

SDAフォワーディングのEast-Westトラフィックフローのトラブルシューティング

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概要

このドキュメントでは、ソフトウェア定義アクセス(SDA)の一部としてEast-Westトラフィックフローを検証する方法について説明します。

前提条件

要件

次の項目に関する知識があることが推奨されます。

- インターネットプロトコル(IP)転送
- Locator/ID Separation Protocol(LISP)

使用するコンポーネント

このドキュメントの情報は、次のソフトウェアとハードウェアのバージョンに基づいています。

- Cisco IOS® XE 17.10.1上のC9000v
- SDA 1.0 (LISP PubSub以外)

このドキュメントの情報は、特定のラボ環境にあるデバイスに基づいて作成されました。このドキュメントで使用するすべてのデバイスは、クリアな（デフォルト）設定で作業を開始しています。本稼働中のネットワークでは、各コマンドによって起こる可能性がある影響を十分確認してください。

関連製品

このドキュメントは、次のバージョンのハードウェアとソフトウェアにも使用できます。

- C9200
- C9300
- C9400
- C9500
- C9600
- Cisco IOS® XE 16.12以降

背景説明

SDAのEast-Westトラフィックフローは、SDAファブリック内のエンドポイントが同じファブリック内の別のエンドポイントと通信することを目的とする概念です。東西の流れと見なされるものと見なされないものに関しては注意が必要です。次に、東西のトラフィックフローの例を示します。

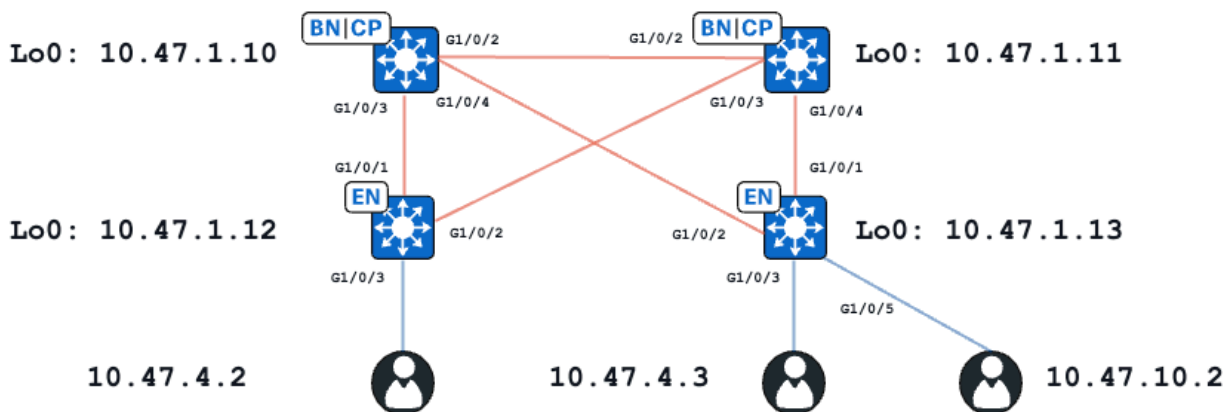
- 同じサブネット内のエンドポイント（172.17.10.2から172.19.10.3へ通信）は、L2LISP拡張と見なされます
- 同じVRF(VN)内にあるエンドポイント（172.19.10.2が172.19.11.2と通信し、両方がVRFキャンパス内にある）は、L3 LISPと見なされます。
- ファブリック内のエンドポイントがL2ハンドオフ境界に接続されているホストと通信する（L2LISPとまったく同じ）

East-Westトラフィックフローは、次の例を参照しません。

- SDAファブリックからファブリックの外部(North-South)へのトラフィック
- VRF間ルーティングもEast-West（VRFキャンパス内のエンドポイント、IPアドレス172.19.10.2がVRFゲスト内のエンドポイント、IPアドレス172.19.11.2と通信）とは見なされません。
- SD-WAN統合ドメイン
- SDAトランジット
- 境界のアフィニティ
- エクストラネット

 注：プラットフォーム(fed)コマンドは異なる場合があります。コマンドは、「show platform fed <active|standby>」と「show platform fed switch <active|standby>」です。例に示されている構文が解析されない場合は、バリエーションを試してください。

トポロジ



この例では、C9000vスイッチはファブリックエッジおよびコロケート境界として機能します。すべてのエンドポイントは、同じ仮想ネットワーク(VN)、red_vn内にあります。10.47.4.2と10.47.4.2のエンドポイントは同じサブネットにあり、10.47.10.2のエンドポイントは異なるサブネットにありますが、同じVNにあります。

コンフィギュレーション

SDAファブリックをデフォルト設定でプロビジョニングするために、Cisco DNA-Centerが使用されることを前提としています。

- レイヤ2拡張が有効になっている (これにより、IPアドレスルックアップではなくMACアドレスルックアップに基づいてトラフィックが強制的に転送される)。
- レイヤ2フラッディングがディセーブルになっている (これにより、エッジデバイスでのARP抑制とLISPが支援するARPラーニングがイネーブルになる)。

適切なホストオンボーディングプロセスの後、インターフェイス設定にはいくつかのセクションがあります。

ファブリックエッジ(10.47.1.12)インターフェイス設定：

```
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
```

ファブリックエッジ(10.47.1.12)のLISP設定 :

```
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
```

ファブリックエッジ(10.47.1.13)インターフェイスの設定 :

```

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

```

ファブリックエッジ(10.47.1.13)LISPの設定

```

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

```

ホストオンボーディングの検証

ホストのオンボーディングプロセスの一環として、いくつかの構造が作成されます。

IPDT/IPデバイストラッキングエントリ

ホストのオンボーディングが成功すると、IPデバイストラッキング(IPDT)テーブルに有効なエントリが存在し、エンドホストが到達可能としてマークされます。

```
<#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, DHCP - IPv4 DHCP
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
```

MAC/ARPエントリ

エンドホストが正常にオンボーディングされると、デフォルトゲートウェイにpingできます（または、この通信をブロックしているエンドポイントにファイアウォールがインストールされていない場合は、デフォルトゲートウェイからpingできます）。

```
<#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
```

エッジノードでは、MACアドレスと対応するARPエントリがテーブル（VRF内）に存在します。

```
<#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
```

ソフトウェアFED MACアドレスプログラミング**

FEDのMACアドレスを確認するには、コマンドshow platform software fed switch active matm macTable vlan <vlan id> mac <mac address>を使用します。

<#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アドレスmacHandleプログラミング****

前のコマンド(0x7f65ec7bda68)のmacHandle値を取得し、show platform hardware fed switch active fwd-asic abstraction print-resource-handle <macHandle> 1で使します。

<#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)

****グローバルポート番号(GPN)の確認****

GPNを「実際の」インターフェイスに関連付けるには、show platform software fed switch active ifm mappings gpnコマンドを使用します

```
<#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アドレスのsiHandleプログラミング****

前のコマンド(0x7f65ec7c21f8)のsiHandle値を取得し、show platform hardware fed switch active fwd-asic abstraction print-resource-handle <si_handle> 1

```
<#root>
```

```
Edge-1#
```

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

```
Handle:0x7f65ec7c21f8 Res-Type:ASIC_RSC_SI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_L3_UNICAST
priv_ri/priv_si Handle: 0x7f65ec7c2498Hardware Indices/Handles: index0:0xc3 mtu_index/13u_ri_index0:0xc3
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 00 00
```

```
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アドレス書き換えインデックスの検証****

前のコマンドのRI値(0x25)を取得し、show platform hardware fed switch active fwd-asic resource asic all rewrite-index range <RI> <RI>で使します

```
<#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アドレス宛先インデックスの検証****

前のコマンド(0x526e)のDI値を取得し、show platform hardware fed switch active fwd-asic resource asic all destination-index range <DI> <DI>で使します

<#root>

Edge-1#

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

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
```

ポートの検証

以前に確認したポートを関連付けるには、`commandshow platform software fed switch active ifm mappings`コマンドを使用し、Port列を確認します。

```
<#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
```

ハードウェアFED MACアドレスの検証

正常に動作している/理想的なシナリオのこの出力は、`macHandle`のデコードで提供される出力と一致します。

```
<#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
```

- ハードウェア(MVID)のVLAN IDは7です
- MACアドレス : 5254.0019.93e9
- GPN:3

LISPエントリ

ホストのオンボーディングが成功すると、エンドホストのLISPエントリがエッジノードにローカルに作成され、コントロールノード (LISP MSMR - LISPマップサーバ/マップリゾルバ) に登録されます。L2とL3に対してチェックできる特定のインスタンスIDスコープに関して、すべてのLISPチェックを実行する必要があります。

```
<#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データベースの検証

L2 LISPデータベースを確認するには、コマンドshow lisp instance-id <L2 LISP ID> ethernet database <mac address>を使用します。

```
<#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アドレス解決(AR)データベースの検証

LISP L2 ARデータベースを確認するには、コマンドshow lisp instance-id <LISP L2 IID> ethernet database address-resolution <mac address>を使用します。

```
<#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 L3データベースの検証

LISP L3データベースを確認するには、コマンドshow lisp instance-id <LISP L3 IID> ipv4 database <IPアドレス/サブネットマスク>

```
<#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の検証****

CEFを確認するには、show ip cef vrf <vrf name> <IP address> internalコマンドを使用します

<#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
```

SDAエッジノードのローカルLISPエントリに加えて、SDAコントロールノード(LISP MS/MR)にはエンドポイントに関する追加情報も含まれています。

コロケートされた境界L2 LISPサーバの検証：

L2 LISPサーバを確認するには、コマンドshow lisp instance-id <L2 LISP ID> ethernet server <MAC Address>を使用します。

```
<#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)

コロケートされた境界L2 LISPアドレス解決(AR)サーバの検証：

L2 LISP ARサーバを確認するには、コマンドshow lisp instance-id <LISP L2 IID> ethernet server address-resolution <IP address>を使用します。

登録履歴を確認するには、コマンド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
*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

コロケートされたBorder L3 LISPサーバの検証

L3 LISPサーバを確認するには、コマンドshow lisp instance-id <LISP L3 IID> ipv4 server <IP address>を使用します。

L3 LISPサーバの登録履歴を確認するには、コマンドshow lisp instance-id <LISP L3 IID> ipv4 server <IPアドレス> 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でのARP解決

SDAファブリックをデフォルト設定でプロビジョニングするためにCisco Catalyst Centerが使用されていることを前提としています。つまり、レイヤ2拡張が有効であり、ファブリック内のすべてのトラフィック (同じVLAN/VN) が、IPアドレスのルックアップやLISP IPインスタンスでは

なく、MACアドレスのルックアップやLISPイーサネットインスタンスに基づいて転送されます。

トラブルシューティングの観点からは、両方のホストでスタティックARPエントリを設定すると、問題がファブリック内の汎用的な接続にあるのか（このような場合は、ホスト間でpingが機能しない）、またはARP解決だけにあるのかを迅速に確認するのに役立ちます。

SDA FabricのARPプロセスは、LISPを利用してホストのIDと場所を解決します。これは、従来のルーティング/スイッチング環境におけるARPの動作とは異なります。

ステップ1：ファブリックエンドポイントがARP要求を送信して、他のファブリックエンドポイントのMAC/IPバインディングを決定します

入インターフェイスでパケットキャプチャを設定して、ホストからARPパケットが受信されたことを確認できます。

```
<#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 exist 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: 00000000000000000000000000000000
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

```

ステップ 2 : エッジノードはARPパケットを消費し、LISP要求を生成してHOST-02のMACアドレスを決定します。

Edge-1は、MACアドレス10.47.4.3を解決するためにLISPマップ要求をLISPコントロールプレーン (コロケート境界) に送信します。

```
<#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'.
```

ステップ 3 : コントロールノードがIP/MACマッピングのLISP要求を受信し、応答をSDAエッジノードに返す

LISPマップ要求がファブリックエッジから受信され、10.47.4.3に結び付けられたMACアドレスでLISPマップ応答で応答する

```
<#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コントロールプレーンは、ローカルデータベースに保存されているアドレス解決エントリに基づいて、プロキシ応答で応答します

```
<#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

ステップ 4 : エッジノードがMACアドレス10.47.4.3のLISP応答を受信

ファブリックエッジノードがLISPプロキシ応答を受信します。

```
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.
```

ステップ 5 : エッジノードがMACアドレスのRLOCの場所を決定するためにLISPマップ要求パケットを送信

最初の3つの手順が正常に完了すると、エッジノードはARPが最初に生成されたMACアドレス10.47.4.3を認識します。レイヤ2拡張が有効な場合、エッジノードはこの情報を10.47.4.2に返信せず、代わりにこの情報を使用して出力ノードエッジのRLOCロケーションを決定します。これにより、従来のレイヤ2ネットワークと同様に、10.47.4.3に向けてARPを転送できます。

このため、エッジノードはイーサネットインスタンスでさらに別のLISPマップ要求パケットを生成し、今度は10.47.4.2のMACアドレスのRLOC情報を要求します。

<#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
```

ステップ6：コントロールノードがLISPマップ要求パケットを受信し、MACアドレスのRLOCの場所を決定します。

コントロールノードはLISPパケットを受信し、ローカルデータベースの状態に基づいて応答します

```
<#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
```

ステップ7：エッジノードがLISPマップ応答を受信する

制御ノードによって生成されたLISPマップ応答がエッジノードによって受信されました：

```
<#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
```

これにより、LISPイーサネットインスタンスのマップキャッシュにエントリが作成され、10.47.4.3が接続されているEdge-2にARPパケットを転送できるようになります

```
<#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)
```

ステップ 8 : ARPはVXLANでカプセル化され、HOST-02に送信されます。

エッジノードが元のARP (ブロードキャスト) パケットをユニキャストとして適切なエッジノードに送信できるように、10.47.4.3が存在する場所を特定するには、LISP関連のすべての手順が必要でした。元のARP要求は、すべての手順が完了するまでエッジノードCPUによってキャッシュ (廃棄されません) されるため、10.47.4.2から1つのARPパケットが送信された場合でも適切にARP解決できます。

ARPパケットは、次の例に示すようにVXLANにカプセル化されます。

```
<#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要求はVXLANにカプセル化され、ブロードキャストARP要求からユニキャストARP要求に変換されます。

```
<#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: 00000000000000000000000000000000
```

```
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
```

ステップ 9 : ARP 応答は 10.47.4.3 によって生成され、10.47.4.2 に向けて送信されます。

```
<#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
```

この時点で、パケットはブロードキャストアドレス (元のARP要求として) ではなく、10.47.4.2のMACアドレスを宛先としており、入力エッジノード(Edge-2)に到達すると、通常のLISP動作がトリガーされます。最初に、エッジノードのLISPイーサネットインスタンスに10.47.4.2のMACアドレスが不足しています。パケットはCPUにパントされ、HOST-01のRLOCを決定するLISPマップ要求が生成されます。この動作は、このドキュメントの他のセクションで説明されているものとまったく同じで、Edge-2で10.47.4.2のLISPマップキャッシュエントリを作成できます。

<#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)
```

このエントリにより、VXLANカプセル化でARP応答がEdge-1に正常に送信され、競合するARP解決プロセス全体の10.47.4.2にさらに転送されます。

SDAファブリックでの基本的なホスト到達可能性 (同じVLAN/同じVN)

ARP解決が正常に完了し、ホスト10.47.4.2と10.47.4.3の両方が互いに適切なARPエントリを持っていると仮定します。

トラブルシューティングの観点からは、両方のホストでスタティックARPエントリを設定すると、ファブリック内の汎用的な接続に問題があるか (このような場合は、ホスト間でpingが機能しない)、またはARPプロセスでのみ問題が発生するかどうかを迅速に確認できるので非常に便利です。

10.47.4.2は10.47.4.3へのICMP要求を生成します。

<#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

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)
```

リモートエンドポイントのMACアドレスを確認し、予期されるL2LI0をポイントします

<#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
```

FEDのMACアドレスを確認すると、追加情報を収集できます

<#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アドレスmacHandleのデコード

前のコマンドのmacHandle(0x7f65ecfdd3a8)を取得し、コマンドshow platform hardware fed switch active fwd-asic abstraction print-resource-handle <macHandle> 1で使します。

<#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, learning
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
```


rewrite-index range <RI> <RI>で使⽤します。

<#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_PAYLOAD
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_PAYLOAD
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)
```

宛先インデックスのデコード

DI(0x5012)を取得し、コマンドshow platform hardware fed switch active fwd-asic resource asic all destination-index range <DI> <DI>で使⽤します

<#root>

Edge-1#

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

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デコード

siHandle(0x7f65ecfdd048)を取得し、コマンドshow platform hardware fed switch active fwd-asic abstraction print-resource-handle <siHandle> 1で使します。

<#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: 0x7f65ecfdd048 Hardware Indices/Handles: index0:0x12 mtu_index/13u_ri_index0:0x12

トラフィックは10.47.1.12を使用してIID 8190のVXLANにカプセル化され、Gig1/0/1およびG1/0/2からロードバランシングされる機能を備えています

<#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

si_hdl、ri_hdl情報を取得するには、show platform software fed switch active ip adjコマンドを使用します。

<#root>

Edge-1#

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

IPV4 Adj entries

dest	if_name	dst_mac	si_hdl	ri_hdl
225.0.0.0	GigabitEthernet1/0/1	0100.5e00.0000	0x7f65ec958128	0x7f65ec958128
10.47.1.10	LISPO.4100	4500.0000.0000	0x7f65ec895ed8	0x7f65ec895ed8
225.0.0.0	GigabitEthernet1/0/2	0100.5e00.0000	0x7f65ec958f68	0x7f65ec958f68
10.47.1.4	GigabitEthernet1/0/2	5254.001c.7de0	0x7f65ec8a5458	0x7f65ec8a5458
225.0.0.0	Null0	f800.0011.0000	0x7f65ec3740c8	0x7f65ec3740c8
10.47.1.0	GigabitEthernet1/0/1	5254.000a.42f3	0x7f65ec8b8468	0x7f65ec8b8468

アンダーレイのネクストホップsi_hdlデコード

si_hdl(0x7f65ec8a5458)を確認するには、show platform hardware fed switch active fwd-asic

abstraction print-resource-handle <si_hdl> 1

<#root>

Edge-1#

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

```
Handle:0x7f65ec8a5458 Res-Type:ASIC_RSC_SI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_L3_UNICAST
priv_ri/priv_si Handle: 0x7f65ec8a4eb8Hardware Indices/Handles: index0:0xbc mtu_index/13u_ri_index0:0x
Features sharing this resource:66 (1)
Cookie length: 56
00 00 00 00 00 00 00 00 26 00 00 00 00 00 00 00 00 00 00 08 00 52 54 00 1c 7d e0 00 00 00 00 00 00
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
```

=====

アンダーレイのネクストホップ書き換えインデックスデコード

RI(0x1a)をデコードするには、コマンドshow platform hardware fed switch active fwd-asic resource ASIC all rewrite-index range <RI> <RI>で使

<#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

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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

アンダーレイのネクストホップ宛先インデックスのデコード

DI(0x526d)をデコードするには、show platform hardware fed switch active fwd-asic resource asic all destination-index range <DI> <DI>を使用します。

<#root>

Edge-1#

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

ASIC#0:

Destination index = 0x526d

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

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								NIF	Y	
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

アンダーレイのネクストホップri_hdlデコード

ri_hdl(0x7f65ec8a4eb8)をデコードするには、show platform hardware fed switch active fwd-asic abstraction print-resource-handle(ri_hdl) 1

<#root>

Edge-1#

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

```
Handle:0x7f65ec8a4eb8 Res-Type:ASIC_RSC_RI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_L3_UNICAST
priv_ri/priv_si Handle: 0x7f65ec903b28Hardware Indices/Handles: index0:0x1a mtu_index/13u_ri_index0:0x
Features sharing this resource:66 (1)]
Cookie length: 56
00 00 00 00 00 00 00 00 26 00 00 00 00 00 00 00 00 00 00 08 00 52 54 00 1c 7d e0 00 00 00 00 00 00 00 00
```

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ファブリックでの基本的なホスト到達可能性 (異なる VLAN/同じVN)

このセクションでは、10.47.4.2と10.47.10.2の間の通信について説明します。これらのホストは異なるVLANに属しているため、両方ともデフォルトゲートウェイを指すデフォルトゲートウェイを設定する必要があります。10.47.4.2の場合は10.47.4.1、10.47.10.2の場合は10.47.10.1です。

ステップ 1 : エンドポイントとデフォルトゲートウェイ間の接続が機能していることを確認します。

```
<#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
```

ステップ 2 : 10.47.4.2からのパケットがEdge-1で正常に受信されたことを確認します。

パケットは、10.47.4.2に面する入カインターフェイスでキャプチャできます。

```
<#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 .....
0020 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: 2a46a8ee000000000000000000000000000000000000000000000000b^@&
      [Length: 56]

```

手順3:LISPルックアップ

入力エッジノードは、パケットの送信先であるHOST-03のロケーション(RLOC)を決定する必要があります。この場合と同様に、エンドホストHOST-03は異なるVLANに存在します(ただし、同じVN/VRF:USERS)。LISP IPv4インスタンスは、IPアドレス(MACアドレスがエッジノード自体に属している)に基づくルックアップとして使用されます。

```
<#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 prefix'
LISP[REMT ]-0: Map-Reply nonce matches pending request for IID 4099 EID 10.47.10.2/32, requester 'remote EID prefix'
```

LISPマップ要求がコントロールノード(LISPマップサーバ) Border-1に到達:

```
<#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 10.47.10.2:4342
LISP[MR ]-0 IID 4099 IPv4: MS EID 10.47.10.2/32: Sending proxy reply to 10.47.1.12.
```

LISPマップ応答がエッジノードに到達：

```
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.
```

ファブリックエッジが10.47.10.2のRLOCを照会し、マップ応答を処理します

```
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.
```

エントリが存在しない場合は、LISPプロセスの観点からデバッグを収集する必要があります。
LIG(LISP Grouper)というツールもあり、これを使用して手動でLISPプロセスを起動できます (これは、冗長な制御ノードの設定と両方の制御ノード間のデータベースの一貫性をテストする非常に効果的な方法です)。

<#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 msec
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 msec
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	-

ルートの検証

CEFはLISPを使用し、LISPは受信したマップキャッシュエントリを使用します

<#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ネクストホップの検証

このパケットはVXLANでカプセル化されるため、LISPネクストホップの確認が必要です。show platform software fed switch active ip adjコマンドを使用して、10.47.1.13 (LISPネクストホップ)に関する追加情報を取得します

<#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

RI(0x2c)を取得し、show platform hardware fed switch active fwd-asic resource asic all rewrite-index range <RI> <RI>で使します。

<#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_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 <-- 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_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 <-- RLOC of Edge-2
```

```
  IPv4 TTL:      0
```

```
  LISP INSTANCEID:  0
```

```
  L3IF LE Index:  46
```

LISPネクストホップDIデコード

DI(0x5012)を取得し、show platform hardware fed switch active fwd-asic resource asic all destination-index range <DI> <DI>で使します。

<#root>

Edge-1#

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

```
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
```


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

=====

アンダーレイのネクストホップの確認

LISPネクストホップに到達するには、アンダーレイに2つの可能なパスがあります。一方のアンダーレイに対して検証が行われ、もう一方のアンダーレイのネクストホップの検証にも同じロジックが適用されます。

<#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

ネクストホップの詳細を取得するには、show platform software fed switch active ip adjを使用します。

<#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>

アンダーレイのネクストホップsi_hdlデコード

si_hdl(0x7f65ec8a5458)を取得し、コマンドshow platform hardware fed switch active fwd-asic abstraction print-resource-handle <si_hdl> 1

<#root>

Edge-1#

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

Handle:0x7f65ec8a5458 Res-Type:ASIC_RSC_SI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_L3_UNICAST.
priv_ri/priv_si Handle: 0x7f65ec8a4eb8Hardware Indices/Handles: index0:0xbc mtu_index/13u_ri_index0:0x
Features sharing this resource:66 (1)]
Cookie length: 56
00 00 00 00 00 00 00 00 26 00 00 00 00 00 00 00 00 00 00 00 08 00 52 54 00 1c 7d e0 00 00 00 00 00 00 00 00

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

=====

アンダーレイのネクストホップRIデコード

RI(0x1a)を取得し、コマンドshow platform hardware fed switch active fwd-asic resource asic all rewrite-index range <RI> <RI>で使します。

<#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

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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

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アンダーレイのネクストホップDIデコード

DI(0x526d)を取得し、コマンドshow platform hardware fed switch active fwd-asic resource asic all destination-index range <DI> <DI>で使します。

<#root>

Edge-1#

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

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

アンダーレイのネクストホップri_hdlデコード

ri_hdl(0x7f65ec8b8158)を取得し、コマンドshow platform hardware fed switch active fwd-asic abstraction print-resource-handle <ri_hdl> 1

<#root>

Edge-1#

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

```
Handle:0x7f65ec8b8158 Res-Type:ASIC_RSC_RI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_L3_UNICAST
priv_ri/priv_si Handle: 0x7f65ec7a6338Hardware Indices/Handles: index0:0x1b mtu_index/13u_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 00 00
```

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
```

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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
```

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パケットはVXLANにカプセル化され、ロードバランシングルールに基づいて送信されます。

Embedded Packet Capture(EPC)を使用すると、すべてのインターフェイス上のトラフィックを同時にキャプチャできます。この時点で、パケットはVXLANカプセル化されています。EPCフィルタは、内部IPv4アドレスではなく、RLOCからRLOCに対して適用される必要があります。

```
<#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 exist 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=63  
 3  1.984077  10.47.4.2 -> 10.47.10.2  ICMP 148 Echo (ping) request  id=0x0046, seq=2/512, ttl=63  
 4  2.999989  10.47.4.2 -> 10.47.10.2  ICMP 148 Echo (ping) request  id=0x0046, seq=3/768, ttl=63
```

```
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)
```


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 default)

.... ..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 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: 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 default)
  .... ..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
```



```

,
<-- MAC Address 5254.0002.cb5 is 10.47.10.2

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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.cb5 is 10.47.10.2

L3IF LE Index 50

```

エンドポイントDIのデコード

DI(0x526e)を取得し、show platform hardware fed switch active fwd-asic resource asic all destination-index range <DI> <DI>で使します。

<#root>

Edge-2#

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

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はパケットのカプセル化を解除し、HOST-03が接続されている出インターフェイスにパケットを送信します。

```
<#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 default)
.... ..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

翻訳について

シスコは世界中のユーザにそれぞれの言語でサポート コンテンツを提供するために、機械と人による翻訳を組み合わせて、本ドキュメントを翻訳しています。ただし、最高度の機械翻訳であっても、専門家による翻訳のような正確性は確保されません。シスコは、これら翻訳の正確性について法的責任を負いません。原典である英語版（リンクからアクセス可能）もあわせて参照することを推奨します。