Hardware EX: Mergulho profundo no encaminhamento de pacotes da ACI.

Contents

Introduction

Este documento descreve diferentes cenários de encaminhamento usando os switches ACI baseados em "EX" na Application Centric Infrastructure (ACI). Ele mostrará como verificar se o hardware está programado corretamente e estamos encaminhando pacotes para os endpoints de destino (EPs) corretos nos EPGs (Endpoint Groups, grupos de endpoints) apropriados.

Prerequisites

Requirements

Não existem requisitos específicos para este documento.

Componentes Utilizados

As informações neste documento são baseadas nas seguintes versões de hardware e software:

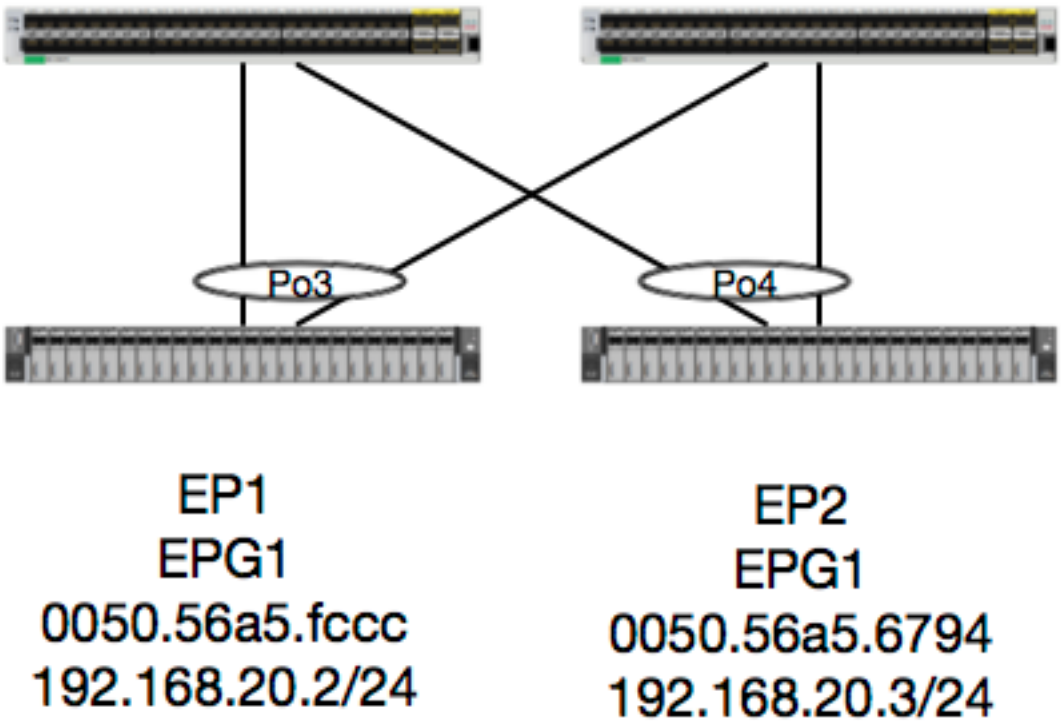
- Uma estrutura da ACI que consiste em dois switches spine e dois switches leaf que usam hardware EX
- Um host ESXi com dois uplinks que vão para cada um dos switches leaf
- Dispositivo Nexus 5000 atuando como roteador.
- Um Application Policy Infrastructure Controller (APIC) usado para a configuração inicial

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.

Cenários

2 EPs no mesmo EPG/mesmo leaf - quadro comutado

Topologia



Dada essa topologia, o fluxo de EP1 para EP2 é um fluxo de L2 e deve ser comutado localmente em qualquer folha em que o tráfego de origem entra. A primeira coisa a verificar com os fluxos da camada 2 (L2) é a tabela de endereços mac para determinar se e onde o switch recebeu quadros:

```
leaf4# show mac address-table | grep fccc
* 30       0050.56a5.fccc    dynamic      -       F    F    po3
leaf4# show mac address-table | grep 6794
* 30       0050.56a5.6794    dynamic      -       F    F    po4
```

Para ver a vlan de encapsulamento, também podemos verificar o banco de dados EP:

```
leaf4# show endpoint mac 0050.56a5.fccc
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
+----------------------------------+--------------+-----------------+-------------+----------
---+
30                                      vlan-2268    0050.56a5.fccc LV
po3
Joey-Tenant:Joey-Internal               vlan-2268      192.168.20.2 LV
po3


calo2-leaf4# show endpoint mac 0050.56a5.6794
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
+----------------------------------+--------------+-----------------+-------------+----------
---+
30                                      vlan-2268    0050.56a5.6794 LV
po4
Joey-Tenant:Joey-Internal               vlan-2268      192.168.20.3 LV
po4
```

Sabemos que FD_VLAN 30 corresponde, mas sempre podemos validar o mapeamento no software:

```
leaf4# show vlan extended | grep 2268
 30   enet  CE         vlan-2268
```

E, claro, podemos verificar o hardware para garantir que a VLAN 30 mapeie para a VLAN 2268 como o encapsulamento do painel frontal.

```
leaf4# vsh_lc
module-1# show system internal eltmc info vlan 30


            vlan_id:             30   :::      hw_vlan_id:             22
          vlan_type:        FD_VLAN   :::         bd_vlan:             28
   access_encap_type:         802.1q   :::    access_encap:           2268
   fabric_encap_type:          VXLAN   :::    fabric_encap:          11960
              sclass:          32778   :::           scope:             11
           untagged:               0
     acess_encap_hex:          0x8dc   :::  fabric_enc_hex:         0x2eb8
     pd_vlan_ft_mask:            0x8
    fd_learn_disable:              0
        qos_class_id:              0   :::      qos_pap_id:              0
          qq_met_ptr:             25   :::      ipmc_index:              0
   ingressBdAclLabel:              0   ::: ingBdAclLblMask:              0
    egressBdAclLabel:              0   ::: egrBdAclLblMask:              0
```

```
         qos_map_idx:              0   :::     qos_map_pri:              0
        qos_map_dscp:              0   :::      qos_map_tc:              0
        vlan_ft_mask:          0xe30
           hw_bd_idx:              0   :::      hw_epg_idx:          11267
          intf_count:              2   ::: glbl_scp_if_cnt:              2

<SNIPPED>
```

Dado que os programas informáticos do PE são aprendidos, podemos também validar que o hardware programou as informações de L2 destes programas de trabalho. No novo hardware, há a HAL (Hardware Abstraction Layer, camada de abstração de hardware) que é o estado do software do hardware. O trabalho da HAL é pegar uma solicitação de programação de software e enviá-la para o hardware.

Para visualizar informações de hardware de L2 sobre um endpoint, podemos examinar a tabela de L2 em HAL para determinados endereços mac:

```
leaf4# vsh_lc
module-1# show platform internal hal ep l2 mac 0050.56a5.fccc
LEGEND:
-------
BDId:              BD Id                                                BD Name:        BD
Name
T:                 EP Type (Pl: Physical Vl: Virtual Xr: Remote         EP Mac:         Mac
L2 IfId:           L2 Interface                                         L2 IfName:      L2
IfName
FDId:              FD Id                                                FD Name:        FD
Name
S Class:           S Class                                              Age Intvl:      Age
Interval
P A:               Packet Action (F: Forward, T: Trap to CPU,
                                  L: Log & Forward, D: Drop, N: None)
S T:               Static Ep                                            S E:
Secure EP
L D:               Learn Disable                                        B N D:          Bind
Notify Disable
E N D:             Epg Notify Disable                                   B E:
Bounce Enable
I D L:             IVxlan Dont Learn                                    SPI:
Source Policy Incomplete
DPI:               Dest Policy Incomplete                               SPA:
Source Policy Applied
DPA:               Dest Policy Applied                                  DSS:            Dest
Shared Service
IL:                Is Local                                             VUB:            Vnid
Use Bd
SO:                SA Only

 L2 EP Count: 1

================================================================================================
======================
                                                                                          B E
I S D S D D   V
     BD          EP               L2       L2              FD        S     Age   P S S L N N
B D P P P P S I U S
BdId Name      T  Mac              IfId     Ifname      FDId Name     Class Intvl A T E D D D
E L I I A A S L B O
================================================================================================
======================
1c   BD-28     Pl 00:50:56:a5:fc:cc 16000002 Po3         1e   FD-30     800a  29f   F 0 0 0 1 0
0 0 0 0 0 0 0 1 0 0
```

```
module-1# show platform internal hal ep l2 mac 0050.56a5.6794
================================================================================================
======================
                                                                                        B E
I S D S D D   V
     BD          EP               L2       L2              FD        S     Age   P S S L N N
B D P P P P S I U S
BdId Name      T  Mac              IfId     Ifname      FDId Name      Class Intvl A T E D D D
E L I I A A S L B O
================================================================================================
======================
1c   BD-28     Pl 00:50:56:a5:67:94 16000003 Po4         1e   FD-30     800a  29f   F 0 0 0 1 0
0 0 0 0 0 0 0 1 0 0
```

Agora que mapeamos o hardware, vamos fazer um ELAM e ver para onde o pacote deve ir.

ELAM

```
leaf4# vsh_lc
module-1# debug platform internal tah elam asic 0
module-1(DBG-TAH-elam)# trigger reset
module-1(DBG-TAH-elam)# trigger init in-select 6 out-select 0
module-1(DBG-TAH-elam-insel6)# set outer l2 src_mac 0050.56a5.fccc dst_mac 0050.56a5.6794
module-1(DBG-TAH-elam-insel6)# start
module-1(DBG-TAH-elam-insel6)# stat
ELAM STATUS
===========
Asic 0 Slice 0 Status Armed
Asic 0 Slice 1 Status Triggered

module-1(DBG-TAH-elam-insel6)# report | grep ovec
  sug_elam_out_sidebnd_no_spare_vec.ovector_idx: 0x9E
```

Ótimo, então o Leaf4 recebeu o quadro no Asic 0 Slice 1. Com o ELAM no novo hardware, há um novo campo que é muito importante na solução de problemas: **ovector_idx**. Esse índice é o índice de porta física do qual o quadro/pacote deve ser encaminhado. Depois que você tiver o ovector_idx, poderemos usar este comando para encontrar a porta para a qual ele mapeia:

```
module-1(DBG-TAH-elam-insel6)# show platform internal hal l2 port gpd
Legend:
-------
IfId:       Interface Id                                IfName:      Interface Name
I P:        Is PC Mbr                                   IfId:           Interface Id
Uc PC Cfg:      UcPcCfg Idx                             Uc PC MbrId:    Uc Pc Mbr Id
As:             Asic                                    AP:             Asic Port
Sl:             Slice                                   Sp:             Slice Port
Ss:             Slice SrcId                             Ovec:           Ovector (slice |
srcid)
L S:            Local Slot                              Reprogram:
L3:             Is L3
    P:    PifTable                                      Xla Idx:        Xlate Idx
    RP:   Rw PifTable                                   Ovx Idx:        OXlate Idx
    IP:   If Profile Table                              N L3:           Num. of L3 Ifs
    RS:   Rw SrcId Table                                NI L3:          Num. of Infra L3 Ifs
    DP:   DPort Table                                   Vif Tid:        Vif Tid
    SP:   SrcPortState Table                            RwV Tid:        RwVif Tid
    RSP:  RwSrcPortstate Table                          Ing Lbl:        Ingress Acl Label
    UC:   UCPcCfg                                       Egr Lbl:        Egress Acl Label
    UM:   UCPcMbr                                       Reprogram:
```

```
PROF ID:        Lport Profile Id
    VS:   VifStateTable                                     HI:             LportProfile Hw
Install
    RV:   Rw VifTable
Num. of Sandboxes: 1

Sandbox_ID: 0, BMP: 0x0
 Port Count: 8

================================================================================================
=========================================
                       Uc   Uc                          |       Reprogram       |
| Rep |
                     I PC   Pc                        L |   R I R D    R  U U X | L Xla Ovx N
NI Vif    RwV    Ing  Egr  | V R | PROF H
IfId     Ifname      P Cfg  MbrID As AP Sl Sp Ss Ovec S | P P P S P Sp Sp C M L | 3 Idx Idx L3
L3 Tid    Tid    Lbl  Lbl  | S V | ID   I
================================================================================================
=========================================
1a004000 Eth1/5      1 0    1d    0  d  0  c  18 18   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      800  0      0 1   0    0
1a005000 Eth1/6      1 0    b     0  e  0  d  1a 1a   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      800  0      0 1   0    0
1a006000 Eth1/7      0 26   5     0  f  0  e  1c 1c   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
D-256  -      800  0      0 1   e    0
1a007000 Eth1/8      0 2e   7     0  10 0  f  1e 1e   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
D-84   -      800  0      0 1   30   0
1a01e000 Eth1/31     1 0    2d    0  37 1  e  1c 9c   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      0    0      0 1   0    0
1a01f000 Eth1/32     1 0    3d    0  38 1  f  1e 9e   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      0    0      0 1   0    0
1a030000 Eth1/49     0 2    1     0  49 1  20 38 b8   1   0 0 0 0 0 0  0  0 0 0   1 8   6   2  2
D-24d  -      400  0      0 0   1    0
1a031000 Eth1/50     0 3    3     0  29 1  0  0  80   1   0 0 0 0 0 0  0  0 0 0   1 9   7   2  2
D-350  -      400  0      0 0   1    0
```

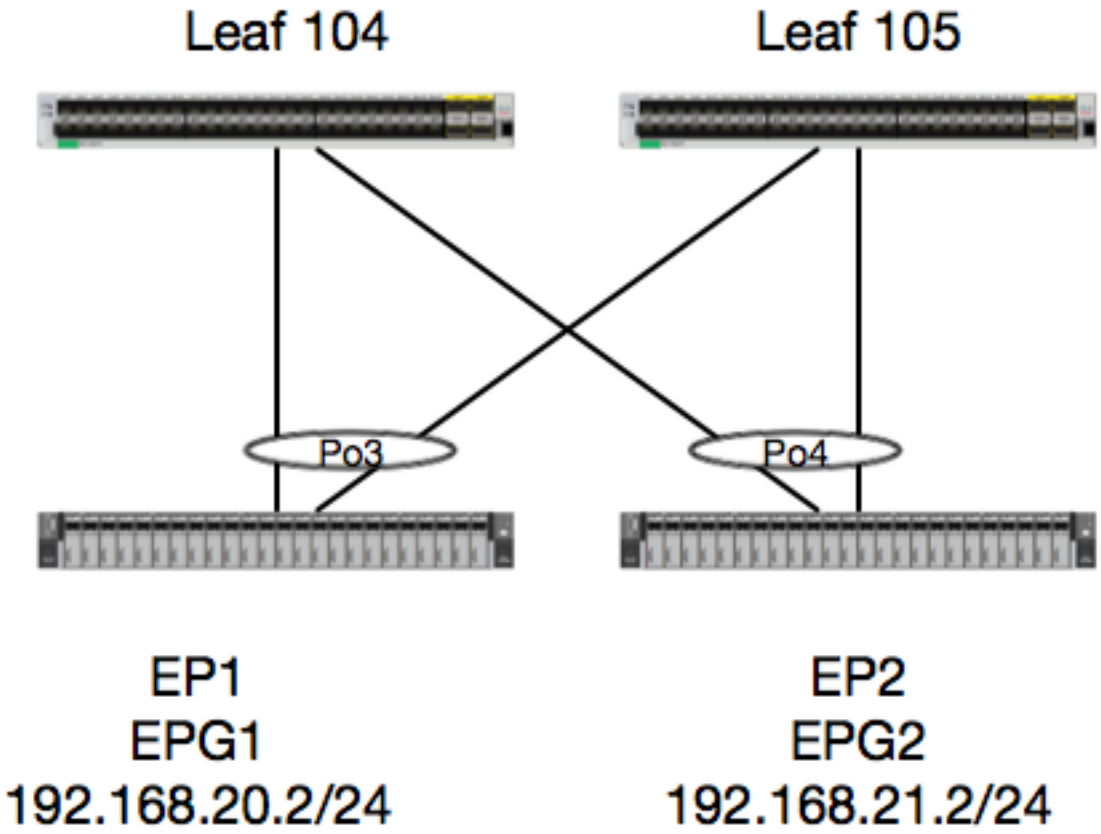
O switch acha que o pacote deve ser encaminhado da interface Ethernet 1/32. Esse é o PO4 onde aprendemos esse endereço MAC?

```
leaf4# show port-channel summary
Flags:  D - Down        P - Up in port-channel (members)
        I - Individual  H - Hot-standby (LACP only)
        s - Suspended   r - Module-removed
        S - Switched    R - Routed
        U - Up (port-channel)
        M - Not in use. Min-links not met
        F - Configuration failed
--------------------------------------------------------------------------------
Group Port-       Type     Protocol  Member Ports
      Channel
--------------------------------------------------------------------------------
1     Po1(SU)     Eth      LACP      Eth1/5(P)
2     Po2(SU)     Eth      LACP      Eth1/6(P)
3     Po3(SU)     Eth      LACP      Eth1/31(P)
4     Po4(SU)     Eth      LACP      Eth1/32(P)
```

Sim, então o pacote será encaminhado da interface 1/32 para o host de destino.

2 EPs em EPG/Mesmo Folha - Pacote Roteado

Topologia



Neste exemplo, rastrearemos o fluxo de pacotes de EP1 para EP2 onde eles existem no mesmo par de folhas do vPC. Os dois grupos de trabalho do PE estão em diferentes grupos de trabalho que utilizam diferentes BDs.

A primeira coisa a fazer é verificar a base de dados do PE para ver se aprendemos com o PE:

```
leaf4# show endpoint ip 192.168.20.2
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
+----------------------------------+--------------+----------------+-------------+----------
---+
30                                      vlan-2268    0050.56a5.fccc LV
po3
Joey-Tenant:Joey-Internal               vlan-2268      192.168.20.2 LV
po3


calo2-leaf4# show endpoint ip 192.168.21.2
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
+-----------------------------------+--------------+----------------+-------------+----------
---+
8                                       vlan-2200    0050.56a5.0c11 LV
po4
Joey-Tenant:Joey-Internal               vlan-2200      192.168.21.2 LV
po4
```

Uma vez que aprendemos com o PE e conhecemos as informações sobre o IP, devemos poder analisar as informações de aprendizagem do PE em matéria de hardware:

```
leaf4# vsh_lc
module-1# show platform internal hal ep l3 all
LEGEND:
-------
VrfName:           Vrf Name                                                T:              Type
(Pl: Physical, Vl: Virtual, Xr: Remote)
EP IP:             Endpoint IP
S Class:           S Class                                                 Age Intvl:      Age
Interval
S T:               Static Ep                                               S E:
Secure EP
L D:               Learn Disable                                           B N D:          Bind
Notify Disable
E N D:             Epg Notify Disable                                      B E:
Bounce Enable
I D L:             IVxlan Dont Learn                                       SPI:
Source Policy Incomplete
DPI:               Dest Policy Incomplete                                  SPA:
Source Policy Applied
DPA:               Dest Policy Applied                                     DSS:            Dest
Shared Service
IL:                Is Local                                                VUB:            Vnid
Use Bd
SO:                SA Only                                                 EP NH L3IfName: EP
Next Hop L3 If Name
NHT:               Next Hop Type (L2: L2 Entry L3: L3 Next Hop)            BD Name:        L2 NH
BD Name
EP Mac:            EP Mac                                                  L3 IfName:      L3 NH
If Name
L2 IfName:         L2 If Name                                              FD Name:        L2
Entry FD Name
IP:                L3 NH IP

 L3 EP Count: 12

================================================================================================
================================================================================
                                                                  B E   I S D S D D   V   EP-NH
N  |
Vrf             EP                                 S     Age   S S L N N B D P P P P S I U S L3
H  | BD        EP                L3           L2          FD
Name          T  IP                               Class Intvl T E D D D E L I I A A S L B O
IfName       T   | Name      Mac                IfName       Ifname      Name      IP
================================================================================================
================================================================================
common*rewall Pl 10.6.112.1                        1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -           -          -         0.0.0.0
common*rewall Pl 10.6.114.1                        1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -           -          -         0.0.0.0
```

```
common*rewall Pl 10.6.114.129                   1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -           -           -         0.0.0.0
common*efault Pl 100.100.101.1                  1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -           -           -         0.0.0.0
Joey-T*ternal Pl 192.168.1.1                    1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -           -           -         0.0.0.0
Joey-T*ternal Xr 192.168.1.100                  8013  128   0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 -
L3   -         00:0c:0c:0c:0c:0c Tunnel2     Tunnel2     -         0.0.0.0
Joey-T*ernal2 Pl 192.168.3.1                    1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -           -           -         0.0.0.0
Joey-T*ternal Pl 192.168.20.1                   1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -           -           -         0.0.0.0
Joey-T*ternal Pl 192.168.20.2                   800a  0     0 0 0 0 0 0 0 0 0 0 0 1 0 0 -
L2   BD-28     00:50:56:a5:fc:cc -           Po3         FD-30     -
Joey-T*ternal Pl 192.168.21.1                   1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -           -           -         0.0.0.0
Joey-T*ternal Pl 192.168.21.2                   800c  0     0 0 0 0 0 0 0 0 0 0 0 1 0 0 -
L2   BD-7      00:50:56:a5:0c:11 -           Po4         FD-8      -
Joey-T*ternal Pl 2001:0:0:100::1                1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -           -           -         0.0.0.0
```

A tabela HAL Layer3 (l3) é muito útil, pois ela nos fornece informações de VLAN/Porta para EPs aprendidos de l3. Sabemos que o destino existe de um Po4, portanto, o pacote deve ser encaminhado para fora de qualquer porta no Po4.

Vamos fazer um ELAM e ver o que temos!

ELAM

```
leaf4# vsh_lc
module-1# debug platform internal tah elam asic 0 module-1(DBG-TAH-elam)# trigger init in-select
6 out-select 0
module-1(DBG-TAH-elam-insel6)# set outer ipv4 src_ip 192.168.20.2 dst_ip 192.168.21.2
module-1(DBG-TAH-elam-insel6)# start
module-1(DBG-TAH-elam-insel6)# stat
ELAM STATUS
===========
Asic 0 Slice 0 Status Armed
Asic 0 Slice 1 Status Armed

module-1(DBG-TAH-elam-insel6)# stat
ELAM STATUS
===========
Asic 0 Slice 0 Status Armed
Asic 0 Slice 1 Status Triggered

module-1(DBG-TAH-elam-insel6)# report | grep ovec
  sug_elam_out_sidebnd_no_spare_vec.ovector_idx: 0x9E
```

Ótimo, então disparamos o pacote, e descobrimos que o "ovector_idx" é 0x9E. O índice do ovetor é o índice de interface física de saída do qual o pacote deve ser encaminhado. Vamos ver qual porta tem esse índice:

```
module-1(DBG-TAH-elam-insel6)# show platform internal hal l2 port gpd
Legend:
-------
IfId:       Interface Id                                IfName:      Interface Name
I P:        Is PC Mbr                                   IfId:           Interface Id
Uc PC Cfg:      UcPcCfg Idx                             Uc PC MbrId:    Uc Pc Mbr Id
```

```
As:             Asic                                        AP:             Asic Port
Sl:             Slice                                       Sp:             Slice Port
Ss:             Slice SrcId                                 Ovec:           Ovector (slice |
srcid)
L S:            Local Slot                                  Reprogram:
L3:             Is L3
    P:    PifTable                                          Xla Idx:        Xlate Idx
    RP:   Rw PifTable                                       Ovx Idx:        OXlate Idx
    IP:   If Profile Table                                  N L3:           Num. of L3 Ifs
    RS:   Rw SrcId Table                                    NI L3:          Num. of Infra L3 Ifs
    DP:   DPort Table                                       Vif Tid:        Vif Tid
    SP:   SrcPortState Table                                RwV Tid:        RwVif Tid
    RSP:  RwSrcPortstate Table                              Ing Lbl:        Ingress Acl Label
    UC:   UCPcCfg                                           Egr Lbl:        Egress Acl Label
    UM:   UCPcMbr                                           Reprogram:
PROF ID:        Lport Profile Id
    VS:   VifStateTable                                     HI:             LportProfile Hw
Install
    RV:   Rw VifTable
Num. of Sandboxes: 1

Sandbox_ID: 0, BMP: 0x0
 Port Count: 8

================================================================================================
==========================================
                       Uc   Uc                          |       Reprogram       |
| Rep |
                     I PC   Pc                       L |   R I R D    R  U U X | L Xla Ovx N
NI Vif    RwV    Ing  Egr  | V R | PROF H
IfId     Ifname      P Cfg  MbrID As AP Sl Sp Ss Ovec S | P P P S P Sp Sp C M L | 3 Idx Idx L3
L3 Tid    Tid    Lbl  Lbl  | S V | ID   I
================================================================================================
==========================================
1a004000 Eth1/5      1 0    1d    0  d  0  c  18 18   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      800  0      0 1   0    0
1a005000 Eth1/6      1 0    b     0  e  0  d  1a 1a   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      800  0      0 1   0    0
1a006000 Eth1/7      0 26   5     0  f  0  e  1c 1c   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
D-256  -      800  0      0 1   c    0
1a007000 Eth1/8      0 2f   7     0  10 0  f  1e 1e   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
D-199  -      800  0      0 1   2e   0
1a01e000 Eth1/31     1 0    2d    0  37 1  e  1c 9c   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      0    0      0 1   0    0
1a01f000 Eth1/32     1 0    3d    0  38 1  f  1e 9e   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      0    0      0 1   0    0
1a030000 Eth1/49     0 2    1     0  49 1  20 38 b8   1   0 0 0 0 0 0  0  0 0 0   1 6   4   2  2
D-24d  -      400  0      0 0   1    0
1a031000 Eth1/50     0 3    3     0  29 1  0  0  80   1   0 0 0 0 0 0  0  0 0 0   1 5   3   2  2
D-350  -      400  0      0 0   1    0
```

Parece que devemos enviar a porta 1/32, está correto?

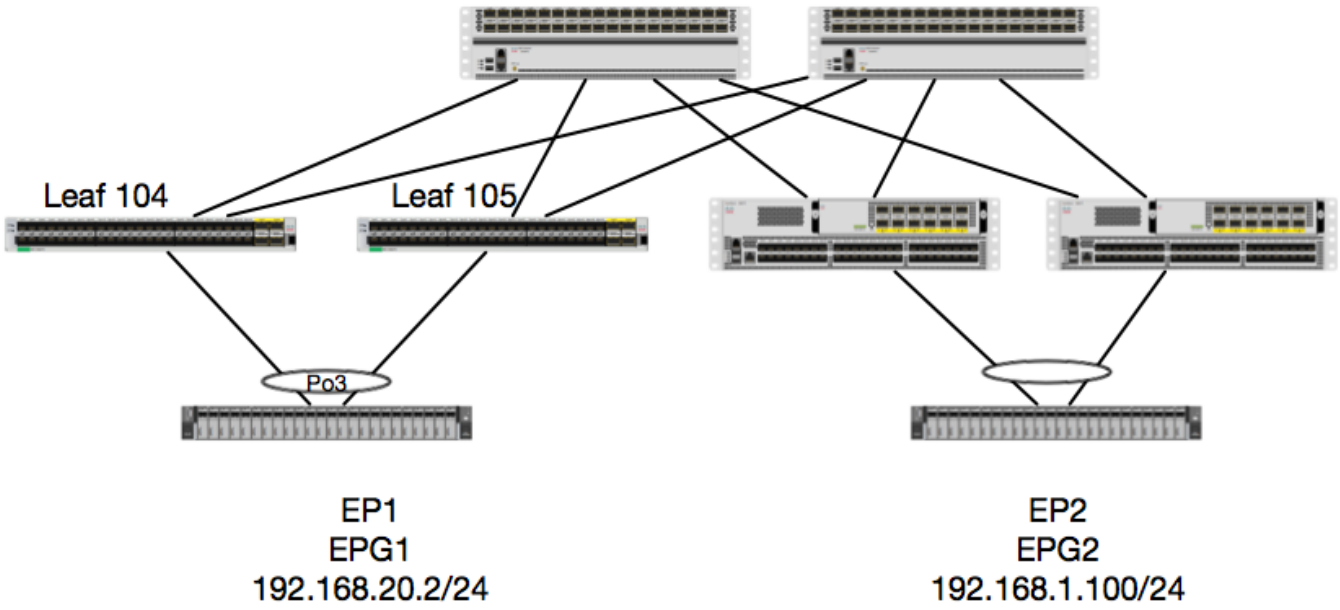
```
leaf4# show port-channel summary
Flags:  D - Down        P - Up in port-channel (members)
        I - Individual  H - Hot-standby (LACP only)
        s - Suspended   r - Module-removed
        S - Switched    R - Routed
        U - Up (port-channel)
        M - Not in use. Min-links not met
        F - Configuration failed
--------------------------------------------------------------------------------
Group Port-       Type     Protocol  Member Ports
```

```
      Channel
--------------------------------------------------------------------------------
1     Po1(SU)     Eth      LACP      Eth1/5(P)
2     Po2(SU)     Eth      LACP      Eth1/6(P)
3     Po3(SU)     Eth      LACP      Eth1/31(P)
4     Po4(SU)     Eth      LACP      Eth1/32(P)
```

Sim, está correto.

2 EPs em EPG/Folha diferente - Pacote roteado

Topologia



Neste exemplo, vamos rastrear o fluxo de pacotes de EP1 para EP2, onde EP1 existe em um par EX vPC e EP2 existe em um par leaf vPC de geração remota. Os dois grupos de trabalho do PE estão em diferentes grupos de trabalho que utilizam diferentes BDs.

Mais uma vez, vamos verificar onde é que o PE é informado:

```
leaf4# show endpoint ip 192.168.20.2
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
+-----------------------------------+---------------+-----------------+--------------+----------
---+
30                                       vlan-2268    0050.56a5.fccc LV
po3
Joey-Tenant:Joey-Internal                vlan-2268      192.168.20.2 LV
po3


calo2-leaf4# show endpoint ip 192.168.1.100
```

```
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
+-----------------------------------+--------------+----------------+-------------+----------
---+
Joey-Tenant:Joey-Internal                                 192.168.1.100
tunnel2
```

Agora, vamos verificar o que o hardware programou:

```
leaf4# vsh_lc
module-1# show platform internal hal ep l3 all
LEGEND:
-------
VrfName:           Vrf Name                                                  T:              Type
(Pl: Physical, Vl: Virtual, Xr: Remote)
EP IP:             Endpoint IP
S Class:           S Class                                                   Age Intvl:      Age
Interval
S T:               Static Ep                                                 S E:
Secure EP
L D:               Learn Disable                                             B N D:          Bind
Notify Disable
E N D:             Epg Notify Disable                                        B E:
Bounce Enable
I D L:             IVxlan Dont Learn                                         SPI:
Source Policy Incomplete
DPI:               Dest Policy Incomplete                                    SPA:
Source Policy Applied
DPA:               Dest Policy Applied                                       DSS:            Dest
Shared Service
IL:                Is Local                                                  VUB:            Vnid
Use Bd
SO:                SA Only                                                   EP NH L3IfName: EP
Next Hop L3 If Name
NHT:               Next Hop Type (L2: L2 Entry L3: L3 Next Hop)              BD Name:        L2 NH
BD Name
EP Mac:            EP Mac                                                    L3 IfName:      L3 NH
If Name
L2 IfName:         L2 If Name                                                FD Name:        L2
Entry FD Name
IP:                L3 NH IP

 L3 EP Count: 12

================================================================================================
================================================================================
                                                                  B E   I S D S D D   V   EP-NH
N  |
Vrf             EP                              S     Age   S S L N N B D P P P P S I U S L3
H  | BD        EP               L3          L2          FD
Name          T  IP                             Class Intvl T E D D D E L I I A A S L B O
IfName       T  | Name      Mac               IfName       Ifname      Name      IP
================================================================================================
================================================================================
common*rewall Pl 10.6.112.1                     1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -           -           -         0.0.0.0
```

```
common*rewall Pl 10.6.114.1                    1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -            -           -         0.0.0.0
common*rewall Pl 10.6.114.129                  1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -            -           -         0.0.0.0
common*efault Pl 100.100.101.1                 1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -            -           -         0.0.0.0
Joey-T*ternal Pl 192.168.1.1                   1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -            -           -         0.0.0.0
Joey-T*ternal Xr 192.168.1.100                 8013  128   0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 -
L3   -         00:0c:0c:0c:0c:0c Tunnel2      Tunnel2     -         0.0.0.0
Joey-T*ernal2 Pl 192.168.3.1                   1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -            -           -         0.0.0.0
Joey-T*ternal Pl 192.168.20.1                  1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -            -           -         0.0.0.0
Joey-T*ternal Pl 192.168.20.2                  800a  0     0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 -
L2   BD-28     00:50:56:a5:fc:cc -            Po3         FD-30     -
Joey-T*ternal Pl 192.168.21.1                  1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -            -           -         0.0.0.0
Joey-T*ternal Pl 192.168.21.2                  800c  0     0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 -
L2   BD-7      00:50:56:a5:0c:11 -            Po4         FD-8      -
Joey-T*ternal Pl 2001:0:0:100::1               1     0     1 0 0 0 0 0 1 1 0 0 0 0 1 0 0 -
L3   -         00:00:00:00:00:00 -            -           -         0.0.0.0
```

Hardware acha que o EP existe no túnel 2. Qual é o destino do túnel 2?

```
module-1# show system internal eltmc info interface tunnel2
          IfInfo:
         interface:        Tunnel2   :::         ifindex:      402718722
               iod:             66   :::           state:            up
               Mod:              0   :::            Port:             0
       Tunnel Index:              0   :::   Tunnel Dst ip:     0xc0a87843
       Tunnel Encap:          ivxlan  ::: Tunnel VPC Peer:             0
  Tunnel Dst ip str: 192.168.120.67   :::      Tunnel ept:           0x1

        [SDK Info]:
        tunnl_name:
            vrf_id:              2   :::        if_index:     0x18010002
        hwencapidx:              0   :::       encaptype:             1
         mac_proxy:              0   :::        v4_proxy:             0
          v6_proxy:              0   :::    ip_addr_type:             0
      ipv4_address:     0xc0a87843

[SDB INFO]:
               iod:             66
        pc_if_index:              0
       fab_if_index:              0
              sv_if:              0
           src_idx:              0
          int_vlan:              0
        encap_vlan:              0
    mod_port_status:     0x41620003
         v6_tbl_id:     0x80000002
         v4_tbl_id:            0x2
        router_mac:00.00.00.00.00.00
        unnumbered:              0
          trunk_id:              0
        tunnel_mod:              0
       tunnel_port:              0
           tep_ip:     0xc0a87843
        ip_if_mode:              0
        sdk_vrf_id:              2
               mtu:           9366   :::        ipmtu_id:             0
      is_fex_fabric:              0
```

Como o destino existe fora de um vPC, esse IP de destino deve ser o IP virtual do vPC dos folhetos remotos. Vamos verificar uma folha remota e ver:

```
leaf1# show system internal epm vpc


Local TEP IP                 : 192.168.160.95
Peer TEP IP                  : 192.168.160.93
vPC configured               : Yes
vPC VIP                      : 192.168.120.67
MCT link status              : Up
Local vPC version bitmap     : 0x7
Peer vPC version bitmap      : 0x7
Negotiated vPC version       : 3
Peer advertisement received  : Yes
Tunnel to vPC peer           : Up
```

Perfeito, então ele aprendeu o EP de destino do par vPC remoto. Vamos ver o que o ELAM vê e verificar se estamos encaminhando o pacote corretamente:

ELAM

```
module-1# debug platform internal tah elam asic 0
module-1(DBG-TAH-elam)# trigger init in-select 6 out-select 0
module-1(DBG-TAH-elam-insel6)# set outer ipv4 src_ip 192.168.20.2 dst_ip 192.168.1.100
module-1(DBG-TAH-elam-insel6)# start
module-1(DBG-TAH-elam-insel6)# stat
ELAM STATUS
===========
Asic 0 Slice 0 Status Armed
Asic 0 Slice 1 Status Triggered
```

Agora, com destinos remotos em hardware EX, há 2 valores ELAM que são muito importantes ao Troubleshoot o fluxo de pacotes. O ovector_idx como antes e o encap_idx:

```
module-1(DBG-TAH-elam-insel6)# report | grep ovec
  sug_elam_out_sidebnd_no_spare_vec.ovector_idx: 0xB8
module-1(DBG-TAH-elam-insel6)# report | grep encap
  sug_lurw_vec.encap_l2_idx: 0x0
  sug_lurw_vec.encap_pcid: 0x0
  sug_lurw_vec.encap_idx: 0x6
  sug_lurw_vec.encap_vld: 0x1
```

No hardware EX, temos a capacidade de conduzir a porta de destino da qual o pacote deve ser encaminhado. Antes, normalmente verificamos o índice encap e verificamos se o índice de destino era o túnel correto. Aqui podemos verificar que porta mapeia para 8B:

```
module-1(DBG-TAH-elam-insel6)# show platform internal hal l2 port gpd
Legend:
-------
IfId:       Interface Id                                IfName:      Interface Name
I P:        Is PC Mbr                                   IfId:           Interface Id
Uc PC Cfg:      UcPcCfg Idx                             Uc PC MbrId:    Uc Pc Mbr Id
As:             Asic                                    AP:             Asic Port
Sl:             Slice                                   Sp:             Slice Port
Ss:             Slice SrcId                             Ovec:           Ovector (slice |
srcid)
```

```
L S:            Local Slot                                  Reprogram:
L3:             Is L3
    P:    PifTable                                          Xla Idx:        Xlate Idx
    RP:   Rw PifTable                                       Ovx Idx:        OXlate Idx
    IP:   If Profile Table                                  N L3:           Num. of L3 Ifs
    RS:   Rw SrcId Table                                    NI L3:          Num. of Infra L3 Ifs
    DP:   DPort Table                                       Vif Tid:        Vif Tid
    SP:   SrcPortState Table                                RwV Tid:        RwVif Tid
    RSP:  RwSrcPortstate Table                              Ing Lbl:        Ingress Acl Label
    UC:   UCPcCfg                                           Egr Lbl:        Egress Acl Label
    UM:   UCPcMbr                                           Reprogram:
PROF ID:        Lport Profile Id
    VS:   VifStateTable                                     HI:             LportProfile Hw
Install
    RV:   Rw VifTable
Num. of Sandboxes: 1

Sandbox_ID: 0, BMP: 0x0
 Port Count: 8

================================================================================================================
=========================================
                       Uc   Uc                          |       Reprogram       |
| Rep |
                     I PC   Pc                       L |   R I R D    R  U U X | L Xla Ovx N
NI Vif    RwV    Ing  Egr  | V R | PROF H
IfId     Ifname      P Cfg  MbrID As AP Sl Sp Ss Ovec S | P P P S P Sp Sp C M L | 3 Idx Idx L3
L3 Tid    Tid    Lbl  Lbl  | S V | ID   I
================================================================================================================
=========================================
1a004000 Eth1/5      1 0    1d    0  d  0  c  18 18   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      800  0      0 1   0    0
1a005000 Eth1/6      1 0    b     0  e  0  d  1a 1a   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      800  0      0 1   0    0
1a006000 Eth1/7      0 26   5     0  f  0  e  1c 1c   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
D-256  -      800  0      0 1   c    0
1a007000 Eth1/8      0 2f   7     0  10 0  f  1e 1e   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
D-199  -      800  0      0 1   2e   0
1a01e000 Eth1/31     1 0    2d    0  37 1  e  1c 9c   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      0    0      0 1   0    0
1a01f000 Eth1/32     1 0    3d    0  38 1  f  1e 9e   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      0    0      0 1   0    0
1a030000 Eth1/49     0 2    1     0  49 1  20 38 b8   1   0 0 0 0 0 0  0  0 0 0   1 6   4   2  2
D-24d  -      400  0      0 0   1    0
1a031000 Eth1/50     0 3    3     0  29 1  0  0  80   1   0 0 0 0 0 0  0  0 0 0   1 5   3   2  2
D-350  -      400  0      0 0   1    0
```

O switch acha que deve encaminhá-lo para a coluna na interface Eth1/49. Mas como podemos verificar se a tampa está correta?

Primeiro precisamos examinar as informações de hardware sobre o túnel. Podemos fazer isso executando este comando HAL:

```
module-1(DBG-TAH-elam-insel6)# show platform internal hal tunnel rtep pi
Non-Sandbox Mode
LEGEND:
-------
Tun Ifid:  Tunnel Ifid                                          IfName:     Tunnel If Name
Lid:       Logical Id                                           ET:        Encap Type V:
Vxlan I: IVxlan N: NVGRE
VrfId:     Vrf Id                                               Vrf Name: Vrf Name
IP:        Tunnel's IP
```

```
Hw Enc:    Hw Encap Idx                                          IVP:        Is VPC Peer
IL:        Is Local                                              P4:         Proxy for v4
P6:        Proxy for V6                                          PM:         Proxy for Mac
II:        Is Ingress Only                                       IC:         Is Copy Service
C OBd:     Copy Service Outer Bd                                 U D:        Use DF
NBT:       Next Base Type E: ECMP N: Next-Hop                    NB Id:      Next Base Id
NH cnt:    Next Hop Count                                        VrfId:      Vrf Id
Vrf Name:  Vrf Name                                              IP:         IP Address
Mac:       Mac                                                   L3 IfId:    L3 IfId
L3IfName:  L3 If Name                                            L2 IfId:    L2 IfId
L2IfName:  L2 If Name

Num. of Sandboxes: 1

Sandbox_ID: 0, BMP: 0x0
 Remote Tep Count: 15

================================================================================================
================================================================================================
=======
                                                                  I                  N N
|

                     E             Vrf                       Hw   V I P P P I I C   U B B
NH  |        Vrf                                        L3       L3           L2       L2

IfId     Ifname       T Lid  VrfId  Name         IP            Enc  P L 4 6 M I C OBd D T Id
Cnt | VrfId  Name         IP            Mac               IfId     IfName       IfId     IfName

================================================================================================
================================================================================================
=======
18010002 Tunnel2      I 3005 2      overlay-1    192.168.120.670    0 0 0 0 0 0 0 1   0 E 2
2     2      overlay-1    0.0.0.0       0d:0d:0d:0d:0d:00 1a030001 Eth1/49.1    1a030000 Eth1/4
9

2      overlay-1    0.0.0.0       0d:0d:0d:0d:0d:00 1a031002 Eth1/50.2    1a031000 Eth1/5
0
```

Essa saída nos dá alguns valores com os quais nos preocupamos:

IfId - A ID da interface alocada para o túnel

IP - O IP do destino. Deve corresponder ao ELTMC.

L3 IfId - A(s) interface(s) da camada 3 que o switch pode usar para encaminhar ao destino apropriado.

Quando soubermos o IfId, poderemos verificar se o encapsulamento que obtivemos no elam corresponde ao destino do túnel:

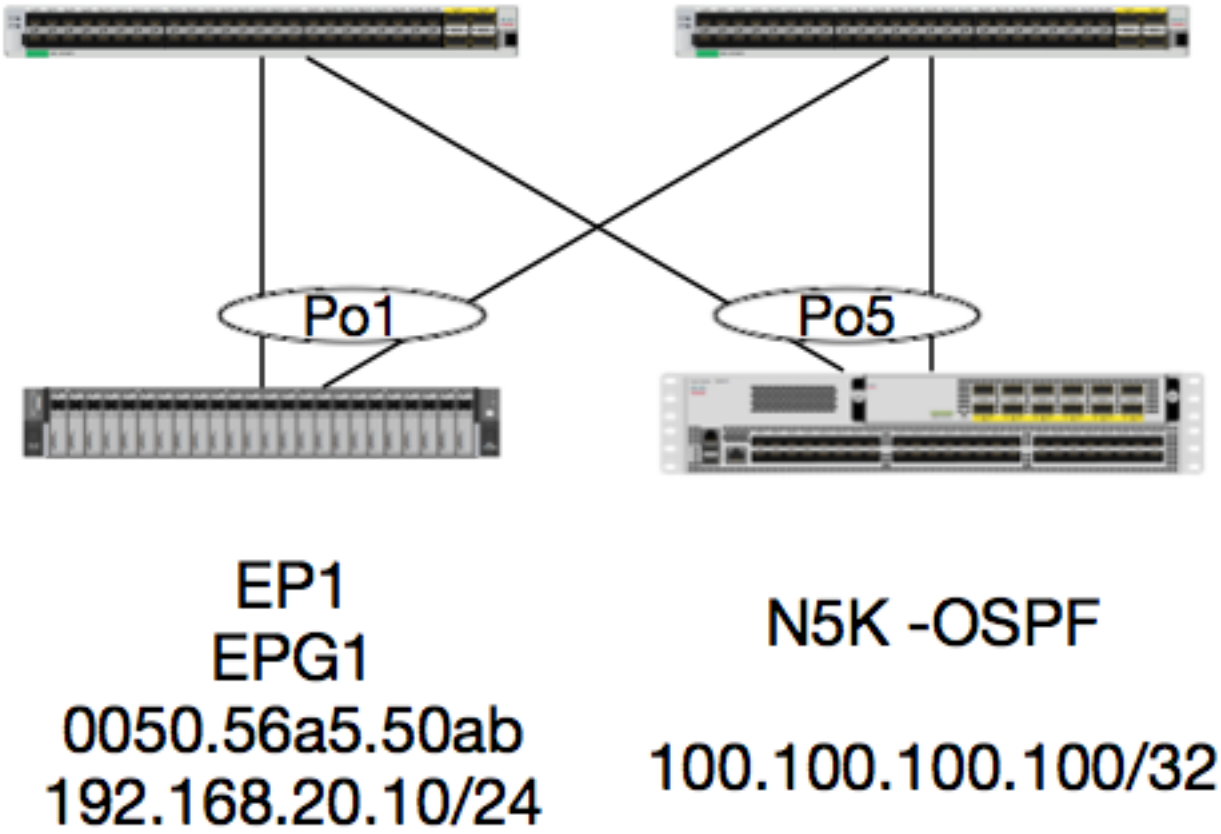
```
module-1(DBG-TAH-elam-insel9)# show platform internal hal tunnel rtep apd
Non-Sandbox Mode
LEGEND:
-------
ifId:        Interface Id                                  IP:           IP address
HwVrfId:     Hardware Vrf Id                               SrcTepIdx:    Source Tep Index
BDXlate:     Egress BDXlate                                DstInfoIdx:   Destination info index
RwEncapIdx:  Rw Encap Index                                ECMPIdx:      ECMP Index
Num:         Number of hops                                ECMPMbrIdx:   ECMP member Index
L2 Index:    L2 Index                                      RwDmacIdx:    Rw Dmax Index
```

```
Num. of Sandboxes: 1

Sandbox_ID: 0, BMP: 0x0
 Remote Tep Count: 15

================================================================================================================
==============================
ifId     IP             HwVrfId BDXlate SrcTepIdx DstInfoIdx RwEncapIdx ECMPIdx  ECMPMbrIdx Num
L2Index  RwDmacIdx
================================================================================================================
==============================
18010002 192.168.120.67 2       1       3a9a      3005       6           0        0          2
1a030000 0         <---- RwEncapIdx is 6!  Same as the "encap_idx" in the ELAM Report.

1a031000 1
```

Este túnel tem um RwEncapIdx (Re-Write Encap Index) de 6, que é o que foi exibido no elam.

1 EP —> L3 out - Fluxo roteado

Topologia



Neste exemplo, rastrearemos o fluxo de pacotes de um pacote de EP1 enviando ICMP a um loopback em um N5K executando OSPF. O N5K é conectado via L3Out no mesmo par de switches EX.

Como verificamos a programação local do EP no início deste documento, vamos supor que o EP seja aprendido corretamente no hardware e continue na verificação de rota.

Primeiro, vamos verificar o estado do OSPF e a tabela de roteamento:

```
leaf6# show ip ospf neighbors vrf jr:sb
 OSPF Process ID default VRF jr:sb
 Total number of neighbors: 2
 Neighbor ID     Pri State            Up Time  Address         Interface
 27.27.27.1        1 FULL/BDR         00:22:39 10.10.27.1      Vlan28   <---- Leaf5
 27.27.27.3        1 FULL/DROTHER     00:22:37 10.10.27.3      Vlan28   <----  N5K
```

```
leaf6# show ip route vrf jr:sb 100.100.100.100
IP Route Table for VRF "jr:sb"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]
'%<string>' in via output denotes VRF <string>

100.100.100.100/32, ubest/mbest: 1/0
    *via 10.10.27.3, vlan28, [110/5], 00:16:58, ospf-default, intra
```

Sabemos que a tabela de roteamento mostra o próximo salto como o 5K em 10.10.27.3. Bom começo, mas como podemos verificar que hardware tem?

Primeiro, vamos verificar a tabela de adjacências no hardware para garantir que o ARP seja resolvido para 10.10.27.3 e que ele seja programado com a interface correta:

```
leaf6# vsh_lc
module-1# show forwarding adjacency

IPv4 adjacency information, adjacency count 20

next-hop        rewrite info   interface       phy i/f
--------------  -------------- --------------- ---------------
10.10.27.1      0022.bdf8.19ff Vlan28          Tunnel3
10.10.27.3      8c60.4f02.88fc Vlan28          port-channel5
```

Os endereços MAC correspondem aos do 5K:

```
ACI-5548-B# show interface vlan 3117
Vlan3117 is up, line protocol is up
  Hardware is EtherSVI, address is  8c60.4f02.88fc
  Internet Address is 10.10.27.3/29
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec
```

Em plataformas EX, há um "hw_vrf_idx" atribuído a um VRF. Este índice será referenciado quando verificarmos a programação de hardware. Vamos encontrar o índice:

```
module-1# show system internal eltmc info vrf jr:sb
VRF-TABLE: jr:sb
            vrf_type:         tenant   :::      context_id:              6
       overlay_index:              0   :::            vnid:        2129921
               scope:              5   :::          sclass:          16386
         v4_table_id:            0x5   :::     v6_table_id:     0x80000005
          intf_count:              5   :::   intrn_vlan_id:              0
            VRF Intf:         Vlan11   ::: src_plcy_incomp:              0
            vnid_hex:       0x208001   :::  ingress_policy:            0x1
       vrf_intf_list: Vlan28,Vlan16,Vlan9,Vlan11,loopback2,
          hw_vrf_idx:           4612   ::: nb_egr_outer_bd:              0
     sb_egr_outer_bd:              0
         vrf_bd_list: 28,16,11,9,
     sb_egr_outer_bd:              0   :::      sdk_vrf_id:              5
```

```
          [SDK Info]:
            vrf_name:          jr:sb
              vrf_id:               5   :::      hw_vrf_idx:           4612
            vrf_vnid:         2129921   :::        is_infra:              0
      tornbinfrahwbd:               0   :::  torsbinfrahwbd:              0
   ingressBdAclLabel:               0   ::: ingBdAclLblMask:              0
    egressBdAclLabel:               0   ::: egrBdAclLblMask:              0
            sg_label:               5   :::          sclass:          16386
       sp_incomplete:               1   :::      sclassprio:              3

[SDB INFO]:
v4 table
            vrf type:               1
              vrf id:               5
                vnid:         2129921
 internal infra vlan:               0
 external router mac:00:22:bd:f8:19:ff
v6 table
            vrf type:               1
              vrf id:               5
                vnid:         2129921
 internal infra vlan:               0
 external router mac:00:22:bd:f8:19:ff
::::
```

Depois de detectar a adjacência, a HAL deve programar uma rota. Podemos verificar isso usando o seguinte comando:

```
module-1# show platform internal hal l3 routes | head

----------------------------------------------------------------------------------------------------
----------------------------------------------------------------------------------------------------
LEGEND:
|
----------------------------------------------------------------------------------------------------
----------------------------------------------------------------------------------------------------
LID: Logical ID           RID: Route ID               PID: Physical ID       NB-ID:Next-Base ID
HIT IDX: Next-Hop HitIndex   CLP : Class Priority       TBI: Trie Base Index             |
SC : Sup-Copy             SSR: Src Sup-Redirect       DSR: Dst Sup-Redirect  TDD  :TTL Disable
NB: NextBaseType             SDC : Src Direct Connect   TRO: Trie Offset                 |
SPI: Src Policy Inc       DPI: Dst Policy Inc         DR : Default Route     LE   :Learn Enable
[E:Ecmp/A:Adj]              ILL : Is Link Local        ISS: Is Shared Services          |
RT : Route Type           FWD: Forwarding             HR : Host Routes       EP   :Ext Prefixes
DLR: Default Lpm Route       CLSS: Class Id             RDEL: Route in Deletion          |
BNE: Bind Notify Enable   SNE: Sclass Notify Enable   BE : Bounce Enable     IDL  :Ivxlan
DoNotLearn  DL : Dest Local              SA  : Src Only             AI : Age Interval
|
SF : Static Flag          SH : Src Hit                DH: Dest Hit
|
module-1# show platform internal hal l3 routes

----------------------------------------------------------------------------------------------------
----------------------------------------------------------------------------------------------------
LEGEND:
|
----------------------------------------------------------------------------------------------------
----------------------------------------------------------------------------------------------------
LID: Logical ID           RID: Route ID               PID: Physical ID       NB-ID:Next-Base ID
HIT IDX: Next-Hop HitIndex   CLP : Class Priority       TBI: Trie Base Index             |
SC : Sup-Copy             SSR: Src Sup-Redirect       DSR: Dst Sup-Redirect  TDD  :TTL Disable
NB: NextBaseType             SDC : Src Direct Connect   TRO: Trie Offset                 |
SPI: Src Policy Inc       DPI: Dst Policy Inc         DR : Default Route     LE   :Learn Enable
[E:Ecmp/A:Adj]              ILL : Is Link Local        ISS: Is Shared Services          |
```

```
RT : Route Type           FWD: Forwarding             HR : Host Routes       EP   :Ext Prefixes
DLR: Default Lpm Route       CLSS: Class Id             RDEL: Route in Deletion          |
BNE: Bind Notify Enable   SNE: Sclass Notify Enable   BE : Bounce Enable     IDL  :Ivxlan
DoNotLearn  DL : Dest Local              SA  : Src Only             AI : Age Interval
|
SF : Static Flag          SH : Src Hit                DH: Dest Hit
|
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
|     |                                          |   |     |          | LID |<-----------------
- Trie ------------>|<Dleft Trie>|                                                              |
| VRF |                 Prefix/Len                | RT| RID |    LID   | Type| PID | FPID/| HIT
|N|  NB-ID  |  NB Hw | PID | FPID/|   TBI   |TRO|Ifindex|CLSS|CLP| AI |SH|DH| Flags           |
|-----|-----------------------------------------|---|-----|----------|-----|     | TID  | IDX
|B|         |  Idx   |     |  TID |---------|---|-------|----|---|----|--|--|-----------------|
|-----|-----------------------------------------|---|-----|----------|-----|<-----------------
- DLEFT ------------>|-----|------|---------|---|-------|----|---|----|--|--|-----------------|
|     |                                          |   |     |          |     | PID | FPID/| HIT
|N|  NB-ID  |  NB Hw |     |      |         |   |       |    |   |    |  |  |                 |
|     |                                          |   |     |          |     |     |  TID | IDX
|B|         |  Idx   |     |      |         |   |       |    |   |    |  |  |                 |
|     |                                          |   |     |          |     |<-----------------
- TCAM ------------>|     |      |         |   |       |    |   |    |  |  |                 |
|     |                                          |   |     |          |     | PID | TCAM | HIT
|N|  NB-ID  |  NB Hw |     |      |         |   |       |    |   |    |  |  |                 |
|     |                                          |   |     |          |     |     |  ID  | IDX
|B|         |  Idx   |     |      |         |   |       |    |   |    |  |  |                 |
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
|Sandbox_ID: 0  Asic Bitmap: 0x0
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------

module-1# show platform internal hal l3 routes | egrep 100.100.100.100
| 4612|                        100.100.100.100/ 32| UC|   e4|      4a04| TRIE|   10| 5/  0|
6010|A|     7567|    802e| 186a| 1/  2|       10|  0|      0|   f|  3|   0| 0| 0|spi,dpi
```

Essa saída nos dá informações sobre a rota do próximo salto. 4612 é o hw_vrf_idx do VRF jr:sb. Para que possamos verificar o Next Hop, a "NB Hw Idx" em TCAM será usada na próxima tabela:

```
module-1# show platform internal hal l3 nexthops
Non-Sandbox Mode
LEGEND:
-------
NHOP ID       : Nhop Identifier (Hex)            CONS          : H/W S/W info Consistency
TYPE          : Nexthop Type                     ACTN          : Nexthop Action
Vrf           : L3 Vrf of the Nhop               L3 INTF       : L3 interface index (Hex)
L2 INTF       : L2 interface index (Hex)         BDID Or RwVRF : Bridge Domain Id Or Rewrite
Vrfid (Hex)
INFR          : ACI Infra valid                  PVRF          : Preserve VRF
LRN           : Learn Enabled                    VRFR          : VRF Rewrite
PID           : Physical ID                      FPID          : FP of this nexthop
TLID          : Tile Id within FP                HIT IDX       : Location of this Nhop (Hex)

Mac Entry:
TYP         : Type                      INTF        : Interface related Info (Hex)
LRN         : Learn Info                DL          : Destination Local
MLD         : Unused                    VNB         : Vnid use BD
DFL         : Default Entry             VLD         : MacKey Valid
FT          : FID Type                  FV          : FID Valid
FID         : FID value (Hex)           Mac         : L2 MAC Address
L2 Ifabric Info:
CLSS        : Source Class                          CLP         : Source Class Priority
```

```
EPG         : EndPoint Group                      BNE         : Bind Notification Enabled
SNE         : Source Address Notification Enabled CNE         : Source class Notification
Enabled
DL          : iVxlan DL                           SPI         : Source Policy Incomplete
DPI         : Dest Policy Incomplete
IP Address  : IP address

Sandbox_ID: 0  Asic Bitmap: 0x0
Summary info for 31 L3 Nexthop objects
         C T A                      BDID  I P   V         T    |---------------------Mac Entry-
-----------------|----L2 Ifabric Info----|
 NHOP    O Y C         L3       L2    Or   N V L R         L HIT|T        L   M V D V|----------
----Mac Key-------|     C      B S C   S D|
  ID     N P T        INTF     INTF  RwVRF F R R F      FP I IDX|Y  INTF  R D L N F L|F F  FID
|     L      N N N D P P|
 (Hex)   S E N Vrf    (H)       (H)   (H)  R F N R PID  ID D (H)|P  (H)   N L D B L D|T V  (H)
Mac          |CLSS P EPG  E E E L I I| IP Address
--------+-+-+-+----+--------+--------+----+-+-+-+-+----+--+-+----+-+------+-+-+-+-+-+-+-+-----
-+-----------------+----+-+----+-+-+-+-+-+-+----------------------------

module-1# show platform internal hal l3 nexthops | grep 802e
    7567 N I F    5  901001c 16000004   1c 0 0 0 0   2e  9 0 802e 0     22 0 0 0 0 0 1 1 1
1214 8c:60:4f:02:88:fc    0 0 2c0d 0 0 0 0 0 0 10.10.27.3
```

Aqui, pegamos o "NB Hw Idx" e o mapeamos para o "HIT IDX". Mostra a entrada correspondente ao Next Hop MAC/IP. Isso é o equivalente a ver o "l3 defip show" e o "l3 egress show" na Broadcom na primeira geração de switches leaf da ACI.

Como podemos ver, a tabela tem as informações corretas:

L2 INTF: 0x16000004 —> The ifIndex of Port-channel 5

IDX: O índice direcionado do Nb Hw Idx em rotas hal l3

MAC: 8c:60:4f:02:88:fc —> MAC da SVI do próximo SALTO em 5K

EPG: SCLASS de EPG L3

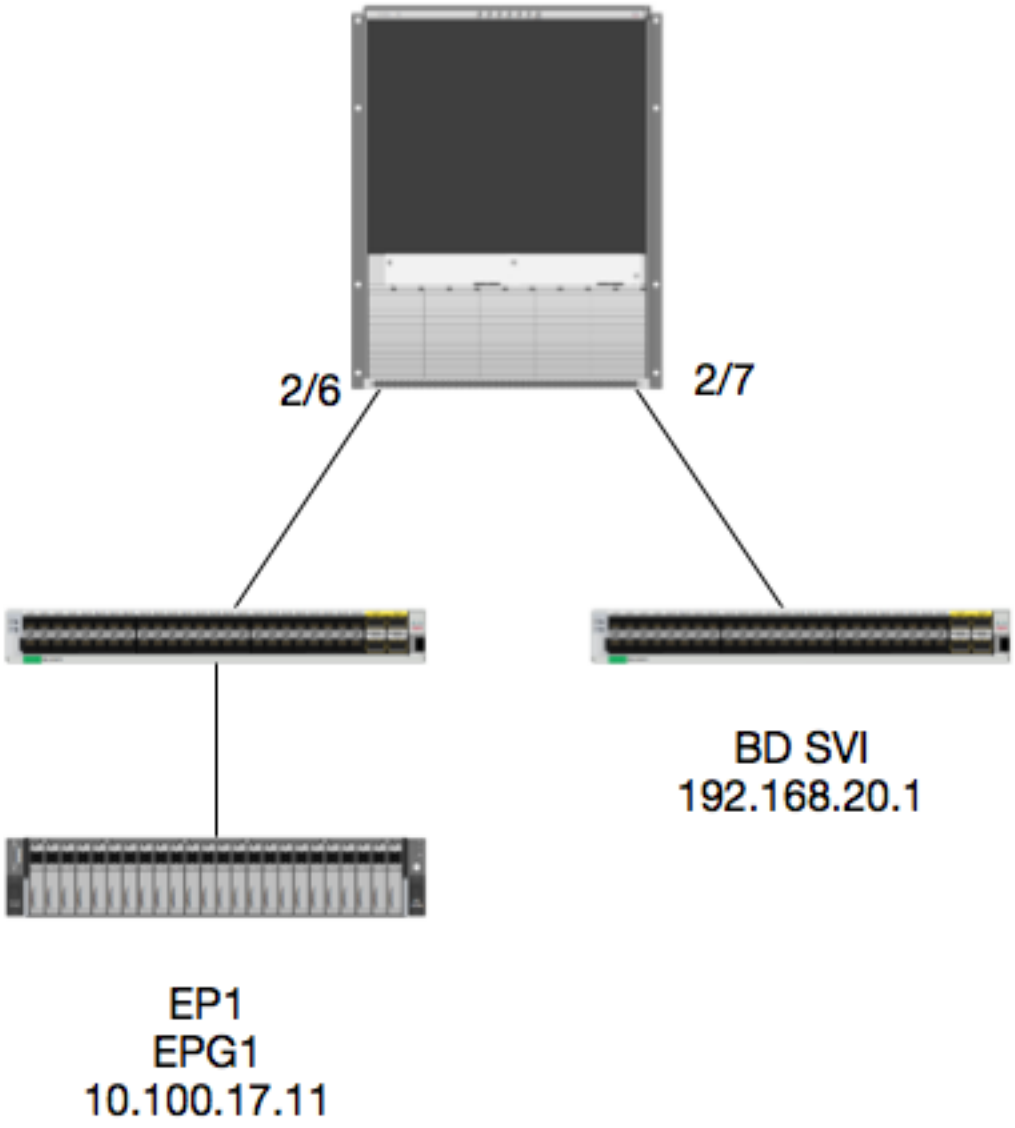
Endereço IP: 10.10.27.3 —> IP do próximo salto da SVI em 5.000

ELAM

```
leaf6# pwd
/var/sysmgr/tmp_logs

leaf6# cat elam_report.txt | grep ip.da
    sug_pr_lu_vec_l3v.ip.da: 0x00000000000000000064646464
leaf6# cat elam_report.txt | grep ip.sa
    sug_pr_lu_vec_l3v.ip.sa: 0x0000000000000000C0A8140A

leaf6# cat elam_report.txt | grep adj
    sug_lurw_vec.dst_addr.adj: 0x8C604F0288FC
      sug_lurw_vec.dst_addr.adj.padfield: 0x04F0288FC
      sug_lurw_vec.dst_addr.adj.idx: 0x2318
  sug_lurw_vec.adj_vld: 0x0

leaf6# cat elam_report.txt | grep macdarslt.hit_idx
        sug_fpc_lookup_vec.fplu_vec.rslt.macdarslt.hit_idx: 0x802E
```

1 EP —> EP remoto ou SVI - Verificação de coluna

Topologia



Lógica

Neste exemplo, rastrearemos o fluxo de pacotes de um pacote de EP1 destinado a uma Interface Virtual Comutada de BD Remota (SVI - Remote BD Switched Virtual Interface). O objetivo deste exemplo será verificar o encaminhamento de coluna para garantir que o pacote seja enviado para a folha correta. Vamos supor que o pacote foi enviado para o Spine Proxy na folha de entrada.

No Spine, primeiro vamos verificar o Protocolo do Conselho de Óragos (COOP) para o IP de destino, já que o pacote é enviado ao Proxy Spine para uma pesquisa:

```
calo1-spine1# show coop internal info ip-db | grep -A 10 192.168.20.1
IP address : 192.168.20.1
Vrf : 2129921
Flags : 0
EP vrf vnid : 2129921
```

```
EP IP :  192.168.20.1
Publisher Id : 10.0.224.88
Record timestamp : 11 04 2016 16:41:16 422062712
Publish timestamp : 11 04 2016 16:41:16 424633605
Seq No: 0
Remote publish timestamp: 01 01 1970 00:00:00 0
URIB Tunnel Info
Num tunnels : 1
Tunnel address : 10.0.224.88    <---- REMOTE LEAF
Tunnel ref count : 1
```

Vamos verificar que folha tem esse endereço TEP:

```
spine1# acidiag fnvread | grep 10.0.224.88
     105        1          calo1-leaf5      FDO20160TPS     10.0.224.88/32    leaf
active   0
```

Como sabemos que o pacote está entrando no Spine no Módulo 2, Porta 6, podemos anexar ao Módulo 2 e observar o Layout da porta.

```
spine1# vsh
Cisco iNX-OS Debug Shell
This shell should only be used for internal commands and exists
for legacy reasons. User should use ibash infrastructure as this
will be deprecated.
calo1-spine1# attach module 2
Attaching to module 2 ...
To exit type 'exit', to abort type '$.'
No directory, logging in with HOME=/
Bad terminal type: "xterm-256color". Will assume vt100.
Cisco iNX-OS Debug Shell
This shell should only be used for internal commands and exists
for legacy reasons. User should use ibash infrastructure as this
will be deprecated.
Loading parse tree (LC). Please be patient...
module-2#

module-2# show platform internal hal l2 port gpd
Legend:
-------
IfId:       Interface Id                                    IfName:      Interface Name
I P:        Is PC Mbr                                       IfId:           Interface Id
Uc PC Cfg:      UcPcCfg Idx                                 Uc PC MbrId:    Uc Pc Mbr Id
As:             Asic                                        AP:             Asic Port
Sl:             Slice                                       Sp:             Slice Port
Ss:             Slice SrcId                                 Ovec:           Ovector (slice |
srcid)
L S:            Local Slot                                  Reprogram:
L3:             Is L3
    P:    PifTable                                          Xla Idx:        Xlate Idx
    RP:   Rw PifTable                                       Ovx Idx:        OXlate Idx
    IP:   If Profile Table                                  N L3:           Num. of L3 Ifs
    RS:   Rw SrcId Table                                    NI L3:          Num. of Infra L3 Ifs
    DP:   DPort Table                                       Vif Tid:        Vif Tid
    SP:   SrcPortState Table                                RwV Tid:        RwVif Tid
    RSP:  RwSrcPortstate Table                              Ing Lbl:        Ingress Acl Label
    UC:   UCPcCfg                                           Egr Lbl:        Egress Acl Label
    UM:   UCPcMbr                                           Reprogram:
PROF ID:        Lport Profile Id
    VS:   VifStateTable                                     HI:             LportProfile Hw
Install
    RV:   Rw VifTable
```

```
Num. of Sandboxes: 1

Sandbox_ID: 0, BMP: 0x0
 Port Count: 7

================================================================================================================
=========================================
                       Uc   Uc                          |       Reprogram       |
| Rep |
                     I PC   Pc                       L |   R I R D    R  U U X | L Xla Ovx N
NI Vif    RwV    Ing  Egr  | V R | PROF H
IfId     Ifname      P Cfg  MbrID As AP Sl Sp Ss Ovec S | P P P S P Sp Sp C M L | 3 Idx Idx L3
L3 Tid    Tid    Lbl  Lbl  | S V | ID   I
================================================================================================================
=========================================
1f5      SpInBndMgmt 0 9de  1a    0  0  0  0  0  0    0   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
D-2d4  D-3e1  0    0      0 0   1    0
1a080000 Eth2/1      0 9a   1c    0  11 0  10 20 20   1   0 0 0 0 0 0  0  0 0 0   1 b   b   1  1
D-f3   D-61   100  0      0 0   1    0
1a081000 Eth2/2      0 9b   22    0  d  0  c  18 18   1   0 0 0 0 0 0  0  0 0 0   1 c   c   1  1
D-1ee  D-30b  100  0      0 0   1    0
1a084000 Eth2/5      0 9e   1e    0  3d 1  14 28 a8   1   0 0 0 0 0 0  0  0 0 0   1 1   1   1  1
D-19a  D-2ee  100  0      0 0   1    0
1a085000 Eth2/6      0 9f   24    0  39 1  10 20 a0   1   0 0 0 0 0 0  0  0 0 0   1 e   e   1  1
D-87   D-184  100  0      0 0   1    0
1a086000 Eth2/7      0 a0   26    0  35 1  c  18 98   1   0 0 0 0 0 0  0  0 0 0   1 d   d   1  1
D-1d0  D-357  100  0      0 0   1    0
1a088000 Eth2/9      0 a2   20    1  d  0  c  18 18   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
D-3ea  D-1a9  100  0      0 0   1    0
```

A Ethernet 2/6 é a interface que se conecta à folha 6 está no ASIC 0 SLICE 1

Agora sabemos em qual ASIC executar nosso ELAM. ASIC 0.

```
module-2# debug platform internal tah elam asic 0
module-2(DBG-TAH-elam)# trigger reset
module-2(DBG-TAH-elam)# trigger init in-select 13 out-select 0
module-2(DBG-TAH-elam-insel13)# set inner ipv4 src_ip 10.100.17.11 dst_ip 192.168.20.1
module-2(DBG-TAH-elam-insel13)# start
stat
module-2(DBG-TAH-elam-insel13)# stat
ELAM STATUS
===========
Asic 0 Slice 0 Status Armed
Asic 0 Slice 1 Status Armed

module-2(DBG-TAH-elam-insel13)# stat
ELAM STATUS
===========
Asic 0 Slice 0 Status Triggered   <---- Packet triggered from FM
Asic 0 Slice 1 Status Triggered   <---- Packet triggered from Front Panel
```

Olhando para o ELAM, podemos encontrar o índice do ovetor:

```
Front Panel ELAM drove sug_elam_out_sidebnd_no_spare_vec.ovector_idx: 0xB8
```

Agora, como mapear 0xb8 para uma porta? Como sabemos que o pacote deve ser enviado a um módulo de estrutura (FM) para uma pesquisa, podemos examinar o mapeamento da porta interna para encontrar o FM mais recente:

```
module-2# show platform internal hal l2 internal-port pi
```

```
Num. of Sandboxes: 1
Legend:
-------
IfId:      Interface Id               IfName:     Interface Name
As:        Asic                       AP:         Asic Port
Sl:        Slice                      SP:         Slice Port
Ss:        Slice SrcId                Ovec:       Ovector
UcPcCfgId: Uc Pc CfgId                Lb Mbrid:   LB MbrId

Sandbox_ID: 0, BMP: 0x0
 Internal Port Count: 32

======================================================================
                                                        UcPc  Lb
IfId     IfName                       As AP Sl SP Ss Ovec CfgId MbrId
======================================================================
7d       -                            0  21 0  20 38 38   0     4
7e       -                            0  29 1  0  0  80   0     8
7f       -                            1  21 0  20 38 38   0     c
80       -                            1  29 1  0  0  80   0     10
81       -                            2  21 0  20 38 38   0     14
82       -                            2  29 1  0  0  80   0     18
83       -                            3  21 0  20 38 38   0     1c
84       -                            3  29 1  0  0  80   0     20
95       -                            0  19 0  18 30 30   0     3
96       -                            0  49 1  20 38 b8   0     7
97       -                            1  19 0  18 30 30   0     b
98       -                            1  49 1  20 38 b8   0     f
99       -                            2  19 0  18 30 30   0     13
9a       -                            2  49 1  20 38 b8   0     17
9b       -                            3  19 0  18 30 30   0     1b
9c       -                            3  49 1  20 38 b8   0     1f
ad       -                            0  25 0  24 40 40   0     1
ae       -                            0  41 1  18 30 b0   0     6
af       -                            1  25 0  24 40 40   0     9
b0       -                            1  41 1  18 30 b0   0     e
b1       -                            2  25 0  24 40 40   0     11
b2       -                            2  41 1  18 30 b0   0     16
b3       -                            3  25 0  24 40 40   0     19
b4       -                            3  41 1  18 30 b0   0     1e
dd       -                            0  15 0  14 28 28   0     2
de       -                            0  4d 1  24 40 c0   0     5
df       -                            1  15 0  14 28 28   0     a
e0       -                            1  4d 1  24 40 c0   0     d
e1       -                            2  15 0  14 28 28   0     12
e2       -                            2  4d 1  24 40 c0   0     15
e3       -                            3  15 0  14 28 28   0     1a
e4       -                            3  4d 1  24 40 c0   0     1d
```

Usando ASIC0 / Ovec B8, obtemos MbrId 0x7, a fatia não importa.

Esse MbrId é a interface no USD que mapeia para uma interface em um FM. Lembre-se de que este MbrId está em hexadecimal e deve ser convertido em decimal.

Podemos descobrir qual FM observando as interfaces USD e inspecionando a porta 7:

```
module-2# show platform internal usd port info | grep -A 3 "Int 7"(if the interface has multiple
digits, will be "Int##" with no space)

Port  73.0 (Int 7) : Admin UP Link UP Remote slot22.asic0
               slice:1 slice port:32 lcl srcid:56 gbl srcid:184
               asic mrl:0xd07c010, mac mrl:0x12c84010, mac:16, chan:0
```

```
                speed 106G serdes: 0x328 0x329 0x32a 0x32b
```

O "slot" é baseado em 0 e a numeração FM é baseada em 1, portanto precisamos adicionar 1 ao número listado aqui. Isso significa que o pacote deve ser enviado para o FM 23.

IP sintético

Assim como em Alpino, há um IP sintético usado como o endereço IP externo para determinar o hash para a pesquisa de COOP. Para encontrar isso, você precisa executar este comando e grp para o IP DST interno:

```
module-2(DBG-TAH-elam-insel7)# show forwarding route synthetic vrf all | grep 192.168.20.1
SYNTH-88        1.203.211.185/32    0x208001          192.168.20.1
```

Isso nos mostra que 1.203.211.185 é nosso IP sintético. Com base nisso, também podemos definir o "DST IP externo" no nosso elam FM como este. Devemos ativar a FM:

ELAM de módulo de estrutura

```
module-23(DBG-TAH-elam-insel7)# trigger reset
module-23(DBG-TAH-elam)# trigger init in-select 13 out-select 0
module-23(DBG-TAH-elam-insel13)# set outer ipv4 dst_ip 1.203.211.185   <----- DST IP IS THE
SYNTHETIC IP
module-23(DBG-TAH-elam-insel13)# set inner ipv4 src_ip 10.100.17.11 dst_ip 192.168.20.1
module-23(DBG-TAH-elam-insel13)# start
stat
module-23(DBG-TAH-elam-insel13)# stat
ELAM STATUS
===========
Asic 0 Slice 0 Status Armed
Asic 0 Slice 1 Status Armed
Asic 0 Slice 2 Status Armed
Asic 0 Slice 3 Status Armed
Asic 0 Slice 4 Status Armed
Asic 0 Slice 5 Status Armed

module-23(DBG-TAH-elam-insel13)# stat
ELAM STATUS
===========
Asic 0 Slice 0 Status Armed
Asic 0 Slice 1 Status Armed
Asic 0 Slice 2 Status Triggered    <---- Triggered on SLICE 2
Asic 0 Slice 3 Status Armed
Asic 0 Slice 4 Status Armed
Asic 0 Slice 5 Status Armed
```

Obviamente, despeje o relatório completo, mas vamos ver o ovector_idx para este pacote que disparamos:

lac_elam_out_sidebnd_no_spare_vec.ovetor_idx: **0x20** <— Índice Ovetorial usado no comando abaixo

Como descobrimos que interface tem esse ovetor? No FM, execute isto:

**** Devido ao bug CSCvf42796 , anexe todos os comandos FM com "| no-more". Caso contrário, determinadas entradas da tabela não podem ser exibidas na saída final.**

```
module-23(DBG-TAH-elam-insel13)# show platform internal hal l2 port gpd | no-more
Legend:
-------
IfId:       Interface Id                                    IfName:      Interface Name
I P:        Is PC Mbr                                       IfId:           Interface Id
Uc PC Cfg:      UcPcCfg Idx                                 Uc PC MbrId:    Uc Pc Mbr Id
As:             Asic                                        AP:             Asic Port
Sl:             Slice                                       Sp:             Slice Port
Ss:             Slice SrcId                                 Ovec:           Ovector (slice |
srcid)
L S:            Local Slot                                  Reprogram:
L3:             Is L3
    P:    PifTable                                          Xla Idx:        Xlate Idx
    RP:   Rw PifTable                                       Ovx Idx:        OXlate Idx
    IP:   If Profile Table                                  N L3:           Num. of L3 Ifs
    RS:   Rw SrcId Table                                    NI L3:          Num. of Infra L3 Ifs
    DP:   DPort Table                                       Vif Tid:        Vif Tid
    SP:   SrcPortState Table                                RwV Tid:        RwVif Tid
    RSP:  RwSrcPortstate Table                              Ing Lbl:        Ingress Acl Label
    UC:   UCPcCfg                                           Egr Lbl:        Egress Acl Label
    UM:   UCPcMbr                                           Reprogram:
PROF ID:        Lport Profile Id
    VS:   VifStateTable                                     HI:             LportProfile Hw
Install
    RV:   Rw VifTable
Num. of Sandboxes: 1

Sandbox_ID: 1, BMP: 0x1
 Port Count: 8

================================================================================================
==========================================
                        Uc   Uc                          |       Reprogram       |
| Rep |
                     I PC   Pc                        L |   R I R D    R  U U X | L Xla Ovx N
NI Vif    RwV    Ing  Egr  | V R | PROF H
IfId     Ifname      P Cfg  MbrID As AP Sl Sp Ss Ovec S | P P P S P Sp Sp C M L | 3 Idx Idx L3
L3 Tid    Tid    Lbl  Lbl  | S V | ID   I
================================================================================================
==========================================
ae       fc0-lc1:0-0 1 0    3     0 11 0 10 20 20 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 - - 0 0 0 0 0
0
af       fc0-lc1:0-1 1 0    4     0  3d 2  c  18 98   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      0    0      0 0   0    0
b0       fc0-lc1:1-0 1 0    13    0  d  0  c  18 18   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      0    0      0 0   0    0
b1       fc0-lc1:1-1 1 0    14    0  39 2  8  10 90   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      0    0      0 0   0    0
b2       fc0-lc1:2-0 1 0    23    0  5d 3  14 28 e8   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      0    0      0 0   0    0
b3       fc0-lc1:2-1 1 0    24    0  21 1  8  10 50   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      0    0      0 0   0    0
b4       fc0-lc1:3-0 1 0    33    0  51 3  8  10 d0   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
-      -      0    0      0 0   0    0
```

Esse ovetor mapeia para LC1 (placa de linha no slot 2, já que é baseada em 0), em ASIC 0 / SLICE 0. Como sabemos pela execução ELAM originalmente no LC, acionamos esta fatia:

```
module-2# debug platform internal tah elam asic 0
module-2(DBG-TAH-elam)# trigger reset
module-2(DBG-TAH-elam)# trigger init in-select 13 out-select 0
module-2(DBG-TAH-elam-insel13)# set inner ipv4 src_ip 10.100.17.11 dst_ip 192.168.20.1
```

```
module-2(DBG-TAH-elam-insel13)# start
stat
module-2(DBG-TAH-elam-insel13)# stat
ELAM STATUS
===========
Asic 0 Slice 0 Status Armed
Asic 0 Slice 1 Status Armed

module-2(DBG-TAH-elam-insel13)# stat
ELAM STATUS
===========
Asic 0 Slice 0 Status Triggered   <---- Packet triggered from FM
Asic 0 Slice 1 Status Triggered   <---- Packet triggered from Front Panel
```

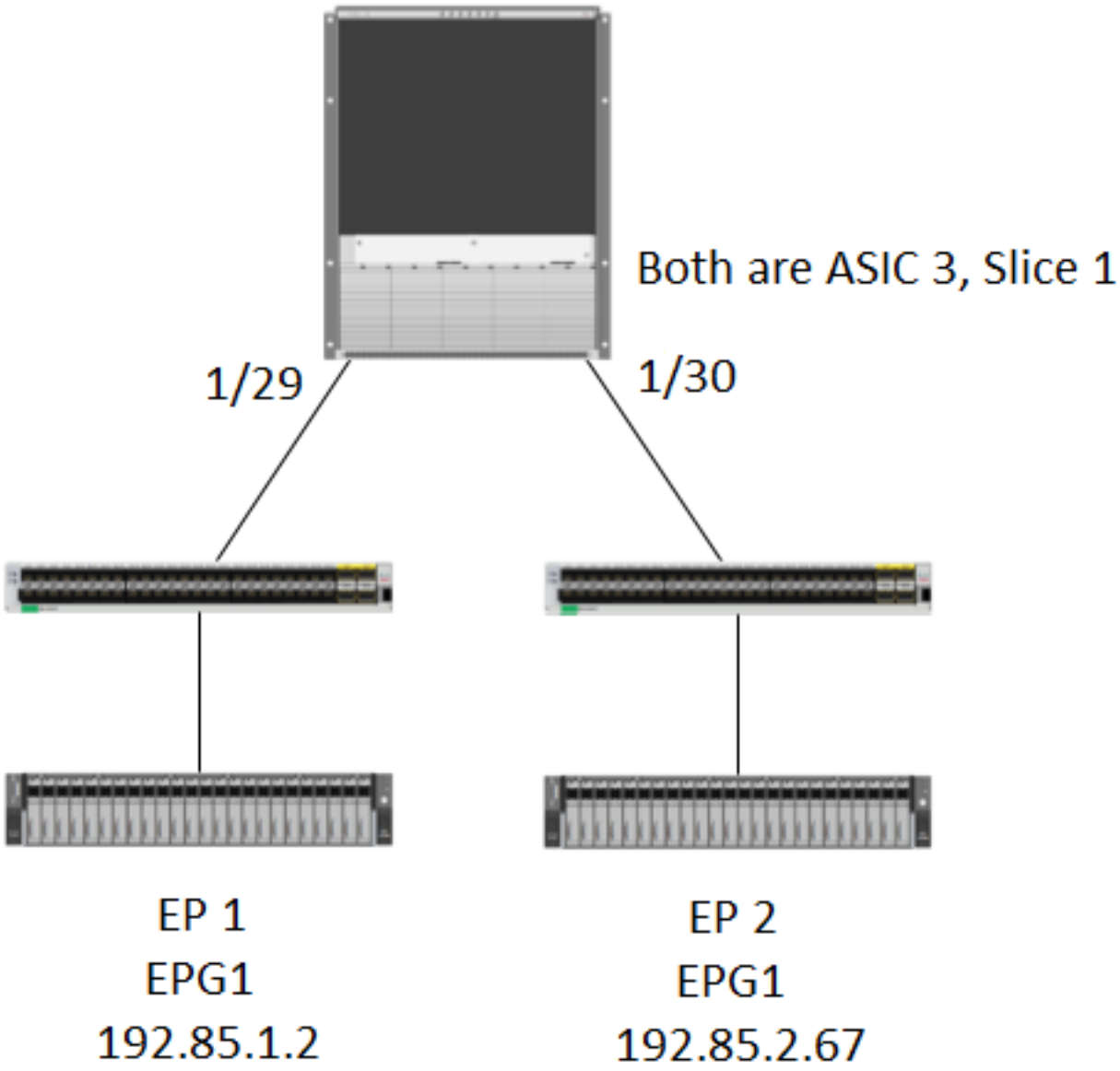
O ovetor neste ELAM é sug_elam_out_sidebnd_no_spare_vec.ovector_idx: **0x98,** que conhecemos do "hal l2 port gpd", mapeia para a interface correta no LC:

```
================================================================================================
=========================================
                       Uc   Uc                          |       Reprogram       |
| Rep |
                     I PC   Pc                        L |   R I R D    R  U U X | L Xla Ovx N
NI Vif    RwV    Ing  Egr  | V R | PROF H
IfId     Ifname      P Cfg  MbrID As AP Sl Sp Ss Ovec S | P P P S P Sp Sp C M L | 3 Idx Idx L3
L3 Tid    Tid    Lbl  Lbl  | S V | ID   I
================================================================================================
=========================================
1f5      SpInBndMgmt 0 9de  1a    0  0  0  0  0  0    0   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
D-2d4  D-3e1  0    0      0 0   1    0
1a080000 Eth2/1      0 9a   1c    0  11 0  10 20 20   1   0 0 0 0 0 0  0  0 0 0   1 b   b   1  1
D-f3   D-61   100  0      0 0   1    0
1a081000 Eth2/2      0 9b   22    0  d  0  c  18 18   1   0 0 0 0 0 0  0  0 0 0   1 c   c   1  1
D-1ee  D-30b  100  0      0 0   1    0
1a084000 Eth2/5      0 9e   1e    0  3d 1  14 28 a8   1   0 0 0 0 0 0  0  0 0 0   1 1   1   1  1
D-19a  D-2ee  100  0      0 0   1    0
1a085000 Eth2/6      0 9f   24    0  39 1  10 20 a0   1   0 0 0 0 0 0  0  0 0 0   1 e   e   1  1
D-87   D-184  100  0      0 0   1    0
1a086000 Eth2/7      0 a0   26    0 35 1 c 18 98   1   0 0 0 0 0 0  0  0 0 0   1 d   d   1  1  D-
1d0  D-357  100  0      0 0   1    0
1a088000 Eth2/9      0 a2   20    1  d  0  c  18 18   1   0 0 0 0 0 0  0  0 0 0   0 0   0   0  0
D-3ea  D-1a9  100  0      0 0   1    0
```

A Ethernet 2/7 é a Interface que se conecta à Folha 5.

Cenário extra: Obtendo um Ovetor que não está na saída "hal internal-port pi"

Topologia



Lógica

Há alguns cenários em que capturamos um pacote que não tem um Ovetor na tabela "**show platform internal hal l2 internal-port pi**". No cenário abaixo, estamos realmente capturando o pacote que volta do FM, portanto, precisamos examinar uma tabela diferente para ver qual porta do painel frontal o pacote está selecionando.

Observe que a topologia acima é um ambiente completamente diferente onde o tráfego de trânsito é aprendido (sem roteamento de proxy). O módulo é um N9K-X9732C-EX.

```
@module-1# debug platform internal tah elam asic 3
@module-1(DBG-elam)# trigger reset
@module-1(DBG-elam)# trigg init in-select 13 out-select 0
@module-1(DBG-elam-insel13)# set inner ipv4 src_ip 192.85.1.2 dst_ip 192.85.2.67
@module-1(DBG-elam-insel13)# star
@module-1(DBG-elam-insel13)# stat
ELAM STATUS
===========
Asic 3 Slice 0 Status Armed
```

```
Asic 3 Slice 1 Status Triggered

@module-1(DBG-elam-insel13)# report | grep ovector
 sug_elam_out_sidebnd_no_spare_vec.ovector_idx: 0xA0 <<<<<<<<<<<<<<<< now we look for this in
the "hal internal-port pi" command


@module-1# show platform internal hal l2 internal-port pi
No sandboxes exist
Num. of Sandboxes: 1
Legend:
-------
IfId:      Interface Id               IfName:     Interface Name
As:        Asic                       AP:         Asic Port
Sl:        Slice                      SP:         Slice Port
Ss:        Slice SrcId                Ovec:       Ovector
UcPcCfgId: Uc Pc CfgId                Lb Mbrid:   LB MbrId

Sandbox_ID: 0, BMP: 0x0
 Internal Port Count: 24

=====================================================================
                                                    UcPc  Lb
IfId     IfName                       As AP Sl SP Ss Ovec CfgId MbrId
=====================================================================
7d       -                            0  21 0  20 38 38   0     4
7e       -                            0  29 1  0  0  80   0     8
7f       -                            1  21 0  20 38 38   0     c
80       -                            1  29 1  0  0  80   0     10
81       -                            2  21 0  20 38 38   0     14
82       -                            2  29 1  0  0  80   0     18
83       -                            3  21 0  20 38 38   0     1c
84       -                            3  29 1  0  0  80   0     20
ad       -                            0  25 0  24 40 40   0     1
ae       -                            0  41 1  18 30 b0   0     6
af       -                            1  25 0  24 40 40   0     9
b0       -                            1  41 1  18 30 b0   0     e
b1       -                            2  25 0  24 40 40   0     11
b2       -                            2  41 1  18 30 b0   0     16
b3       -                            3  25 0  24 40 40   0     19
b4       -                            3  41 1  18 30 b0   0     1e
dd       -                            0  15 0  14 28 28   0     2
de       -                            0  4d 1  24 40 c0   0     5
df       -                            1  15 0  14 28 28   0     a
e0       -                            1  4d 1  24 40 c0   0     d
e1       -                            2  15 0  14 28 28   0     12
e2       -                            2  4d 1  24 40 c0   0     15
e3       -                            3  15 0  14 28 28   0     1a
e4       -                            3  4d 1  24 40 c0   0     1d  <<<<<<<  we cant find an
entry that matches 0xA0


@module-1# show platform internal hal l2 port gpd
Legend:
-------
<snip>

Sandbox_ID: 0, BMP: 0x0
 Port Count: 6

=============================================================================================
==========================================
                      Uc   Uc                          |       Reprogram
|                                        | Rep |
```

```
                    I PC   Pc                          L |   R I R D    R  U U X | L Xla Ovx N  NI
Vif    RwV    Ing  Egr  | V R | PROF H
IfId     Ifname      P Cfg  MbrID As AP Sl Sp Ss Ovec S | P P P S P Sp Sp C M L | 3 Idx Idx L3
L3 Tid    Tid    Lbl  Lbl  | S V | ID   I
=============================================================================================
==========================================
1f5      SpInBndMgmt 0 9de  1a    0  0  0  0  0  0    0   0 0 0 0 0 0  0  0 0 0   0 0   0   0
0  D-2d4  D-3e1  0    0      0 0   1    0
1a000000 Eth1/1      0 1b   1c    0  11 0  10 20 20   1   0 0 0 0 0 0  0  0 0 0   1 1   1   1
1  D-13b  D-33b  500  0      1 0   3    0
1a01c000 Eth1/29     0 37   1e    3  3d 1  14 28 a8   1   0 0 0 0 0 0  0  0 0 0   1 8   8   1
1  D-3f2  D-7a   100  0      0 0   2    0
1a01d000 Eth1/30     0 38   20    3  39 1  10 20 a0   1   0 0 0 0 0 0  0  0 0 0   1 5   5   1
1  D-36e  D-362  100  0      0 0   2    0
1a01e000 Eth1/31     0 39   22    3  35 1  c  18 98   1   0 0 0 0 0 0  0  0 0 0   1 9   9   1
1  D-273  D-8    100  0      0 0   2    0
1a01f000 Eth1/32     0 3a   24    3  31 1  8  10 90   1   0 0 0 0 0 0  0  0 0 0   1 a   a   1
1  D-154  D-5d   100  0      0 0   2    0
```

1/30 é a interface phys que se conecta à folha 102, verificada por topologia, ASIC 3, Fatia 1