Dépannage de la résolution ARP dans le fabric SD-Access **En construction**

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Introduction

Ce document décrit comment dépanner le protocole ARP (Address Resolution Protocol) dans le fabric SD-Access.

Conditions préalables

Exigences

Cisco vous recommande de prendre connaissance des rubriques suivantes :

- Transmission IP (Internet Protocol)
- Protocole LISP (Locator/ID Separation Protocol)
- Protocole ARP (Address Resolution Protocol)

Composants utilisés

Les informations contenues dans ce document sont basées sur les versions de matériel et de logiciel suivantes :

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

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. Si votre réseau est en ligne, assurez-vous de bien comprendre l'incidence possible des commandes.

Ce document peut également être utilisé avec les versions de matériel et de logiciel suivantes :

- C9200
- C9300
- C9400
- C9500
- C9600
- Cisco IOS® XE 16.12 et versions ultérieures

Topologie
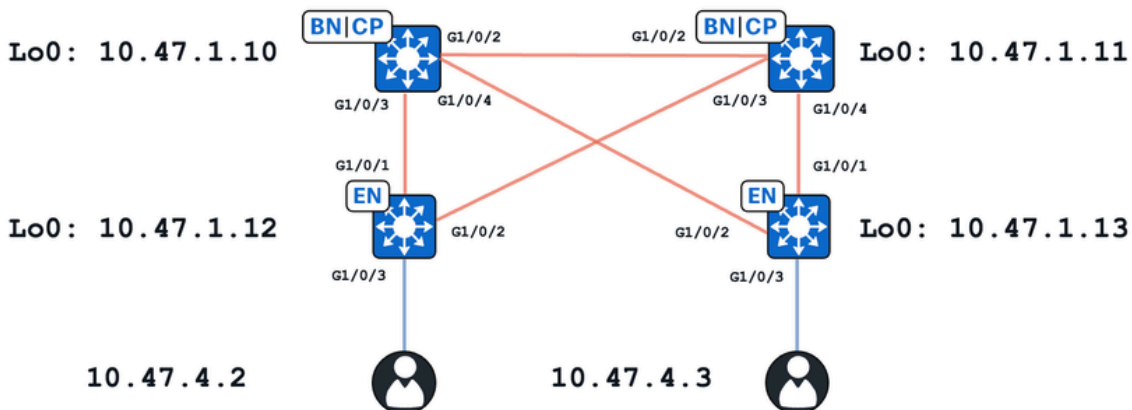
Dans cet exercice :

- 10.47.1.10 et 10.47.1.11 sont des frontières colocalisées
- 10.47.1.12 et 10.47.1.13 sont des noeuds de périphérie de fabric
- 10.47.4.2 et 10.47.4.3 sont des points de terminaison au sein du fabric SDA et se trouvent dans le même VLAN/sous-réseau et le même VLAN (red_vn)

Deux cas d'utilisation principaux sont présentés dans ce document :

- Résolution ARP entre 10.47.4.2 et 10.47.4.3 via un chemin de monodiffusion
- Résolution ARP entre 10.47.4.2 et 10.47.4.3 via un chemin d'inondation

État initial du chemin de monodiffusion

Dans SDA, il existe deux méthodes principales pour la résolution ARP dans le fabric. Ce que l'on appelle le chemin de monodiffusion indique qu'il n'y a pas de configuration de l'inondation ARP de couche 2 (L2) ou l'absence de « flood arp nd » configuré sous l'ID d'instance (IID) de couche 2 LISP qui correspond au VLAN en question. En plus de cette mise en garde, pour qualifier le chemin ARP de monodiffusion, il n'y a pas de configuration de « IP local proxy ARP » ou pas de présence d'un pool de couche 3 uniquement.

Si ces conditions sont remplies, poursuivez avec cette section de dépannage et il est supposé que les deux points d'extrémité (10.47.4.2 et 10.47.4.3) peuvent atteindre leurs passerelles par défaut respectives qui existent sur les commutateurs de périphérie de fabric qui existent en tant que 10.47.4.1

<#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 = 257/292/344 ms
```

<#root>

Edge-2#

ping vrf red_vn 10.47.4.3

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.47.4.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 221/321/566 ms
```

🔍 Conseil : il est recommandé d'envoyer une requête ping à la passerelle par défaut à partir de l'hôte d'extrémité vers le commutateur de périphérie, et non l'inverse, afin d'éviter les conclusions erronées liées aux paquets ICMP abandonnés par un pare-feu sur le périphérique hôte d'extrémité.

Vérifiez ensuite que chaque noeud de périphérie de fabric dispose de son point d'extrémité respectif dans IP Device-Tracking (IPDT), la base de données LISP L2, la base de données de résolution d'adresses L2 et la base de données L3.

Périphérie 1 :

Pour vérifier le point de terminaison dans IPDT, utilisez la commande show device-tracking

database interface <interface connection to endpoint>

<#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   15s   REACHABLE 228 s try 0(6374 s)

Pour vérifier le point de terminaison dans la base de données L2 LISP, utilisez la commande show lisp eid-table vlan <vlan id> ethernet database <mac address> utilisez les adresses VLAN et MAC de la commande précédente

<#root>

Edge-1#

show lisp eid-table vlan 1026 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: 3w5d, Last-change: 3w5d
  Domain-ID: local
  Service-Insertion: N/A
  Locator   Pri/Wgt Source   State
  10.47.1.12   10/10   cfg-intf   site-self, reachable <-- Edge-1's RLOC
  Map-server   Uptime   ACK Domain-ID
  10.47.1.10   1w3d   Yes 0
  10.47.1.11   3w5d   Yes 0

Pour vérifier la base de données AR de couche 2, utilisez la commande show lisp eid-table vlan <vlan-id> ethernet database address-resolution <mac address>

<#root>

Edge-1#

show lisp eid-table vlan 1026 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 IID, and IPv4 address, r

Pour vérifier la base de données L3 LISP, utilisez la commande show lisp instance-id <L3 ID> ipv4 database <adresse IPv4>/subnet mask utilisez l'ID de l'instance L3 LISP de la commande précédente

<#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
  Uptime: 3w5d, Last-change: 3w5d
  Domain-ID: local
  Service-Insertion: N/A
  Locator   Pri/Wgt Source   State

10.47.1.12

   10/10   cfg-intf   site-self, reachable

<-- Edge-1's own RLOC

  Map-server   Uptime   ACK Domain-ID
  10.47.1.10   1w0d   Yes 0
  10.47.1.11   1w0d   Yes 0

Périphérie 2 :

Pour vérifier le point de terminaison dans IPDT, utilisez la commande show device-tracking database interface <interface connection to local endpoint>

<#root>

Edge-2#

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

portDB has 3 entries for interface Gi1/0/3, 3 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        age

DH4


10.47.4.3


 5254.001e.ad00

        Gi1/0/3   1026        0024       122s       REACHABLE  124 s try 0(5810 s)
```

Pour vérifier le point de terminaison dans la base de données L2 LISP, utilisez la commande show lisp eid-table vlan <vlan id> ethernet database <mac address> utilisez les adresses VLAN et MAC de la commande précédente

```
<#root>

Edge-2#

show lisp eid-table vlan 1026 ethernet database 5254.001e.ad00

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

5254.001e.ad00/48, dynamic-eid Auto-L2-group-8190, inherited from default locator-set rloc_691b1fe4-526
  Uptime: 3w5d, Last-change: 3w5d
  Domain-ID: local
  Service-Insertion: N/A
  Locator       Pri/Wgt  Source      State
  10.47.1.13    10/10    cfg-intf    site-self, reachable <-- Edge-2's RLOC
  Map-server        Uptime        ACK  Domain-ID
  10.47.1.10        1w2d          Yes  0
  10.47.1.11        1w2d          Yes  0
```

Pour vérifier la base de données d'AR de couche 2, utilisez la commande show lisp eid-table vlan <vlan-id> ethernet database address-resolution <mac address>

```
<#root>

Edge-2#

show lisp eid-table vlan 1026 ethernet database address-resolution 5254.001e.ad00
```

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

Hardware Address        L3 InstID Host Address

5254.001e.ad00                4099 10.47.4.3/32 <-- Endpoint MAC address, LISP L3 IID, and IPv4 address, r
```

Pour vérifier la base de données L3 LISP, utilisez la commande show lisp instance-id <L3 ID> ipv4 database <adresse IPv4>/subnet mask utilisez l'ID de l'instance L3 LISP de la commande précédente

<#root>

Edge-2#

show lisp instance-id 4099 ipv4 database 10.47.4.3/32

```
LISP ETR IPv4 Mapping Database for LISP 0 EID-table vrf ed_vn (IID 4099), LSBs: 0x1
Entries total 1, no-route 0, inactive 0, do-not-register 2
```

10.47.4.3/32

```
, dynamic-eid red-IPV4, inherited from default locator-set rloc_691b1fe4-5264-44c2-bb1b-0903b3eb2c51
  Uptime: 1w0d, Last-change: 1w0d
  Domain-ID: local
  Service-Insertion: N/A
  Locator      Pri/Wgt  Source     State
```

10.47.1.13

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

<-- Edge-2, RLOC

```
  Map-server        Uptime        ACK  Domain-ID
  10.47.1.10        1w0d          Yes  0
  10.47.1.11        1w0d          Yes  0
```

Bordures colocalisées :

Idéalement, les deux terminaux sont enregistrés du point de vue LISP L2, AR L2 et L3 dans les deux plans de contrôle de fabric (Border-1 et Border-2). Pour dériver l'ID LISP de couche 2, vérifiez un noeud Périphérie de fabric et utilisez la commande show vlan id <vlan id>

<#root>

Edge-1#

show vlan id 1026

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

L2LI0:8190

```
, Gi1/0/3
```

<-- L2 LISP IID

```
VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1026 enet  101026     1500  -      -      -        -    -        0      0

Remote SPAN VLAN
----------------
Disabled

Primary Secondary Type             Ports
------- --------- ---------------- ----------------------------------------
```

Utilisez l'ID de couche 2 dans la commande show lisp instance-id <L2 IID> ethernet server pour vérifier le serveur d'un point de vue LISP de couche 2

<#root>

```
Border-1#
```

show lisp instance-id 8190 ethernet server

```
LISP Site Registration Information
* = Some locators are down or unreachable
# = Some registrations are sourced by reliable transport

Site Name       Last     Up    Who Last          Inst    EID Prefix
                Register       Registered         ID
site_uci        never    no    --                8190    any-mac
                1w3d     yes#
```

10.47.1.12

```
:21038     8190
```

 5254.0019.93e9/48 <-- RLOC of the FE node, EID prefix that was registered

```
            1w2d       yes#
```

10.47.1.13

```
:16056     8190
```

 5254.001e.ad00/48 <-- RLOC of the FE node, EID prefix that was registered

Pour vérifier le serveur de l'AR de couche 2, utilisez la commande show lisp instance-id <L2 ID> ethernet server address-resolution

<#root>

Border-1#

show lisp instance-id 8190 ethernet server address-resolution

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

L3 InstID	Host Address	Hardware Address
4099	10.47.4.2/32	5254.0019.93e9 <-- L3 LISP IID, Endpoint IPv4 A
4099	10.47.4.3/32	5254.001e.ad00 <-- L3 LISP IID, Endpoint IPv4 A

Pour vérifier le serveur L3, utilisez la commande show lisp instance-id <L3 ID> ipv4 server

<#root>

Border-1#

show lisp instance-id 4099 ipv4 server

LISP Site Registration Information
* = Some locators are down or unreachable
# = Some registrations are sourced by reliable transport

Site Name	Last Register	Up	Who Last Registered	Inst ID	EID Prefix
site_uci	never	no	--	4099	0.0.0.0/0
	6d01h	yes#	10.47.1.11:22876	4099	8.8.8.8/32
	1w0d	yes#	10.47.1.10:21610	4099	10.47.2.4/30
	1w0d	yes#	10.47.1.11:22876	4099	10.47.2.12/30
	never	no	--	4099	10.47.4.0/24
	1w0d	yes#	10.47.1.12:21038	4099	10.47.4.2/32
	1w0d	yes#	10.47.1.13:16056	4099	10.47.4.3/32
	1w0d	yes#	10.47.1.11:22876	4099	10.47.6.0/24
	1w0d	yes#	10.47.1.11:22876	4099	10.47.7.0/24
	1w0d	yes#	10.47.1.11:22876	4099	10.47.9.8/29
	never	no	--	4099	10.47.10.0/24
	1w0d	yes#	10.47.1.13:16056	4099	10.47.10.2/32

Les plans de contrôle présentent un bref historique des événements d'enregistrement des entrées L3, L2 et AR, ce qui peut s'avérer utile lors du dépannage des clients en itinérance ou d'une boucle possible dans laquelle les clients sont enregistrés de manière inattendue par plusieurs arêtes de fabric en très peu de temps.

<#root>

Border-1#

show lisp instance-id 8190 ethernet server resolution registration-history | include Timestamp|10.47.4.2

Timestamp (UTC)   Instance Proto Roam WLC Source

```
*Oct  9 19:14:39.183      8190 TCP   No   No  10.47.1.12

                                    +*10.47.4.2/32 / 5254.0019.93e9 <-- Last registered at Oct 9

*Oct 9  19:14:41.183      8190 TCP   No   No  10.47.1.13

                                    +*10.47.4.3/32 / 5254.001e.ad00 <-- Last registered at OCt 9
```

Workflow de haut niveau de demande ARP de chemin de monodiffusion
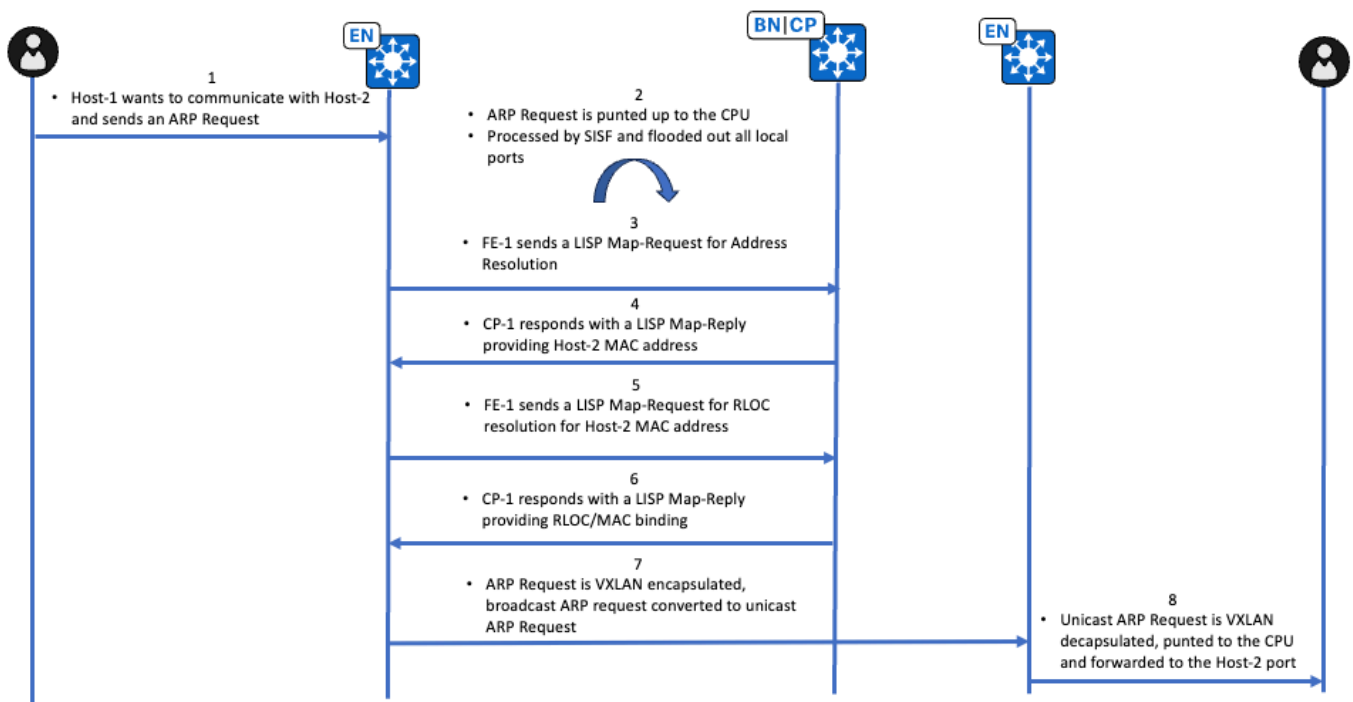
Vérification de requête ARP de chemin de monodiffusion

Le point de terminaison qui possède l'adresse IP 10.47.4.2 envoie une requête ARP de diffusion, confirmée via une capture de paquets intégrée (EPC) sur Edge-1

Périphérie 1 (10.47.1.12)

```
<#root>

Edge-1#

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

Edge-1#

monitor capture 1 start

Edge-1#
```

```
monitor capture 1 stop


Capture statistics collected at software:
        Capture duration - 39 seconds
        Packets received - 21
        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.


Edge-1#

show monitor capture 1 buffer 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 19, 2023 23:43:31.893095000 UTC
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1697759011.893095000 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

)
    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

Cette requête ARP est envoyée au processeur pour un traitement ultérieur. Utilisez la capture d'éjection FED pour obtenir des informations supplémentaires.

<#root>

Edge-1#

debug platform software fed switch active punt packet-capture set-filter "arp"

Edge-1#

debug platform software fed switch active punt packet-capture start

Edge-1#

debug platform software fed switch active punt packet-capture stop

Edge-1#

show platform software fed switch active punt packet-capture brief

```
Punt packet capturing: disabled. Buffer wrapping: disabled
Total captured so far: 8 packets. Capture capacity : 4096 packets
Capture filter : "arp"

------ Punt Packet Number: 1, Timestamp: 2023/10/19 23:55:03.552 ------
 interface : physical: GigabitEthernet1/0/3[if-id: 0x0000000b], pal:
```

 GigabitEthernet1/0/3 [if-id: 0x0000000b] <-- Physical interface the ARP Request was received from

```
 metadata  : cause: 109 [snoop packets], sub-cause: 1,
```

q-no: 16

, linktype: MCP_LINK_TYPE_IP [1]

<-- Punted for cause snoop packets to CPU queue 16

 ether hdr : dest mac:

ffff.ffff.ffff

, src mac:

5254.0019.93e9

 ether hdr : ethertype:

0x0806 (ARP)

Pour connaître la file d'attente CPU 16, utilisez la commande show platform software fed switch active punt cpuq 16

<#root>

Edge-1#

show platform software fed switch active punt cpuq 16

Punt CPU Q Statistics
==

```
CPU Q Id                    : 16
CPU Q Name                  : CPU_Q_PROTO_SNOOPING
Packets received from ASIC  : 49054
Send to IOSd total attempts :
```

49054 <-- Same number as received from ASIC

Send to IOSd failed count :

0 <-- No failures

Idéalement, la file d'attente de surveillance de protocole dans le régulateur de CPU (file d'attente 16) ne contient pas d'abandon. Utilisez la commande show platform hardware fed switch active qos queue stats internal cpu policer

<#root>

Edge-1#

show platform hardware fed switch active qos queue stats internal cpu policer | include QId|Proto

QId	PlcIdx	Queue Name	Enabled	Rate	Rate	Drop(Bytes)	Drop(Frames)
16	12	Proto Snooping	No	2000	2000	0	0

<-- No drops

Ensuite, la requête ARP ponctuée est traitée par le service Punt. Vous pouvez voir ce comportement avec le debug, debug platform software infrastructure punt

<#root>

Edge-1#

debug platform software infrastructure punt

```
*Oct 20 00:07:01.509: PUNT RX: mcprp_process_receive_packet: pak->vlan_id: 1026
*Oct 20 00:07:01.509:  Punt: IP proto   src 147.233.
```

10.47

, dst

4.2

```
.0.0, from table 0, intf Gi1/0/3, encap ARPA, size 60, cause snoop packets(L3)
```

<-- The IP address is obscured, but it is 10.47.4.2

```
*Oct 20 00:07:01.509:  punt cause:snoop packets invoking reg_invoke_mcprp_punt_feature_msg
*Oct 20 00:07:01.509:  punt cause:snoop packets MCPRP_PUNT_PAK_PROC_OK_DONE
```

⚠ Attention : ce débogage est bavard, utilisez-le avec prudence.

Une fois que le service Punt a traité le paquet, il le transmet au processus Proto Snoop et Proto ARP Snoop. Ceci crée une entrée dans la table de surveillance ARP et le paquet est envoyé à Device-Tracking/SISF. Pour le voir, debug arp ainsi que debug platform fhs all

<#root>

Edge-1#

debug arp

Edge-1#

debug platform fhs all

*Oct 20 00:12:06.908:

ARP packet received from ARP snooper(Gi1/0/3 10.47.4.2 (5254.0019.93e9) VLAN:1026)

⚠ Attention : ces débogages sont bavards, utilisez-les avec prudence

---

Utilisez la commande show platform arpsnooping client <adresse MAC> pour voir ce qui arrive à la requête ARP

```
<#root>

Edge-1#

show platform arpsnooping client 5254.0019.93e9

PLAT_DAI      : Platform DAI shim
FWDPLANE      : Dataplane forwarding
BRIDGE        : Packet to be bridged
ARPSN         : Arp Snooping
Packet Trace for client MAC 5254.0019.93E9:


Timestamp               Sender Mac        Sender IP       Target Mac        Target IP       Opcode
----------------------  --------------    ------------    ----------------  --------------  -------
2023/10/24 14:37:15.045 5254.0019.93e9    10.47.4.2       0000.0000.0000    10.47.4.3       ARP_REQUEST
2023/10/24 14:37:15.045 5254.0019.93e9    10.47.4.2       0000.0000.0000    10.47.4.3       ARP_REQUEST
2023/10/24 14:37:15.045 5254.0019.93e9    10.47.4.2       0000.0000.0000    10.47.4.3       ARP_REQUEST

INJECT:BD_DPIDX_TO_FWDPLANE
```

Lorsque IPDT/SISF traite le paquet, il vérifie le contenu de la requête ARP et crée une entrée temporaire en attendant la résolution via LISP.

```
<#root>

Edge-1#

show device-tracking messages detailed 255 | i 5254.0019.93e9

 [Tue Oct 24 14:37:12.000] VLAN 1026, From Gi1/0/3 seclvl [guard], MAC 5254.0019.93e9: ARP::REQ,
 [Tue Oct 24 14:37:13.000] VLAN 1026, From Gi1/0/3 seclvl [guard], MAC 5254.0019.93e9: ARP::REQ,
```

Si vous utilisez debug device-tracking, vous voyez qu'il y a une entrée pointant vers 0000.0000.00fd dans device-tracking. Tout ce que cela signifie est que l'hôte derrière Gi1/0/3 demande un hôte qui n'a pas encore été résolu, il est dans un état transitoire (ou permanent dans le cas où il demande un hôte qui n'existe pas, ce n'est pas nécessairement une mauvaise chose)

```
<#root>

Edge-1

#debug device-tracking


  Device-tracking - General debugging is on
*Oct 24 14:55:02.967: SISF[POL]: vlan 1026 matches vlan list on policy IPDT_POLICY for target Gi1/0/3
*Oct 24 14:55:02.967: SISF[POL]: Found matching policy IPDT_POLICY for feature Device-tracking on Gi1/0/
*Oct 24 14:55:02.967:SISF[GLN]: Checking if ARP ownership can be taken by device-tracking
*Oct 24 14:55:02.967:SISF[GLN]: Not an ARP reply, do not take over
*Oct 24 14:55:02.967:SISF[POL]: Found matching policy LISP-AR-RELAY-VLAN for feature Address Resolution
*Oct 24 14:55:02.967: SISF[MAC]:

Creating new MAC entry for 0000.0000.00fd on interface        if none exists
```

```
*Oct 24 14:55:02.967: SISF[MAC]: Number of MAC entries in MAC-CREATING state incremented to 1
*Oct 24 14:55:02.968: SISF[BT ]: Attaching 0000.0000.00fd entry in MacAdrDB for 10.47.4.3
*Oct 24 14:55:02.968: SISF[GLN]: Binding entry event 1 for 10.47.4.3
```

SISF déclenche la résolution ARP à l'aide de LISP en raison de la stratégie LISP-AR-RELAY-VLAN, une fois que les processus LISP Control-Plane peuvent prendre le relais.

<#root>

Edge-1#

debug lisp control-plane all

Edge-1#

debug l2lisp all

```
*Oct 24 15:10:27.677: LISP Client 'SISF client':
```

SISF request to resolve 10.47.4.3 in Vlan 1026.

Edge-1 envoie une requête de mappage LISP pour résoudre l'adresse MAC 10.47.4.3 via le ou les plans de contrôle LISP

<#root>

Edge-1#

debug lisp control-plane all

Edge-1#

debug l2lisp all

```
*Oct 24 15:10:27.681: LISP[REMT ]-0: Map Request: Delay is over for IID 8190 EID 10.47.4.3/32, requeste
*Oct 24 15:10:27.681: LISP[REMT ]-0 IID 8190: Schedule processing of Map-Requests from 'remote EID pref
*Oct 24 15:10:27.681: LISP[REMT ]-0: Map Request:
```

Sending request for IID 8190 EID 10.47.4.3/32, requester 'AR'.

Une capture de paquets intégrée bidirectionnelle (EPC) effectuée au niveau du processeur (plan de contrôle) de Edge-1 illustre la requête ARP entrante et la requête de mappage LISP suivante

<#root>

Edge-1#

monitor capture 1 control-plane both match any

Edge-1#

monitor capture 1 start

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

monitor capture 1 stop


Edge-1#

show monitor capture 1 buffer display-filter "arp.dst.proto_ipv4==10.47.4.3 or lisp"

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

   60   10.110293 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
   61   10.111714     10.47.4.3 -> 10.47.4.3    LISP 114 Encapsulated Map-Request for Unknown LCAF Type (5
```

Vous pouvez prendre une vue plus détaillée de la carte LISP Map-Request

<#root>

Edge-1#

show monitor capture 1 buffer display-filter "frame.number==61" detailed


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

Frame 61: 114 bytes on wire (912 bits), 114 bytes captured (912 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 24, 2023 15:20:08.948469000 UTC
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1698160808.948469000 seconds
    [Time delta from previous captured frame: 0.001421000 seconds]
    [Time delta from previous displayed frame: 0.000000000 seconds]
    [Time since reference or first frame: 10.111714000 seconds]
    Frame Number: 61
    Frame Length: 114 bytes (912 bits)
    Capture Length: 114 bytes (912 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:ip:udp:lisp:ip:udp:lisp]
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

)

<-- Ignore the SMAC/DMAC this is done up at the CPU, not final MAC addresses

```
    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: 10.47.1.10 <-- Edge-1 RLOC and one of the collocated border RLOC, respectively

    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
        1100 00.. = Differentiated Services Codepoint: Class Selector 6 (48)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 100
    Identification: 0x599c (22940)
    Flags: 0x0000
        0... .... .... .... = Reserved bit: Not set
        .0.. .... .... .... = Don't fragment: Not set
        ..0. .... .... .... = More fragments: Not set
    Fragment offset: 0
    Time to live: 255
    Protocol: UDP (17)
    Header checksum: 0x4ab9 [validation disabled]
    [Header checksum status: Unverified]
    Source: 10.47.1.12
    Destination: 10.47.1.10
User Datagram Protocol, Src Port: 4342, Dst Port: 4342
    Source Port: 4342
    Destination Port: 4342
    Length: 80
    Checksum: 0x6393 [unverified]
    [Checksum Status: Unverified]
    [Stream index: 0]
    [Timestamps]
        [Time since first frame: 0.000000000 seconds]
        [Time since previous frame: 0.000000000 seconds]
Locator/ID Separation Protocol
    1000 .... .... .... .... .... = Type: Encapsulated Control Message (8)
    .... 0... .... .... .... .... .... .... = S bit (LISP-SEC capable): Not set
    .... .0.. .... .... .... .... .... .... = D bit (DDT-originated): Not set
    .... ..00 0000 0000 0000 0000 0000 0000 = Reserved bits: 0x0000000
Internet Protocol Version 4,

Src: 10.47.4.3, Dst: 10.47.4.3


<-- MAP Request to resolve the MAC address tied to 10.47.4.3

    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
        1100 00.. = Differentiated Services Codepoint: Class Selector 6 (48)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 68
    Identification: 0x599b (22939)
    Flags: 0x0000
        0... .... .... .... = Reserved bit: Not set
        .0.. .... .... .... = Don't fragment: Not set
        ..0. .... .... .... = More fragments: Not set
    Fragment offset: 0
    Time to live: 255
    Protocol: UDP (17)
    Header checksum: 0x44ea [validation disabled]
    [Header checksum status: Unverified]
    Source: 10.47.4.3
```

```
        Destination: 10.47.4.3
User Datagram Protocol, Src Port: 4342, Dst Port: 4342
    Source Port: 4342
    Destination Port: 4342
    Length: 48
    Checksum: 0x9622 [unverified]
    [Checksum Status: Unverified]
    [Stream index: 1]
    [Timestamps]
        [Time since first frame: 0.000000000 seconds]
        [Time since previous frame: 0.000000000 seconds]
Locator/ID Separation Protocol
    0001 .... .... .... .... .... = Type: Map-Request (1)
    .... 0000 00.. .... .... .... = Flags: 0x00
        .... 0... .... .... .... .... = A bit (Authoritative): Not set
        .... .0.. .... .... .... .... = M bit (Map-Reply present): Not set
        .... ..0. .... .... .... .... = P bit (Probe): Not set
        .... ...0 .... .... .... .... = S bit (Solicit-Map-Request): Not set
        .... .... 0... .... .... .... = p bit (Proxy ITR): Not set
        .... .... .0.. .... .... .... = s bit (SMR-invoked): Not set
    .... .... ..00 0000 000. .... = Reserved bits: 0x000
    .... .... .... .... ...0 0000 = ITR-RLOC Count: 0
    Record Count: 1
    Nonce: 0xcffee30fb39a05b7
    Source EID AFI: Reserved (0)
    Source EID: not set
    ITR-RLOC 1: 10.47.1.12
        ITR-RLOC AFI: IPv4 (1)
        ITR-RLOC Address: 10.47.1.12
    Map-Request Record 1: Unknown LCAF Type (53)/32
        Reserved: 0x00
        Prefix Length: 32
        Prefix AFI: LISP Canonical Address Format (LCAF) (16387)
        Prefix: Unknown LCAF Type (53)
            LCAF: Unknown (53)
                LCAF Header: 00003520000a
                    Reserved bits: 0x00
                    Flags: 0x00
                    Type: Unknown (53)
                    Reserved bits: 0x20
                    Length: 10
                [Expert Info (Error/Protocol): LCAF type 53 is not defined in draft-ietf-lisp-lcaf-05]
                    [LCAF type 53 is not defined in draft-ietf-lisp-lcaf-05]
                    [Severity level: Error]
                    [Group: Protocol]
```

Bordure(s) colocalisée(s) (10.47.1.10 et 10.47.1.11)

Ensuite, le plan de contrôle LISP répond à l'arête 1 avec une carte LISP Map-Reply. Cela peut être vu dans les débogages ainsi que dans CPU EPC.

<#root>

Border-2#

show monitor capture 1 buffer display-filter lisp

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

```
113  12.767420    10.47.4.3 -> 10.47.4.3     LISP 114 Encapsulated Map-Request for Unknown LCAF Type (5
114  12.774428    10.47.1.11 -> 10.47.1.12   LISP 96 Map-Reply for Unknown LCAF Type (53)/32
```

Lorsque nous examinons les paquets plus en détail, nous pouvons voir la requête de mappage
LISP et la réponse de mappage LISP suivante

<#root>

Border-2#

show monitor capture 1 buffer display-filter frame.number==113 detailed

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

Frame 113: 114 bytes on wire (912 bits), 114 bytes captured (912 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 24, 2023 15:41:06.566253000 UTC
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1698162066.566253000 seconds
    [Time delta from previous captured frame: 0.013424000 seconds]
    [Time delta from previous displayed frame: 0.000000000 seconds]
    [Time since reference or first frame: 12.767420000 seconds]
    Frame Number: 113
    Frame Length: 114 bytes (912 bits)
    Capture Length: 114 bytes (912 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:ip:udp:lisp:ip:udp:lisp]
Ethernet II, Src: 52:54:00:04:84:a3 (

52:54:00:04:84:a3

), Dst: 52:54:00:1c:7d:e0 (

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

)

<-- True MAC addresses

    Destination: 52:54:00:1c:7d:e0 (52:54:00:1c:7d:e0)
        Address: 52:54:00:1c:7d:e0 (52:54:00:1c:7d:e0)
        .... ..1. .... = LG bit: Locally administered address (this is NOT the factory d
        ....0 .... = IG bit: Individual address (unicast)
    Source: 52:54:00:04:84:a3 (52:54:00:04:84:a3)
        Address: 52:54:00:04:84:a3 (52:54:00:04:84:a3)
        .... ..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: 10.47.1.11 <-- Edge-1 RLOC and Border-2 RLOC, respectively

    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
        1100 00.. = Differentiated Services Codepoint: Class Selector 6 (48)
```

```
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 100
    Identification: 0x5e19 (24089)
    Flags: 0x0000
        0... .... .... .... = Reserved bit: Not set
        .0.. .... .... .... = Don't fragment: Not set
        ..0. .... .... .... = More fragments: Not set
    Fragment offset: 0
    Time to live: 255
    Protocol: UDP (17)
    Header checksum: 0x463b [validation disabled]
    [Header checksum status: Unverified]
    Source: 10.47.1.12
    Destination: 10.47.1.11
User Datagram Protocol, Src Port: 4342, Dst Port: 4342
    Source Port: 4342
    Destination Port: 4342
    Length: 80
    Checksum: 0x6392 [unverified]
    [Checksum Status: Unverified]
    [Stream index: 1]
    [Timestamps]
        [Time since first frame: 0.000000000 seconds]
        [Time since previous frame: 0.000000000 seconds]
Locator/ID Separation Protocol
    1000 .... .... .... .... .... = Type: Encapsulated Control Message (8)
    .... 0... .... .... .... .... .... .... = S bit (LISP-SEC capable): Not set
    .... .0.. .... .... .... .... .... .... = D bit (DDT-originated): Not set
    .... ..00 0000 0000 0000 0000 0000 0000 = Reserved bits: 0x0000000
Internet Protocol Version 4,

Src: 10.47.4.3, Dst: 10.47.4.3 <-- LISP MAP Request for 10.47.4.3

    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
        1100 00.. = Differentiated Services Codepoint: Class Selector 6 (48)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 68
    Identification: 0x5e18 (24088)
    Flags: 0x0000
        0... .... .... .... = Reserved bit: Not set
        .0.. .... .... .... = Don't fragment: Not set
        ..0. .... .... .... = More fragments: Not set
    Fragment offset: 0
    Time to live: 255
    Protocol: UDP (17)
    Header checksum: 0x406d [validation disabled]
    [Header checksum status: Unverified]
    Source: 10.47.4.3
    Destination: 10.47.4.3
User Datagram Protocol, Src Port: 4342, Dst Port: 4342
    Source Port: 4342
    Destination Port: 4342
    Length: 48
    Checksum: 0xe9a8 [unverified]
    [Checksum Status: Unverified]
    [Stream index: 2]
    [Timestamps]
        [Time since first frame: 0.000000000 seconds]
        [Time since previous frame: 0.000000000 seconds]
Locator/ID Separation Protocol
    0001 .... .... .... .... = Type: Map-Request (1)
```

```
.... 0000 00.. .... .... .... = Flags: 0x00
    .... 0... .... .... .... .... = A bit (Authoritative): Not set
    .... .0.. .... .... .... .... = M bit (Map-Reply present): Not set
    .... ..0. .... .... .... .... = P bit (Probe): Not set
    .... ...0 .... .... .... .... = S bit (Solicit-Map-Request): Not set
    .... .... 0... .... .... .... = p bit (Proxy ITR): Not set
    .... .... .0.. .... .... .... = s bit (SMR-invoked): Not set
.... .... ..00 0000 000. .... = Reserved bits: 0x000
.... .... .... .... ...0 0000 = ITR-RLOC Count: 0
Record Count: 1
Nonce: 0x50c5f2b60b41ca1c
Source EID AFI: Reserved (0)
Source EID: not set
ITR-RLOC 1: 10.47.1.12
    ITR-RLOC AFI: IPv4 (1)
    ITR-RLOC Address: 10.47.1.12
Map-Request Record 1: Unknown LCAF Type (53)/32
    Reserved: 0x00
    Prefix Length: 32
    Prefix AFI: LISP Canonical Address Format (LCAF) (16387)
    Prefix: Unknown LCAF Type (53)
        LCAF: Unknown (53)
            LCAF Header: 00003520000a
                Reserved bits: 0x00
                Flags: 0x00
                Type: Unknown (53)
                Reserved bits: 0x20
                Length: 10
            [Expert Info (Error/Protocol): LCAF type 53 is not defined in draft-ietf-lisp-lcaf-05]
                [LCAF type 53 is not defined in draft-ietf-lisp-lcaf-05]
                [Severity level: Error]
                [Group: Protocol]
```

Nous pouvons également consulter la carte-réponse LISP qui est renvoyée

```
<#root>

Border-2#

show monitor capture 1 buffer display-filter frame.number==114 detailed

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

Frame 114: 96 bytes on wire (768 bits), 96 bytes captured (768 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 24, 2023 15:41:06.573261000 UTC
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1698162066.573261000 seconds
    [Time delta from previous captured frame: 0.007008000 seconds]
    [Time delta from previous displayed frame: 0.000000000 seconds]
    [Time since reference or first frame: 12.774428000 seconds]
    Frame Number: 114
    Frame Length: 96 bytes (768 bits)
    Capture Length: 96 bytes (768 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:ip:udp:lisp]
```

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

)

 <-- CPU Inject does not properly show MAC addresses

    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: 10.47.1.11, Dst: 10.47.1.12 <-- Border-2 RLOC and Edge-1 RLOC, respectively

    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
        1100 00.. = Differentiated Services Codepoint: Class Selector 6 (48)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 82
    Identification: 0xe231 (57905)
    Flags: 0x0000
        0... .... = Reserved bit: Not set
        .0.. .... = Don't fragment: Not set
        ..0. .... = More fragments: Not set
    Fragment offset: 0
    Time to live: 255
    Protocol: UDP (17)
    Header checksum: 0xc234 [validation disabled]
    [Header checksum status: Unverified]
    Source: 10.47.1.11
    Destination: 10.47.1.12
User Datagram Protocol, Src Port: 4342, Dst Port: 4342
    Source Port: 4342
    Destination Port: 4342
    Length: 62
    Checksum: 0xe1d6 [unverified]
    [Checksum Status: Unverified]
    [Stream index: 1]
    [Timestamps]
        [Time since first frame: 0.007008000 seconds]
        [Time since previous frame: 0.007008000 seconds]
Locator/ID Separation Protocol
    0010 .... = Type: Map-Reply (2)
    .... 0... .... = P bit (Probe): Not set
    .... .0.. .... = E bit (Echo-Nonce locator reachability algorithm enabled): Not set
    .... ..0. .... = S bit (LISP-SEC capable): Not set
    ....0 0000 0000 0000 0000 = Reserved bits: 0x00000
    Record Count: 1
    Nonce: 0x50c5f2b60b41ca1c
    Mapping Record 1, EID Prefix: Unknown LCAF Type (53)/32, TTL: 1440, Action: No-Action, Not Authorit
        Record TTL: 1440

```
            Locator Count: 1
            EID Mask Length: 32
            000. .... .... .... = Action: No-Action (0)
            ...0 .... .... .... = Authoritative bit: Not set
            .... .000 0000 0000 = Reserved: 0x000
            0000 .... .... .... = Reserved: 0x0
            .... 0000 0000 0000 = Mapping Version: 0
            EID Prefix AFI: LISP Canonical Address Format (LCAF) (16387)
            EID Prefix: Unknown LCAF Type (53)
                LCAF: Unknown (53)
                    LCAF Header: 00003520000a
                        Reserved bits: 0x00
                        Flags: 0x00
                        Type: Unknown (53)
                        Reserved bits: 0x20
                        Length: 10
                    [Expert Info (Error/Protocol): LCAF type 53 is not defined in draft-ietf-lisp-lcaf-05]
                        [LCAF type 53 is not defined in draft-ietf-lisp-lcaf-05]
                        [Severity level: Error]
                        [Group: Protocol]
        Locator Record 1, RLOC: 52:54:00:1e:ad:00, Unreachable, Priority/Weight: 1/100, Multicast Prior
            Priority: 1
            Weight: 100
            Multicast Priority: 1
            Multicast Weight: 100
            Flags: 0x0000
                0000 0000 0000 0... = Reserved: 0x0000
                .... .... .... .0.. = Local: Not set
                .... .... .... ..0. = Probe: Not set
                .... .... .... ...0 = Reachable: Not set
            AFI: 802 (includes all 802 media plus Ethernet) (6)
            Locator: 52:54:00:1e:ad:00
```

<#root>

Border-2#

debug lisp control-plane all

```
All LISP control debugging is on at verbose level
Border-2#
```

debug l2lisp all

```
All L2Lisp debugging is on
*Oct 24 16:02:17.854: LISP[TRNSP]-0: Processing received Encap-Control(8) message on GigabitEthernet1/0,
*Oct 24 16:02:17.854: LISP[TRNSP]-0: Processing received Map-Request(1) message on GigabitEthernet1/0/3
*Oct 24 16:02:17.855: LISP[MR   ]-0: Received Map-Request with 1 records, first EID IID 8190 10.47.4.3/
*Oct 24 16:02:17.855: LISP[MR   ]-0 IID 8190
```

Eth-ARP: MS EID 10.47.4.3/32: Sending proxy reply to 10.47.1.12.

Maintenant que Edge-1 a reçu une réponse de mappage LISP pour la requête de résolution d'adresse (AR) indiquant que 10.47.4.3 est 5254.001e.ad00, Edge-1 génère une autre requête de mappage LISP pour déterminer le RLOC pour l'adresse MAC du point d'extrémité

```
<#root>

Edge-1#

debug lisp control-plane all

Edge-1#

debug l2lisp all

*Oct 24 16:19:54.843: LISP[REMT ]-0: Received Map-Reply with nonce 0x37F890B9-0xAC60D2B9, 1 records.
*Oct 24 16:19:54.843: LISP[MS   ]-0: This is a Address Resolution message.
*Oct 24 16:19:54.843: LISP[REMT ]-0: Map-Reply nonce matches pending request for IID 8190 EID 10.47.4.3,
*Oct 24 16:19:54.843: LISP[REMT ]-0:

Processing Map-Reply mapping record for IID 8190 Eth-ARP 10.47.4.3/32 LCAF 53, ttl 1440, action none, no

*Oct 24 16:19:54.843: LISP[REMT ]-0:

5254.001e.ad00 pri/wei/dID/mID/met/si_type/si_id/si_flg/afn_id=1/100/0/0/4294967295/none/0/UNSPEC/UNSPEC

*Oct 24 17:11:24.056: LISP[REMT ]-0 IID 8190: Schedule processing of Map-Requests from 'remote EID pref

Map Request: Sending request for IID 8190 EID 5254.001e.ad00/48, requester 'remote EID prefix'.>
```

Le plan de contrôle LISP reçoit la requête LISP Map-Request, qui concerne l'adresse MAC
10.47.4.3, consulte la table du serveur Ethernet pour l'ID LISP L2 8190 et envoie une réponse
LISP Map-Reply avec la liaison MAC-RLOC

```
<#root>

Border-1#

show monitor capture 1 buff display-filter lisp brief

Starting the packet display ........ Press Ctrl + Shift + 6 to exit
  250  28.656076     0.0.0.0 -> 0.0.0.0      LISP 176 Encapsulated Map-Request for [8190] 52:54:00:1e:
  251  28.658851

10.47.1.10 -> 10.47.1.12   LISP 96 Map-Reply for [8190] 52:54:00:1e:ad:00/48
```

Nous pouvons examiner de plus près la requête de carte LISP et la réponse de carte

<#root>

Border-1#

show monitor capture 1 buffer display-filter frame.number==250 detailed

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

Frame 250: 176 bytes on wire (1408 bits), 176 bytes captured (1408 bits) on interface /tmp/epc_ws/wif_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 24, 2023 17:37:11.647755000 UTC
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1698169031.647755000 seconds
    [Time delta from previous captured frame: 0.315724000 seconds]
    [Time delta from previous displayed frame: 0.000000000 seconds]
    [Time since reference or first frame: 28.656076000 seconds]
    Frame Number: 250
    Frame Length: 176 bytes (1408 bits)
    Capture Length: 176 bytes (1408 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:ip:udp:lisp:ip:udp:lisp]
Ethernet II, Src: 52:54:00:04:84:b1 (52:54:00:04:84:b1), Dst: 52:54:00:0a:42:f3 (52:54:00:0a:42:f3)
    Destination: 52:54:00:0a:42:f3 (52:54:00:0a:42:f3)
        Address: 52:54:00:0a:42:f3 (52:54:00:0a:42:f3)
        .... ..1. .... = LG bit: Locally administered address (this is NOT the factory d
        ....0 .... = IG bit: Individual address (unicast)
    Source: 52:54:00:04:84:b1 (52:54:00:04:84:b1)
        Address: 52:54:00:04:84:b1 (52:54:00:04:84:b1)
        .... ..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: 10.47.1.10 <-- Edge-1 RLOC and Border-1 RLOC, respectively

    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
        1100 00.. = Differentiated Services Codepoint: Class Selector 6 (48)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 162
    Identification: 0x75e5 (30181)
    Flags: 0x0000
        0... .... = Reserved bit: Not set
        .0.. .... = Don't fragment: Not set
        ..0. .... = More fragments: Not set
    Fragment offset: 0
    Time to live: 255
    Protocol: UDP (17)
    Header checksum: 0x2e32 [validation disabled]
    [Header checksum status: Unverified]
    Source: 10.47.1.12
    Destination: 10.47.1.10
User Datagram Protocol, Src Port: 4342, Dst Port: 4342

```
    Source Port: 4342
    Destination Port: 4342
    Length: 142
    Checksum: 0x46f1 [unverified]
    [Checksum Status: Unverified]
    [Stream index: 4]
    [Timestamps]
        [Time since first frame: 0.000000000 seconds]
        [Time since previous frame: 0.000000000 seconds]
Locator/ID Separation Protocol
    1000 .... .... .... .... .... = Type: Encapsulated Control Message (8)
    .... 0... .... .... .... .... .... .... = S bit (LISP-SEC capable): Not set
    .... .0.. .... .... .... .... .... .... = D bit (DDT-originated): Not set
    .... ..00 0000 0000 0000 0000 0000 0000 = Reserved bits: 0x0000000
Internet Protocol Version 4, Src: 0.0.0.0, Dst: 0.0.0.0
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
        1100 00.. = Differentiated Services Codepoint: Class Selector 6 (48)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 130
    Identification: 0x75e4 (30180)
    Flags: 0x0000
        0... .... .... .... = Reserved bit: Not set
        .0.. .... .... .... = Don't fragment: Not set
        ..0. .... .... .... = More fragments: Not set
    Fragment offset: 0
    Time to live: 255
    Protocol: UDP (17)
    Header checksum: 0x44c7 [validation disabled]
    [Header checksum status: Unverified]
    Source: 0.0.0.0
    Destination: 0.0.0.0
User Datagram Protocol, Src Port: 4342, Dst Port: 4342
    Source Port: 4342
    Destination Port: 4342
    Length: 110
    Checksum: 0x18bb [unverified]
    [Checksum Status: Unverified]
    [Stream index: 5]
    [Timestamps]
        [Time since first frame: 0.000000000 seconds]
        [Time since previous frame: 0.000000000 seconds]
Locator/ID Separation Protocol
    0001 .... .... .... .... .... = Type: Map-Request (1)
    .... 0100 00.. .... .... .... = Flags: 0x10
        .... 0... .... .... .... .... = A bit (Authoritative): Not set
        .... .1.. .... .... .... .... = M bit (Map-Reply present): Set
        .... ..0. .... .... .... .... = P bit (Probe): Not set
        .... ...0 .... .... .... .... = S bit (Solicit-Map-Request): Not set
        .... .... 0... .... .... .... = p bit (Proxy ITR): Not set
        .... .... .0.. .... .... .... = s bit (SMR-invoked): Not set
    .... .... ..00 0000 000. .... = Reserved bits: 0x000
    .... .... .... .... ...0 0000 = ITR-RLOC Count: 0
    Record Count: 1
    Nonce: 0x86438e956066d3ca
    Source EID AFI: LISP Canonical Address Format (LCAF) (16387)
    Source EID: [8190] 00:00:0c:9f:f3:41
        LCAF: Instance ID: 8190, Address: 00:00:0c:9f:f3:41
            LCAF Header: 00000220000c
                Reserved bits: 0x00
                Flags: 0x00
```

```
                     Type: Instance ID (2)
                     Reserved bits: 0x20
                     Length: 12
                  Instance ID: 8190
                  Address AFI: 802 (includes all 802 media plus Ethernet) (6)
                  Address: 00:00:0c:9f:f3:41 (00:00:0c:9f:f3:41)
       ITR-RLOC 1: 10.47.1.12
           ITR-RLOC AFI: IPv4 (1)
           ITR-RLOC Address: 10.47.1.12
       Map-Request Record 1: [8190]

  52:54:00:1e:ad:00/48 <-- Map-Request for this specific MAC address


           Reserved: 0x00
           Prefix Length: 48
           Prefix AFI: LISP Canonical Address Format (LCAF) (16387)
           Prefix: [8190] 52:54:00:1e:ad:00
               LCAF: Instance ID: 8190, Address: 52:54:00:1e:ad:00
                  LCAF Header: 00000220000c
                      Reserved bits: 0x00
                      Flags: 0x00
                      Type: Instance ID (2)
                      Reserved bits: 0x20
                      Length: 12
                  Instance ID: 8190
                  Address AFI: 802 (includes all 802 media plus Ethernet) (6)
                  Address: 52:54:00:1e:ad:00 (52:54:00:1e:ad:00)
       Map-Reply Record
           Mapping Record 1, EID Prefix: [8190] 00:00:0c:9f:f3:41/48, TTL: 1440, Action: No-Action, Author
               Record TTL: 1440
               Locator Count: 1
               EID Mask Length: 48
               000. .... .... .... = Action: No-Action (0)
               ...1 .... .... .... = Authoritative bit: Set
               .... .000 0000 0000 = Reserved: 0x000
               0000 .... .... .... = Reserved: 0x0
               .... 0000 0000 0000 = Mapping Version: 0
               EID Prefix AFI: LISP Canonical Address Format (LCAF) (16387)
               EID Prefix: [8190] 00:00:0c:9f:f3:41
                  LCAF: Instance ID: 8190, Address: 00:00:0c:9f:f3:41
                      LCAF Header: 00000220000c
                          Reserved bits: 0x00
                          Flags: 0x00
                          Type: Instance ID (2)
                          Reserved bits: 0x20
                          Length: 12
                      Instance ID: 8190
                      Address AFI: 802 (includes all 802 media plus Ethernet) (6)
                      Address: 00:00:0c:9f:f3:41 (00:00:0c:9f:f3:41)
               Locator Record 1, Local RLOC: 10.47.1.12, Reachable, Priority/Weight: 10/10, Multicast Prio
                   Priority: 10
                   Weight: 10
                   Multicast Priority: 10
                   Multicast Weight: 10
                   Flags: 0x0005
                       0000 0000 0000 0... = Reserved: 0x0000
                       .... .... .... .1.. = Local: Set
                       .... .... .... ..0. = Probe: Not set
                       .... .... .... ...1 = Reachable: Set
                   AFI: IPv4 (1)
                   Locator: 10.47.1.12
```

```
<#root>

Border-1#

show monitor capture 1 buffer display-filter frame.number==251 detailed

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

Frame 251: 96 bytes on wire (768 bits), 96 bytes captured (768 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 24, 2023 17:37:11.650530000 UTC
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1698169031.650530000 seconds
    [Time delta from previous captured frame: 0.002775000 seconds]
    [Time delta from previous displayed frame: 0.000000000 seconds]
    [Time since reference or first frame: 28.658851000 seconds]
    Frame Number: 251
    Frame Length: 96 bytes (768 bits)
    Capture Length: 96 bytes (768 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:ip:udp:lisp]
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)
    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: 10.47.1.10, Dst: 10.47.1.12 <-- Border-1 RLOC, Edge-1 RLOC, respectively

    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
        1100 00.. = Differentiated Services Codepoint: Class Selector 6 (48)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 82
    Identification: 0x12a9 (4777)
    Flags: 0x0000
        0... .... .... .... = Reserved bit: Not set
        .0.. .... .... .... = Don't fragment: Not set
        ..0. .... .... .... = More fragments: Not set
    Fragment offset: 0
    Time to live: 255
    Protocol: UDP (17)
    Header checksum: 0x91be [validation disabled]
    [Header checksum status: Unverified]
    Source: 10.47.1.10
    Destination: 10.47.1.12
User Datagram Protocol, Src Port: 4342, Dst Port: 4342
    Source Port: 4342
    Destination Port: 4342
    Length: 62
```

```
    Checksum: 0xd63e [unverified]
    [Checksum Status: Unverified]
    [Stream index: 4]
    [Timestamps]
        [Time since first frame: 0.002775000 seconds]
        [Time since previous frame: 0.002775000 seconds]
Locator/ID Separation Protocol
    0010 .... .... .... .... .... = Type: Map-Reply (2)
    .... 0... .... .... .... .... = P bit (Probe): Not set
    .... .0.. .... .... .... .... = E bit (Echo-Nonce locator reachability algorithm enabled): Not set
    .... ..0. .... .... .... .... = S bit (LISP-SEC capable): Not set
    .... ...0 0000 0000 0000 0000 = Reserved bits: 0x00000
    Record Count: 1
    Nonce: 0x86438e956066d3ca
    Mapping Record 1, EID Prefix: [8190] 52:54:00:1e:ad:00/48, TTL: 1440, Action: No-Action, Not Author
        Record TTL: 1440
        Locator Count: 1
        EID Mask Length: 48
        000. .... .... .... = Action: No-Action (0)
        ...0 .... .... .... = Authoritative bit: Not set
        .... .000 0000 0000 = Reserved: 0x000
        0000 .... .... .... = Reserved: 0x0
        .... 0000 0000 0000 = Mapping Version: 0
        EID Prefix AFI: LISP Canonical Address Format (LCAF) (16387)
        EID Prefix: [8190] 52:54:00:1e:ad:00
            LCAF: Instance ID: 8190, Address: 52:54:00:1e:ad:00
                LCAF Header: 00000220000c
                    Reserved bits: 0x00
                    Flags: 0x00
                    Type: Instance ID (2)
                    Reserved bits: 0x20
                    Length: 12
                Instance ID: 8190
                Address AFI: 802 (includes all 802 media plus Ethernet) (6)
                Address: 52:54:00:1e:ad:00 (52:54:00:1e:ad:00)
        Locator Record 1, RLOC: 10.47.1.13, Reachable, Priority/Weight: 10/10, Multicast Priority/Weigh
            Priority: 10
            Weight: 10
            Multicast Priority: 10
            Multicast Weight: 10
            Flags: 0x0001
                0000 0000 0000 0... = Reserved: 0x0000
                .... .... .... .0.. = Local: Not set
                .... .... .... ..0. = Probe: Not set
                .... .... .... ...1 = Reachable: Set
            AFI: IPv4 (1)


  Locator: 10.47.1.13 <-- This RLOC owns the MAC address
```

<#root>

Border-1#

debug lisp control-plane all

Border-1#

```
debug l2lisp all
```

*Oct 24 18:03:00.361: LISP[TRNSP]-0: Processing received Map-Request(1) message on GigabitEthernet1/0/3
*Oct 24 18:03:00.361: LISP[MR   ]-0: Received Map-Request with 1 records, first EID IID 8190 5254.001e.
*Oct 24 18:03:00.361: LISP[MR   ]-0

IID 8190 MAC: MS EID 5254.001e.ad00/48: Sending proxy reply to 10.47.1.12.

Edge-1 reçoit la carte LISP-Réponse de Border-1

<#root>

Edge-1#

```
debug lisp control-plane all
```

Edge-1#

```
debug l2lisp all
```

*Oct 24 17:11:24.558: LISP[TRNSP]-0: Processing received Map-Reply(2) message on GigabitEthernet1/0/1 f
*Oct 24 17:11:24.558: LISP[REMT]-0: Received Map-Reply with nonce 0x38A78BA8-0xC378149D, 1 records.
*Oct 24 17:11:24.558: LISP[REMT]-0: Map-Reply nonce matches pending request for IID 8190 EID 5254.001e
*Oct 24 17:11:24.558: LISP[REMT]-0:

Processing Map-Reply mapping record for IID 8190 MAC 5254.001e.ad00/48 LCAF 2, ttl 1440, action none, no

*Oct 24 17:11:24.559: LISP[REMT]-0:

10.47.1.13

 pri/wei/dID/mID/met/si_type/si_id/si_flg/afn_id=10/10/0/0/4294967295/none/0/UNSPEC/UNSPEC lpR.

L'intégralité de la requête ARP via l'échange LISP/SISF peut être visualisée sur Edge-1 via CPU EPC

<#root>

Edge-1#

show monitor capture 1 buffer display-filter "arp.dst.proto_ipv4==10.47.4.3 or lisp"

Starting the packet display .... Press Ctrl + Shift + 6 to exit
  120 18.415474 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

<-- Broadcast ARP Request punted up to the CPU

  121 18.416092   10.47.4.3 -> 10.47.4.3   LISP 114 Encapsulated Map-Request for Unknown LCAF Type (

<-- LISP Map-Request to obtain the MAC address of 10.47.4.3

  135 19.598041   10.47.1.11 -> 10.47.1.12   LISP 96 Map-Reply for Unknown LCAF Type (53)/32

<-- LISP Map-Reply providing the MAC address of 10.47.4.3

```
  136  19.613072      0.0.0.0 -> 0.0.0.0      LISP 176 Encapsulated Map-Request for [8190] 52:54:00:1e:
```

<-- LISP Map-Request to obtain the RLOC for MAC address 5254.001e.ad00

```
  138  20.119722    10.47.1.10 -> 10.47.1.12   LISP 96 Map-Reply for [8190] 52:54:00:1e:ad:00/48
```

 <-- LISP Map-Reply for the RLOC that owns MAC address 5254.001e.ad00

```
  143  20.477618 52:54:00:19:93:e9 -> 52:54:00:1e:ad:00 ARP 60 Who has 10.47.4.3? Tell 10.47.4.2
```

<-- Unicast ARP Request injected down from the CPU

Une fois que le plan de contrôle sur Edge-1 a convergé, il y a une entrée de cache de carte ainsi qu'une entrée à distance SISF (RMT)

<#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: 00:06:26, expires: 23:53:34, via map-reply, complete
  Sources: map-reply
  State: complete, last modified: 00:06:26, map-source: 10.47.1.13
  Active, Packets out: 11(0 bytes), counters are not accurate (~ 00:00:00 ago)
  Encapsulating dynamic-EID traffic
  Locator      Uptime    State Pri/Wgt      Encap-IID
```

10.47.1.13

```
  00:06:26  up       10/10        -
    Last up-down state change:       00:06:26, state change count: 1
    Last route reachability change:  2w0d, state change count: 1
    Last priority / weight change:   never/never
    RLOC-probing loc-status algorithm:
      Last RLOC-probe sent:          00:06:25 (rtt 1104ms)
```

Edge-1#

show device-tracking database address 10.47.4.3

```
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
```

RMT

```
10.47.4.3


5254.001e.ad00

         L2LI0      1026       0005        7mn         STALE      try 0 731 s
```

Ensuite, la requête ARP de monodiffusion est injectée à partir du processeur. Rappelez-vous que les paquets injectés par le processeur ne peuvent pas être capturés dans la direction de sortie avec EPC sur les interfaces physiques, que l'analyseur de port de commutation (SPAN) ou un EPC d'entrée sur le noeud de périphérie de fabric récepteur peut être utilisé pour confirmer la réception de la requête ARP de monodiffusion encapsulée VXLAN

Périphérie 2 (10.47.1.13)

Vérifiez d'abord que l'interface LISP ou tunnel est répertoriée dans le résultat de l'ID de VLAN pour VLAN 1026

```
<#root>
Edge-2#

show vlan id 1026


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

L2LI0:8190

, Gi1/0/3

<-- L2 LISP IID is associated


VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1026 enet  101026     1500  -      -      -        -    -        0      0

Remote SPAN VLAN
----------------
Disabled

Primary Secondary Type            Ports
------- --------- --------------- ----------------------------------------
```

Maintenant, un EPC en entrée sur Edge-2 présente la réponse ARP encapsulée VXLAN reçue. Comme la requête ARP monodiffusion est encapsulée dans un VXLAN, vous pouvez utiliser une liste de contrôle d'accès IP pour la faire correspondre à l'envoi RLOC Edge-1 vers RLOC Edge-2 (10.47.1.12 vers 10.47.1.13, respectivement) pour aider à filtrer le trafic.

```
<#root>

Edge-2(config)#

ip access-list extended tac


Edge-2(config-ext-nacl)#

permit ip host 10.47.1.12 host 10.47.1.13


Edge-2#

monitor capture 1 interface g1/0/1 in access-list tac

Edge-2#

monitor capture 1 interface g1/0/2 in access-list tac

Edge-2#

monitor capture 1 start

Started capture point : 1
Edge-2#

monitor capture 1 stop

Capture statistics collected at software:
    Capture duration - 20 seconds
    Packets received - 10
    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

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
```

En examinant de plus près cette requête ARP, vous pouvez voir qu'il y a une encapsulation VXLAN, un en-tête UDP et d'autres en-têtes, car une trame ARP est petite, 60 octets normalement.

```
<#root>

Edge-2#

show monitor capture 1 buffer display-filter frame.number==1 detailed

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

```
Frame 1: 110 bytes on wire (880 bits), 110 bytes captured (880 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 24, 2023 18:57:34.642468000 UTC
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1698173854.642468000 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: 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 <-- Edge-1 RLOC and Edge-2 RLOC, respectively

    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: 0x798a (31114)
    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: 0xed8b [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: 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):
```

8190 <-- LISP L2 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

```
)
```

<-- True source and destination endpoint MAC address

```
    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

Edge-2 désactive l'encapsulation VXLAN et envoie la requête ARP monodiffusion au processeur pour traitement ultérieur. Ceci peut être vu via une capture de Punject FED.

<#root>

```
Edge-2#
```

```
debug platform software fed switch active punt packet-capture start
```

Punt packet capturing started.

Edge-2#

```
debug platform software fed switch active punt packet-capture stop
```

Punt packet capturing stopped. Captured 21 packet(s)

Edge-2#

```
show platform software fed sw active punt packet-capture display-filter "arp" brief
```

Punt packet capturing: disabled. Buffer wrapping: disabled
Total captured so far: 21 packets. Capture capacity : 4096 packets

------ Punt Packet Number: 6, Timestamp: 2023/10/24 19:14:32.930 ------
 interface : physical: [if-id: 0x00000000], pal:

L2LISP0

 [if-id: 0x00000017]
 metadata : cause: 109 [snoop packets], sub-cause: 1,

q-no: 16,

 linktype: MCP_LINK_TYPE_IP [1]
 ether hdr :

 dest mac: 5254.001e.ad00, src mac: 5254.0019.93e9

 ether hdr : ethertype: 0x0806 (ARP)

La requête ARP est envoyée au processus ARP Snooper.

<#root>

```
Edge-2#debug platform software infrastructure punt
```

```
*Oct 24 19:18:38.916: PUNT RX: mcprp_process_receive_packet: pak->vlan_id: 1026
*Oct 24 19:18:38.916:  Punt: IP proto   src 147.233.
```

10.47, dst 4.2.

0.0, from table 0, intf L2LI0, encap LISP, size 60

,

 cause snoop packets(L3)

<-- You can see the 10.47.4.2

```
*Oct 24 19:18:38.916:  punt cause:snoop packets invoking reg_invoke_mcprp_punt_feature_msg
*Oct 24 19:18:38.916:  punt cause:snoop packets
```

MCPRP_PUNT_PAK_PROC_OK_DONE

> ⚠ Attention : ce débogage est bavard, utilisez-le avec prudence.

Comme cette requête ARP provient d'une interface LISP/tunnel L2, Edge-2 n'apprend jamais 10.47.4.2 comme point d'extrémité local d'un EID dynamique dans LISP

<#root>

Edge-2#s

how platform arpsnooping client 5254.0019.93e9

```
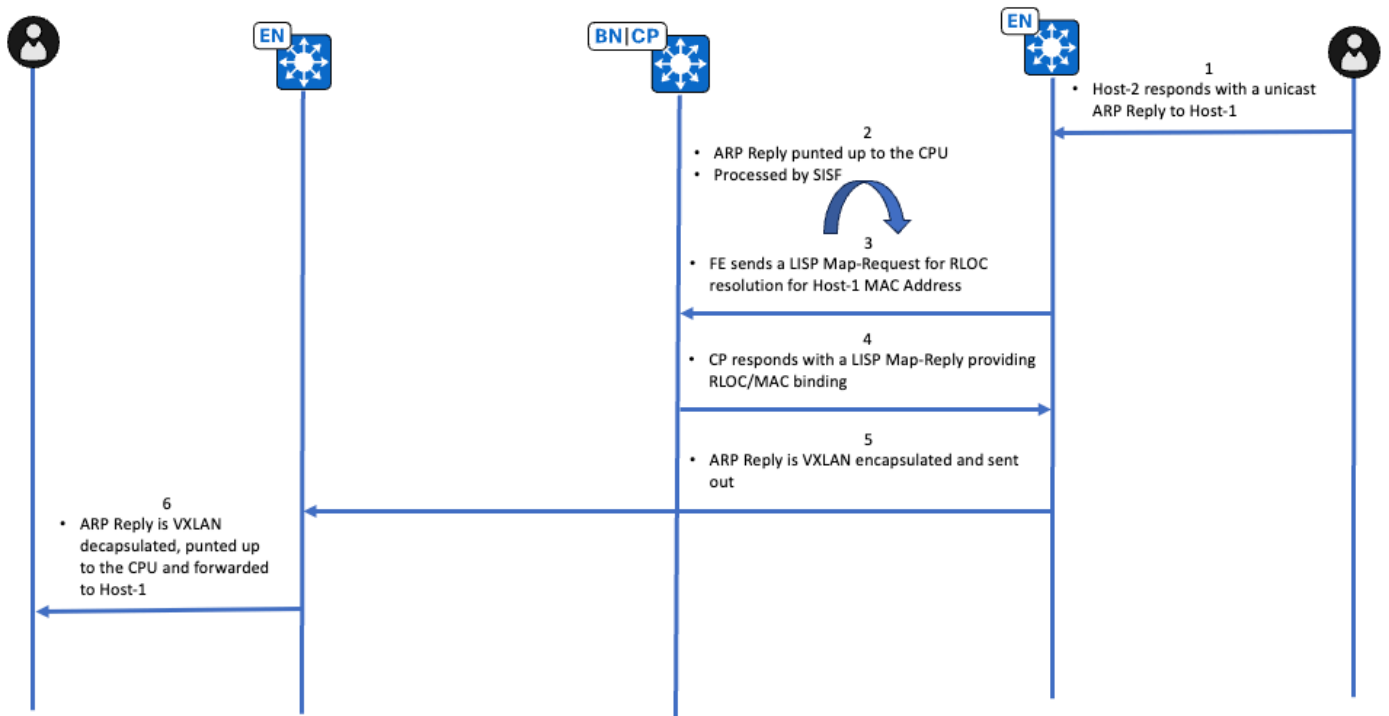PLAT_DAI        : Platform DAI shim
FWDPLANE        : Dataplane forwarding
BRIDGE          : Packet to be bridged
ARPSN           : Arp Snooping
Packet Trace for client MAC 5254.0019.93E9:
```

Timestamp	Sender Mac	Sender IP	Target Mac	Target IP	Opcode
2023/10/24 15:57:01.129	5254.0019.93e9	10.47.4.2	0000.0000.0000	10.47.4.3	ARP_REQUEST
2023/10/24 15:57:01.129	5254.0019.93e9	10.47.4.2	0000.0000.0000	10.47.4.3	ARP_REQUEST
2023/10/24 15:57:01.129	5254.0019.93e9	10.47.4.2	0000.0000.0000	10.47.4.3	ARP_REQUEST

PLATF_DAI:SHUNTED

Maintenant, la requête ARP est injectée du processeur vers le bas dans le VLAN 1026, en particulier Gi1/0/3, où 10.47.4.3 est connecté.

<#root>

Edge-2#

show mac address-table address 5254.001e.ad00

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

Vlan	Mac Address	Type	Ports
1026	5254.001e.ad00	DYNAMIC	Gi1/0/3

Total Mac Addresses for this criterion: 1

Edge-2#

show platform arpsnooping client 5254.001e.ad00

```
PLAT_DAI        : Platform DAI shim
FWDPLANE        : Dataplane forwarding
BRIDGE          : Packet to be bridged
ARPSN           : Arp Snooping
Packet Trace for client MAC 5254.001E.AD00:
```

Timestamp	Sender Mac	Sender IP	Target Mac	Target IP	Opcode
2023/10/24 15:57:01.129	5254.0019.93e9	10.47.4.2	0000.0000.0000	10.47.4.3	ARP_REQUEST

```
2023/10/24 15:57:01.129  5254.0019.93e9  10.47.4.2        0000.0000.0000  10.47.4.3       ARP_REQUEST
```

Workflow de haut niveau de réponse ARP de chemin de monodiffusion

Vérification de la réponse ARP du chemin de monodiffusion

Périphérie 2 (10.47.1.13)

Le point de terminaison qui possède 10.47.4.3 répond avec une réponse ARP monodiffusion, la réponse ARP est envoyée au CPU en raison de la présence d'IPDT. La vérification initiale s'effectue via EPC sur l'interface faisant face au point d'extrémité.

```
<#root>

Edge-2#

show monitor capture 1 buffer display-filter arp

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

    2  88.712035

52:54:00:1e:ad:00 -> 00:00:0c:9f:f3:41 ARP 60 10.47.4.3 is at 52:54:00:1e:ad:00
```

Ensuite, vérifiez l'action punt avec un punject FED

<#root>

Edge-2#

debug platform software fed sw active punt packet-capture start

Punt packet capturing started.

Edge-2#

debug platform software fed sw active punt packet-capture stop

Punt packet capturing stopped. Captured 22 packet(s)

Edge-2#

show platform software fed sw active punt packet-capture display-filter "arp" brief

Punt packet capturing: disabled. Buffer wrapping: disabled
Total captured so far: 22 packets. Capture capacity : 4096 packets

------ Punt Packet Number: 6, Timestamp: 2023/10/24 20:32:35.634 ------
 interface : physical: [if-id: 0x00000000], pal:

L2LISP0

 [if-id: 0x00000017]
 metadata : cause: 109 [

snoop packets]

, sub-cause: 1,

q-no: 16

, linktype: MCP_LINK_TYPE_IP [1]

<-- Punted for Snoop Packets to CPU queue 16

 ether hdr :

dest mac: 5254.001e.ad00

,

src mac: 5254.0019.93e9

 ether hdr : ethertype: 0x0806 (ARP)

Ensuite, la réponse ARP est transmise à ARP Snooper et à Device-Tracking

<#root>

Edge-2#

debug platform software infrastructure punt

*Oct 24 19:18:39.101: PUNT RX: mcprp_process_receive_packet: pak->vlan_id: 1026
*Oct 24 19:18:39.101: Punt: IP proto   src 173.0.

10.47

, dst

4.3

.82.84, from table 0, intf Gi1/0/3, encap ARPA, size 60, cause snoop packets(L3)

<-- 10.47.4.3 is obscured

```
*Oct 24 19:18:39.101:  punt cause:snoop packets invoking reg_invoke_mcprp_punt_feature_msg
*Oct 24 19:18:39.101:  punt cause:snoop packets MCPRP_PUNT_PAK_PROC_OK_DONE
```

<#root>

Edge-2#

debug platform fhs

Edge-2#

debug platform fhs all

ARP packet received from ARP snooper(Gi1/0/3 10.47.4.3 (5254.001e.ad00) VLAN:10

⚠ Attention : ces débogages sont bavards, utilisez-les avec prudence.

<#root>

Edge-2#

debug device-tracking

```
*Oct 24 20:42:22.554: SISF[CLA]: Interest on target vlan 1026
*Oct 24 20:42:22.554: SISF[CLA]:          feature Device-tracking
*Oct 24 20:42:22.554: SISF[CLA]:          feature Address Resolution Relay
*Oct 24 20:42:22.555: SISF[SWI]:
```

Gi1/0/3 vlan 1026 Feature_0 Device-tracking priority 128

```
*Oct 24 20:42:22.555: SISF[SWI]:
```

Gi1/0/3 vlan 1026 Feature_1 Address Resolution Relay priority 81

```
*Oct 24 20:42:22.555: SISF[PRS]:
```

 ARP-REPLY target set to 10.47.4.2

```
*Oct 24 20:42:22.556: SISF[SWI]: Gi1/0/3 vlan 1026 Feature Device-tracking rc: OK
*Oct 24 20:42:22.556: SISF[ARR]: Gi1/0/3 vlan 1026 Receive a msg in AR
*Oct 24 20:42:22.557: SISF[ARR]:
```

 Gi1/0/3 vlan 1026 Not ARP Request or NS, return OK

```
*Oct 24 20:42:22.557: SISF[SWI]: Gi1/0/3 vlan 1026 Feature Address Resolution Relay rc: OK
*Oct 24 20:42:22.557: SISF[SWI]: Gi1/0/3 vlan 1026 Features execution OK
```

Puisque la réponse ARP pointe déjà vers une adresse MAC de destination réelle (pas comme un

espace réservé comme vu temporairement sur Edge-1), Edge-2 peut déclencher une requête LISP Map-Request pour résoudre l'association RLOC-MAC.

<#root>

Edge-2#

debug lisp control-plane all

Edge-2#

debug l2lisp all

*Oct 24 20:47:34.400: LISP[REMT]-0 IID 8190: Schedule processing of Map-Requests from 'remote EID pref
*Oct 24 20:47:34.401: LISP[REMT]-0:

 Map Request: Sending request for IID 8190 EID 5254.0019.93e9/48, requester 'remote EID prefix'.

*Oct 24 20:47:35.166: LISP[TRNSP]-0: Processing received Map-Reply(2) message on GigabitEthernet1/0/1 f
*Oct 24 20:47:35.166: LISP[REMT]-0:

Received Map-Reply with nonce 0x5879579E-0xCAFC0AA5, 1 records.

*Oct 24 20:47:35.166: LISP[REMT]-0:

Processing Map-Reply mapping record for IID 8190 MAC 5254.0019.93e9/48 LCAF 2, ttl 1440, action none, no

*Oct 24 20:47:35.166: LISP[REMT]-0:

10.47.1.12

 pri/wei/dID/mID/met/si_type/si_id/si_flg/afn_id=10/10/0/0/4294967295/none/0/UNSPEC/UNSPEC lpR.

Utilisez la commande show lisp instance-id <L2 ID> ethernet map-cache <adresse MAC de destination> pour vérifier vers quel RLOC cette réponse ARP doit être envoyée avec l'encapsulation VXLAN

<#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: 00:03:45, expires: 23:56:15, via map-reply, complete
  Sources: map-reply
  State: complete, last modified: 00:03:45, map-source: 10.47.1.12
  Active, Packets out: 6(0 bytes), counters are not accurate (~ 00:00:59 ago)
  Encapsulating dynamic-EID traffic
  Locator   Uptime   State Pri/Wgt   Encap-IID

10.47.1.12

```
00:03:45  up       10/10        -
   Last up-down state change:        00:03:45, state change count: 1
   Last route reachability change:   2w0d, state change count: 1
   Last priority / weight change:    never/never
  RLOC-probing loc-status algorithm:
     Last RLOC-probe sent:           00:03:45 (rtt 861ms)
```

Après la résolution LISP, la réponse ARP peut être injectée depuis le processeur vers 10.47.1.12 RLOC dans le sous-réseau

<#root>

Edge-2#

show ip cef 10.47.1.12

```
10.47.1.12/32
  nexthop 10.47.1.2 GigabitEthernet1/0/2
  nexthop 10.47.1.6 GigabitEthernet1/0/1
```

Le flux entier peut être vu sur le CPU Edge-2 via EPC, la différence entre une réponse ARP et une requête ARP est qu'il n'y a pas de résolution LISP AR dans ce flux.

<#root>

Edge-2#

show monitor capture 1 buffer display-filter "arp.src.proto_ipv4==10.47.4.3 or lisp"

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

```
   62   9.355185 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
```

<-- ARP Reply punted up to the CPU

```
   63   9.355486     0.0.0.0 -> 0.0.0.0      LISP 176 Encapsulated Map-Request for [8190] 52:54:00:19:
```

<-- LISP Map-Request to resolve RLOC-MAC association

```
   88  12.058412   10.47.1.10 -> 10.47.1.13   LISP 96 Map-Reply for [8190] 52:54:00:19:93:e9/48
```

<-- LISP Map-Reply providing the RLOC-MAC association

```
   90  12.072455 52:54:00:1e:ad:00 -> 52:54:00:19:93:e9 ARP 110 10.47.4.3 is at 52:54:00:1e:ad:00
```

<-- VXLAN Encapsulated ARP Reply that is injected by the CPU

𝒫 Conseil : la capture FED Punject ne capture pas les réponses ARP injectées, utilisez FED inject verbose traces

---

Vous pouvez utiliser la commande show platform arpsnooping client <adresse MAC source> pour

voir les actions prises sur Edge-2 en relation avec la réponse ARP

<#root>

Edge-2#

show platform arpsnooping client 5254.001e.ad00

```
PLAT_DAI      : Platform DAI shim
FWDPLANE      : Dataplane forwarding
BRIDGE        : Packet to be bridged
ARPSN         : Arp Snooping
Packet Trace for client MAC 5254.001E.AD00:
```

Timestamp	Sender Mac	Sender IP	Target Mac	Target IP	Opcode
2023/10/24 20:47:38.151	5254.001e.ad00	10.47.4.3	5254.0019.93e9	10.47.4.2	ARP_REPLY

PLATF_DAI:RECEIVED INPUT

| 2023/10/24 20:47:38.151 | 5254.001e.ad00 | 10.47.4.3 | 5254.0019.93e9 | 10.47.4.2 | ARP_REPLY |
| 2023/10/24 20:47:38.152 | 5254.001e.ad00 | 10.47.4.3 | 5254.0019.93e9 | 10.47.4.2 | ARP_REPLY |

PLATF_DAI:TO_ARPSND

| 2023/10/24 20:47:38.152 | 5254.001e.ad00 | 10.47.4.3 | 5254.0019.93e9 | 10.47.4.2 | ARP_REPLY |
| 2023/10/24 20:47:38.152 | 5254.001e.ad00 | 10.47.4.3 | 5254.0019.93e9 | 10.47.4.2 | ARP_REPLY |

INJECT:INJ_VLAN_IFINPUT_TO_BDI

| 2023/10/24 20:47:38.152 | 5254.001e.ad00 | 10.47.4.3 | 5254.0019.93e9 | 10.47.4.2 | ARP_REPLY |

INJECT:BD_DPIDX_TO_FWDPLANE

Périphérie 1 (10.47.1.12)

Edge-1 reçoit la réponse ARP encapsulée VXLAN, désactive l'en-tête VXLAN et envoie la réponse ARP au processeur pour traitement ultérieur.

<#root>

Edge-1#

debug platform software infrastructure punt

```
*Oct 24 21:42:11.303: PUNT RX: mcprp_process_receive_packet: pak->vlan_id: 1026
*Oct 24 21:42:11.303:  Punt: IP proto   src 173.0.
```

10.47

, dst

```
4.3

.82.84, from table 0,

intf L2LI0

, encap LISP, size 60, cause snoop packets(L3)

<-- Can see 10.47.4.3 IP address that has been obscured

*Oct 24 21:42:11.303:  punt cause:snoop packets invoking reg_invoke_mcprp_punt_feature_msg
*Oct 24 21:42:11.303:  punt cause:snoop packets MCPRP_PUNT_PAK_PROC_OK_DONE
```

Vous pouvez utiliser la commande show platform arpsnooping client <adresse MAC source> pour obtenir des informations supplémentaires sur la façon dont la réponse ARP est gérée sur Edge-1

```
<#root>

Edge-1#

show platform arpsnooping client 5254.001e.ad00

PLAT_DAI       : Platform DAI shim
FWDPLANE       : Dataplane forwarding
BRIDGE         : Packet to be bridged
ARPSN          : Arp Snooping
Packet Trace for client MAC 5254.001E.AD00:


Timestamp               Sender Mac       Sender IP     Target Mac       Target IP       Opcode
----------------------  ---------------  ------------  ---------------- --------------  -------
2023/10/24 20:40:33.741  5254.001e.ad00  10.47.4.3     5254.0019.93e9   10.47.4.2       ARP_REPLY
2023/10/24 20:40:33.741  5254.001e.ad00  10.47.4.3     5254.0019.93e9   10.47.4.2       ARP_REPLY
2023/10/24 20:40:33.741  5254.001e.ad00  10.47.4.3     5254.0019.93e9   10.47.4.2       ARP_REPLY

PLATF_DAI:SHUNTED


2023/10/24 20:40:33.741  5254.001e.ad00  10.47.4.3     5254.0019.93e9   10.47.4.2       ARP_REPLY
2023/10/24 20:40:33.741  5254.001e.ad00  10.47.4.3     5254.0019.93e9   10.47.4.2       ARP_REPLY

INJECT:BD_DPIDX_TO_FWDPLANE
```

Edge-1 prend la réponse ARP pointillée et envoie la réponse ARP dans le VLAN 1026, au port où réside le point d'extrémité 10.47.4.2

```
<#root>

Edge-1#

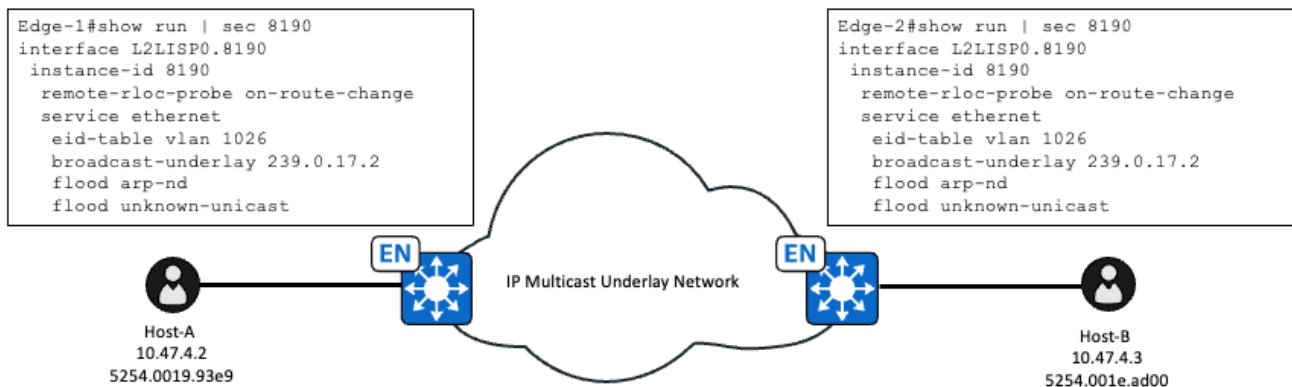show mac address-table address 5254.0019.93e9

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

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

Chemin d'inondation ARP (inondation L2)

Avec l'inondation de couche 2, la résolution ARP peut également se produire lorsque tous les noeuds de périphérie de fabric dans le fabric ainsi que les bordures activées pour le transfert de couche 2/diffusion dirigée IP rejoignent un groupe de multidiffusion sous-jacent commun. Chaque fois qu'un paquet/une trame qui peut être diffusé arrive à un noeud Edge, il est encapsulé dans un VXLAN avec l'adresse IP de destination du groupe de multidiffusion sous-jacent. L'inondation L2 peut s'appliquer à la résolution ARP dans certains scénarios :

- La commande flood arp-nd est configurée sous l'instance LISP L2 pour le VLAN, les trames broadcast ARP sont diffusées à tous les bords du fabric à l'aide du groupe de multidiffusion broadcast-underlay.
- La commande flood arp-nd est configurée mais Cisco Catalyst Center lorsque l'inondation de couche 2 est activée dans un pool et que le pool n'est pas marqué comme pool sans fil
- La multidiffusion sous-jacente doit être configurée via l'automatisation LAN ou manuellement. Aucun des workflows de multidiffusion de fabric ne configure automatiquement la multidiffusion sous-jacente.

Une fois que la multidiffusion sous-jacente est configurée et que flood arp-nd est activé, cela change la façon dont la requête ARP est traitée, qui utilisait à l'origine la résolution basée sur LISP/SISF. Une fois que flood arp-nd est configuré sous l'instance LISP L2, ceci désactive la politique IPDT LISP-ARP-RELAY-VLAN pour le VLAN, et n'est pas utilisé.

```
<#root>

Edge-1#

show device-tracking policies vlan 1026
```

```
Target                   Type  Policy              Feature         Target range
vlan 1026                VLAN  DT-PROGRAMMATIC     Device-tracking vlan all
vlan 1026                VLAN  LISP-DT-GLEAN-VLAN-MULTI-IP Device-tracking vlan all
```

Vérification de la demande ARP du chemin de diffusion

Périphérie 1 (10.47.1.12)

Une fois qu'une requête ARP est reçue du client dans le VLAN activé par diffusion de couche 2 avec la commande flood arp-nd configurée, elle n'est plus gérée par la surveillance ARP. La requête ARP est envoyée au processeur pour l'apprentissage IPDT, mais pas pour le transfert.

ARP Snooper ne traite pas la requête ARP, qui peut être vue avec la commande show platform arpsnooping client <adresse MAC>

```
<#root>

Edge-1#

show platform arpsnooping client 5254.0019.93e9

PLAT_DAI       : Platform DAI shim
FWDPLANE       : Dataplane forwarding
BRIDGE         : Packet to be bridged
ARPSN          : Arp Snooping
Packet Trace for client MAC 5254.0019.93E9:


Timestamp               Sender Mac       Sender IP    Target Mac        Target IP      Opcode
----------------------  --------------   ------------ ----------------  -------------  -------
 Filtered entries counters:
  ARPSN_FILTER_SVI: 0
```

Edge-1 ne crée pas d'entrée RMT IPDT pour le point d'extrémité 10.47.4.3 comme indiqué dans le résultat

```
<#root>

Edge-1#

show monitor capture 1 buffer display-filter arp brief

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

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

Edge-1#

show device-tracking database address 10.47.4.3

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
```

Maintenant, la requête ARP est encapsulée VXLAN dans le groupe de diffusion multicast sous-jacent. Edge-1 a une mroute avec Loopback0 comme source, et le groupe le groupe sous-jacent de diffusion.

<#root>

Edge-1#

show run int lo0

```
Building configuration...

Current configuration : 135 bytes
!
interface Loopback0
 ip address 10.47.1.12 255.255.255.255
 no ip redirects
```

 ip pim sparse-mode <-- PIM must be enabled

```
 ip router isis
 clns mtu 1400
end
```

<#root>

Edge-1#

show ip mroute 239.0.17.2

```
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       G - Received BGP C-Mroute, g - Sent BGP C-Mroute,
       N - Received BGP Shared-Tree Prune, n - BGP C-Mroute suppressed,
       Q - Received BGP S-A Route, q - Sent BGP S-A Route,
       V - RD & Vector, v - Vector, p - PIM Joins on route,
       x - VxLAN group, c - PFP-SA cache created entry,
       * - determined by Assert, # - iif-starg configured on rpf intf,
       e - encap-helper tunnel flag, l - LISP decap ref count contributor
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
                       t - LISP transit group
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
```

```
(*, 239.0.17.2), 5w1d/00:02:05, RP 10.47.1.14, flags: SJC
  Incoming interface: GigabitEthernet1/0/2, RPF nbr 10.47.1.4
  Outgoing interface list:
    L2LISP0.8190, Forward/Sparse-Dense, 01:56:41/00:00:18, flags:
    L2LISP0.8192, Forward/Sparse-Dense, 2w2d/00:00:58, flags:
    L2LISP0.8188, Forward/Sparse-Dense, 5w1d/00:01:58, flags:
```

(

10.47.1.12

, 239.0.17.2), 00:02:53/00:00:06, flags: PFT

<-- Lo0 interface of Edge-1

  Incoming interface:

Null0

, RPF nbr 0.0.0.0,

<-- Incoming interface Null0 is expected

  Outgoing interface list:

GigabitEthernet1/0/2

, Forward/Sparse, 00:04:40/00:02:45, flags:

<-- Outgoing interface Gig1/0/2 faces the fabric underlay

En réalité, flood arp-nd bascule IPDT/SISF plutôt que de s'inonder. L'inondation L2 inonde déjà les diffusions, mais l'astuce est de désactiver la stratégie LISP AR du suivi de périphérique, la propriété d'ARP est maintenant libérée et peut être inondée comme n'importe quelle autre diffusion.

Pour vérifier la programmation matérielle pour l'inondation L2, utilisez la commande show platform software dpidb l2lisp <L2 LISP ID>

<#root>

Edge-1#

show platform software dpidb l2lisp 8190

Instance Id:8190,

dpidx:25

, vlan:1026, Parent Interface:L2LISP0(if_id:23)

<-- dpidx value used in the next command

Prenez la valeur dpidx de la commande précédente et utilisez la commande show platform

software fed switch active ifm if-id <valeur dpidx>

<#root>

Edge-1#

show platform software fed switch active ifm if-id 25

```
Interface IF_ID        : 0x0000000000000019
Interface Name         : L2LISP0.8190
Interface Block Pointer : 0x7f65ec85ba78
Interface Block State  : READY
Interface State        : Enabled
Interface Status       : ADD, UPD
Interface Ref-Cnt      : 2
Interface Type         : L2_LISP
Created Time           : 2023/09/19 17:57:32.046
Last Modified Time     : 2023/10/25 17:59:09.265
Current Time           : 2023/10/25 20:15:44.624
    Is top interface   : FALSE
    Asic_num           : 0
    Switch_num         : 0
    AAL port Handle    : 7a00003a
    Parent interface id : 17
    Multicast Tunnel IP :
```

239.0.17.2

```
    Mcast Tunnel Handle : 0x7f65ed356918
    L2 Multicast Tunnel IP  : 0.0.0.0
    L2 Multicast Vlan Id    : 0
    L2 Multicast Tunnel Hdl : NULL
    Vlan Id            : 1026
    Instance Id        : 8190
    Dest Port          : 4789
    SGT                : Enable
    Underlay VRF (V4)  : 0
    Underlay VRF (V6)  : 0
    Flood Access-tunnel : Disable
    Flood unknown ucast : Enable
```

    Broadcast   : Enable

```
    Multicast Flood    : Enable
    L2 Multicast Flood  : Disable
    Host Activity report: Enabled
<snip>
```

Vous pouvez utiliser EPC sur Gi1/0/2 dans la direction de sortie, parce que cette requête ARP est transférée en entrée et en sortie sans nécessiter d'injection de CPU, vous pouvez faire confiance aux captures EPC dans la décision de sortie cette fois.

<#root>

Edge-1#

monitor capture 1 start

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

monitor capture 1 stop

```
Capture statistics collected at software:
    Capture duration - 22 seconds
    Packets received - 5
    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
```

110

```
 Who has 10.47.4.3? Tell 10.47.4.2
```

<-- Size 110 because VXLAN, UDP, and other headers

Vous pouvez examiner de plus près la requête ARP encapsulée VXLAN

<#root>

```
Edge-1#
```

show monitor capture 1 buffer display-filter frame.number==1 detailed

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

Frame 1: 110 bytes on wire (880 bits), 110 bytes captured (880 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 25, 2023 20:44:36.578645000 UTC
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1698266676.578645000 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: 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: 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

)

<-- Ignore the all 0s MAC, not accurate

    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: 239.0.17.2 <-- Source is Edge-1 RLOC, Destination is the broadcast underlay group

    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: 0x8dab (36267)
    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: 255
    Protocol: UDP (17)
    Header checksum: 0xe2a3 [validation disabled]
    [Header checksum status: Unverified]
    Source: 10.47.1.12
    Destination: 239.0.17.2
User Datagram Protocol, Src Port: 65280, Dst Port: 4789
    Source Port: 65280
    Destination Port: 4789
    Length: 76
    [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): 8190 <-- L2 LISP IID

    Reserved: 0
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 and DMAC of the ARP Request

```
    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)
    Trailer: 00000000000000000000000000000000000
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

Périphérie 2 (10.47.1.13)

Edge-2 rejoint le groupe de diffusion sous-jacent, 239.0.17.2 et a S, G pour Edge-1, il reçoit le paquet multicast encapsulé VXLAN sur Gig1/0/1 et la sous-interface LISP0.8190 est dans la liste d'interfaces sortantes. Les versions antérieures du code comme 17.3 ou plus anciennes utilisent une interface de tunnel au lieu d'une sous-interface LISP0.

<#root>

Edge-2#

show ip mroute 239.0.17.2

```
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
```

```
        U - URD, I - Received Source Specific Host Report,
        Z - Multicast Tunnel, z - MDT-data group sender,
        Y - Joined MDT-data group, y - Sending to MDT-data group,
        G - Received BGP C-Mroute, g - Sent BGP C-Mroute,
        N - Received BGP Shared-Tree Prune, n - BGP C-Mroute suppressed,
        Q - Received BGP S-A Route, q - Sent BGP S-A Route,
        V - RD & Vector, v - Vector, p - PIM Joins on route,
        x - VxLAN group, c - PFP-SA cache created entry,
        * - determined by Assert, # - iif-starg configured on rpf intf,
        e - encap-helper tunnel flag, l - LISP decap ref count contributor
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
                        t - LISP transit group
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 239.0.17.2), 5w1d/stopped, RP 10.47.1.14, flags: SJC
  Incoming interface: GigabitEthernet1/0/1, RPF nbr 10.47.1.6
  Outgoing interface list:
    L2LISP0.8190, Forward/Sparse-Dense, 02:28:57/00:01:02, flags:
    L2LISP0.8192, Forward/Sparse-Dense, 2w2d/00:00:32, flags:
    L2LISP0.8188, Forward/Sparse-Dense, 5w1d/00:02:54, flags:

(10.47.1.12, 239.0.17.2), 00:00:03/00:02:56, flags: JT
  Incoming interface:
```

GigabitEthernet1/0/1

, RPF nbr 10.47.1.6

<-- Interface that faces the fabric underlay and the RPF interface towards 10.47.1.12

```
  Outgoing interface list:
    L2LISP0.8188, Forward/Sparse-Dense, 00:00:03/00:02:56, flags:
    L2LISP0.8192, Forward/Sparse-Dense, 00:00:03/00:02:56, flags:
```

L2LISP0.8190, Forward/Sparse-Dense, 00:00:03/00:02:56, flags:

Edge-2 reçoit le paquet encapsulé VXLAN, désactive l'en-tête VXLAN et diffuse le paquet dans le VLAN 1026, qui peut être vu dans un EPC sur l'interface entrante ainsi que l'interface faisant face au point d'extrémité.

<#root>

```
Edge-2#
```

monitor capture 1 interface gig1/0/1 in match any

```
Edge-2#
```

monitor capture 1 int g1/0/3 out

```
Edge-2#
```

monitor capture 1 start

```
Started capture point : 1
Edge-2#
```

```
monitor capture 1 stop

Capture statistics collected at software:
    Capture duration - 22 seconds
    Packets received - 43
    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 display-filter arp

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

    10   6.230153 52:54:00:19:93:e9 -> ff:ff:ff:ff:ff:ff ARP

110

 Who has 10.47.4.3? Tell 10.47.4.2

<-- Size 110 is the VXLAN encapsulated ARP Request

    11   6.404781 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

<-- Size 60 is the original ARP Request
```

Vérification de la réponse ARP du chemin de diffusion

Les réponses ARP sont presque toujours en monodiffusion, à moins qu'elles ne soient des ARP gratuites. Pour les réponses ARP de monodiffusion, il n'y a aucune distinction entre le flux de travail pour le chemin de monodiffusion basé sur LISP/SISF ou le chemin d'inondation basé sur flood arp-nd, les deux utilisant le même chemin de monodiffusion qui inclut la détection SISF/IPDT. Vous pouvez utiliser la section Vérification de la réponse ARP du chemin de monodiffusion pour le dépannage.