 f37fd2 00:50:56:95:5c:4d 1  0 00/2e 8003 A    9 0 0   1 0 0 0 0 1 0
1720 0 f37fd3 00:50:56:95:c3:6f 1  0 00/24 c002 A    c 0 0   1 0 0 0 0 1 0
1902 0 f1ffde 00:50:56:95:4e:d3 1  0 00/2e 8006 A    f 0 0   1 0 0 0 0 1 0
2176 0 f07fea 00:50:56:95:17:b7 1  0 00/0f 8004 A    d 0 0   1 0 0 0 0 1 0
3507 0 fa7f9a 00:50:56:95:3e:ee 1  0 00/2e c005 A   10 0 0   1 0 0 0 0 1 0
3777 0 f37fd3 00:50:56:95:68:c4 1  1 04/04 4002 A   11 0 0   1 1 0 0 0 0 0
3921 0 f07fea 00:50:56:95:24:8f 1  0 00/0f 8004 A    d 0 0   1 0 0 0 0 1 0
```

Enter this command in order to view a list of the destination entries (look for the destination MAC address):

```
module-1# show platform internal ns forwarding gst-l2
error opening file
: No such file or directory

================================================================================
TABLE INSTANCE : 0
================================================================================
Legend:
POS: Entry Position O: Overlay Instance
V: Valid Bit MD/PT: Mod/Port
PT: Pointer Type(A=Adj, E=ECMP, D=DstEncap N=Invalid)
PTR: ECMP/Adj/DstEncap/MET pointer
ML: MET Last
ST: Static PTH: Num Paths
BN: Bounce CP: Copy To CPU
PA: Policy Applied PI: Policy Incomplete
DL: Dst Local SP: Spine Proxy
--------------------------------------------------------------------------------
                                    MO       SRC  P     M S     B C P P D S
POS  O VNID   Address           V DE MD/PT CLSS T PTR L T PTH N P A I L P
--------------------------------------------------------------------------------
2139 0 ff7f72 00:50:56:95:7b:16 1 0  00/00 8006 A d   0 0 1   0 0 0 0 1 0
2195 0 faff97 00:50:56:95:5d:6e 1 0  00/00 8005 A f   0 0 1   0 0 0 0 1 0
3379 0 f07fea 00:50:56:95:bd:89 1 1  00/00 8004 A 10  0 0 1   0 0 0 0 0 0
4143 0 f07fea 00:50:56:95:17:b7 1 0  00/00 8004 A a   0 0 1   0 0 0 0 1 0
4677 0 f07feb 00:50:56:95:68:c4 1 0  00/00 4002 A e   0 0 1   0 0 0 0 1 0
5704 0 f07fea 00:50:56:95:24:8f 1 0  00/00 8004 A a   0 0 1   0 0 0 0 1 0
6191 0 f7ffaf 00:50:56:95:00:33 1 0  00/00 4007 A c   0 0 1   0 0 0 0 1 0
```

Take note of the Pointer (***PTR***) field in these outputs, which is the adjacency pointer. This value is used in the next command in order to find the destination encapsulated VLAN. This is a HEX value that you must convert to a decimal value (0 x 10 in decimal is 16).

Enter this command into the CLI, with ***16*** as the adjacency pointer:

```
module-1# show platform internal ns forwarding adj 16
error opening file
: No such file or directory

================================================================================
TABLE INSTANCE : 0
================================================================================
Legend
TD: TTL Dec Disable         UP: USE PCID
DM: Dst Mac Rewrite         SM: Src Mac Rewrite
RM IDX: Router Mac IDX      SR: Seg-ID Rewrite
--------------------------------------------------------------------------------
ENCP T U USE  D                   S RM  S        SRC
POS   SEG-ID PTR  D P PCI  M DST-MAC          M IDX R SEG-ID CLSS
--------------------------------------------------------------------------------
 16      0 2ffa 0 0    0 1 00:0c:0c:0c:0c:0c 0   0 0      0    0
```

Take note of the ***ENCP PTR*** value in this output, which is used in order to find the destination Tunnel

Endpoint (TEP) address:

```
module-1# show platform internal ns forwarding encap 0x2ffa
error opening file
: No such file or directory

================================================================================
TABLE INSTANCE : 0
================================================================================
Legend
MD: Mode (LUX & RWX)        LB: Loopback
LE: Loopback ECMP           LB-PT: Loopback Port
ML: MET Last                TD: TTL Dec Disable
DV: Dst Valid               DT-PT: Dest Port
DT-NP: Dest Port Not-PC     ET: Encap Type
OP: Override PIF Pinning    HR: Higig DstMod RW
HG-MD: Higig DstMode        KV: Keep VNTAG
--------------------------------------------------------------------------------
M PORT L L LB MET  M T D DT DT E TST O H HG K M E
POS   D FTAG B E PT PTR  L D V PT NP T IDX P R MD V D T Dst MAC           DIP
--------------------------------------------------------------------------------
12282 0  c00 0 1  0    0 0 0 0  0  0 3   7 0 0  0 0 0 3 00:00:00:00:00:00 192.168.56.93
```

In this case, the frame is encapsulated in iVXLAN via the source IP address of the local TEP and destination IP address of the TEP that is listed. Based on the ELTMC output, the VXLAN ID for that BD is ***15761386***, so this is the ID that is placed into the VXLAN packet. When the traffic reaches the other side, it is de-encapsulated, and since the destination MAC address is local, it is forwarded out of the port in the ***l2 show*** command from the Broadcom.

Single BD/Two EPGs with One Endpoint in Each EPG on the Same Leaf

This section describes how to verify the hardware programming and packet flow for two endpoints in different EPGs but with the same BD. The traffic flows to the same Leaf switch. This is also known as a Physical Local-to-Physical Local (PL-to-PL) Bridged packet. It is *Bridged* because communication is allowed between two encapsulated VLANs without the need for a Layer 3 (L3) interface to perform routing.

The first thing that you should verify is whether the MAC address information for both the source and destination IP addresses on the Leaf switches is learned on the expected interface (***1/48*** in this case). This is the MAC and IP address information that is used in this example:

- Source MAC address: ***0050.5695.908b***
- Source IP address: ***192.168.1.50***
- Destination MAC address: ***0050.5695.bd89***
- Destination IP address: ***192.168.1.51***

Enter the ***show mac address-table*** command into the CLI in order to verify this information:

```
leaf1# show mac address-table | grep 908b
* 34       0050.5695.908b    dynamic      -       F    F    eth1/48
leaf1# show mac address-table | grep bd89
* 38       0050.5695.bd89    dynamic      -       F    F    eth1/48
```

You should then enter into the Broadcom (BCM) shell and verify that the BCM learns the correct MAC address information:

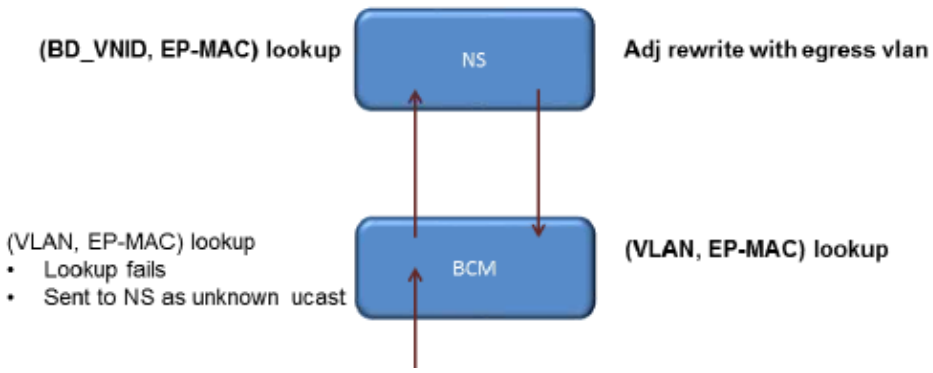
```
bcm-shell.0> l2 show
mac=00:50:56:95:bd:89 vlan=55 GPORT=0x30 modid=0 port=48/xe47
mac=00:50:56:95:90:8b vlan=54 GPORT=0x30 modid=0 port=48/xe47 Hit
```

The output shows that the BCM has learned the MAC address information; however, the MAC addresses are on different VLANs. This is expected, as the traffic comes in from the host with different encapsulated VLANs (different EPGs).

Enter into the ELTMC in order verify the ***HW_VlanID*** that is displayed in the BCM shell against the BD VLAN for the two encapsulated VLANs:

```
module-1# show system internal eltmc info vlan brief
VLAN-Info
VlanId  HW_VlanId Type            Access_enc Access_enc Fabric_enc Fabric_enc BDVlan
Type                 Type
================================================================================
13       15    BD_CTRL_VLAN     802.1q      4093     VXLAN  16777209       0
14       16         BD_VLAN   Unknown         0     VXLAN  15957970      14
15       17         BD_VLAN   Unknown         0     VXLAN  16613250      15
16       18         FD_VLAN    802.1q       301     VXLAN      8509      15
17       19         BD_VLAN   Unknown         0     VXLAN  16220082      17
18       46         BD_VLAN   Unknown         0     VXLAN  14745592      18
19       50         BD_VLAN   Unknown         0     VXLAN  16646015      19
20       51         FD_VLAN    802.1q       502     VXLAN      8794      19
21       23         BD_VLAN   Unknown         0     VXLAN  16121792      21
22       24         FD_VLAN    802.1q       538     VXLAN      8830      21
23       25         BD_VLAN   Unknown         0     VXLAN  15826915      23
24       28         FD_VLAN    802.1q       537     VXLAN      8829      23
25       26         BD_VLAN   Unknown         0     VXLAN  16351138      25
26       29         FD_VLAN    802.1q       500     VXLAN      8792      25
27       27         BD_VLAN   Unknown         0     VXLAN  16678779      27
28       30         FD_VLAN    802.1q       534     VXLAN      8826      27
29       52         BD_VLAN   Unknown         0     VXLAN  15859681      29
31       47         FD_VLAN    802.1q       602     VXLAN      9194      18
32       31         FD_VLAN    802.1q       292     VXLAN      8500      55
33       20         BD_VLAN   Unknown         0     VXLAN  15761386      33
34       54         FD_VLAN    802.1q       299     VXLAN      8507      54
35       33         BD_VLAN   Unknown         0     VXLAN  16449431      35
38       55         FD_VLAN    802.1q       300     VXLAN      8508      54
39       53         FD_VLAN    802.1q       501     VXLAN      8793      29
```

In this ELTMC output, you can see that the ***HW_VlanId*** for each entry is mapped to the ***Access_enc*** that the traffic is tagged with when it enters the switch (check the VMware port groups in order to verify whether it is virtualized) and that the ***VlanId*** is the PI VLAN that appeared in the MAC address table. This is a Bridged connection in this case because the BD VLAN is the same (they are both on VLAN 54). This diagram shows the BCM-to-NorthStar interaction:



NorthStar adjusts the packet and rewrites the egress frame with the ***HW_VlanId*** of the destination IP address. This way, the BCM has a local hit in that VLAN and sends the frame out through port ***1/48***.

Two BDs/Two EPGs with One Endpoint in Each EPG on the Same Leaf (Routed Packet)

This section describes how to verify the hardware programming and packet flow for two endpoints in different EPGs that use different BDs. The traffic flows to the same Leaf switch, but it must be routed. This is also known as a PL−to−PL *Routed* packet.

The first thing that you should verify is whether the MAC address information for both the source and destination IP addresses on the Leaf switch in learned on the expected interface (***1/48*** in this case). This is the MAC and IP address information that is used in this example:

- Source MAC address: ***0050.5695.908b***
- Source IP address: ***192.168.1.50***
- Default Gateway: ***192.168.1.1***
- Destination MAC address: ***0050.5695.bd89***
- Destination IP address: ***192.168.3.51***
- Default Gateway: ***192.168.3.1***

While you can view the MAC address table in order to verify the L2 information, an important piece of the solution for the L3 routed traffic is the Endpoint Manager (EPM). The EPM is the process that tracks all of the endpoints on a particular device.

Verify that the EPM has knowledge of the two endpoints on the first Leaf switch (***Leaf1***):

```
leaf1# show endpoint ip 192.168.1.50
Legend:
 O − peer−attached    H − vtep             a − locally−aged     S − static
 V − vpc−attached     p − peer−aged        L − local            M − span
 s − static−arp       B − bounce
+---------------+---------------+-----------------+--------------+-------------+
      VLAN/       Encap           MAC Address       MAC Info/       Interface
      Domain      VLAN            IP Address        IP Info
+---------------+---------------+-----------------+--------------+-------------+
56                      vlan−299    0050.5695.908b L                    eth1/48
Joey−Tenant:Joey−Internal        vlan−299      192.168.1.50 L
```

The source IP address is learned on Ethernet ***1/48***, and it is local to this switch.

```
leaf1# show endpoint ip 192.168.3.51
Legend:
 O − peer−attached    H − vtep             a − locally−aged     S − static
 V − vpc−attached     p − peer−aged        L − local            M − span
 s − static−arp       B − bounce
+---------------+---------------+-----------------+--------------+-------------+
      VLAN/       Encap           MAC Address       MAC Info/       Interface
      Domain      VLAN            IP Address        IP Info
+---------------+---------------+-----------------+--------------+-------------+
44                      vlan−291    0050.5695.bd89 L                    eth1/48
Joey−Tenant:Joey−Internal        vlan−291      192.168.3.51 L
```

As shown, the destination IP address is learned on Ethernet ***1/48*** and it is local to this switch.

In order to obtain more detailed information about these endpoints, connect to the Linecard (LC):

```
leaf1# vsh_lc
module−1# show system internal epmc endpoint ip 192.168.1.50

MAC : 0050.5695.908b ::: Num IPs : 1
IP# 0 : 192.168.1.50 ::: IP# 0 flags :
```

```
Vlan id : 56 ::: Vlan vnid : 8507 ::: BD vnid : 15990734
VRF vnid : 2523136 ::: phy if : 0x1a02f000 ::: tunnel if : 0
Interface : Ethernet1/48
VTEP tunnel if : N/A ::: Flags : 0x80004c04
Ref count : 5 ::: sclass : 0x2ab5
Timestamp : 02/01/1970 00:43:53.129731
last mv timestamp 12/31/1969 19:00:00.000000 ::: ep move count : 0
previous if : 0 ::: loop detection count : 0
EP Flags : local,IP,MAC,class-set,timer,
Aging:Timer-type : Host-tracker timeout ::: Timeout-left : 423 ::: Hit-bit :
Yes ::: Timer-reset count : 406

PD handles:
Bcm l2 hit-bit : Yes
[L2]: Asic : NS ::: ADJ : 0x14 ::: LST SA : 0x83a ::: LST DA : 0x83a :::
GST ING : 0xedb ::: BCM : Yes
[L3-0]: Asic : NS ::: ADJ : 0x14 ::: LST SA : 0xe56 ::: LST DA : 0xe56 :::
GST ING : 0x12ae ::: BCM : Yes
::::
```

Take note of the ***VRF vnid*** and the ***BD vnid*** values.

```
module-1# show system internal epmc endpoint ip 192.168.3.51

MAC : 0050.5695.bd89 ::: Num IPs : 1
IP# 0 : 192.168.3.51 ::: IP# 0 flags :
Vlan id : 44 ::: Vlan vnid : 8499 ::: BD vnid : 15761386
VRF vnid : 252313 6 ::: phy if : 0x1a02f000 ::: tunnel if : 0
Interface : Ethernet1/48
VTEP tunnel if : N/A ::: Flags : 0x80004c04
Ref count : 5 ::: sclass : 0x8004
Timestamp : 02/01/1970 00:43:53.130524
last mv timestamp 12/31/1969 19:00:00.000000 ::: ep move count : 0
previous if : 0 ::: loop detection count : 0
EP Flags : local,IP,MAC,class-set,timer,
Aging:Timer-type : Host-tracker timeout ::: Timeout-left : 532 ::: Hit-bit :
Yes ::: Timer-reset count : 1

PD handles:
Bcm l2 hit-bit : Yes
[L2]: Asic : NS ::: ADJ : 0x15 ::: LST SA : 0x28e ::: LST DA : 0x28e :::
GST ING : 0xd33 ::: BCM : Yes
[L3-0]: Asic : NS ::: ADJ : 0x15 ::: LST SA : 0x497b ::: LST DA : 0x497b :::
GST ING : 0x1e98 ::: BCM : Yes
::::
```

The ***VRF vnid*** value in this output is the same because both of the routes are a part of the same Virtual Routing and Forwarding (VRF) in the routing table (same context). The ***BD vnid*** value is different, since the two endpoints are in different BDs.

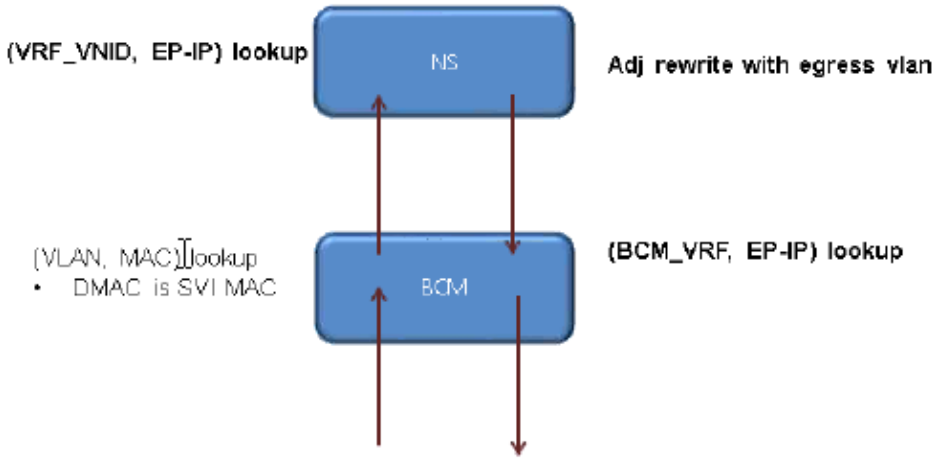
Just as you viewed the NorthStar tables in order to verify the hardware programming for the MAC addresses at an L2 level, you can do the same in order to verify the L3 table:

```
module-1# show platform internal ns forwarding lst-l3
error opening file
: No such file or directory

==============================================================================
TABLE INSTANCE : 0
==============================================================================
Legend:
POS: Entry Position             O: Overlay Instance
V: Valid Bit                    MD/PT: Mod/Port
PT: Pointer Type(A=Adj, E=ECMP, D=DstEncap N=Invalid)
```

```
PTR: ECMP/Adj/DstEncap/MET pointer
ML: MET Last
ST: Static                          PTH: Num Paths
BN: Bounce                          CP: Copy To CPU
PA: Policy Applied                  PI: Policy Incomplete
DL: Dst Local                       SP: Spine Proxy
------------------------------------------------------------------------------
MO       SRC  P      M S     B C P P D S
POS   O VNID   Address           V DE MD/PT CLSS T PTR  L T PTH N P A I L P
------------------------------------------------------------------------------
2881 0 268000 192.168.1.1       1  0 00/00    1 A    0 0 1   1 0 0 0 1 0 0
3003 0 208001 80.80.80.10       1  0 00/14 800d A    0 0 0   1 0 0 0 1 0 0
3051 0 208001 30.30.30.30       1  0 00/14 c009 A    0 0 0   1 0 0 0 0 0 0
3328 0 268000 192.168.2.1       1  0 00/00    1 A    0 0 1   1 0 0 0 1 0 0
3670 0 268000 192.168.1.50      1  0 00/09 2ab5 A    0 0 0   1 0 0 0 0 0 0
3721 0 2b8001 50.50.50.1        1  0 00/00    1 A    0 0 1   1 0 0 0 1 0 0
3903 0 268000 192.168.3.1       1  0 00/00    1 A    0 0 1   1 0 0 0 1 0 0
18811 0 268000 192.168.3.51     1  0 00/09 8004 A    0 0 0   1 0 0 0 0 0 0
```

This diagram illustrates the flow through the ASICs:



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