# Risoluzione dei problemi relativi al flusso del traffico di inoltro SDA da est a ovest

## Sommario



## Introduzione

In questo documento viene descritto come convalidare il flusso del traffico tra oriente e occidente come parte di SDA (Software Defined Access).

## Prerequisiti

### Requisiti

Cisco raccomanda la conoscenza dei seguenti argomenti:

- Inoltro IP (Internet Protocol)
- Locator/ID Separation Protocol (LISP)

### Componenti usati

Le informazioni fornite in questo documento si basano sulle seguenti versioni software e hardware:

- C9000v su Cisco IOS® XE 17.10.1
- SDA 1.0 (non LISP PubSub)

Le informazioni discusse in questo documento fanno riferimento a dispositivi usati in uno specifico ambiente di emulazione. Su tutti i dispositivi menzionati nel documento la configurazione è stata ripristinata ai valori predefiniti. Se la rete è operativa, valutare attentamente eventuali conseguenze derivanti dall'uso dei comandi.

### Prodotti correlati

Il presente documento può essere utilizzato anche per le seguenti versioni hardware e software:

- C9200
- C9300
- C9400
- C9500
- C9600
- Cisco IOS® XE 16.12 e versioni successive

## Premesse

Il flusso del traffico est-ovest SDA si riferisce al concetto in base al quale un endpoint all'interno del fabric SDA desidera comunicare con un altro endpoint all'interno dello stesso fabric. Ci sono alcune riserve su ciò che è e non è considerato un flusso est-ovest. Un flusso di traffico tra oriente e occidente può essere costituito dagli esempi seguenti:

- Endpoint nella stessa subnet (172.17.10.2 che parla con 172.19.10.3). Questa estensione viene considerata L2LISP
- Endpoint che si trovano nello stesso VRF (VN) (172.19.10.2 che parla con 172.19.11.2 ed entrambi si trovano nel campus VRF). Questo è considerato LISP L3
- Endpoint all'interno della struttura che comunica con un host collegato a un bordo handoff L2, esattamente uguale a L2LISP

I flussi di traffico est-ovest non fanno riferimento ai seguenti esempi:

- Il traffico ha avuto origine dal fabric SDA verso l'esterno del fabric, ovvero da nord a sud
- Inoltre, il routing tra VRF non viene considerato orientale-occidentale (un endpoint nel campus VRF, indirizzo IP 172.19.10.2 che comunica con un endpoint nel guest VRF, indirizzo IP 172.19.11.2)
- Domini integrati SD-WAN
- Transito SDA
- Affinità bordo
- Extranet

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Nota: i comandi della piattaforma (feed) possono variare. Il comando può essere "show platform fed <active|standby>" oppure "show platform fed switch <active|standby>". Se la sintassi indicata negli esempi non viene analizzata, provare a utilizzare la variante.

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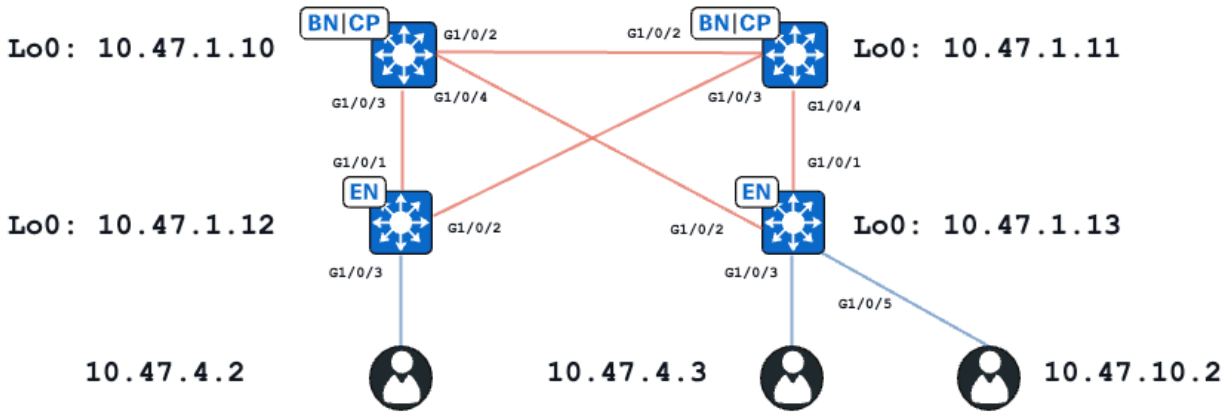
# Topologia




Ai fini di questo esempio, gli switch C9000v funzionano come Fabric Edges (Bordi fabric) e Collocated Borders (Bordi collocati). Tutti gli endpoint si trovano nella stessa rete virtuale (VN), red_vn. Gli endpoint 10.47.4.2 e 10.47.4.2 si trovano nella stessa subnet, mentre l'endpoint 10.47.10.2 si trova in una subnet diversa ma con la stessa VN.

# Configurazione

Si presume che Cisco DNA-Center venga utilizzato per il provisioning del fabric SDA con le impostazioni predefinite:

- L'estensione di livello 2 è abilitata (ciò forza l'inoltro del traffico in base alle ricerche dell'indirizzo MAC anziché dell'indirizzo IP).
- L'allagamento di livello 2 è disabilitato (ciò abilita la soppressione ARP sui dispositivi periferici e l'apprendimento ARP assistito da LISP).

Al termine del corretto processo di caricamento dell'host, la configurazione dell'interfaccia contiene diverse sezioni:

Configurazione interfaccia Fabric Edge (10.47.1.12):

```
interface GigabitEthernet1/0/3
 switchport access vlan 1026
 switchport mode access
 device-tracking attach-policy IPDT_POLICY
 spanning-tree portfast
 spanning-tree bpduguard enable
end

interface Vlan1026
 description Configured from Cisco DNA-Center
 mac-address 0000.0c9f.f341
 vrf forwarding red_vn
 ip address 10.47.4.1 255.255.255.0
 ip helper-address 10.47.9.9
```

```
 no ip redirects
 ip route-cache same-interface
 no lisp mobility liveness test
 lisp mobility red-IPV4
end
```

Configurazione LISP Fabric Edge (10.47.1.12):

```
router lisp
 locator-table default
 locator-set rloc_222e1707-175d-4019-a783-060404f8bc2f
  IPv4-interface Loopback0 priority 10 weight 10
  exit-locator-set
!
instance-id 4099
  remote-rloc-probe on-route-change
  dynamic-eid red-IPV4
   database-mapping 10.47.4.0/24 locator-set rloc_222e1707-175d-4019-a783-060404f8bc2f
   exit-dynamic-eid
  !
  dynamic-eid red-helpdesk-IPV4
   database-mapping 10.47.10.0/24 locator-set rloc_222e1707-175d-4019-a783-060404f8bc2f
   exit-dynamic-eid
  !
  service ipv4
   eid-table vrf red_vn
   map-cache 0.0.0.0/0 map-request
   sgt distribution
   sgt
   exit-service-ipv4
  !
  exit-instance-id
!
 !
 instance-id 8190
  remote-rloc-probe on-route-change
  service ethernet
   eid-table vlan 1026
   database-mapping mac locator-set rloc_222e1707-175d-4019-a783-060404f8bc2f
   dynamic-eid detection multiple-addr bridged-vm
   exit-service-ethernet
  !
  exit-instance-id
 !
 instance-id 8192
  remote-rloc-probe on-route-change
  service ethernet
   eid-table vlan 1028
   database-mapping mac locator-set rloc_222e1707-175d-4019-a783-060404f8bc2f
   dynamic-eid detection multiple-addr bridged-vm
   exit-service-ethernet
  !
  exit-instance-id
```

Configurazione interfaccia Fabric Edge (10.47.1.13):

```
interface GigabitEthernet1/0/3
 switchport access vlan 1026
 switchport mode access
 device-tracking attach-policy IPDT_POLICY
 spanning-tree portfast
 spanning-tree bpduguard enable
end
!
interface GigabitEthernet1/0/5
 switchport access vlan 1028
 switchport mode access
 device-tracking attach-policy IPDT_POLICY
 spanning-tree portfast
 spanning-tree bpduguard enable
end
!
interface Vlan1026
 description Configured from Cisco DNA-Center
 mac-address 0000.0c9f.f341
 vrf forwarding red_vn
 ip address 10.47.4.1 255.255.255.0
 ip helper-address 10.47.9.9
 no ip redirects
 ip route-cache same-interface
 no lisp mobility liveness test
 lisp mobility red-IPV4
end
!
interface Vlan1028
 description Configured from Cisco DNA-Center
 mac-address 0000.0c9f.f800
 vrf forwarding red_vn
 ip address 10.47.10.1 255.255.255.0
 ip helper-address 10.47.9.9
 no ip redirects
 ip route-cache same-interface
 no lisp mobility liveness test
 lisp mobility red-helpdesk-IPV4
end
```

## Configurazione LISP Fabric Edge (10.47.1.13)

```
router lisp
 locator-table default
 locator-set rloc_691b1fe4-5264-44c2-bb1b-0903b3eb2c51
  IPv4-interface Loopback0 priority 10 weight 10
  exit-locator-set
 !
 instance-id 4099
  remote-rloc-probe on-route-change
  dynamic-eid red-IPV4
   database-mapping 10.47.4.0/24 locator-set rloc_691b1fe4-5264-44c2-bb1b-0903b3eb2c51
   exit-dynamic-eid
  !
  dynamic-eid red-helpdesk-IPV4
   database-mapping 10.47.10.0/24 locator-set rloc_691b1fe4-5264-44c2-bb1b-0903b3eb2c51
```

```
   exit-dynamic-eid
  !
  service ipv4
   eid-table vrf red_vn
   map-cache 0.0.0.0/0 map-request
   sgt distribution
   sgt
   exit-service-ipv4
  !
  exit-instance-id
!
 instance-id 8190
  remote-rloc-probe on-route-change
  service ethernet
   eid-table vlan 1026
   database-mapping mac locator-set rloc_691b1fe4-5264-44c2-bb1b-0903b3eb2c51
   dynamic-eid detection multiple-addr bridged-vm
   exit-service-ethernet
  !
  exit-instance-id
 !
 instance-id 8192
  remote-rloc-probe on-route-change
  service ethernet
   eid-table vlan 1028
   database-mapping mac locator-set rloc_691b1fe4-5264-44c2-bb1b-0903b3eb2c51
   dynamic-eid detection multiple-addr bridged-vm
   exit-service-ethernet
  !
  exit-instance-id
```

# Verifica caricamento host

Nell'ambito del processo di caricamento dell'host, vengono create diverse strutture:

## Voce IPDT / IP Device Tracking

Dopo il completamento dell'onboarding dell'host, nella tabella IP Device Tracking (IPDT) è presente una voce valida e l'host finale deve essere contrassegnato come REACHABLE:

<#root>

```
Edge-1#
```

**show device-tracking database interface g1/0/3**

```
portDB has 2 entries for interface Gi1/0/3, 2 dynamic
Codes: L - Local, S - Static, ND - Neighbor Discovery, ARP - Address Resolution Protocol, DH4 - IPv4 DH
Preflevel flags (prlvl):
0001:MAC and LLA match     0002:Orig trunk            0004:Orig access
0008:Orig trusted trunk    0010:Orig trusted access   0020:DHCP assigned
0040:Cga authenticated     0080:Cert authenticated    0100:Statically assigned


    Network Layer Address                  Link Layer Address     Interface  vlan       prlvl      ag
```

```
DH4 10.47.4.2                           5254.0019.93e9        Gi1/0/3    1026       0024       3mr
```

## Voce MAC/ARP

Quando l'host finale viene caricato correttamente, può eseguire il ping sul gateway predefinito (o dal gateway predefinito se non è installato alcun firewall che blocca questa comunicazione):

```
<#root>

Edge-1#

ping vrf red_vn 10.47.4.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.47.4.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 142/150/161 ms
```

Nel nodo perimetrale è presente un indirizzo MAC e la voce ARP corrispondente nella tabella (in VRF):

```
<#root>

Edge-1#

show mac address-table interface g1/0/3

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

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----
1026    5254.0019.93e9    DYNAMIC     Gi1/0/3
Total Mac Addresses for this criterion: 1

Edge-1#

show ip arp vrf red_vn

Protocol  Address          Age (min)  Hardware Addr   Type   Interface
Internet  10.47.4.1              -   0000.0c9f.f341  ARPA   Vlan1026

Internet  10.47.4.2              1   5254.0019.93e9  ARPA   Vlan1026

Internet  10.47.10.1             -   0000.0c9f.f800  ARPA   Vlan1028
```

Programmazione degli indirizzi MAC FED per il software**

Per controllare l'indirizzo MAC nel FED, usare il comando show platform software fed switch active matm macTable vlan <id vlan> mac <indirizzo mac>

<#root>

Edge-1#

**show platform software fed switch active matm macTable vlan 1026 mac 5254.0019.93e9**

VLAN   MAC                  Type  Seq#    EC_Bi  Flags

**machandle**

**siHandle**

            riHandle

**diHandle**

              *a_time  *e_time  ports                                                                  Con
---------------------------------------------------------------------------------------------------------
1026   5254.0019.93e9        0x1       9      0      0

**0x7f65ec7bda68**

**0x7f65ec7c21f8**

      0x0

**0x7f65ec6e1368**

            300        7  GigabitEthernet1/0/3                                                  Yes

======platform hardware details ======

Asic: 0
 htm-handle = 0x7f65ec95dc68 MVID = 7 gpn = 1
 SI = 0xc3 RI = 0x25 DI = 0x526e
 DI = 0x526e pmap = 0x00000000 0x00000004 pmap_intf : [GigabitEthernet1/0/3]

Asic: 1
 SI = 0xc3 RI = 0x25 DI = 0x526e
 DI = 0x526e pmap = 0x00000000 0x00000000

**Programmazione macHandle indirizzo MAC**

Prendere il valore macHandle del comando precedente (0x7f65ec7bda68) e usarlo in show platform hardware fed switch active fwd-asic abstraction print-resource-handle <macHandle> 1

<#root>

Edge-1#

**show platform hardware fed switch active fwd-asic abstraction print-resource-handle 0x7f65ec7bda68 1**

Handle:0x7f65ec7bda68 Res-Type:ASIC_RSC_HASH_TCAM Res-Switch-Num:0 Asic-Num:255 Feature-ID:AL_FID_L2 Lk
priv_ri/priv_si Handle: (nil)Hardware Indices/Handles: handle [ASIC: 0]: 0x7f65ec95dc68
Features sharing this resource:Cookie length: 12
19 00 54 52 e9 93 07 80 07 00 00 00

Detailed Resource Information (ASIC_INSTANCE# 0)

```
---------------------------------------
Number of HTM Entries: 1

Entry 0: (handle 0x7f65ec95dc68)

Absolute Index: 6778
Time Stamp: 4
KEY -
```

**vlan:7**

**mac:0x5254001993e9**

```
 l3_if:0
```

**gpn:3**

```
 epoch:0 static:0 flood_en:0 vlan_lead_wless_flood_en: 0 client_home_asic: 0 learning_peerid 0, learnin
MASK - vlan:0 mac:0x0 l3_if:0 gpn:0 epoch:0 static:0 flood_en:0 vlan_lead_wless_flood_en: 0 client_home_
SRC_AD - need_to_learn:0 lrn_v:0 catchall:0 static_mac:0 chain_ptr_v:0 chain_ptr: 0 static_entry_v:0 au
DST_AD - si:0xb7 bridge:0 replicate:0 blk_fwd_o:0 v4_rmac:0 v6_rmac:0 catchall:0 ign_src_lrn:0 port_mas
============================================================
```

**Verifica MVID**

Il numero 7 nell'output precedente è l'ID della VLAN mappata (MVID) nell'hardware. Per verificare che corrispondano alla vlan "reale", usare il comando show platform software fed switch active vlan<vlan number>

<#root>

```
Edge-1#
```

**show platform software fed switch active vlan 1026**

```
VLAN Fed Information
```

**Vlan**

**Id**

```
  IF Id                LE Handle            STP Handle           L3 IF Handle         SVI IF ID
```

**MVID**

```
-------------------------------------------------------------------------------------------------------
```

**1026**

```
     0x0000000000420011   0x00007f65ec6a08b8   0x00007f65ec6a1138   0x00007f65ec77e838   0x000000000000
```

**7**

**Verifica GPN (Global Port Number)**

Per correlare il GPN a un'interfaccia "reale", usare il comando show platform software fed switch active ifm mappings gpn

<#root>

```
Edge-1#
```

**show platform software fed switch active ifm mappings gpn**

```
Mappings Table

GPN         Interface                           IF_ID               IF_TYPE
-------------------------------------------------------------------------------------------------
1           GigabitEthernet1/0/1                0x0000001a          ETHER
2           GigabitEthernet1/0/2                0x0000001b          ETHER
```

**3**

**GigabitEthernet1/0/3**

```
             0x0000000b          ETHER
```

**<-- GPN 3 lines up with the expected Egress interface**

**Programmazione siHandle indirizzo MAC**

Sfruttare il valore siHandle del comando precedente (0x7f65ec7c21f8) e utilizzare in show platform hardware fed switch active fwd-asic abstraction print-resource-handle <si_handle> 1

<#root>

```
 Edge-1#
```

**show platform hardware fed switch active fwd-asic abstraction print-resource-handle 0x7f65ec7c21f8 1**

```
Handle:0x7f65ec7c21f8 Res-Type:ASIC_RSC_SI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_L3_UNICAST_
priv_ri/priv_si Handle: 0x7f65ec7c2498Hardware Indices/Handles: index0:0xc3  mtu_index/l3u_ri_index0:0x0
Features sharing this resource:66 (1)]
57 (1)]
Cookie length: 56
00 00 00 00 00 00 00 00 02 04 00 00 00 00 00 00 00 00 00 00 07 00 52 54 00 19 93 e9 00 00 00 00 00 00 0

Detailed Resource Information (ASIC_INSTANCE# 0)
----------------------------------------
```

**Station Index (SI) [0xc3] <-- Station Index is comprised of the Rewrite Index (RI) and Destination Index**

```
stationTableGenericLabel = 0
stationFdConstructionLabel = 0x7
lookupSkipIdIndex = 0
```

```
rcpServiceId = 0
dejaVuPreCheckEn = 0x1
```

**Replication Bitmap: LD <-- Local Data (LD) indicates that the destination is on this ASIC**

```
Detailed Resource Information (ASIC_INSTANCE# 1)
----------------------------------------
```

**Station Index (SI) [0xc3] <-- Station Index is comprised of the Rewrite Index (RI) and Destination Index**

```
stationTableGenericLabel = 0
stationFdConstructionLabel = 0x7
lookupSkipIdIndex = 0
rcpServiceId = 0
dejaVuPreCheckEn = 0x1
```

**Replication Bitmap: CD <-- Core Data (CD) indicates that the destination is on the same ASIC, different**

```
==============================================================
```

**Verifica dell'indice di riscrittura dell'indirizzo MAC**

Accettare il valore RI del comando precedente (0x25) e utilizzare in show platform hardware feed switch active fwd-asic resource asic all rewrite-index range <RI> <RI>

<#root>

```
Edge-1#
```

**show platform hardware fed switch active fwd-asic resource asic all rewrite-index range 0x25 0x25**

```
ASIC#:0 RI:37 Rewrite_type:AL_RRM_REWRITE_L3_UNICAST_IPV4_SHARED(1) Mapped_rii:L3_UNICAST_IPV4(9)
 MAC Addr:
```

**MAC Addr: 52:54:00:19:93:e9**

```
,
 L3IF LE Index 41

ASIC#:0 RI:38 Rewrite_type:AL_RRM_REWRITE_L3_UNICAST_IPV4_SHARED(1) Mapped_rii:L3_UNICAST_IPV4(9)
 MAC Addr: MAC Addr: 01:00:5e:00:00:00,
 L3IF LE Index 40

ASIC#:0 RI:39 Rewrite_type:AL_RRM_REWRITE_L3_UNICAST_IPV4_SHARED(1) Mapped_rii:L3_UNICAST_IPV4(9)
 MAC Addr: MAC Addr: 52:54:00:00:50:17,
 L3IF LE Index 40

ASIC#:1 RI:37 Rewrite_type:AL_RRM_REWRITE_L3_UNICAST_IPV4_SHARED(1) Mapped_rii:L3_UNICAST_IPV4(9)
 MAC Addr:
```

**MAC Addr: 52:54:00:19:93:e9**

```
,
```

```
 L3IF LE Index 41


ASIC#:1 RI:38 Rewrite_type:AL_RRM_REWRITE_L3_UNICAST_IPV4_SHARED(1) Mapped_rii:L3_UNICAST_IPV4(9)
 MAC Addr: MAC Addr: 01:00:5e:00:00:00,
 L3IF LE Index 40


ASIC#:1 RI:39 Rewrite_type:AL_RRM_REWRITE_L3_UNICAST_IPV4_SHARED(1) Mapped_rii:L3_UNICAST_IPV4(9)
 MAC Addr: MAC Addr: 52:54:00:00:50:17,
 L3IF LE Index 40
```

**Verifica indice destinazione indirizzo MAC**

Accettare il valore DI dall'interfaccia del comando precedente (0x526e) e utilizzare in show platform hardware fed switch active fwd-asic resource asic all destination-index range <DI> <DI>

<#root>

```
Edge-1#

show platform hardware fed switch active fwd-asic resource asic all destination-index range 0x526e 0x526

ASIC#0:


Destination index   = 0x526e

pmap = 0x00000000 0x00000004 <-- Convert decimal 4 to binary, which is 0100. Count this binary right to

pmap_intf : [GigabitEthernet1/0/3]
cmi                 = 0x0
rcp_pmap            = 0x0
al_rsc_cmi
CPU Map Index (CMI) [0]
ctiLo0              = 0
ctiLo1              = 0
ctiLo2              = 0
cpuQNum0            = 0
cpuQNum1            = 0
cpuQNum2            = 0
npuIndex            = 0
stripSeg            = 0
copySeg             = 0
ASIC#1:


Destination index   = 0x526e
pmap                = 0x00000000 0x00000000
cmi                 = 0x0
rcp_pmap            = 0x0
al_rsc_cmi
CPU Map Index (CMI) [0]
ctiLo0              = 0
ctiLo1              = 0
ctiLo2              = 0
cpuQNum0            = 0
cpuQNum1            = 0
cpuQNum2            = 0
```

```
npuIndex            = 0
stripSeg            = 0
copySeg             = 0
```

**Verifica porta**

Per correlare la porta rilevata in precedenza, utilizzare il comando show platform software fed switch active ifm mappings e controllare la colonna Port.

<#root>

```
Edge-1#
```

**show platform software fed switch active ifm mappings**

```
------------------ show platform software fed switch active ifm mappings  ------------------
Interface                IF_ID    Inst Asic Core Port SubPort Mac  Cntx LPN  GPN  Type Active
GigabitEthernet1/0/1     0x1a       0   0   0    0      0      1    0    1    1    NIF  Y
GigabitEthernet1/0/2     0x1b       0   0   0    1      0      2    1    2    2    NIF  Y
```

**GigabitEthernet1/0/3**

```
      0xb        0   0   0
```

**2**

```
      0      3    2    3    3    NIF  Y
```

**<-- Matches port 2 from previous output**

**Verifica indirizzo MAC FED hardware**

Questo output in uno scenario di funzionamento/ideale corrisponde a quello fornito dalla decodifica macHandle.

<#root>

```
Edge-1#
```

**show platform hardware fed switch active matm macTable vlan 1026 mac 5254.0019.93e9**

```
HEAD: MAC address 5254.0019.93e9 in VLAN 1026
KEY:
```

**vlan 7**

```
,
```

**mac 0x5254001993e9**

```
, l3_if 0,
```

**gpn 3**

```
, epoch 0, static 0, flood_en 0, vlan_lead_wless_flood_en 0, client_home_asic 0, learning_peerid 0, lea
MASK: vlan 0, mac 0x0, l3_if 0, gpn 0, epoch 0, static 0, flood_en 0, vlan_lead_wless_flood_en 0, clien
SRC_AD: need_to_learn 0, lrn_v 0, catchall 0, static_mac 0, chain_ptr_v 0, chain_ptr 0, static_entry_v
```

```
DST_AD: si 0xb7, bridge 0, replicate 0, blk_fwd_o 0, v4_mac 0, v6_mac 0, catchall 0, ign_src_lrn 0, por

Total Mac number of addresses:: 1
```

- L'ID VLAN nell'hardware (MVID) è 7
- Indirizzo MAC: 5254.0019.93e9
- GPN: 3

## Voce LISP

Dopo il corretto caricamento dell'host, le voci LISP per l'host finale vengono create localmente sul nodo perimetrale e registrate sui nodi di controllo (LISP MSMR - LISP Map Server / Map Resolver). Tutti i controlli LISP devono essere eseguiti in relazione all'ambito di ID istanza specifico che può essere controllato per L2 e per L3:

<#root>

```
Edge-1#

show vlan id 1026

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1026 red                              active

L2LI0:8190

, Gi1/0/3

<-- L2 LISP Instance ID tied to VLAN 1026
```

**Verifica del database LISP L2**

Per controllare il database L2 LISP, usare il comando show lisp instance-id <ID ID LISP L2> ethernet database <indirizzo MAC>

<#root>

```
Edge-1#

show lisp instance-id 8190 ethernet database 5254.0019.93e9

LISP ETR MAC Mapping Database for LISP 0 EID-table Vlan 1026 (IID 8190), LSBs: 0x1
Entries total 1, no-route 0, inactive 0, do-not-register 2
5254.0019.93e9/48, dynamic-eid Auto-L2-group-8190, inherited from default locator-set rloc_222e1707-175
  Uptime: 2d17h, Last-change: 2d17h
  Domain-ID: local
  Service-Insertion: N/A
  Locator     Pri/Wgt  Source     State

10.47.1.12
```

```
   10/10   cfg-intf   site-self, reachable

 -----> Our own RLOC

  Map-server       Uptime         ACK  Domain-ID

 10.47.1.10

       1d11h          Yes  0

-----> RLOC of upstream collocated border


10.47.1.11

       2d17h          Yes  0

-----> RLOC of upstream collocated border
```

**Verifica del database LISP L2 Address Resolution (AR)**

Per controllare il database LISP L2 AR, utilizzare il comando show lisp instance-id <LISP L2 ID> ethernet database address-resolution <mac address>

<#root>

```
Edge-1#

show lisp instance-id 8190 ethernet database address-resolution 5254.0019.93e9

LISP ETR Address Resolution for LISP 0 EID-table Vlan 1026 (IID 8190)
(*) -> entry being deleted

Hardware Address       L3 InstID Host Address
5254.0019.93e9              4099 10.47.4.2/32  <-- Endpoint MAC Address, LISP L3 Instance ID, Endpoint I
```

**Verifica del database LISP L3**

Per controllare il database LISP L3, usare il comando show lisp instance-id <LISP L3 ID> database ipv4 <indirizzo IP/subnet mask>

<#root>

```
 Edge-1#

show lisp instance-id 4099 ipv4 database 10.47.4.2/32

LISP ETR IPv4 Mapping Database for LISP 0 EID-table vrf red_vn (IID 4099), LSBs: 0x1
Entries total 1, no-route 0, inactive 0, do-not-register 1

10.47.4.2

/32, dynamic-eid red-IPV4, inherited from default locator-set rloc_222e1707-175d-4019-a783-060404f8bc2f

-----> Endpoint IPv4 Address
```

```
  Uptime: 2d18h, Last-change: 2d18h
  Domain-ID: local
  Service-Insertion: N/A
  Locator     Pri/Wgt  Source     State


10.47.1.12

   10/10   cfg-intf   site-self, reachable

-----> Our own RLOC

  Map-server       Uptime         ACK  Domain-ID


10.47.1.10

       1d11h          Yes  0

 -----> RLOC of upstream collocated border



10.47.1.11

       2d17h          Yes  0

 -----> RLOC of upstream collocated border
```

**Verifica CEF**

Per controllare il file CEF, usare il comando show ip cef vrf <nome vrf> <indirizzo IP> internal

<#root>

```
Edge-1#

show ip cef vrf red_vn 10.47.4.2 internal


10.47.4.2/32, epoch 1, flags [att, sc], RIB[D], refcnt 6, per-destination sharing
  sources: RIB, Adj, IPL
  feature space:
    IPRM: 0x00058000
    Broker: linked, distributed at 3rd priority
  subblocks:
    SC owned,sourced:

LISP local EID

 -
    SC inherited: LISP remote EID - locator status bits 0x00000000
    SC inherited: LISP cfg dyn-EID - LISP configured dynamic-EID
    LISP EID attributes: localEID Yes, c-dynEID Yes, d-dynEID Yes, a-dynEID No
    SC owned,sourced: LISP generalised SMR - [disabled, not inheriting, 0x7F06D0A67E40 locks: 1]
    Adj source:

IP adj out of Vlan1026

,

addr 10.47.4.2
```

```
 7F06D300B738
      Dependent covered prefix type adjfib, cover 10.47.4.0/24
    2 IPL sources [no flags]
  ifnums:
    Vlan1026(29): 10.47.4.2
  path list 7F06CEE8D720, 3 locks, per-destination, flags 0x49 [shble, rif, hwcn]
    path 7F06D0A900C8, share 1/1, type attached nexthop, for IPv4
      nexthop 10.47.4.2 Vlan1026, IP adj out of Vlan1026, addr 10.47.4.2 7F06D300B738
  output chain:


IP adj out of Vlan1026, addr 10.47.4.2

 7F06D300B738
```

Oltre alle voci LISP locali sul nodo edge SDA, i nodi di controllo SDA (LISP MS/MR) contengono anche informazioni aggiuntive sugli endpoint:

Verifica server LISP L2 con bordo collocato:

Per controllare il server L2 LISP, usare il comando show lisp instance-id <ID LISP L2> ethernet server <Indirizzo MAC>

<#root>

```
Border-1#

show lisp instance-id 8190 ethernet server 5254.0019.93e9

LISP Site Registration Information

Site name: site_uci
Description: map-server configured from Cisco DNA-Center
Allowed configured locators: any
Requested EID-prefix:

  EID-prefix:

5254.0019.93e9

/48 instance-id 8190

<-- Endpoint MAC Address

    First registered:     2w5d
    Last registered:      3d16h
    Routing table tag:    0
    Origin:               Dynamic, more specific of any-mac
    Merge active:         No
    Proxy reply:          Yes
    Skip Publication:     No
    Force Withdraw:       No
    TTL:                  1d00h
    State:                complete
    Extranet IID:         Unspecified
    Registration errors:
      Authentication failures:   0
      Allowed locators mismatch: 0
```

**ETR**

**10.47.1.12**

:21038, last registered 3d16h, proxy-reply, map-notify

**<-- Egress Tunnel Router (Fabric Edge IP address)**

```
                          TTL 1d00h, no merge, hash-function sha1
                          state complete, no security-capability
                          nonce 0xB60C4314-0x97BB332D
                          xTR-ID 0xAB3179F6-0xC774F22C-0x00F2C82E-0x3A66738D
                          site-ID unspecified
                          Domain-ID local
                          Multihoming-ID unspecified
                          sourced by reliable transport
      Locator     Local  State      Pri/Wgt  Scope
```

**10.47.1.12**

yes up 10/10 IPv4 none

**<--(Fabric Edge IP address)**

Verifica server AR (Address Resolution) LISP Bordo L2 collocato:

Per controllare il server L2 LISP AR, usare il comando show lisp instance-id <LISP L2 ID> ethernet server address-resolution <indirizzo IP>

Per controllare la cronologia delle registrazioni, usare il comando show lisp instance-id <LISP L2 ID> ethernet server address-resolution <indirizzo IP> registration-history

<#root>

Border-1#

**show lisp instance-id 8190 ethernet server address-resolution 10.47.4.2**

Address-resolution data for router lisp 0 instance-id 8190

Site name: site_uci

Host Address:

**10.47.4.2**

/32
Hardware Address:

**5254.0019.93e9**

First registered: 2w5d
Last registered: 3d16h
Registration errors:
Authentication failures: 0
ETR

**10.47.1.12**

```
:21038
  Last registered:       3d16h
  TTL:                   1d00h
  xTR-ID:                0xAB3179F6-0xC774F22C-0x00F2C82E-0x3A66738D
  Site-ID:               unspecified
  Registered addr:       5254.0019.93e9
  L3 Instance ID:        4099

Border-1#
```

**show lisp instance-id 8190 ethernet server address-resolution 10.47.4.2 registration-history**

```
Map-Server registration history
Roam = Did host move to a new location?
WLC = Did registration come from a Wireless Controller?
Prefix qualifier: + = Register Event, - = Deregister Event, * = AR register event

Timestamp (UTC)      Instance Proto Roam WLC Source
                                            EID prefix / Locator
*Sep 29 16:50:27.762     8190 TCP   No   No  10.47.1.12
                                           +*10.47.4.2/32 / 5254.0019.93e9
*Oct  1 21:05:11.086     8190 TCP   No   No  10.47.1.12
                                           +*10.47.4.2/32 / 5254.0019.93e9
*Oct  2 06:51:11.882     8190 TCP   No   No  10.47.1.12
                                           +*10.47.4.2/32 / 5254.0019.93e9
*Oct  3 00:56:33.642     8190 TCP   No   No  10.47.1.12
                                           +*10.47.4.2/32 / 5254.0019.93e9
*Oct  3 01:53:45.934     8190 TCP   No   No  10.47.1.12
                                           +*10.47.4.2/32 / 5254.0019.93e9
*Oct  6 04:36:08.685     8190 TCP   No   No  10.47.1.12
                                           +*10.47.4.2/32 / 5254.0019.93e9
```

Verifica server LISP L3 con bordo collocato

Per controllare il server L3 LISP, usare il comando show lisp instance-id <LISP L3 IID> server ipv4 <indirizzo IP>

Per controllare la cronologia delle registrazioni del server L3 LISP, usare il comando show lisp instance-id <LISP L3 IID> ipv4 server <indirizzo IP> registration-history

<#root>

```
Border-1#
```

**show lisp instance-id 4099 ipv4 server 10.47.4.2**

```
LISP Site Registration Information

Site name: site_uci
Description: map-server configured from Cisco DNA-Center
Allowed configured locators: any
Requested EID-prefix:

  EID-prefix:
```

**10.47.4.2**

```
/32 instance-id 4099
```

```
    First registered:     2w5d
    Last registered:      02:39:39
    Routing table tag:    0
    Origin:               Dynamic, more specific of 10.47.4.0/24
    Merge active:         No
    Proxy reply:          Yes
    Skip Publication:     No
    Force Withdraw:       No
    TTL:                  1d00h
    State:                complete
    Extranet IID:         Unspecified
    Registration errors:
      Authentication failures:   0
      Allowed locators mismatch: 0
    ETR
```

**10.47.1.12**

```
:21038, last registered 02:39:39, proxy-reply, map-notify
                          TTL 1d00h, no merge, hash-function sha1
                          state complete, no security-capability
                          nonce 0x128CB668-0xF7B85F77
                          xTR-ID 0xAB3179F6-0xC774F22C-0x00F2C82E-0x3A66738D
                          site-ID unspecified
                          Domain-ID local
                          Multihoming-ID unspecified
                          sourced by reliable transport
      Locator     Local  State      Pri/Wgt  Scope
```

**10.47.1.12**

```
  yes    up          10/10   IPv4 none

Border-1#
```

**show lisp instance-id 4099 ipv4 server 10.47.4.2/32 registration-history**

```
Map-Server registration history
Roam = Did host move to a new location?
WLC = Did registration come from a Wireless Controller?
Prefix qualifier: + = Register Event, - = Deregister Event, * = AR register event

Timestamp (UTC)      Instance Proto Roam WLC Source
                                            EID prefix / Locator
*Oct  6 04:36:01.548     4099 UDP   No   No  10.47.1.12
                                              + 10.47.4.2/32
*Oct  6 04:36:08.686     4099 TCP   No   No  10.47.1.12
                                              + 10.47.4.2/32
*Oct  9 18:35:48.058     4099 TCP   No   No  10.47.1.12
                                              + 10.47.4.2/32
```

# Risoluzione ARP in SDA

Si presume che Cisco Catalyst Center sia stato utilizzato per effettuare il provisioning del fabric SDA con le impostazioni predefinite. Ciò significa che l'estensione di layer 2 è abilitata e che tutto il traffico all'interno dell'infrastruttura (nella stessa VLAN/VN) viene inoltrato in base alle ricerche di

indirizzi MAC / all'istanza Ethernet LISP, anziché in base alle ricerche di indirizzi IP / all'istanza IP LISP.

Dal punto di vista della risoluzione dei problemi, può essere utile configurare le voci ARP statiche su entrambi gli host per verificare rapidamente se il problema è dovuto alla connettività generica nella struttura (in questo caso il ping non funziona tra gli host) o solo alla risoluzione ARP.

Il processo ARP in SDA Fabric sfrutta il protocollo LISP per identificare e localizzare gli host ed è diverso dal comportamento ARP negli ambienti di routing/switching tradizionali.

Passaggio 1: l'endpoint fabric invia una richiesta ARP per determinare il binding MAC/IP per l'altro endpoint fabric

L'acquisizione del pacchetto può essere configurata sull'interfaccia in entrata per confermare che il pacchetto ARP sia stato ricevuto dall'host:

<#root>

```
Edge-1#

monitor capture 1 interface g1/0/3 in match any

Edge-1#

mon cap 1 start

Started capture point : 1
Edge-1#

mon cap 1 stop

Capture statistics collected at software:
    Capture duration - 22 seconds
    Packets received - 13
    Packets dropped - 0
    Packets oversized - 0

Number of Bytes dropped at asic not collected

Capture buffer will exists till exported or cleared

Stopped capture point : 1
Edge-1#

show monitor capture 1 buffer brief

Starting the packet display ........ Press Ctrl + Shift + 6 to exit

    1   0.000000 52:54:00:19:93:e9 -> ff:ff:ff:ff:ff:ff ARP 60 Who has 10.47.4.3? Tell 10.47.4.2
    2   1.028893 52:54:00:19:93:e9 -> ff:ff:ff:ff:ff:ff ARP 60 Who has 10.47.4.3? Tell 10.47.4.2
    3   2.058244 52:54:00:19:93:e9 -> ff:ff:ff:ff:ff:ff ARP 60 Who has 10.47.4.3? Tell 10.47.4.2

Edge-1#

show monitor capture 1 buffer display-filter arp detailed


Starting the packet display ........ Press Ctrl + Shift + 6 to exit
```

```
Frame 1: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface /tmp/epc_ws/wif_to_ts_p
    Interface id: 0 (/tmp/epc_ws/wif_to_ts_pipe)
        Interface name: /tmp/epc_ws/wif_to_ts_pipe
    Encapsulation type: Ethernet (1)
    Arrival Time: Oct 10, 2023 14:52:03.659290000 UTC
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1696949523.659290000 seconds
    [Time delta from previous captured frame: 0.000000000 seconds]
    [Time delta from previous displayed frame: 0.000000000 seconds]
    [Time since reference or first frame: 0.000000000 seconds]
    Frame Number: 1
    Frame Length: 60 bytes (480 bits)
    Capture Length: 60 bytes (480 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:arp]
Ethernet II, Src: 52:54:00:19:93:e9 (
```

**52:54:00:19:93:e9**

```
), Dst:
```

**ff:ff:ff:ff:ff:ff**

```
 (ff:ff:ff:ff:ff:ff)
```

**<-- SMAC/DMAC respectively**

```
    Destination: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)
        Address: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)
        .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory d
        .... ...1 .... .... .... .... = IG bit: Group address (multicast/broadcast)
    Source: 52:54:00:19:93:e9 (52:54:00:19:93:e9)
        Address: 52:54:00:19:93:e9 (52:54:00:19:93:e9)
        .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory d
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Type: ARP (
```

**0x0806**

```
)
    Padding: 000000000000000000000000000000000000
Address Resolution Protocol (request)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address:
```

**52:54:00:19:93:e9**

```
 (52:54:00:19:93:e9)
    Sender IP address:
```

**10.47.4.2**

```
    Target MAC address:
```

**00:00:00:00:00:00**

```
 (00:00:00:00:00:00)
    Target IP address:
```

**10.47.4.3**

Passaggio 2. Edge Node utilizza il pacchetto ARP e genera la richiesta LISP per determinare l'indirizzo MAC di HOST-02.

Edge-1 invia una Map-Request LISP per risolvere l'indirizzo MAC 10.47.4.3 ai Control-Planes LISP (Border collocati):

<#root>

```
Edge-1#
debug lisp control-plane all
Edge-1#
debug l2lisp all
```

```
LISP[REMT ]-0: Map Request: Delay is over for IID 8190 EID 10.47.4.3/32, requester 'AR'.
LISP[REMT ]-0 IID 8190: Schedule processing of Map-Requests from 'remote EID prefix' in IPv4.
LISP[REMT ]-0: Map Request: Sending request for IID 8190 EID 10.47.4.3/32, requester 'AR'.
```

Passaggio 3. Il nodo di controllo riceve la richiesta LISP per il mapping IP/MAC e invia una risposta al nodo perimetrale SDA

LISP Map-Request viene ricevuto dal perimetro della struttura e risponde con un LISP Map-Reply con l'indirizzo MAC associato a 10.47.4.3

<#root>

```
Border-1#
debug lisp control-plane all

Border-1#
debug l2lisp all
```

```
LISP[TRNSP]-0: Processing received Map-Request(1) message on GigabitEthernet1/0/3 from 10.47.4.3:4342 t
LISP[MR   ]-0: Received Map-Request with 1 records, first EID IID 8190 10.47.4.3/32, source EID UNSPEC,
LISP[MR   ]-0 IID 8190 Eth-ARP: MS EID 10.47.4.3/32: Sending proxy reply to 10.47.1.12.
```

Il Control-Plane LISP risponde con una risposta proxy basata sulla voce di risoluzione degli indirizzi memorizzata nel database locale

<#root>

```
Border-1#
show lisp instance-id 8190 ethernet server address-resolution 10.47.4.3
```

```
Address-resolution data for router lisp 0 instance-id 8190

Site name: site_uci

Host Address:

10.47.4.3

/32
Hardware Address:

5254.001e.ad00

First registered:     21:11:17
Last registered:      21:11:17
Registration errors:
  Authentication failures:   0
 ETR 10.47.1.13:16056
  Last registered:       21:11:17
  TTL:                   1d00h
  xTR-ID:                0x8CEE6478-0x9358E248-0xE935FF07-0x8C3C5450
  Site-ID:               unspecified
  Registered addr:

5254.001e.ad00

  L3 Instance ID:

4099
```

Passaggio 4. Edge Node riceve una risposta LISP con indirizzo MAC 10.47.4.3

La risposta del proxy LISP viene ricevuta dal nodo perimetrale dell'infrastruttura:

```
LISP[REMT ]-0: Processing Map-Reply mapping record for IID 8190 MAC 5254.001e.ad00/48 LCAF 2, ttl 1440,
LISP[REMT ]-0: Processing mapping information for EID prefix IID 8190 5254.001e.ad00/48.
```

Passaggio 5. Edge Node invia il pacchetto LISP Map-Request per determinare la posizione RLOC per l'indirizzo MAC

Dopo aver completato con successo i primi tre passi, Edge Node conosce l'indirizzo MAC 10.47.4.3 per il quale è stato inizialmente generato ARP. Poiché l'estensione di layer 2 è abilitata, il nodo perimetrale non risponde a questa informazione a 10.47.4.2, ma la utilizza per determinare la posizione RLOC del bordo del nodo di uscita, in modo da poter inoltrare ARP verso 10.47.4.3 come in una rete tradizionale di layer 2.

Per questo motivo, Edge Node genera un altro pacchetto LISP Map Request nell'istanza Ethernet, questa volta richiedendo informazioni RLOC per l'indirizzo MAC 10.47.4.2:

<#root>

```
Edge-1#
debug lisp control-plane all

Edge-1#
debug l2lisp all

*Oct 10 17:01:41.430: LISP[REMT ]-0 IID 8190: Schedule processing of Map-Requests from 'remote EID pref
*Oct 10 17:01:41.430: LISP[REMT ]-0: Map Request: Sending request for IID 8190 EID 5254.001e.ad00/48, r
```

Passaggio 6: il pacchetto LISP Map-Request viene ricevuto dal nodo di controllo per determinare la posizione RLOC per l'indirizzo MAC

Il nodo di controllo riceve il pacchetto LISP e gli risponde in base allo stato del database locale

```
<#root>
Border-1#
debug lisp control-plane all
Border-1#
debug l2lisp all

*Oct 10 16:04:42.055: LISP[MR   ]-0 IID 8190 Eth-ARP: MS EID 10.47.4.3/32: Sending proxy reply to 10.47
*Oct 10 16:04:42.407: LISP[MR   ]-0: Received Map-Request with 1 records, first EID IID 8190 5254.001e.
*Oct 10 16:04:42.408: LISP[MR   ]-0 IID 8190 MAC: MS EID 5254.001e.ad00/48: Sending proxy reply to 10.4
```

Passaggio 7: LISP Map-Reply è stato ricevuto da Edge Node

La risposta della mappa LISP generata dal nodo di controllo viene ricevuta dal nodo perimetrale:

```
<#root>
Edge-1#
debug lisp control-plane all

Edge-1#
debug l2lisp all

*Oct 10 17:44:00.181: LISP[TRNSP]-0: Processing received Map-Reply(2) message on GigabitEthernet1/0/2 f
*Oct 10 17:44:00.181: LISP[REMT ]-0: Received Map-Reply with nonce 0xF954EC80-0x039D7E4A, 1 records.
*Oct 10 17:44:00.181: LISP[REMT ]-0: Map-Reply nonce matches pending request for IID 8190 EID 5254.001e
*Oct 10 17:44:00.181: LISP[REMT ]-0: Processing Map-Reply mapping record for IID 8190 MAC 5254.001e.ad0
*Oct 10 17:44:00.181: LISP[REMT ]-0: Map Request: Received reply with rtt 560ms.
*Oct 10 17:44:00.181: LISP[REMT ]-0: Processing mapping information for EID prefix IID 8190 5254.001e.a
```

In questo modo viene finalmente creata una voce nella map-cache dell'istanza LISP Ethernet e il pacchetto ARP può essere inoltrato verso Edge-2 a cui è connesso 10.47.4.3

<#root>

```
Edge-1#
```

```
show lisp instance-id 8190 ethernet map-cache 5254.001e.ad00
```

```
LISP MAC Mapping Cache for LISP 0 EID-table Vlan 1026 (IID 8190), 1 entries

5254.001e.ad00/48, uptime: 00:04:11, expires: 23:55:48, via map-reply, complete
  Sources: map-reply
  State: complete, last modified: 00:04:11, map-source: 10.47.1.13
  Active, Packets out: 8(0 bytes), counters are not accurate (~ 00:00:04 ago)
  Encapsulating dynamic-EID traffic
  Locator     Uptime    State  Pri/Wgt     Encap-IID
  10.47.1.13  00:04:11  up      10/10        -
    Last up-down state change:         00:04:11, state change count: 1
    Last route reachability change:    00:04:11, state change count: 1
    Last priority / weight change:     never/never
    RLOC-probing loc-status algorithm:
      Last RLOC-probe sent:            00:04:11 (rtt 560ms)
```

Passaggio 8. ARP è incapsulato nella VXLAN e inviato all'HOST-02

Tutti i passaggi relativi al LISP erano necessari per determinare dove si trova 10.47.4.3, in modo che il nodo perimetrale potesse inviare il pacchetto ARP (broadcast) originale come unicast verso il nodo perimetrale corretto. La richiesta ARP originale viene memorizzata nella cache (non eliminata) dalla CPU del nodo perimetrale finché non vengono completati tutti i passaggi per ottenere una risoluzione ARP corretta anche quando è stato inviato un singolo pacchetto ARP da 10.47.4.2.

Il pacchetto ARP è incapsulato nella VXLAN, come mostrato nell'esempio:

<#root>

```
Edge-2#
```

```
show monitor capture 1 buffer display-filter arp brief
```

```
Starting the packet display ........ Press Ctrl + Shift + 6 to exit
   67  15.149181 52:54:00:19:93:e9 -> 52:54:00:1e:ad:00 ARP 110 Who has 10.47.4.3? Tell 10.47.4.2
   68  15.155511 52:54:00:19:93:e9 -> 52:54:00:1e:ad:00 ARP 110 Who has 10.47.4.3? Tell 10.47.4.2
```

La richiesta ARP è stata incapsulata nella VXLAN e convertita da una richiesta ARP broadcast a una richiesta ARP unicast.

<#root>

```
Frame 68: 110 bytes on wire (880 bits), 110 bytes captured (880 bits) on interface /tmp/epc_ws/wif_to_t
```

```
    Interface id: 0 (/tmp/epc_ws/wif_to_ts_pipe)
        Interface name: /tmp/epc_ws/wif_to_ts_pipe
    Encapsulation type: Ethernet (1)
    Arrival Time: Oct 10, 2023 17:56:43.256570000 UTC
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1696960603.256570000 seconds
    [Time delta from previous captured frame: 0.006330000 seconds]
    [Time delta from previous displayed frame: 0.006330000 seconds]
    [Time since reference or first frame: 15.155511000 seconds]
    Frame Number: 68
    Frame Length: 110 bytes (880 bits)
    Capture Length: 110 bytes (880 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:ip:udp:vxlan:eth:ethertype:arp]
Ethernet II, Src: 52:54:00:0a:42:11 (52:54:00:0a:42:11), Dst: 52:54:00:17:fe:65 (52:54:00:17:fe:65)
    Destination: 52:54:00:17:fe:65 (52:54:00:17:fe:65)
        Address: 52:54:00:17:fe:65 (52:54:00:17:fe:65)
        .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory d
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Source: 52:54:00:0a:42:11 (52:54:00:0a:42:11)
        Address: 52:54:00:0a:42:11 (52:54:00:0a:42:11)
        .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory d
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Type: IPv4 (0x0800)
Internet Protocol Version 4, Src:
```

**10.47.1.12**

```
, Dst:
```

**10.47.1.13 <-- 10.47.1.12 is Edge-1 RLOC, 10.47.1.13 is Edge-2 RLOC**

```
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
        0000 00.. = Differentiated Services Codepoint: Default (0)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 96
    Identification: 0x1781 (6017)
    Flags: 0x4000, Don't fragment
        0... .... .... .... = Reserved bit: Not set
        .1.. .... .... .... = Don't fragment: Set
        ..0. .... .... .... = More fragments: Not set
    Fragment offset: 0
    Time to live: 253
    Protocol: UDP (17)
    Header checksum: 0x4f95 [validation disabled]
    [Header checksum status: Unverified]
    Source: 10.47.1.12
    Destination: 10.47.1.13
User Datagram Protocol, Src Port: 65354, Dst Port: 4789
    Source Port: 65354
    Destination Port: 4789
    Length: 76
    [Checksum: [missing]]
    [Checksum Status: Not present]
    [Stream index: 0]
    [Timestamps]
        [Time since first frame: 15.155511000 seconds]
        [Time since previous frame: 0.006330000 seconds]
Virtual eXtensible Local Area Network
    Flags: 0x8800, GBP Extension, VXLAN Network ID (VNI)
```

```
        1... .... .... .... = GBP Extension: Defined
        .... .... .0.. .... = Don't Learn: False
        .... 1... .... .... = VXLAN Network ID (VNI): True
        .... .... .... 0... = Policy Applied: False
        .000 .000 0.00 .000 = Reserved(R): 0x0000
    Group Policy ID: 0

    VXLAN Network Identifier (VNI): 8190 <-- L2 LISP IID

    Reserved: 0
Ethernet II, Src:

52:54:00:19:93:e9

 (52:54:00:19:93:e9), Dst:

52:54:00:1e:ad:00

 (52:54:00:1e:ad:00)

<--Unicast ARP Request

    Destination: 52:54:00:1e:ad:00 (52:54:00:1e:ad:00)
        Address: 52:54:00:1e:ad:00 (52:54:00:1e:ad:00)
        .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory d
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Source: 52:54:00:19:93:e9 (52:54:00:19:93:e9)
        Address: 52:54:00:19:93:e9 (52:54:00:19:93:e9)
        .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory d
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Type: ARP (

0x0806

)
    Trailer: 000000000000000000000000000000000000
Address Resolution Protocol (

request

)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address: 52:54:00:19:93:e9 (52:54:00:19:93:e9)
    Sender IP address: 10.47.4.2
    Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)
    Target IP address: 10.47.4.3
```

## Passaggio 9. La risposta ARP viene generata da 10.47.4.3 e inviata verso 10.47.4.2

<#root>

```
Edge-2#

show monitor capture 1 buffer display-filter arp brief

Starting the packet display ........ Press Ctrl + Shift + 6 to exit

    1   0.000000 52:54:00:1e:ad:00 -> 52:54:00:19:93:e9 ARP 60 10.47.4.3 is at 52:54:00:1e:ad:00
```

```
    2   0.069429 52:54:00:1e:ad:00 -> 52:54:00:19:93:e9 ARP 60 10.47.4.3 is at 52:54:00:1e:ad:00
   11   5.960508 52:54:00:1e:ad:00 -> 52:54:00:19:93:e9 ARP 60 Who has 10.47.4.2? Tell 10.47.4.3
```

In questo momento, il pacchetto non è destinato a un indirizzo di broadcast (come richiesta ARP originale), ma all'indirizzo MAC 10.47.4.2, quando raggiunge il nodo perimetrale in entrata (Edge-2), viene attivata la normale operazione LISP. Inizialmente l'indirizzo MAC 10.47.4.2 non è presente nell'istanza LISP Ethernet di Edge Node. Il pacchetto viene indirizzato alla CPU per generare la richiesta di mappa LISP per determinare la RLOC per HOST-01. Questo comportamento è esattamente uguale a quello descritto in altre sezioni di questo documento e consente di creare una voce LISP Map Cache per 10.47.4.2 su Edge-2:

<#root>

```
Edge-2#
```

**show lisp instance-id 8190 ethernet map-cache 5254.0019.93e9**

```
LISP MAC Mapping Cache for LISP 0 EID-table Vlan 1026 (IID 8190), 1 entries

5254.0019.93e9/48, uptime: 03:18:28, expires: 20:41:32, via map-reply, complete
  Sources: map-reply
  State: complete, last modified: 03:18:28, map-source: 10.47.1.12
  Active, Packets out: 386(0 bytes), counters are not accurate (~ 00:00:12 ago)
  Encapsulating dynamic-EID traffic
  Locator     Uptime    State  Pri/Wgt     Encap-IID
```

**10.47.1.12**

```
  03:18:28  up      10/10        -
    Last up-down state change:         03:18:28, state change count: 1
    Last route reachability change:    03:18:28, state change count: 1
    Last priority / weight change:     never/never
    RLOC-probing loc-status algorithm:
      Last RLOC-probe sent:            03:18:28 (rtt 710ms)
```

Questa voce consente di inviare correttamente la risposta ARP verso il bordo 1 nell'incapsulamento VXLAN e di inoltrarla ulteriormente alla versione 10.47.4.2, completando il processo di risoluzione ARP.

# Raggiungibilità host di base nell'infrastruttura SDA (stessa VLAN/stessa VN)

Si presume che la risoluzione ARP sia stata completata correttamente e che gli host 10.47.4.2 e 10.47.4.3 dispongano reciprocamente delle voci ARP corrette.

Dal punto di vista della risoluzione dei problemi, è molto utile configurare le voci ARP statiche su entrambi gli host per verificare rapidamente se il problema è dovuto alla connettività generica nell'infrastruttura (in questo caso il ping non funziona tra gli host) o solo al processo ARP.

10.47.4.2 genera una richiesta ICMP verso 10.47.4.3:

<#root>

```
Edge-1#
```

**show monitor capture 1 buffer brief**

```
Starting the packet display ........ Press Ctrl + Shift + 6 to exit

    1   0.000000    10.47.4.2 -> 10.47.4.3    ICMP 98 Echo (ping) request  id=0x0040, seq=3/768, ttl=64

Edge-1#
```

**show monitor capture 1 buffer detail**

```
Starting the packet display ........ Press Ctrl + Shift + 6 to exit

Frame 1: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface /tmp/epc_ws/wif_to_ts_p
    Interface id: 0 (/tmp/epc_ws/wif_to_ts_pipe)
        Interface name: /tmp/epc_ws/wif_to_ts_pipe
    Encapsulation type: Ethernet (1)
    Arrival Time: Oct 10, 2023 18:21:21.484694000 UTC
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1696962081.484694000 seconds
    [Time delta from previous captured frame: 0.000000000 seconds]
    [Time delta from previous displayed frame: 0.000000000 seconds]
    [Time since reference or first frame: 0.000000000 seconds]
    Frame Number: 1
    Frame Length: 98 bytes (784 bits)
    Capture Length: 98 bytes (784 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:ip:icmp:data]
Ethernet II, Src:
```

**52:54:00:19:93:e9**

```
 (52:54:00:19:93:e9), Dst:
```

**52:54:00:1e:ad:00**

```
 (52:54:00:1e:ad:00)
```

**<-- Endpoint MAC, Anycast GW MAC respectively**

```
    Destination: 52:54:00:1e:ad:00 (52:54:00:1e:ad:00)
        Address: 52:54:00:1e:ad:00 (52:54:00:1e:ad:00)
        .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory d
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Source: 52:54:00:19:93:e9 (52:54:00:19:93:e9)
        Address: 52:54:00:19:93:e9 (52:54:00:19:93:e9)
        .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory d
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Type: IPv4 (0x0800)
Internet Protocol Version 4, Src:
```

**10.47.4.2**

```
, Dst:
```

**10.47.4.3**

```
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
        0000 00.. = Differentiated Services Codepoint: Default (0)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 84
    Identification: 0x7321 (29473)
    Flags: 0x4000, Don't fragment
        0... .... .... .... = Reserved bit: Not set
        .1.. .... .... .... = Don't fragment: Set
        ..0. .... .... .... = More fragments: Not set
    Fragment offset: 0
    Time to live: 64
    Protocol: ICMP (1)
    Header checksum: 0xab25 [validation disabled]
    [Header checksum status: Unverified]
    Source: 10.47.4.2
    Destination: 10.47.4.3
Internet Control Message Protocol
    Type: 8 (Echo (ping) request)
    Code: 0
    Checksum: 0x02ea [correct]
    [Checksum Status: Good]
    Identifier (BE): 64 (0x0040)
    Identifier (LE): 16384 (0x4000)
    Sequence number (BE): 3 (0x0003)
    Sequence number (LE): 768 (0x0300)
    Data (56 bytes)

0000  68 95 8c 3d 00 00 00 00 00 00 00 00 00 00 00 00   h..=............
0010  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
0020  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
0030  00 00 00 00 00 00 00 00                           ........
        Data: 68958c3d0000000000000000000000000000000000000000b^@&
        [Length: 56]
```

Il pacchetto ICMP viene inviato verso la versione 10.47.4.3 al nodo perimetrale specificato nel campo Locator: 10.47.1.13 (Edge-2) e può essere acquisito tramite acquisizione pacchetti incorporata.

Quando il pacchetto viene ricevuto su una VLAN con estensione L2 abilitata, la ricerca viene eseguita nell'istanza LISP Ethernet:

<#root>

```
Edge-1#

show lisp instance-id 8190 ethernet map-cache 5254.001e.ad00

LISP MAC Mapping Cache for LISP 0 EID-table Vlan 1026 (IID 8190), 1 entries

5254.001e.ad00/48, uptime: 00:22:29, expires: 23:37:32, via map-reply, complete
  Sources: map-reply
  State: complete, last modified: 00:22:29, map-source: 10.47.1.13
  Active, Packets out: 42(0 bytes), counters are not accurate (~ 00:00:58 ago)
  Encapsulating dynamic-EID traffic
  Locator     Uptime    State  Pri/Wgt     Encap-IID
```

```
 10.47.1.13

  00:22:29  up      10/10        -
    Last up-down state change:         00:22:29, state change count: 1
    Last route reachability change:    00:22:29, state change count: 1
    Last priority / weight change:     never/never
    RLOC-probing loc-status algorithm:
      Last RLOC-probe sent:            00:22:28 (rtt 1609ms)
```

Controllare l'indirizzo MAC dell'endpoint remoto e puntare L2LI0, come previsto

<#root>

```
Edge-1#

show mac add add 5254.001e.ad00

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

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----
1026    5254.001e.ad00    CP_LEARN    L2LI0
Total Mac Addresses installed by LISP: REMOTE: 1
```

Controllare l'indirizzo MAC in FED, è possibile ottenere ulteriori informazioni

<#root>

```
Edge-1#

show platform software fed sw active matm macTable vlan 1026 mac 5254.001e.ad00

VLAN   MAC                  Type  Seq#    EC_Bi  Flags

machandle


siHandle


riHandle

            diHandle              *a_time  *e_time  ports
-----------------------------------------------------------------------------------------------------------

1026


5254.001e.ad00

  0x1000001       0      0     64

0x7f65ecfdd3a8
```

**0x7f65ecfdd1f8**

**0x7f65ecfdd048**

```
      0x0                          0        2  RLOC 10.47.1.13 adj_id 97

======platform hardware details ======

Asic: 0

 htm-handle = 0x7f65ecc4d188 MVID = 7 gpn = 1
 SI = 0xc7 RI = 0x12 DI = 0x5012
Asic: 1
 SI = 0xc7 RI = 0x12 DI = 0x5013
```

## Decodifica macHandle indirizzo MAC

Prendere il macHandle (0x7f65ecfdd3a8) del comando precedente e usarlo nel comando show platform hardware fed switch active fwd-asic abstraction print-resource-handle <macHandle> 1

## <#root>

```
Edge-1#
```

**show platform hardware fed switch active fwd-asic abstraction print-resource-handle 0x7f65ecfdd3a8 1**

```
Handle:0x7f65ecfdd3a8 Res-Type:ASIC_RSC_HASH_TCAM Res-Switch-Num:0 Asic-Num:255 Feature-ID:AL_FID_L2_WI
priv_ri/priv_si Handle: (nil)Hardware Indices/Handles: handle [ASIC: 0]: 0x7f65ecc4d188
Features sharing this resource:Cookie length: 12
1e 00 54 52 00 ad 07 80 07 00 00 00


Detailed Resource Information (ASIC_INSTANCE# 0)
----------------------------------------
Number of HTM Entries: 1

Entry 0: (handle 0x7f65ecc4d188)

Absolute Index: 4706
Time Stamp: 14
KEY -
```

**vlan:7**

**mac:0x5254001ead00**

```
 l3_if:0
```

**gpn:3401**

```
 epoch:0 static:0 flood_en:0 vlan_lead_wless_flood_en: 0 client_home_asic: 0 learning_peerid 0, learnin
MASK - vlan:0 mac:0x0 l3_if:0 gpn:0 epoch:0 static:0 flood_en:0 vlan_lead_wless_flood_en: 0 client_home_
SRC_AD - need_to_learn:0 lrn_v:0 catchall:0 static_mac:0 chain_ptr_v:0 chain_ptr: 0 static_entry_v:0 au
DST_AD - si:0xc7 bridge:0 replicate:0 blk_fwd_o:0 v4_rmac:0 v6_rmac:0 catchall:0 ign_src_lrn:0 port_mas
```

```
============================================================
```

Decodifica isHandle indirizzo MAC

Prendere il comando siHandle (0x7f65ecfdd1f8) dal comando precedente e usarlo nel comando show platform hardware fed switch active fwd-asic abstraction print-resource-handle <siHandle> 1

<#root>

```
Edge-1#

show platform hardware fed switch active fwd-asic abstraction print-resource-handle 0x7f65ecfdd1f8 1

Handle:0x7f65ecfdd1f8 Res-Type:ASIC_RSC_SI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_L2_WIRELES
priv_ri/priv_si Handle: 0x7f65ecfdd048Hardware Indices/Handles: index0:0xc7  mtu_index/l3u_ri_index0:0x
Features sharing this resource:58 (1)]
Cookie length: 56
00 00 00 00 00 00 00 00 02 04 00 00 00 00 00 00 00 00 00 00 07 00 61 00 00 00 00 00 00 00 00 00 00 00 0

Detailed Resource Information (ASIC_INSTANCE# 0)
----------------------------------------

Station Index (SI) [0xc7] <-- Contains the Rewrite Index (RI) and Outgoing Interface Information (DI)
RI = 0x12 <-- Rewrite Index = Contains information for forwarding
DI = 0x5012 <-- Destination Index = Outgoing Interface

stationTableGenericLabel = 0
stationFdConstructionLabel = 0x7
lookupSkipIdIndex = 0
rcpServiceId = 0
dejaVuPreCheckEn = 0
Replication Bitmap: LD

Detailed Resource Information (ASIC_INSTANCE# 1)
----------------------------------------

Station Index (SI) [0xc7] <-- Contains the Rewrite Index (RI) and Outgoing Interface Information (DI)
RI = 0x12 <-- Rewrite Index = Contains information for forwarding
DI = 0x5013 <-- Destination Index = Outgoing Interface

stationTableGenericLabel = 0
stationFdConstructionLabel = 0x7
lookupSkipIdIndex = 0
rcpServiceId = 0
dejaVuPreCheckEn = 0
Replication Bitmap: LD

============================================================
```

Riscrivi decodifica indice

Eseguire il comando RI (0x12) e usare nel comando show platform hardware feed switch active

fwd-asic resource asic all rewrite-index range <RI> <RI>

<#root>

```
Edge-1#

show platform hardware fed switch active fwd-asic resource asic all rewrite-index range 0x12 0x12

ASIC#:0 RI:18 Rewrite_type:AL_RRM_REWRITE_L2_PAYLOAD_L2LISP_ENCAP(115) Mapped_rii:LVX_L2_ENCAP_L2_PAYLO
 Src IP:

10.47.1.12 <-- Local RLOC

 Dst IP:

10.47.1.13 <-- Remote RLOC

 iVxlan dstMac:  0x5254:0x01c:0x7de0
 iVxlan srcMac:  0x00:0x00:0x00
 IPv4 TTL:       0
 iid present:    1
 lisp iid:       0
 lisp flags:     0
 dst Port:       4789
 update only l3if:       0
 is Sgt:         1
 is TTL Prop:    0
 L3if LE:        0 (0)
 Port LE:        0 (0)
 Vlan LE:        7 (0)

ASIC#:1 RI:18 Rewrite_type:AL_RRM_REWRITE_L2_PAYLOAD_L2LISP_ENCAP(115) Mapped_rii:LVX_L2_ENCAP_L2_PAYLO
 Src IP:

10.47.1.12 <-- Local RLOC

 Dst IP:

10.47.1.13 <-- Remote RLOC

 iVxlan dstMac:  0x5254:0x01c:0x7de0
 iVxlan srcMac:  0x00:0x00:0x00
 IPv4 TTL:       0
 iid present:    1
 lisp iid:       0
 lisp flags:     0
 dst Port:       4789
 update only l3if:       0
 is Sgt:         1
 is TTL Prop:    0
 L3if LE:        0 (0)
 Port LE:        0 (0)
 Vlan LE:        7 (0)
```

Decodifica indice destinazione

Utilizzare l'ID (0x5012) e il comando show platform hardware fed switch active fwd-asic resource asic all destination-index range <DI> <DI>

<#root>

```
Edge-1#

show platform hardware fed switch active fwd-asic resource asic all destination-index range 0x5012 0x501

ASIC#0:

Destination index   = 0x5012

DI_RCP_PORT1 <-- Recirculation port for VXLAN imposition

pmap                = 0x00000000 0x00000000
cmi                 = 0x0
rcp_pmap            = 0x1
al_rsc_cmi
CPU Map Index (CMI) [0]
ctiLo0              = 0
ctiLo1              = 0
ctiLo2              = 0
cpuQNum0            = 0
cpuQNum1            = 0
cpuQNum2            = 0
npuIndex            = 0
stripSeg            = 0
copySeg             = 0
ASIC#1:

Destination index   = 0x5012

DI_RCP_PORT1 <-- Recirculation port for VXLAN imposition

pmap                = 0x00000000 0x00000000
cmi                 = 0x0
rcp_pmap            = 0x0
al_rsc_cmi
CPU Map Index (CMI) [0]
ctiLo0              = 0
ctiLo1              = 0
ctiLo2              = 0
cpuQNum0            = 0
cpuQNum1            = 0
cpuQNum2            = 0
npuIndex            = 0
stripSeg            = 0
copySeg             = 0
```

## Decodifica siHandle

Prendere il siHandle (0x7f65ecfdd048) e usarlo nel comando show platform hardware fed switch active fwd-asic abstraction print-resource-handle <siHandle> 1

<#root>

```
Edge-1#

show platform hardware fed switch active fwd-asic abstraction print-resource-handle 0x7f65ecfdd048 1

Handle:0x7f65ecfdd048 Res-Type:ASIC_RSC_RI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_L2_WIRELES
priv_ri/priv_si Handle: 0x7f65ecfdcd78Hardware Indices/Handles: index0:0x12  mtu_index/l3u_ri_index0:0x
```

```
Features sharing this resource:58 (1)]
Cookie length: 56
00 00 00 00 00 00 00 00 02 04 00 00 00 00 00 00 00 00 00 00 07 00 61 00 00 00 00 00 00 00 00 00 00 00 0


Detailed Resource Information (ASIC_INSTANCE# 0)
----------------------------------------
ASIC#:0 RI:18 Rewrite_type:AL_RRM_REWRITE_L2_PAYLOAD_L2LISP_ENCAP(115) Mapped_rii:LVX_L2_ENCAP_L2_PAYLO
 Src IP:

10.47.1.12 <-- Local RLOC

 Dst IP:

10.47.1.13 <-- Remote RLOC

 iVxlan dstMac:     0x610:0x00:0x00
 iVxlan srcMac:     0x00:0x00:0x00
 IPv4 TTL:     0
 iid present:     1
 lisp iid:     0
 lisp flags:     0
 dst Port:     4789
 update only l3if:     0
 is Sgt:     1
 is TTL Prop:     0
 L3if LE:     0 (0)
 Port LE:     279 (0)
 Vlan LE:     7 (0)


Detailed Resource Information (ASIC_INSTANCE# 1)
----------------------------------------
ASIC#:1 RI:18 Rewrite_type:AL_RRM_REWRITE_L2_PAYLOAD_L2LISP_ENCAP(115) Mapped_rii:LVX_L2_ENCAP_L2_PAYLO
Src IP:

10.47.1.12 <-- Local RLOC


Dst IP:

10.47.1.13 <-- Remote RLOC

 iVxlan dstMac:     0x610:0x00:0x00
 iVxlan srcMac:     0x00:0x00:0x00
 IPv4 TTL:     0
 iid present:     1
 lisp iid:     0
 lisp flags:     0
 dst Port:     4789
 update only l3if:     0
 is Sgt:     1
 is TTL Prop:     0
 L3if LE:     0 (0)
 Port LE:     279 (0)
 Vlan LE:     7 (0)

============================================================
```

## Verifica ciclo di lavorazione secondario

Il traffico è incapsulato nella VXLAN con ID 8190 con 10.47.1.12 e può essere con carico bilanciato Gig1/0/1 e G1/0/2

<#root>

```
Edge-1#
```

**show ip route 10.47.1.13**

```
Routing entry for 10.47.1.13/32
  Known via "isis", distance 115, metric 30, type level-2
  Redistributing via isis
  Last update from 10.47.1.4 on GigabitEthernet1/0/2, 2d22h ago
  Routing Descriptor Blocks:
    10.47.1.4, from 10.47.1.13, 2d22h ago, via GigabitEthernet1/0/2
      Route metric is 30, traffic share count is 1
  * 10.47.1.0, from 10.47.1.13, 2d22h ago, via GigabitEthernet1/0/1
      Route metric is 30, traffic share count is 1

Edge-1#
```

**show ip cef 10.47.1.13**

```
10.47.1.13/32
  nexthop 10.47.1.0 GigabitEthernet1/0/1
  nexthop 10.47.1.4 GigabitEthernet1/0/2
```

Per ottenere le informazioni si_hdl, ri_hdl, usare il comando show platform software fed switch active ip adj

<#root>

```
Edge-1#
```

**show platform software fed switch active ip adj**

```
IPV4 Adj entries
dest                                    if_name                dst_mac          si_hdl          r
----                                    -------                -------          ------          -
225.0.0.0                               GigabitEthernet1/0/1   0100.5e00.0000   0x7f65ec958128 0
10.47.1.10                              LISP0.4100             4500.0000.0000   0x7f65ec895ed8 0
225.0.0.0                               GigabitEthernet1/0/2   0100.5e00.0000   0x7f65ec958f68 0

10.47.1.4                               GigabitEthernet1/0/2   5254.001c.7de0   0x7f65ec8a5458 0x

225.0.0.0                               Null0                  f800.0011.0000   0x7f65ec3740c8 0

10.47.1.0                               GigabitEthernet1/0/1   5254.000a.42f3   0x7f65ec8b8468 0x
```

Decodifica si_hdl hop successivo sottostante

Per controllare il si_hdl (0x7f65ec8a5458) usare nel comando show platform hardware fed switch

active fwd-asic abstraction print-resource-handle <si_hdl> 1

<#root>

```
Edge-1#

show platform hardware fed switch active fwd-asic abstraction print-resource-handle 0x7f65ec8a5458 1

Handle:0x7f65ec8a5458 Res-Type:ASIC_RSC_SI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_L3_UNICAST
priv_ri/priv_si Handle: 0x7f65ec8a4eb8Hardware Indices/Handles: index0:0xbc  mtu_index/l3u_ri_index0:0x
Features sharing this resource:66 (1)]
Cookie length: 56
00 00 00 00 00 00 00 00 26 00 00 00 00 00 00 00 00 00 00 00 08 00 52 54 00 1c 7d e0 00 00 00 00 00 00 0
Detailed Resource Information (ASIC_INSTANCE# 0)
----------------------------------------

Station Index (SI) [0xbc]     -----> Contains RI and DI information
RI = 0x1a             -----> Rewrite Index = MAC address rewrite information for L3 forwarding to the ne
DI = 0x526d            -----> Destination Index = Outgoing Interface

stationTableGenericLabel = 0
stationFdConstructionLabel = 0x7
lookupSkipIdIndex = 0
rcpServiceId = 0
dejaVuPreCheckEn = 0

Replication Bitmap: LD         -----> Local Data, indicating that this ASIC is directly connected to the


Detailed Resource Information (ASIC_INSTANCE# 1)
----------------------------------------

Station Index (SI) [0xbc]     -----> Contains RI and DI information
RI = 0x1a             -----> Rewrite Index = MAC address rewrite information for L3 forwarding to the ne
DI = 0x526d            -----> Destination Index = Outgoing Interface

stationTableGenericLabel = 0
stationFdConstructionLabel = 0x7
lookupSkipIdIndex = 0
rcpServiceId = 0
dejaVuPreCheckEn = 0

Replication Bitmap: CD        -----> Core Data, indicating that this instance of the ASIC is on the same

============================================================
```

Decodifica indice riscrittura hop successivo

Per decodificare l'URI (0x1a) usare nel comando show platform hardware feed switch active fwd-asic resource asic all rewrite-index range <RI> <RI>

<#root>

```
Edge-1#

show platform hardware fed switch active fwd-asic resource asic all rewrite-index range 0x1a 0x1a

ASIC#:0
```

```
 RI:26

 Rewrite_type:AL_RRM_REWRITE_L3_UNICAST_IPV4_SHARED(1) Mapped_rii:L3_UNICAST_IPV4(9)

-----> Decimal 26 is hex 0x1a

MAC Addr: MAC Addr: 52:54:00:1c:7d:e0,

-----> MAC address 5254.001c.7de0 for the next-hop adjacency

L3IF LE Index 38
ASIC#:1 RI:26 Rewrite_type:AL_RRM_REWRITE_L3_UNICAST_IPV4_SHARED(1) Mapped_rii:L3_UNICAST_IPV4(9)
MAC Addr: MAC Addr: 52:54:00:1c:7d:e0,

-----> MAC address 5254.001c.7de0 for the next-hop adjacency

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```

Decodifica indice destinazione hop successivo sottostante

Per decodificare l'ID (0x526d) utilizzare in show platform hardware feed switch active fwd-asic resource asic all destination-index range <DI> <DI>

<#root>

```
Edge-1#

show platform hardware fed switch active fwd-asic resource asic all destination-index range 0x526d 0x526

ASIC#0:

Destination index   = 0x526d

pmap                = 0x00000000 0x00000002 <-- Convert decimal 2 to binary, which is 0010. Count this b

pmap_intf : [GigabitEthernet1/0/2]
cmi                 = 0x0
rcp_pmap            = 0x0
al_rsc_cmi
CPU Map Index (CMI) [0]
ctiLo0              = 0
ctiLo1              = 0
ctiLo2              = 0
cpuQNum0            = 0
cpuQNum1            = 0
cpuQNum2            = 0
npuIndex            = 0
stripSeg            = 0
copySeg             = 0
ASIC#1:

Destination index   = 0x526d
pmap                = 0x00000000 0x00000000
cmi                 = 0x0
rcp_pmap            = 0x0
al_rsc_cmi
CPU Map Index (CMI) [0]
ctiLo0              = 0
ctiLo1              = 0
ctiLo2              = 0
```

```
cpuQNum0            = 0
cpuQNum1            = 0
cpuQNum2            = 0
npuIndex            = 0
stripSeg            = 0
copySeg             = 0

Edge-1#

show platform software fed switch active ifm mappings

Interface                IF_ID    Inst Asic Core

Port

 SubPort Mac  Cntx LPN  GPN  Type Active
GigabitEthernet1/0/1      0x1a       0   0   0    0      0      1    0    1    1    NIF  Y

GigabitEthernet1/0/2

 0x1b       0   0   0

1

     0      2    1    2    2    NIF  Y

<-- Port 1 lines up to G1/0/2

GigabitEthernet1/0/3      0xb        0   0   0    2      0      3    2    3    3    NIF  Y
GigabitEthernet1/0/4      0xc        0   0   0    3      0      4    3    4    4    NIF  Y
GigabitEthernet1/0/5      0xd        0   0   0    4      0      5    4    5    5    NIF  Y
GigabitEthernet1/0/6      0xe        0   0   0    5      0      6    5    6    6    NIF  Y
GigabitEthernet1/0/7      0xf        0   0   0    6      0      7    6    7    7    NIF  Y
GigabitEthernet1/0/8      0x10       0   0   0    7      0      8    7    8    8    NIF  Y
```

Decodifica ri_hdl hop successivo sottostante

Per decodificare il ri_hdl (0x7f65ec8a4eb8) usare in show platform hardware fed switch active fwd-asic abstraction print-resource-handle (ri_hdl) 1

<#root>

```
Edge-1#

show platform hardware fed switch active fwd-asic abstraction print-resource-handle 0x7f65ec8a4eb8 1

Handle:0x7f65ec8a4eb8 Res-Type:ASIC_RSC_RI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_L3_UNICAST_
priv_ri/priv_si Handle: 0x7f65ec903b28Hardware Indices/Handles: index0:0x1a  mtu_index/l3u_ri_index0:0x0
Features sharing this resource:66 (1)]
Cookie length: 56
00 00 00 00 00 00 00 00 26 00 00 00 00 00 00 00 00 00 00 00 08 00 52 54 00 1c 7d e0 00 00 00 00 00 00 0

Detailed Resource Information (ASIC_INSTANCE# 0)
----------------------------------------
ASIC#:0

RI:26

 Rewrite_type:AL_RRM_REWRITE_L3_UNICAST_IPV4_SHARED(1) Mapped_rii:L3_UNICAST_IPV4(9)
```

```
<-- Decimal 26 is 0x1a in hex

    MAC Addr: MAC Addr:

52:54:00:1c:7d:e0

,

<-- MAC address 5254.001c.7de0 for the next-hop adjacency

    L3IF LE Index 38


Detailed Resource Information (ASIC_INSTANCE# 1)
----------------------------------------
ASIC#:1

RI:26

 Rewrite_type:AL_RRM_REWRITE_L3_UNICAST_IPV4_SHARED(1) Mapped_rii:L3_UNICAST_IPV4(9)

<-- Decimal 26 is 0x1a in hex

 MAC Addr: MAC Addr:

52:54:00:1c:7d:e0

,
    MAC Addr: MAC Addr:

52:54:00:1c:7d:e0

,

<-- MAC address 5254.001c.7de0 for the next-hop adjacency


    L3IF LE Index 38


============================================================
```

# Raggiungibilità host di base in fabric SDA (VLAN diverse / stessa VN)

In questa sezione viene esaminata la comunicazione tra 10.47.4.2 e 10.47.10.2. Poiché questi host appartengono a VLAN diverse, è necessario configurare entrambi il gateway predefinito che punti al gateway predefinito. Per 10.47.4.2 è 10.47.4.1 e 10.47.10.2 è 10.47.10.1.

Passaggio 1. Verificare che la connettività tra l'endpoint e il gateway predefinito funzioni:

<#root>

```
Edge-1#

ping vrf red_vn 10.47.4.2

Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 10.47.4.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 155/164/181 ms
```

<#root>

```
Edge-2#
```

**ping vrf red_vn 10.47.10.1**

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.47.10.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 41/46/62 ms
```

Passaggio 2. Confermare che il pacchetto da 10.47.4.2 sia stato ricevuto correttamente da Edge-1:

Il pacchetto può essere acquisito sull'interfaccia in entrata verso 10.47.4.2:

<#root>

```
Edge-1#
```

**monitor capture 1 interface g1/0/3 in match any**

```
Edge-1#
```

**mon cap 1 start**

```
Started capture point : 1
Edge-1#
```

**mon cap 1 stop**

```
Capture statistics collected at software:
    Capture duration - 12 seconds
    Packets received - 9
    Packets dropped - 0
    Packets oversized - 0

Number of Bytes dropped at asic not collected

Capture buffer will exists till exported or cleared

Stopped capture point : 1

Edge-1#
```

**show monitor capture 1 buffer brief**

```
Starting the packet display ........ Press Ctrl + Shift + 6 to exit

    1   0.000000    10.47.4.2 -> 10.47.10.2   ICMP 98 Echo (ping) request  id=0x0041, seq=0/0, ttl=64
    2   0.023447    10.47.4.2 -> 10.47.10.2   ICMP 98 Echo (ping) request  id=0x0041, seq=0/0, ttl=64

Edge-1#
```

**show monitor capture 1 buffer detailed**

```
Starting the packet display ........ Press Ctrl + Shift + 6 to exit

Frame 1: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface /tmp/epc_ws/wif_to_ts_p
    Interface id: 0 (/tmp/epc_ws/wif_to_ts_pipe)
        Interface name: /tmp/epc_ws/wif_to_ts_pipe
    Encapsulation type: Ethernet (1)
    Arrival Time: Oct 11, 2023 15:27:46.033825000 UTC
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1697038066.033825000 seconds
    [Time delta from previous captured frame: 0.000000000 seconds]
    [Time delta from previous displayed frame: 0.000000000 seconds]
    [Time since reference or first frame: 0.000000000 seconds]
    Frame Number: 1
    Frame Length: 98 bytes (784 bits)
    Capture Length: 98 bytes (784 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:ip:icmp:data]
Ethernet II, Src: 52:54:00:19:93:e9 (
```

**52:54:00:19:93:e9**

```
), Dst: 00:00:0c:9f:f3:41 (
```

**00:00:0c:9f:f3:41**

```
)
```

**<-- SMAC and DMAC respectively**

```
    Destination: 00:00:0c:9f:f3:41 (00:00:0c:9f:f3:41)
        Address: 00:00:0c:9f:f3:41 (00:00:0c:9f:f3:41)
        .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Source: 52:54:00:19:93:e9 (52:54:00:19:93:e9)
        Address: 52:54:00:19:93:e9 (52:54:00:19:93:e9)
        .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory d
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Type: IPv4 (0x0800)
Internet Protocol Version 4, Src:
```

**10.47.4.2**

```
, Dst:
```

**10.47.10.2**

```
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
        0000 00.. = Differentiated Services Codepoint: Default (0)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 84
    Identification: 0x395e (14686)
    Flags: 0x4000, Don't fragment
        0... .... .... .... = Reserved bit: Not set
        .1.. .... .... .... = Don't fragment: Set
        ..0. .... .... .... = More fragments: Not set
    Fragment offset: 0
    Time to live: 64
    Protocol: ICMP (1)
    Header checksum: 0xdee9 [validation disabled]
```

```
    [Header checksum status: Unverified]
    Source: 10.47.4.2
    Destination: 10.47.10.2
Internet Control Message Protocol
    Type: 8 (Echo (ping) request)
    Code: 0
    Checksum: 0x248a [correct]
    [Checksum Status: Good]
    Identifier (BE): 65 (0x0041)
    Identifier (LE): 16640 (0x4100)
    Sequence number (BE): 0 (0x0000)
    Sequence number (LE): 0 (0x0000)
    Data (56 bytes)

0000  2a 46 a8 ee 00 00 00 00 00 00 00 00 00 00 00 00   *F..............
0010  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
0020  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
0030  00 00 00 00 00 00 00 00                           ........
        Data: 2a46a8ee0000000000000000000000000000000000000000b^@&
        [Length: 56]
```

Fase 3 - Ricerca LISP

Ingress Edge Node deve determinare la posizione (RLOC) dell'HOST-03 a cui invia i pacchetti. Poiché in questo caso l'host finale HOST-03 si trova in una VLAN diversa (ma nella stessa VN / VRF: USERS), viene utilizzata l'istanza LISP IPv4 in quanto la ricerca si basa sull'indirizzo IP (l'indirizzo MAC appartiene allo stesso nodo perimetrale).

<#root>

```
Edge-1#
```

**debug lisp control-plane all**

```
LISP[REMT ]-0: Map Request: Sending request for IID 4099 EID 10.47.10.2/32, requester 'remote EID prefi
LISP[REMT ]-0: Map-Reply nonce matches pending request for IID 4099 EID 10.47.10.2/32, requester 'remot
```

LISP Map Request raggiunge Control Node (LISP Map Server) Border-1:

<#root>

```
Border-1#
```

**debug lisp control-plane all**

```
LISP[TRNSP]-0: Processing received Map-Request(1) message on GigabitEthernet1/0/3 from 10.47.10.2:4342
LISP[MR   ]-0: Received Map-Request with 1 records, first EID IID 4099 10.47.10.2/32, source EID 10.47.
LISP[MR   ]-0 IID 4099 IPv4: MS EID 10.47.10.2/32: Sending proxy reply to 10.47.1.12.
```

LISP Map-Reply raggiunge Edge Node:

```
LISP[REMT ]-0: Processing Map-Reply mapping record for IID 4099 IPv4 10.47.10.2/32 LCAF 2, ttl 1440, ac
LISP[REMT ]-0: Processing mapping information for EID prefix IID 4099 10.47.10.2/32.
```

Fabric Edge esegue una query per RLOC per 10.47.10.2 ed elabora Map-Reply

```
LISP[REMT ]-0: Map Request: Sending request for IID 4099 EID 10.47.10.2/32, requester 'remote EID RLOC'
LISP[REMT ]-0: Processing Map-Reply mapping record for IID 4099 IPv4 10.47.10.2/32 LCAF 2, ttl 1440, ac
LISP[REMT ]-0: Processing mapping information for EID prefix IID 4099 10.47.10.2/32.
```

Se l'immissione non esiste, i debug devono essere raccolti dal punto di vista del processo LISP. Esiste anche uno strumento, chiamato LIG (LISP Grouper), che può essere utilizzato per attivare manualmente il processo LISP (questo è un modo molto efficace per testare la configurazione ridondante del nodo di controllo e la coerenza del database tra entrambi i nodi di controllo):

<#root>

```
Edge-1#
```

**lig instance-id 4099 10.47.10.2 to 10.47.1.10**

```
Mapping information for EID 10.47.10.2 from 10.47.1.10 with RTT 334 msecs
10.47.10.2/32, uptime: 00:00:00, expires: 23:59:59, via map-reply, complete
  Locator     Uptime    State  Pri/Wgt     Encap-IID
  10.47.1.13  00:00:00  up      10/10        -

Edge-1#
```

**lig instance-id 4099 10.47.10.2 to 10.47.1.11**

```
Mapping information for EID 10.47.10.2 from 10.47.1.11 with RTT 327 msecs
10.47.10.2/32, uptime: 00:00:06, expires: 23:59:59, via map-reply, complete
  Locator     Uptime    State  Pri/Wgt     Encap-IID
  10.47.1.13  00:00:06  up      10/10        -
```

Verifica route

CEF utilizza LISP e LISP utilizza la voce map-cache che ha ricevuto

<#root>

```
Edge-1#
```

**show ip cef vrf red_vn 10.47.10.2**

```
10.47.10.2/32
  nexthop 10.47.1.13 LISP0.4099

Edge-1#
```

**show ip route 10.47.1.13**

```
Routing entry for 10.47.1.13/32
  Known via "isis", distance 115, metric 30, type level-2
  Redistributing via isis
  Last update from 10.47.1.4 on GigabitEthernet1/0/2, 3d19h ago
  Routing Descriptor Blocks:
    10.47.1.4, from 10.47.1.13, 3d19h ago, via GigabitEthernet1/0/2
      Route metric is 30, traffic share count is 1
  * 10.47.1.0, from 10.47.1.13, 3d19h ago, via GigabitEthernet1/0/1
      Route metric is 30, traffic share count is 1

Edge-1#
```

**show lisp instance-id 4099 ipv4 map-cache  10.47.10.2**

```
LISP IPv4 Mapping Cache for LISP 0 EID-table vrf red_vn (IID 4099), 1 entries


10.47.10.2

/32, uptime: 00:08:48, expires: 23:51:17, via map-reply, complete
  Sources: map-reply
  State: complete, last modified: 00:08:48, map-source: 10.47.1.11
  Active, Packets out: 51(29376 bytes), counters are not accurate (~ 00:00:15 ago)
  Encapsulating dynamic-EID traffic
  Locator     Uptime    State  Pri/Wgt     Encap-IID


10.47.1.13

  00:08:48  up      10/10        -
    Last up-down state change:         00:08:48, state change count: 1
    Last route reachability change:    22:07:12, state change count: 1
    Last priority / weight change:     never/never
    RLOC-probing loc-status algorithm:
      Last RLOC-probe sent:            00:08:48 (rtt 931ms)
```

## Verifica LISP Next-Hop

Poiché il pacchetto è incapsulato in VXLAN, deve essere eseguita la verifica dell'hop successivo del LISP. Per ulteriori informazioni sulla versione 10.47.1.13, l'hop successivo LISP, usare il comando show platform software fed switch active ip adj

**<#root>**

```
Edge-1#
```

**show platform software fed switch active ip adj**

```
IPV4 Adj entries
dest                                    if_name                dst_mac          si_hdl          r
----                                    -------                -------          ------          -
10.47.1.10                              LISP0.4100             4500.0000.0000   0x7f65ec895ed8 0
10.47.1.4                               GigabitEthernet1/0/2   5254.001c.7de0   0x7f65ec8a5458 0
10.47.1.0                               GigabitEthernet1/0/1   5254.000a.42f3   0x7f65ec8b8468 0
10.47.4.2                               Vlan1026               5254.0019.93e9   0x7f65ec7c21f8 0

10.47.1.13                              LISP0.4099             4500.0000.0000   0x7f65ed00f668 0x
```

LISP Next-Hop si_hdl Decodifica

Prendere il si_hdl (0x7f65ed00f668) e usarlo in show platform hardware fed switch active fwd-asic abstraction print-resource-handle <si_hdl> 1

<#root>

```
Edge-1#

show platform hardware fed switch active fwd-asic abstraction print-resource-handle 0x7f65ed00f668 1

Handle:0x7f65ed00f668 Res-Type:ASIC_RSC_SI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_LISP Lkp-f
priv_ri/priv_si Handle: 0x7f65ed00fd58Hardware Indices/Handles: index0:0xc8  mtu_index/l3u_ri_index0:0x
Features sharing this resource:109 (1)]
Cookie length: 56
00 00 00 00 00 00 00 00 38 5f 84 ec 0a 2f 01 0d ff ff ff ff 00 00 00 00 00 00 00 00 00 00 00 00 00 00


Detailed Resource Information (ASIC_INSTANCE# 0)
----------------------------------------


Station Index (SI) [0xc8] <-- Contains the RI and DI
RI = 0x2c <-- Rewrite Index contains information for L3 Forwarding
DI = 0x5012 <-- Destination Index contains information for the destination port

stationTableGenericLabel = 0
stationFdConstructionLabel = 0x7
lookupSkipIdIndex = 0xc
rcpServiceId = 0
dejaVuPreCheckEn = 0
Replication Bitmap: LD


Detailed Resource Information (ASIC_INSTANCE# 1)
----------------------------------------

Station Index (SI) [0xc8] <-- Contains the RI and DI
RI = 0x2c <-- Rewrite Index contains information for L3 Forwarding
DI = 0x5013 <-- Destination Index contains information for the destination port

stationTableGenericLabel = 0
stationFdConstructionLabel = 0x7
lookupSkipIdIndex = 0xc
rcpServiceId = 0
dejaVuPreCheckEn = 0
Replication Bitmap: LD

============================================================
```

Decodifica RI LISP Next-Hop

Prendere il RI (0x2c) e usarlo in show platform hardware feed switch active fwd-asic resource asic all rewrite-index range <RI> <RI>

<#root>

```
Edge-1#
```

**show platform hardware fed switch active fwd-asic resource asic all rewrite-index range 0x2c 0x2c**

```
ASIC#:0 RI:44 Rewrite_type:AL_RRM_REWRITE_IPV4_VXLAN_INNER_IPV4_ENCAP(110) Mapped_rii:LVX_L3_ENCAP_L2_PA
 Dst Mac:     MAC Addr: ba:25:cd:f4:ad:38,
 Src IP:
```

**10.47.1.12 <-- Local RLOC**

```
 Dst IP:
```

**10.47.1.13 <-- RLOC of Edge-2**

```
 IPv4 TTL:     0
 LISP INSTANCEID:     0
 L3IF LE Index:     46

ASIC#:1 RI:44 Rewrite_type:AL_RRM_REWRITE_IPV4_VXLAN_INNER_IPV4_ENCAP(110) Mapped_rii:LVX_L3_ENCAP_L2_PA
 Dst Mac:     MAC Addr: ba:25:cd:f4:ad:38,
 Src IP:
```

**10.47.1.12 <-- Local RLOC**

```
 Dst IP:
```

**10.47.1.13 <-- RLOC of Edge-2**

```
 IPv4 TTL:     0
 LISP INSTANCEID:     0
 L3IF LE Index:     46
```

## LISP Next-Hop ID Decode

Prendere l'ID (0x5012) e usarlo in show platform hardware fed switch active fwd-asic resource asic all destination-index range <DI> <DI>

### <#root>

```
Edge-1#
```

**show platform hardware fed switch active fwd-asic resource asic all destination-index range 0x5012 0x501**

```
ASIC#0:

Destination index   = 0x5012
```

**DI_RCP_PORT1 <-- Expected, this means the packet is recirculated for VXLAN imposition**

```
pmap                = 0x00000000 0x00000000
cmi                 = 0x0
rcp_pmap            = 0x1
al_rsc_cmi
CPU Map Index (CMI) [0]
ctiLo0              = 0
ctiLo1              = 0
ctiLo2              = 0
cpuQNum0            = 0
cpuQNum1            = 0
```

```
cpuQNum2            = 0
npuIndex            = 0
stripSeg            = 0
copySeg             = 0
ASIC#1:

Destination index   = 0x5012
```

**DI_RCP_PORT1 <-- Expected, this means the packet is recirculated for VXLAN imposition**

```
pmap                = 0x00000000 0x00000000
cmi                 = 0x0
rcp_pmap            = 0x0
al_rsc_cmi
CPU Map Index (CMI) [0]
ctiLo0              = 0
ctiLo1              = 0
ctiLo2              = 0
cpuQNum0            = 0
cpuQNum1            = 0
cpuQNum2            = 0
npuIndex            = 0
stripSeg            = 0
copySeg             = 0
```

## LISP Next-Hop ri_hdl Decodifica

Prendere il ri_hdl (0x7f65ed00fd58) e usare nel comando show platform hardware fed switch active fwd-asic abstraction print-resource-handle <ri_hdl> 1

### <#root>

```
Edge-1#
```

**show platform hardware fed switch active fwd-asic abstraction print-resource-handle 0x7f65ed00fd58 1**

```
Handle:0x7f65ed00fd58 Res-Type:ASIC_RSC_RI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_LISP Lkp-f
priv_ri/priv_si Handle: 0x7f65ed00b618Hardware Indices/Handles: index0:0x2c  mtu_index/l3u_ri_index0:0x
Features sharing this resource:109 (1)]
Cookie length: 56
00 00 00 00 00 00 00 00 2e 00 00 00 0a 2f 01 0d ff ff ff ff 00 00 00 00 00 00 00 00 00 00 00 00 00 0


Detailed Resource Information (ASIC_INSTANCE# 0)
----------------------------------------
ASIC#:0 RI:44 Rewrite_type:AL_RRM_REWRITE_IPV4_VXLAN_INNER_IPV4_ENCAP(110) Mapped_rii:LVX_L3_ENCAP_L2_P
 Dst Mac:     MAC Addr: ba:25:cd:f4:ad:38,
 Src IP:
```

**10.47.1.12 <-- Local RLOC**

```
 Dst IP:
```

**10.47.1.13 <-- Edge-2 RLOC**

```
 IPv4 TTL:     0
 LISP INSTANCEID:     0
 L3IF LE Index:     46
```

```
Detailed Resource Information (ASIC_INSTANCE# 1)
----------------------------------------
ASIC#:1 RI:44 Rewrite_type:AL_RRM_REWRITE_IPV4_VXLAN_INNER_IPV4_ENCAP(110) Mapped_rii:LVX_L3_ENCAP_L2_P
 Dst Mac:     MAC Addr: ba:25:cd:f4:ad:38,
 Src IP:
```

**10.47.1.12 <-- Local RLOC**

```
 Dst IP:
```

**10.47.1.13 <-- Edge-2 RLOC**

```
 IPv4 TTL:     0
 LISP INSTANCEID:     0
 L3IF LE Index:     46

==============================================================
```

Verifica Underlay Next-Hop

Per raggiungere il LISP Next-Hop, ci sono due possibili percorsi nel underlay, la verifica si verifica per uno, la stessa logica si applica nella verifica dell'altro underlay next-hop.

<#root>

```
Edge-1#
```

**show ip route 10.47.1.13**

```
Routing entry for 10.47.1.13/32
  Known via "isis", distance 115, metric 30, type level-2
  Redistributing via isis
  Last update from 10.47.1.4 on GigabitEthernet1/0/2, 3d19h ago
  Routing Descriptor Blocks:
```

**10.47.1.4**

```
, from 10.47.1.13, 3d19h ago, via GigabitEthernet1/0/2
      Route metric is 30, traffic share count is 1
  *
```

**10.47.1.0**

```
, from 10.47.1.13, 3d19h ago, via GigabitEthernet1/0/1
      Route metric is 30, traffic share count is 1
```

Per ulteriori informazioni sugli hop successivi, usare il comando show platform software fed switch active ip adj

<#root>

```
Edge-1#
```

```
show platform software fed switch active ip adj

IPV4 Adj entries
dest                                    if_name                 dst_mac          si_hdl          r
----                                    -------                 -------          ------          -

10.47.1.4                               GigabitEthernet1/0/2    5254.001c.7de0   0x7f65ec8a5458 0x

10.47.1.0                               GigabitEthernet1/0/1    5254.000a.42f3   0x7f65ec8b8468 0x

<snip>
```

Decodifica si_hdl hop successivo sottostante

Prendere il si_hdl (0x7f65ec8a5458) e usare nel comando show platform hardware fed switch active fwd-asic abstraction print-resource-handle <si_hdl> 1

<#root>

```
Edge-1#

show platform hardware fed switch active fwd-asic abstraction print-resource-handle 0x7f65ec8a5458 1

Handle:0x7f65ec8a5458 Res-Type:ASIC_RSC_SI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_L3_UNICAST_
priv_ri/priv_si Handle: 0x7f65ec8a4eb8Hardware Indices/Handles: index0:0xbc  mtu_index/l3u_ri_index0:0x0
Features sharing this resource:66 (1)]
Cookie length: 56
00 00 00 00 00 00 00 00 26 00 00 00 00 00 00 00 00 00 00 00 08 00 52 54 00 1c 7d e0 00 00 00 00 00 00 0

Detailed Resource Information (ASIC_INSTANCE# 0)
----------------------------------------


Station Index (SI) [0xbc] <-- Contains the RI and DI
RI = 0x1a <-- Rewrite index contains information for L3 Forwarding
DI = 0x526d <-- Destination index contains information for the destination port

stationTableGenericLabel = 0
stationFdConstructionLabel = 0x7
lookupSkipIdIndex = 0
rcpServiceId = 0
dejaVuPreCheckEn = 0
Replication Bitmap: LD


Detailed Resource Information (ASIC_INSTANCE# 1)
----------------------------------------

Station Index (SI) [0xbc] <-- Contains the RI and DI
RI = 0x1a <-- Rewrite index contains information for L3 Forwarding
DI = 0x526d <-- Destination index contains information for the destination port

stationTableGenericLabel = 0
stationFdConstructionLabel = 0x7
lookupSkipIdIndex = 0
rcpServiceId = 0
dejaVuPreCheckEn = 0
Replication Bitmap: CD
```

```
============================================================
```

Decodifica RI Underlay Next-Hop

Utilizzare il comando RI (0x1a) e show platform hardware feed switch active fwd-asic resource asic all rewrite-index range <RI> <RI>

<#root>

```
Edge-1#
show platform hardware fed switch active fwd-asic resource asic all rewrite-index range 0x1a 0x1a
ASIC#:0
RI:26
 Rewrite_type:AL_RRM_REWRITE_L3_UNICAST_IPV4_SHARED(1) Mapped_rii:L3_UNICAST_IPV4(9)
<-- Decimal 26 is hex 0x1a
    MAC Addr: MAC Addr:
52:54:00:1c:7d:e0
,
<-- MAC Address 5254.001c.7de0 corresponds to the next-hop
    L3IF LE Index 38

ASIC#:1
RI:26
 Rewrite_type:AL_RRM_REWRITE_L3_UNICAST_IPV4_SHARED(1) Mapped_rii:L3_UNICAST_IPV4(9)
<-- Decimal 26 is hex 0x1a
    MAC Addr: MAC Addr:
 52:54:00:1c:7d:e0
,
<-- MAC Address 5254.001c.7de0 corresponds to the next-hop
    L3IF LE Index 38
```

Decodifica ID hop successivo sottostante

Utilizzare l'ID (0x526d) e il comando show platform hardware fed switch active fwd-asic resource asic all destination-index range <DI> <DI>

<#root>

```
Edge-1#
```

**show platform hardware fed switch active fwd-asic resource asic all destination-index range 0x526d 0x526**

ASIC#0:

Destination index   = 0x526d

**pmap                = 0x00000000 0x00000002 <-- Take decimal 2 and convert to binary, so 0010, and then**

pmap_intf : [GigabitEthernet1/0/2]
cmi                 = 0x0
rcp_pmap            = 0x0
al_rsc_cmi
CPU Map Index (CMI) [0]
ctiLo0              = 0
ctiLo1              = 0
ctiLo2              = 0
cpuQNum0            = 0
cpuQNum1            = 0
cpuQNum2            = 0
npuIndex            = 0
stripSeg            = 0
copySeg             = 0
ASIC#1:

Destination index   = 0x526d

**pmap                = 0x00000000 0x00000000**

cmi                 = 0x0
rcp_pmap            = 0x0
al_rsc_cmi
CPU Map Index (CMI) [0]
ctiLo0              = 0
ctiLo1              = 0
ctiLo2              = 0
cpuQNum0            = 0
cpuQNum1            = 0
cpuQNum2            = 0
npuIndex            = 0
stripSeg            = 0
copySeg             = 0

Edge-1#

**show platform software fed  switch active ifm mappings**

Interface                IF_ID    Inst Asic Core

**Port**

 SubPort Mac  Cntx LPN  GPN  Type Active
GigabitEthernet1/0/1      0x1a       0   0   0    0      0      1    0    1    1    NIF  Y

**GigabitEthernet1/0/2**

 0x1b       0   0   0

**1**

      0      2    1    2    2    NIF  Y

**<-- Port 1 maps to Gig1/0/2**

GigabitEthernet1/0/3      0xb        0   0   0    2      0      3    2    3    3    NIF  Y
GigabitEthernet1/0/4      0xc        0   0   0    3      0      4    3    4    4    NIF  Y
GigabitEthernet1/0/5      0xd        0   0   0    4      0      5    4    5    5    NIF  Y

```
GigabitEthernet1/0/6      0xe         0   0   0    5      0      6    5    6    6    NIF  Y
GigabitEthernet1/0/7      0xf         0   0   0    6      0      7    6    7    7    NIF  Y
GigabitEthernet1/0/8      0x10        0   0   0    7      0      8    7    8    8    NIF  Y
```

Decodifica ri_hdl hop successivo sottostante

Prendere il ri_hdl (0x7f65ec8b8158) e usare nel comando show platform hardware fed switch active fwd-asic abstraction print-resource-handle <ri_hdl> 1

<#root>

```
Edge-1#

show platform hardware fed switch active fwd-asic abstraction print-resource-handle 0x7f65ec8b8158 1

Handle:0x7f65ec8b8158 Res-Type:ASIC_RSC_RI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_L3_UNICAST_
priv_ri/priv_si Handle: 0x7f65ec7a6338Hardware Indices/Handles: index0:0x1b  mtu_index/l3u_ri_index0:0x
Features sharing this resource:66 (1)]
Cookie length: 56
00 00 00 00 00 00 00 00 25 00 00 00 00 00 00 00 00 00 00 00 08 00 52 54 00 0a 42 f3 00 00 00 00 00 00 0

Detailed Resource Information (ASIC_INSTANCE# 0)
----------------------------------------
ASIC#:0 RI:27 Rewrite_type:AL_RRM_REWRITE_L3_UNICAST_IPV4_SHARED(1) Mapped_rii:L3_UNICAST_IPV4(9)
    MAC Addr: MAC Addr:

52:54:00:0a:42:f3

,
    L3IF LE Index 37


Detailed Resource Information (ASIC_INSTANCE# 1)
----------------------------------------
ASIC#:1 RI:27 Rewrite_type:AL_RRM_REWRITE_L3_UNICAST_IPV4_SHARED(1) Mapped_rii:L3_UNICAST_IPV4(9)
    MAC Addr: MAC Addr:

52:54:00:0a:42:f3

,
    L3IF LE Index 37


============================================================
```

I pacchetti vengono incapsulati nella VXLAN e inviati in base alle regole di bilanciamento del carico. L'EPC (Embedded Packet Capture) può essere utilizzato per acquisire il traffico su tutte le interfacce contemporaneamente. Ricordare a questo punto che il pacchetto è incapsulato dalla VXLAN, il filtro EPC deve essere applicato alla RLOC rispetto alla RLOC, non agli indirizzi IPv4 interni.

<#root>

```
Edge-1#

monitor capture 1 interface range g1/0/1-2 out match ipv4 host 10.47.1.12 host 10.47.1.13

Edge-1#

monitor capture 1 start

Started capture point : 1
Edge-1#
Edge-1#

monitor capture 1 stop

Capture statistics collected at software:
    Capture duration - 18 seconds
    Packets received - 4
    Packets dropped - 0
    Packets oversized - 0

Number of Bytes dropped at asic not collected

Capture buffer will exists till exported or cleared

Stopped capture point : 1

Edge-1#

show monitor capture 1 buffer brief

Starting the packet display ........ Press Ctrl + Shift + 6 to exit

    1   0.000000    10.47.4.2 -> 10.47.10.2   ICMP 148 Echo (ping) request  id=0x0046, seq=0/0, ttl=63
    2   0.980849    10.47.4.2 -> 10.47.10.2   ICMP 148 Echo (ping) request  id=0x0046, seq=1/256, ttl=6
    3   1.984077    10.47.4.2 -> 10.47.10.2   ICMP 148 Echo (ping) request  id=0x0046, seq=2/512, ttl=6
    4   2.999989    10.47.4.2 -> 10.47.10.2   ICMP 148 Echo (ping) request  id=0x0046, seq=3/768, ttl=6

Edge-1#

show monitor capture 1 buffer detailed


Starting the packet display ........ Press Ctrl + Shift + 6 to exit

Frame 1: 148 bytes on wire (1184 bits), 148 bytes captured (1184 bits) on interface /tmp/epc_ws/wif_to_
    Interface id: 0 (/tmp/epc_ws/wif_to_ts_pipe)
        Interface name: /tmp/epc_ws/wif_to_ts_pipe
    Encapsulation type: Ethernet (1)
    Arrival Time: Oct 11, 2023 16:50:52.262553000 UTC
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1697043052.262553000 seconds
    [Time delta from previous captured frame: 0.000000000 seconds]
    [Time delta from previous displayed frame: 0.000000000 seconds]
    [Time since reference or first frame: 0.000000000 seconds]
    Frame Number: 1
    Frame Length: 148 bytes (1184 bits)
    Capture Length: 148 bytes (1184 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:ip:udp:vxlan:eth:ethertype:ip:icmp:data]
Ethernet II, Src:

00:00:00:00:00:00

 (00:00:00:00:00:00), Dst:
```

**00:00:00:00:00:00**

(00:00:00:00:00:00)

**<-- EPC does not capture L3 rewrite on egress properly, this is OK**

```
    Destination: 00:00:00:00:00:00 (00:00:00:00:00:00)
        Address: 00:00:00:00:00:00 (00:00:00:00:00:00)
        .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Source: 00:00:00:00:00:00 (00:00:00:00:00:00)
        Address: 00:00:00:00:00:00 (00:00:00:00:00:00)
        .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Type: IPv4 (0x0800)
Internet Protocol Version 4, Src:
```

**10.47.1.12**

, Dst:

**10.47.1.13 <-- RLOC to RLOC**

```
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
        0000 00.. = Differentiated Services Codepoint: Default (0)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 134
    Identification: 0x1d6f (7535)
    Flags: 0x4000, Don't fragment
        0... .... .... .... = Reserved bit: Not set
        .1.. .... .... .... = Don't fragment: Set
        ..0. .... .... .... = More fragments: Not set
    Fragment offset: 0
    Time to live: 64
    Protocol: UDP (17)
    Header checksum: 0x0682 [validation disabled]
    [Header checksum status: Unverified]
    Source: 10.47.1.12
    Destination: 10.47.1.13
User Datagram Protocol, Src Port: 65354, Dst Port: 4789
    Source Port: 65354
    Destination Port: 4789
    Length: 114
    [Checksum: [missing]]
    [Checksum Status: Not present]
    [Stream index: 0]
    [Timestamps]
        [Time since first frame: 0.000000000 seconds]
        [Time since previous frame: 0.000000000 seconds]
Virtual eXtensible Local Area Network
    Flags: 0x8800, GBP Extension, VXLAN Network ID (VNI)
        1... .... .... .... = GBP Extension: Defined
        .... .... .0.. .... = Don't Learn: False
        .... 1... .... .... = VXLAN Network ID (VNI): True
        .... .... .... 0... = Policy Applied: False
        .000 .000 0.00 .000 = Reserved(R): 0x0000
    Group Policy ID: 0
    VXLAN Network Identifier (VNI):
```

**4099 <-- LISP L3 IID**

```
    Reserved: 0
Ethernet II, Src: 00:00:00:00:61:00 (
```

**00:00:00:00:61:00**

), Dst: ba:25:cd:f4:ad:38 (

**ba:25:cd:f4:ad:38**

)

**<-- Dummy Ethernet header for VXLAN**

```
    Destination: ba:25:cd:f4:ad:38 (ba:25:cd:f4:ad:38)
        Address: ba:25:cd:f4:ad:38 (ba:25:cd:f4:ad:38)
        .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory d
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Source: 00:00:00:00:61:00 (00:00:00:00:61:00)
        Address: 00:00:00:00:61:00 (00:00:00:00:61:00)
        .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Type: IPv4 (0x0800)
Internet Protocol Version 4, Src:
```

**10.47.4.2**

, Dst:

**10.47.10.2 <-- True IPv4 addresses**

```
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
        0000 00.. = Differentiated Services Codepoint: Default (0)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 84
    Identification: 0x92f6 (37622)
    Flags: 0x4000, Don't fragment
        0... .... .... .... = Reserved bit: Not set
        .1.. .... .... .... = Don't fragment: Set
        ..0. .... .... .... = More fragments: Not set
    Fragment offset: 0
    Time to live: 63
    Protocol: ICMP (1)
    Header checksum: 0x8651 [validation disabled]
    [Header checksum status: Unverified]
    Source: 10.47.4.2
    Destination: 10.47.10.2
Internet Control Message Protocol
    Type: 8 (Echo (ping) request)
    Code: 0
    Checksum: 0xa383 [correct]
    [Checksum Status: Good]
    Identifier (BE): 70 (0x0046)
    Identifier (LE): 17920 (0x4600)
    Sequence number (BE): 0 (0x0000)
    Sequence number (LE): 0 (0x0000)
    Data (56 bytes)

0000  78 1e dc 17 00 00 00 00 00 00 00 00 00 00 00 00   x...............
0010  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
0020  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
0030  00 00 00 00 00 00 00 00                           ........
        Data: 781edc17000000000000000000000000000000000000000b^@&
        [Length: 56]
```

Il pacchetto VXLAN incapsulato raggiunge il perimetro 2:

```
<#root>

Edge-2#

monitor capture 1 interface range g1/0/1-2 in match ipv4 host 10.47.1.12 host 10.47.1.13

Edge-2#

monitor capture 1 start

Started capture point : 1
Edge-2#

monitor capture 1 stop

Capture statistics collected at software:
    Capture duration - 7 seconds
    Packets received - 6
    Packets dropped - 0
    Packets oversized - 0

Number of Bytes dropped at asic not collected

Capture buffer will exists till exported or cleared

Stopped capture point : 1

Edge-2#

show monitor capture 1 buffer brief

Starting the packet display ........ Press Ctrl + Shift + 6 to exit

    1   0.000000    10.47.4.2 -> 10.47.10.2   ICMP 148 Echo (ping) request  id=0x0047, seq=0/0, ttl=63
    2   0.007826    10.47.4.2 -> 10.47.10.2   ICMP 148 Echo (ping) request  id=0x0047, seq=0/0, ttl=63
    3   0.086345    10.47.4.2 -> 10.47.10.2   ICMP 148 Echo (ping) request  id=0x0047, seq=1/256, ttl=6
    4   0.097490    10.47.4.2 -> 10.47.10.2   ICMP 148 Echo (ping) request  id=0x0047, seq=1/256, ttl=6
    5   1.150969    10.47.4.2 -> 10.47.10.2   ICMP 148 Echo (ping) request  id=0x0047, seq=2/512, ttl=6
    6   1.163817    10.47.4.2 -> 10.47.10.2   ICMP 148 Echo (ping) request  id=0x0047, seq=2/512, ttl=6

Edge-2#

show monitor capture 1 buffer detailed


Starting the packet display ........ Press Ctrl + Shift + 6 to exit

Frame 1: 148 bytes on wire (1184 bits), 148 bytes captured (1184 bits) on interface /tmp/epc_ws/wif_to_
    Interface id: 0 (/tmp/epc_ws/wif_to_ts_pipe)
        Interface name: /tmp/epc_ws/wif_to_ts_pipe
    Encapsulation type: Ethernet (1)
    Arrival Time: Oct 11, 2023 16:58:12.702159000 UTC
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1697043492.702159000 seconds
    [Time delta from previous captured frame: 0.000000000 seconds]
    [Time delta from previous displayed frame: 0.000000000 seconds]
    [Time since reference or first frame: 0.000000000 seconds]
    Frame Number: 1
    Frame Length: 148 bytes (1184 bits)
    Capture Length: 148 bytes (1184 bits)
    [Frame is marked: False]
```

```
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:ip:udp:vxlan:eth:ethertype:ip:icmp:data]
Ethernet II, Src: 52:54:00:0a:42:11 (
```

**52:54:00:0a:42:11**

```
), Dst: 52:54:00:17:fe:65 (
```

**52:54:00:17:fe:65**

```
)
```

**<-- True MAC addresses post L3 rewrite**

```
    Destination: 52:54:00:17:fe:65 (52:54:00:17:fe:65)
        Address: 52:54:00:17:fe:65 (52:54:00:17:fe:65)
        .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory d
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Source: 52:54:00:0a:42:11 (52:54:00:0a:42:11)
        Address: 52:54:00:0a:42:11 (52:54:00:0a:42:11)
        .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory d
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Type: IPv4 (0x0800)
Internet Protocol Version 4, Src:
```

**10.47.1.12**

```
, Dst:
```

**10.47.1.13 <-- RLOC to RLOC**

```
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
        0000 00.. = Differentiated Services Codepoint: Default (0)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 134
    Identification: 0x1d7b (7547)
    Flags: 0x4000, Don't fragment
        0... .... .... .... = Reserved bit: Not set
        .1.. .... .... .... = Don't fragment: Set
        ..0. .... .... .... = More fragments: Not set
    Fragment offset: 0
    Time to live: 62
    Protocol: UDP (17)
    Header checksum: 0x0876 [validation disabled]
    [Header checksum status: Unverified]
    Source: 10.47.1.12
    Destination: 10.47.1.13
User Datagram Protocol, Src Port: 65354, Dst Port: 4789
    Source Port: 65354
    Destination Port: 4789
    Length: 114
    [Checksum: [missing]]
    [Checksum Status: Not present]
    [Stream index: 0]
    [Timestamps]
        [Time since first frame: 0.000000000 seconds]
        [Time since previous frame: 0.000000000 seconds]
Virtual eXtensible Local Area Network
    Flags: 0x8800, GBP Extension, VXLAN Network ID (VNI)
        1... .... .... .... = GBP Extension: Defined
        .... .... .0.. .... = Don't Learn: False
        .... 1... .... .... = VXLAN Network ID (VNI): True
        .... .... .... 0... = Policy Applied: False
```

```
        .000 .000 0.00 .000 = Reserved(R): 0x0000
    Group Policy ID: 0
    VXLAN Network Identifier (VNI):
```

**4099 <-- LISP L3 IID**

```
    Reserved: 0
Ethernet II, Src: 00:00:00:00:61:00 (
```

**00:00:00:00:61:00**

```
), Dst: ba:25:cd:f4:ad:38 (
```

**ba:25:cd:f4:ad:38**

```
)
```

**<-- Dummy Ethernet header for VXLAN**

```
    Destination: ba:25:cd:f4:ad:38 (ba:25:cd:f4:ad:38)
        Address: ba:25:cd:f4:ad:38 (ba:25:cd:f4:ad:38)
        .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory d
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Source: 00:00:00:00:61:00 (00:00:00:00:61:00)
        Address: 00:00:00:00:61:00 (00:00:00:00:61:00)
        .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Type: IPv4 (0x0800)
Internet Protocol Version 4, Src:
```

**10.47.4.2**

```
, Dst:
```

**10.47.10.2**

```
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
        0000 00.. = Differentiated Services Codepoint: Default (0)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 84
    Identification: 0x1abb (6843)
    Flags: 0x4000, Don't fragment
        0... .... .... .... = Reserved bit: Not set
        .1.. .... .... .... = Don't fragment: Set
        ..0. .... .... .... = More fragments: Not set
    Fragment offset: 0
    Time to live: 63
    Protocol: ICMP (1)
    Header checksum: 0xfe8c [validation disabled]
    [Header checksum status: Unverified]
    Source: 10.47.4.2
    Destination: 10.47.10.2
Internet Control Message Protocol
    Type: 8 (Echo (ping) request)
    Code: 0
    Checksum: 0x044f [correct]
    [Checksum Status: Good]
    Identifier (BE): 71 (0x0047)
    Identifier (LE): 18176 (0x4700)
    Sequence number (BE): 0 (0x0000)
    Sequence number (LE): 0 (0x0000)
    Data (56 bytes)
```

```
0000  e8 37 0b 32 00 00 00 00 00 00 00 00 00 00 00 00   .7.2............
0010  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
0020  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
0030  00 00 00 00 00 00 00 00                           ........
        Data: e8370b320000000000000000000000000000000000000000b^@&
        [Length: 56]
```

Edge-2 decapsula l'intestazione VXLAN e consulta la relativa tabella ARP per inoltrare la richiesta ICMP verso 10.47.10.2

<#root>

```
Edge-2#

show ip cef vrf red_vn 10.47.10.2

10.47.10.2/32
  nexthop 10.47.10.2 Vlan1028

Edge-2#

show platform software fed switch active ip adj

IPV4 Adj entries
dest                                    if_name                dst_mac          si_hdl         r
----                                    -------                -------          ------         -

10.47.10.2                              Vlan1028               5254.0002.cbf5   0x7f5744f89988 0x


<snip>
```

Decodifica s_hdl endpoint

Prendere il si_hdl (0x7f5744f89988) e usarlo in show platform hardware fed switch active fwd-asic abstraction print-resource-handle <si_hdl> 1

<#root>

```
Edge-2#

show platform hardware fed switch active fwd-asic abstraction print-resource-handle  0x7f5744f89988 1

Handle:0x7f5744f89988 Res-Type:ASIC_RSC_SI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_L3_UNICAST_
priv_ri/priv_si Handle: 0x7f5744f8afa8Hardware Indices/Handles: index0:0xc8  mtu_index/l3u_ri_index0:0x0
Features sharing this resource:66 (1)]
57 (1)]
Cookie length: 56
00 00 00 00 00 00 00 00 04 04 00 00 00 00 00 00 00 00 00 00 07 00 52 54 00 02 cb f5 00 00 00 00 00 00 0


Detailed Resource Information (ASIC_INSTANCE# 0)
----------------------------------------


Station Index (SI) [0xc8] <-- Station Index contains RI and DI
```

```
RI = 0x2c <-- Rewrite Index contains information for L2 Forwarding
DI = 0x526e <-- Rewrite Index contains destination port information

stationTableGenericLabel = 0
stationFdConstructionLabel = 0x7
lookupSkipIdIndex = 0
rcpServiceId = 0
dejaVuPreCheckEn = 0x1
Replication Bitmap: LD


Detailed Resource Information (ASIC_INSTANCE# 1)
----------------------------------------

Station Index (SI) [0xc8] <-- Station Index contains RI and DI
RI = 0x2c <-- Rewrite Index contains information for L2 Forwarding
DI = 0x526e <-- Rewrite Index contains destination port information

stationTableGenericLabel = 0
stationFdConstructionLabel = 0x7
lookupSkipIdIndex = 0
rcpServiceId = 0
dejaVuPreCheckEn = 0x1
Replication Bitmap: CD

==============================================================
```

Decodifica URI endpoint

Utilizzare il comando RI (0x2c) e show platform hardware feed switch active fwd-asic resource asic all rewrite-index range <RI> <RI>

<#root>

```
Edge-2#

show platform hardware fed switch active fwd-asic resource asic all rewrite-index range 0x2c 0x2c

ASIC#:0

RI:44

 Rewrite_type:AL_RRM_REWRITE_L3_UNICAST_IPV4_SHARED(1) Mapped_rii:L3_UNICAST_IPV4(9)

 <-- Decimal 44 is hex 0x2c

    MAC Addr: MAC Addr:

52:54:00:02:cb:f5

,

<-- MAC Address 5254.0002.cbf5 is 10.47.10.2

    L3IF LE Index 50


ASIC#:1 RI:44 Rewrite_type:AL_RRM_REWRITE_L3_UNICAST_IPV4_SHARED(1) Mapped_rii:L3_UNICAST_IPV4(9)

 <-- Decimal 44 is hex 0x2c
```

```
    MAC Addr: MAC Addr:
52:54:00:02:cb:f5
,
<-- MAC Address 5254.0002.cbf5 is 10.47.10.2
    L3IF LE Index 50
```

Decodifica ID endpoint

Prendere l'ID (0x526e) e usarlo in show platform hardware fed switch active fwd-asic resource asic all destination-index range <DI> <DI>

<#root>

```
Edge-2#
show platform hardware fed switch active fwd-asic resource asic all destination-index range 0x526e 0x526
ASIC#0:
Destination index   = 0x526e
pmap                = 0x00000000 0x00000010 <-- Convert 10 into binary, 0001 and 0000, so 00010000, and
pmap_intf : [GigabitEthernet1/0/5]
cmi                 = 0x0
rcp_pmap            = 0x0
al_rsc_cmi
CPU Map Index (CMI) [0]
ctiLo0              = 0
ctiLo1              = 0
ctiLo2              = 0
cpuQNum0            = 0
cpuQNum1            = 0
cpuQNum2            = 0
npuIndex            = 0
stripSeg            = 0
copySeg             = 0
ASIC#1:
Destination index   = 0x526e
pmap                = 0x00000000 0x00000000
cmi                 = 0x0
rcp_pmap            = 0x0
al_rsc_cmi
CPU Map Index (CMI) [0]
ctiLo0              = 0
ctiLo1              = 0
ctiLo2              = 0
cpuQNum0            = 0
cpuQNum1            = 0
cpuQNum2            = 0
npuIndex            = 0
stripSeg            = 0
copySeg             = 0
Edge-2#
```

```
show platform software fed switch active ifm mappings

Interface                IF_ID    Inst Asic Core Port SubPort Mac  Cntx LPN  GPN  Type Active
GigabitEthernet1/0/1     0x1a       0   0    0    0      0      1    0    1    1    NIF  Y
GigabitEthernet1/0/2     0x1b       0   0    0    1      0      2    1    2    2    NIF  Y
GigabitEthernet1/0/3     0xb        0   0    0    2      0      3    2    3    3    NIF  Y
GigabitEthernet1/0/4     0xc        0   0    0    3      0      4    3    4    4    NIF  Y

GigabitEthernet1/0/5

      0xd        0   0   0

4

     0      5    4    5    5    NIF  Y

<-- Port 4 corresponds to Gig1/0/5

GigabitEthernet1/0/6     0xe        0   0    0    5      0      6    5    6    6    NIF  Y
GigabitEthernet1/0/7     0xf        0   0    0    6      0      7    6    7    7    NIF  Y
GigabitEthernet1/0/8     0x10       0   0    0    7      0      8    7    8    8    NIF  Y
```

Edge-2 decapsula il pacchetto e lo invia all'interfaccia in uscita a cui è collegato HOST-03:

<#root>

```
Edge-2#

monitor capture 1 interface g1/0/5 out match ipv4 host 10.47.4.2 host 10.47.10.2

Edge-2#

monitor capture 1 start

Started capture point : 1
Edge-2#

monitor capture 1 stop

Capture statistics collected at software:
    Capture duration - 6 seconds
    Packets received - 3
    Packets dropped - 0
    Packets oversized - 0

Number of Bytes dropped at asic not collected

Capture buffer will exists till exported or cleared

Stopped capture point : 1

Edge-2#

show monitor capture 1 buffer brief


Starting the packet display ........ Press Ctrl + Shift + 6 to exit

    1   0.000000    10.47.4.2 -> 10.47.10.2   ICMP 106 Echo (ping) request  id=0x0048, seq=0/0, ttl=62
    2   0.984985    10.47.4.2 -> 10.47.10.2   ICMP 106 Echo (ping) request  id=0x0048, seq=1/256, ttl=6
    3   1.985357    10.47.4.2 -> 10.47.10.2   ICMP 106 Echo (ping) request  id=0x0048, seq=2/512, ttl=6
```

```
Edge-2#
```

**show monitor capture 1 buffer detailed**

```
Starting the packet display ........ Press Ctrl + Shift + 6 to exit

Frame 1: 106 bytes on wire (848 bits), 106 bytes captured (848 bits) on interface /tmp/epc_ws/wif_to_ts
    Interface id: 0 (/tmp/epc_ws/wif_to_ts_pipe)
        Interface name: /tmp/epc_ws/wif_to_ts_pipe
    Encapsulation type: Ethernet (1)
    Arrival Time: Oct 11, 2023 17:22:20.730331000 UTC
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1697044940.730331000 seconds
    [Time delta from previous captured frame: 0.000000000 seconds]
    [Time delta from previous displayed frame: 0.000000000 seconds]
    [Time since reference or first frame: 0.000000000 seconds]
    Frame Number: 1
    Frame Length: 106 bytes (848 bits)
    Capture Length: 106 bytes (848 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:cmd:ethertype:ip:icmp:data]
Ethernet II, Src:
```

**00:00:00:00:61:00**

```
 (00:00:00:00:61:00), Dst:
```

**ff:ff:ff:ff:ff:ff**

```
 (ff:ff:ff:ff:ff:ff)
```

**<-- Dummy Ethernet header, EPC does not capture it properly**

```
    Destination: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)
        Address: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)
        .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory d
        .... ...1 .... .... .... .... = IG bit: Group address (multicast/broadcast)
    Source: 00:00:00:00:61:00 (00:00:00:00:61:00)
        Address: 00:00:00:00:61:00 (00:00:00:00:61:00)
        .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Type: CiscoMetaData (0x8909)
Cisco MetaData
    Version: 1
    Length: 1
    Options: 0x0001
    SGT: 0
    Type: IPv4 (0x0800)
Internet Protocol Version 4, Src:
```

**10.47.4.2**

```
, Dst:
```

**10.47.10.2 <-- True IP addresses**

```
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
        0000 00.. = Differentiated Services Codepoint: Default (0)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 84
    Identification: 0x35e4 (13796)
```

```
    Flags: 0x4000, Don't fragment
        0... .... .... .... = Reserved bit: Not set
        .1.. .... .... .... = Don't fragment: Set
        ..0. .... .... .... = More fragments: Not set
    Fragment offset: 0
    Time to live: 62
    Protocol: ICMP (1)
    Header checksum: 0xe463 [validation disabled]
    [Header checksum status: Unverified]
    Source: 10.47.4.2
    Destination: 10.47.10.2
Internet Control Message Protocol
    Type: 8 (Echo (ping) request)
    Code: 0
    Checksum: 0x2693 [correct]
    [Checksum Status: Good]
    Identifier (BE): 72 (0x0048)
    Identifier (LE): 18432 (0x4800)
    Sequence number (BE): 0 (0x0000)
    Sequence number (LE): 0 (0x0000)
    Data (56 bytes)

0000  69 9c 67 88 00 00 00 00 00 00 00 00 00 00 00 00   i.g.............
0010  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
0020  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
0030  00 00 00 00 00 00 00 00                           ........
        Data: 699c67880000000000000000000000000000000000000000b^@&
        [Length: 56]
```

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