排除SDA轉發東 — 西流量故障

目錄

簡介

本文說明如何驗證作為軟體定義訪問(SDA)一部分的East-West Traffic Flow。

必要條件

需求

思科建議您瞭解以下主題：

- 網際網路通訊協定(IP)轉送
- Locator/ID Separation Protocol(LISP)

採用元件

本文中的資訊係根據以下軟體和硬體版本：

- Cisco IOS® XE 17.10.1上的C9000v
- SDA 1.0（非LISP PubSub）

本文中的資訊是根據特定實驗室環境內的裝置所建立。文中使用到的所有裝置皆從已清除（預設）的組態來啟動。如果您的網路運作中，請確保您瞭解任何指令可能造成的影響。

相關產品

本文件也適用於以下硬體和軟體版本：

- C9200
- C9300
- C9400
- C9500
- C9600
- Cisco IOS® XE 16.12及更高版本

背景資訊

SDA東 — 西流量流指的是SDA交換矩陣內的一個端點希望與同一交換矩陣內的另一個端點通訊的概念。關於什麼是東向西流、什麼又不認為是東西向流，有一些警告。東 — 西流量可以是以下示例：

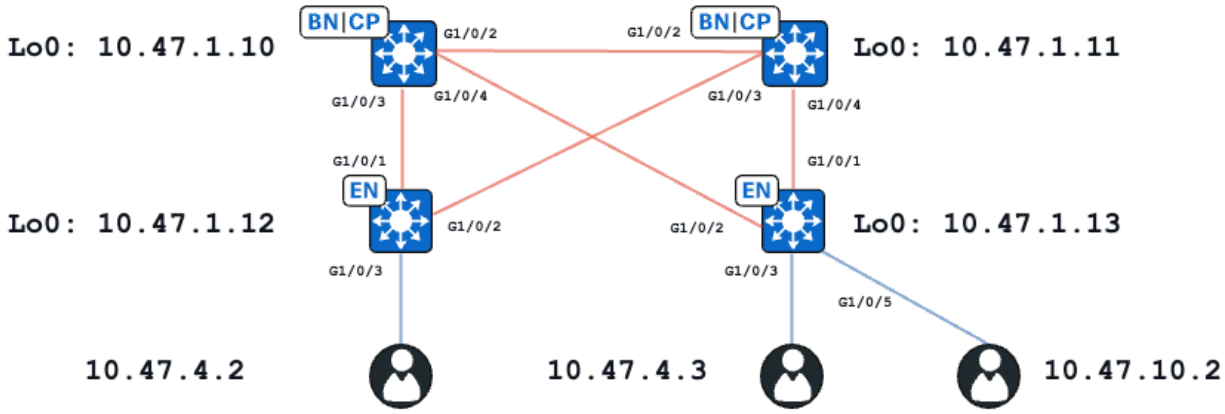
- 位於同一子網（172.17.10.2與172.19.10.3通訊）中的終端被視為L2LISP擴展
- 位於同一VRF(VN)中的端點（172.19.10.2與172.19.11.2通話且兩者均位於VRF園區中）這被視為L3 LISP
- 交換矩陣內的終端與連線到L2切換邊界的主機進行通訊，與L2LISP完全相同

東 — 西流量不引用以下示例：

- 從SDA交換矩陣發往交換矩陣外部的流量，即南北流量
- VRF間路由也不視為東 — 西（VRF園區中的端點，IP地址172.19.10.2與VRF訪客中的端點通話，IP地址172.19.11.2）
- SD-WAN整合域
- SDA傳輸
- 邊界關聯
- Extranet

注意：平台(fed)命令可能有所不同。命令可以是「show platform fed <active|standby>」和「show platform fed switch <active|standby>」。如果示例中註明的語法未解析出，請嘗試變體。

拓撲



在本示例中，C9000v交換機用作交換矩陣邊緣和並置邊界。所有終端都位於同一個虛擬網路(VN)中，即red_vn。10.47.4.2和10.47.4.2上的端點位於同一子網中，10.47.10.2上的端點位於不同子網中，但使用相同的VN。

組態

假設使用CIsco DNA-Center來預配SDA交換矩陣，預設設定如下：

- 已啟用第2層擴展（這將強制根據MAC地址查詢而不是IP地址查詢來轉發流量）。
- 第2層泛洪被禁用（這樣會在邊緣裝置上啟用ARP抑制並輔助LISP進行ARP學習）。

在正確的主機登入過程之後，介面配置包含幾個部分：

交換矩陣邊緣(10.47.1.12)介面配置：

```
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
```

交換矩陣邊緣(10.47.1.12)LISP配置：

```
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
```

交換矩陣邊緣(10.47.1.13)介面配置：

```
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
```

交換矩陣邊緣(10.47.1.13)LISP配置

```
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
```

主機加入驗證

作為主機自註冊過程的一部分，將建立以下幾種結構：

IPDT/IP裝置追蹤專案

主機載入成功後，IP裝置追蹤(IPDT)表中存在有效專案，且終端主機標籤為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
```

MAC/ARP條目

當終端主機成功登入時，它可以ping通預設網關（或者，如果在阻止此通訊的終端上沒有安裝防火牆，則可以從預設網關ping通）：

<#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
```

在邊緣節點上，有一個MAC地址，以及表中相應的ARP條目（在VRF中）：

<#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
```

軟體FED MAC地址程式設計**

要檢查FED中的MAC地址，請使用show platform software fed switch active matm macTable vlan <vlan id> mac <mac address>命令

<#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
```

MAC地址macHandle程式設計

從上一個命令(0x7f65ec7bda68)獲取macHandle值，並用於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
============================================================
```

MVID驗證

上一個輸出中的數字7是硬體中的對映VLAN ID(MVID)。若要確認它們是否與「真實」vlan相符，請使用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
```

全域連線埠號碼(GPN)驗證

要將GPN與「真實」介面相關聯，請使用命令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

MAC Address siHandle Programming

從上一個命令(0x7f65ec7c21f8)獲取siHandle值，並在show platform hardware fed switch active fwd-asic abstraction print-resource-handle <si_handle> 1中使用

<#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

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

MAC位址重寫 — 索引驗證

從上一個命令(0x25)獲取RI值，並在show platform hardware fed switch active fwd-asic resource asic all rewrite-index range <RI> <RI>中使用

<#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
```

MAC Address Destination-Index驗證

從上一個命令(0x526e)獲取DI值，並在show platform hardware fed switch active fwd-asic resource asic all destination-index range <DI> <DI>中使用

<#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
```

連線埠驗證

要關聯先前看到的埠，請使用show platform software fed switch active ifm mappings命令並檢視Port列。

<#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

硬體饋送的MAC地址驗證

工作/理想情況下的此輸出與macHandle解碼器提供的輸出匹配。

<#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

- 硬體中的VLAN ID(MVID)為7
- MAC地址：5254.0019.93e9
- GPN:3

LISP條目

主機登入成功後，終端主機的LISP條目在邊緣節點本地建立，並在控制節點上註冊（LISP MSMR -

LISP對映伺服器/對映解析器）。對於可以為L2和L3檢查的特定例項ID範圍，需要進行所有LISP檢查：

<#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

L2 LISP資料庫驗證

要檢查L2 LISP資料庫，請使用命令show lisp instance-id <L2 LISP ID> ethernet database <mac address>

<#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
```

LISP L2地址解析(AR)資料庫驗證

要檢查LISP L2 AR資料庫，請使用命令show lisp instance-id <LISP L2 IID> 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
```

LISP第3層資料庫驗證

要檢查LISP第3層資料庫，請使用命令show lisp instance-id <LISP L3 IID> ipv4資料庫<IP地址/子網掩碼>

<#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

CEF驗證

要檢查CEF，請使用命令show ip cef vrf <vrf name> <IP address> 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

除了SDA邊緣節點上的本地LISP條目外，SDA控制節點(LISP MS/MR)還包含有關終端的額外資訊：

並置邊界L2 LISP伺服器驗證：

要檢查L2 LISP伺服器，請使用命令show lisp instance-id <L2 LISP ID> ethernet server <MAC Address>

<#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)

並置邊界L2 LISP地址解析(AR)伺服器驗證：

要檢查L2 LISP AR伺服器，請使用命令show lisp instance-id <LISP L2 IID> ethernet server address-resolution <IP address>

要檢查註冊歷史記錄，請使用命令show lisp instance-id <LISP L2 IID> ethernet server address-resolution <IP address> 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
```

並置邊界L3 LISP伺服器驗證

要檢查L3 LISP伺服器，請使用命令show lisp instance-id <LISP L3 IID> ipv4 server <IP address>

要檢查L3 LISP伺服器註冊歷史記錄，請使用命令show lisp instance-id <LISP L3 IID> ipv4 server <IP address> 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
```

SDA中的ARP解析

假設已使用CIsco Catalyst Center來預配SDA交換矩陣（預設設定）。這表示已啟用第2層擴展，並且交換矩陣內（位於同一VLAN/VN中）的所有流量都會根據MAC位址查詢/LISP乙太網路執行個體進行轉送，而不是IP位址查詢/LISP IP執行個體進行轉送。

從故障排除的角度來看，在兩台主機上配置靜態ARP條目以快速檢查問題是否與交換矩陣中的通用連線有關（在這種情況下，ping在主機之間不起作用）或僅與ARP解析有關，可能會非常有用。

SDA交換矩陣中的ARP過程利用LISP來解析主機的識別和位置，與傳統路由/交換環境中的ARP行為不同。

第1步：交換矩陣終端傳送ARP請求以確定其他交換矩陣終端的MAC/IP繫結

可在輸入介面上設定封包擷取，以確認是否已從主機收到ARP封包：

```
<#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

步驟 2.邊緣節點使用ARP資料包並生成LISP請求以確定HOST-02的MAC地址。

Edge-1向LISP控制平面（並置邊界）傳送解析MAC地址10.47.4.3的LISP對映請求：

<#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'.
```

步驟 3.控制節點接收用於IP/MAC對映的LISP請求，並將響應傳送回SDA邊緣節點

從Fabric Edge接收LISP對映請求，並使用與10.47.4.3關聯的MAC地址的LISP對映回覆進行響應

<#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.
```

LISP控制平面根據儲存在本地資料庫中的地址解析條目使用代理回覆進行響應

<#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
```

步驟 4.邊緣節點收到MAC地址為10.47.4.3的LISP應答

LISP代理回覆由交換矩陣邊緣節點接收：

```
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.
```

步驟 5.邊緣節點傳送LISP對映請求資料包來確定MAC地址的RLOC位置

成功完成前三個步驟後，邊緣節點知道最初為其生成ARP的MAC地址10.47.4.3。啟用第2層擴展後，邊緣節點不會用此資訊回復到10.47.4.2，而是使用它來確定出口節點邊緣的RLOC位置，以便像在傳統第2層網路中那樣將ARP轉發到10.47.4.3。

因此，邊緣節點在乙太網例項中又生成一個LISP對映請求資料包，這次請求10.47.4.2的MAC地址的RLOC資訊：

```
<#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
```

第6步：控制節點接收LISP對映請求資料包，以確定MAC地址的RLOC位置

控制節點接收LISP資料包，並根據其本地資料庫狀態回覆該資料包

```
<#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
```

第7步：邊緣節點接收LISP對映回覆

邊緣節點接收由控制節點生成的LISP對映應答：

<#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
```

這最終在LISP乙太網例項對映快取中建立一個條目，並允許將ARP資料包轉發到連線10.47.4.3的Edge-2

<#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)
```

步驟 8.ARP封裝在VXLAN中，並傳送到HOST-02

所有LISP相關步驟都需要確定10.47.4.3的位置，以便邊緣節點可以將原始ARP（廣播）資料包作為單播傳送到正確的邊緣節點。 邊緣節點CPU快取原始ARP請求（不丟棄），直到完成所有步驟，即使從10.47.4.2傳送單個ARP資料包，也能正確解析ARP。

ARP封包封裝在VXLAN中，如範例所示：

<#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
```

ARP請求已封裝在VXLAN中，並從廣播ARP請求轉換為單播ARP請求。

<#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
```

步驟 9.ARP應答由10.47.4.3生成，並傳送到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
```

此時，資料包的目的地不是廣播地址（作為原始ARP請求），而是10.47.4.2的MAC地址，當它到達入口邊緣節點(Edge-2)時，會觸發正常的LISP操作。最初，邊緣節點的LISP乙太網例項中缺少MAC地址10.47.4.2，資料包被傳送到CPU以生成LISP對映請求，從而確定HOST-01的RLOC。此行為與本文檔其他部分所述完全相同，並且允許為Edge-2上的10.47.4.2建立LISP對映快取條目：

<#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)
```

該條目允許在VXLAN封裝中將ARP應答成功傳送到Edge-1，並進一步轉發到10.47.4.2競爭整個ARP解析過程。

SDA交換矩陣中的基本主機可達性（相同VLAN/相同VN）

假設ARP解析成功完成，並且兩個主機10.47.4.2和10.47.4.3彼此具有適當的ARP條目。

從故障排除的角度來看，在兩台主機上配置靜態ARP條目非常有用，可以快速檢查問題是否與交換矩陣中的通用連線有關（在這種情況下，主機之間的ping不起作用），還是僅與ARP過程有關。

10.47.4.2向10.47.4.3產生ICMP請求：

<#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]
```

向10.47.4.3傳送的ICMP資料包將傳送到定位器欄位10.47.1.13(Edge-2)中指定的邊緣節點，可以通過嵌入式資料包捕獲進行捕獲。

在啟用L2擴展的VLAN中收到資料包後，將在LISP乙太網例項中完成查詢：

<#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)
```

檢查遠端終端的MAC地址，它指向L2LI0，這是預期的

<#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
```

檢查FED中的MAC地址，可以收集其他資訊

<#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
```

MAC地址macHandle解碼

從前面的命令獲取macHandle(0x7f65ecfdd3a8)，然後在show platform hardware fed switch active fwd-asic abstraction print-resource-handle <macHandle> 1命令中使用

<#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


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

MAC地址siHandle解碼

從上一個命令獲取siHandle(0x7f65ecfdd1f8)，並在命令show platform hardware fed switch active fwd-asic abstraction print-resource-handle <siHandle> 1中使用

<#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

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

重寫索引解碼

採用RI(0x12)並在命令show platform hardware fed switch active fwd-asic resource asic all rewrite-index range <RI> <RI>中使用

<#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)
```

Destination-Index Decode

採用DI(0x5012)並在命令show platform hardware fed switch active fwd-asic resource asic all destination-index range <DI> <DI>中使用

<#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
```

siHandle解碼

採用siHandle(0x7f65ecfdd048)並在命令show platform hardware fed switch active fwd-asic abstraction print-resource-handle <siHandle> 1中使用

<#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)

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

底層路由驗證

流量使用10.47.1.12封裝在IID 8190的VXLAN中，能夠對Gig1/0/1和G1/0/2進行負載均衡

<#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
```

要獲取si_hdl、ri_hdl資訊，請使用命令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
```

Underlay Next-Hop si_hdl解碼

檢查si_hdl(0x7f65ec8a5458)，在show platform hardware fed switch active fwd-asic abstraction print-resource-handle <si_hdl> 1命令中使用

<#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 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

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

底層下一躍點重寫索引解碼

要解碼RI(0x1a)，請使用show platform hardware fed 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

L3IF LE Index 38
```

底層下一躍點目的地索引解碼

解碼show platform hardware fed switch active fwd-asic resource asic all destination-index range <DI> <DI>中使用的DI(0x526d)

<#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
```

底層下一跳ri_hdl解碼

要解碼show platform hardware fed switch active fwd-asic abstraction print-resource-handle(ri_hdl)1中使用的ri_hdl(0x7f65ec8a4eb8)

<#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

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

SDA交換矩陣中的基本主機可達性（不同VLAN/相同VN）

在本節中，將檢查10.47.4.2和10.47.10.2之間的通訊。由於這些主機屬於不同的VLAN，因此兩台主機都需要配置指向預設網關的預設網關。10.47.4.2是10.47.4.1,10.47.10.2是10.47.10.1。

步驟 1.確認終端和預設網關之間的連線工作正常：

<#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
```

步驟 2.確認Edge-1成功收到來自10.47.4.2的資料包：

可在面向10.47.4.2的輸入介面上捕獲資料包：

<#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]
```

第3步 — LISP查詢

入口邊緣節點必須確定將資料包傳送到的HOST-03的位置(RLOC)。在此例中，終端主機HOST-03位於不同的VLAN中（但具有相同的VN/VRF: USERS），LISP IPv4例項用於基於IP地址的查詢（MAC地址屬於邊緣節點本身）。

```
<#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對映請求到達控制節點（LISP對映伺服器）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對映回復到達邊緣節點：

```
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.
```

交換矩陣邊緣將查詢RLOC的10.47.10.2並處理對映應答

```
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.
```

如果條目不存在，則需要從LISP進程的角度收集調試。還有一種稱為LIG（LISP群組）的工具，可用於手動觸發LISP進程（這是測試冗餘控制節點配置以及兩個控制節點之間的資料庫一致性的非常有效的方法）：

<#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        -
```

路由驗證

CEF使用LISP，而LISP使用其已接收的對映快取條目

<#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)
```

LISP下一躍點驗證

由於此資料包是VXLAN封裝的，因此需要對LISP下一跳進行驗證。使用命令show platform software fed switch active ip adj 獲取有關10.47.1.13（LISP下一跳）的其他資訊

<#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下一跳si_hdl解碼

採用si_hdl(0x7f65ed00f668)並用於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

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

LISP下一跳RI解碼

採用RI(0x2c)並用於show platform hardware fed 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下一跳DI解碼

採用DI(0x5012)並在show platform hardware fed switch active fwd-asic resource asic all destination-index range <DI> <DI>中使用

<#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下一跳ri_hdl解碼

採用ri_hdl(0x7f65ed00fd58)並在命令show platform hardware fed switch active fwd-asic abstraction print-resource-handle <ri_hdl> 1中使用

<#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

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

底層下一躍點驗證

要到達LISP下一跳，底層中有兩個可能的路徑，一個路徑進行驗證，另一個底層下一跳的驗證應用相同的邏輯。

<#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
```

要獲取有關下一跳的詳細資訊，請使用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>
```

Underlay Next-Hop si_hdl解碼

採用si_hdl(0x7f65ec8a5458)並在命令show platform hardware fed switch active fwd-asic abstraction print-resource-handle <si_hdl> 1中使用

<#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

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

底層下一躍點RI解碼

採用RI(0x1a)並在命令show platform hardware fed switch active fwd-asic resource asic all rewrite-index range <RI> <RI>中使用

<#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
```

底層下一跳DI解碼

採用DI(0x526d)並在命令show platform hardware fed switch active fwd-asic resource asic all destination-index range <DI> <DI>中使用

<#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
```

底層下一跳ri_hdl解碼

採用ri_hdl(0x7f65ec8b8158)並在命令show platform hardware fed switch active fwd-asic abstraction print-resource-handle <ri_hdl> 1中使用

<#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


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

封包會封裝在VXLAN中，並根據負載平衡規則傳送。嵌入式資料包捕獲(EPC)可用於同時捕獲所有介面上的流量。請記住，此時資料包是VXLAN封裝的，EPC過濾器必須針對RLOC到RLOC，而不是內部IPv4地址。

<#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]
```

封裝的VXLAN封包抵達邊緣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將VXLAN標頭解除封裝，並查詢其ARP表，將ICMP請求轉發到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>
```

端點si_hdl解碼

採用si_hdl(0x7f5744f8988)並用於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

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

終端RI解碼

採用RI(0x2c)並在命令show platform hardware fed switch active fwd-asic resource asic all rewrite-index range <RI> <RI>中使用

<#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
```

終端DI解碼

採用DI(0x526e)並用於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將封包解除封裝，並將其傳送到HOST-03所連線的輸出介面：

<#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]
```

關於此翻譯

思科已使用電腦和人工技術翻譯本文件，讓全世界的使用者能夠以自己的語言理解支援內容。請注意，即使是最佳機器翻譯，也不如專業譯者翻譯的內容準確。Cisco Systems, Inc. 對這些翻譯的準確度概不負責，並建議一律查看原始英文文件（提供連結）。