

設定LISP上的多點傳送第1階段

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簡介

本檔案將說明在透過Locator/ID分隔通訊協定(LISP)進行多點傳送實作的階段1中使用輸入複製。這意味著單播路由定位器(RLOC)核心用於傳輸身份資訊(EID)組播。

必要條件

需求

思科建議您瞭解LISP和組播。

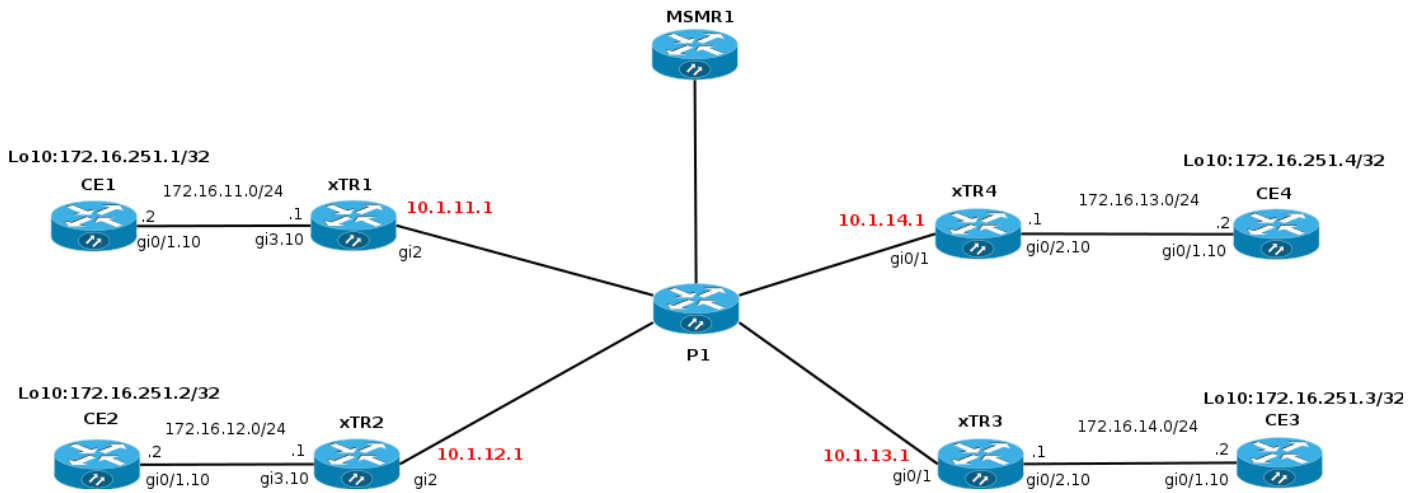
採用元件

本文件所述內容不限於特定軟體和硬體版本。

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

設定

網路圖表



組態

階段1支援組播資料包的單播頭端複製。

- 第1階段支援開始於XE 3.13和Cisco IOS® 15.4(2)T。
- 第1階段支援通過IPv4的IPv4 EID RLOC (傳輸) 開始於XE 3.13和Cisco IOS® 15.4(2)T。
- 第1階段支援基於IPv4的IPv6 EID RLOC (傳輸) 僅在預設vrf中從Polaris 16.6.1開始，僅適用於具有用於軟體定義接入(SDA)的VXLAN封裝的LISP。
- 第1階段支持使用IID的EID虛擬路由和轉發(VRF) (分段) (通過PIM VRF支援) 。
- 階段1支援任何源組播(ASM)和源特定組播(SSM)模型。
- 第1階段僅支援靜態路由處理器(RP)配置。
- 第1階段不支援RP冗餘。
- 階段1支援LISP和非LISP功能的源站點和接收站點的各種組合。
- 不支援將LISP組播作為LISP移動資料中心互聯(DCI)解決方案。

假設在網路上配置了組播(pim sparse-mode/rp)。

為了啟用通過LISP的組播，您必須在LISP0或LISP0.xx介面下新增「ip pim sparse-mode」。通過在LISP介面上啟用PIM，它包含在RPF中。通過LISP站點可到達的字首的RPF資訊包括LISP隧道和由上游站點的RLOC地址表示的鄰居。

僅允許通過LISP隧道傳送加入/修剪消息。站點之間不交換PIM Hello消息。PIM加入/修剪消息被單播封裝到上游xTR (RP或源) 。其他xTR/PxTR看不到加入/修剪消息。MVPN中沒有與預設MDT類似的功能。

必須在LISP隧道介面下啟用PIM以進行組播處理。

EID虛擬化將LISP例項ID與EID VRF結合使用。介面LISP0.x，其中x=IID為每個EID VRF/LISP例項ID建立。

```
xTR1#sh run
!
interface LISP0
 ip pim sparse-mode <<<< PIM under the LISP interface
!
interface LISP0.20
 ip pim sparse-mode <<<< PIM under the LISP interface
end
```

```
xTR1#sh ip pim int
```

| Address | Interface | Ver/ Mode | Nbr Count | Query Intvl | DR Prior | DR |
|-------------|---------------------|-----------|-----------|-------------|----------|-------------|
| 172.16.11.1 | GigabitEthernet3.10 | v2/S | 1 | 30 | 1 | 172.16.11.2 |
| 10.1.255.1 | LISP0 | v2/S | 0 | 30 | 1 | 10.1.255.1 |

沒有通過LISP介面看到鄰居，因為沒有活動源/接收器，對等體之間不會交換PIM Hello。

```
xTR1#sh ip pim nei
```

```
PIM Neighbor Table
```

```
Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,  
      P - Proxy Capable, S - State Refresh Capable, G - GenID Capable,  
      L - DR Load-balancing Capable
```

| Neighbor Address | Interface | Uptime/Expires | Ver | DR Prio/Mode |
|------------------|---------------------|-------------------|-----|--------------|
| 172.16.11.2 | GigabitEthernet3.10 | 01:43:52/00:01:34 | v2 | 1 / DR S P G |

SSM

讓我們配置CE2上的介面lo10以加入組。它觸發(S, G)連線，因為已指定組和源。

```
CE2#conf t
```

```
Enter configuration commands, one per line. End with CNTL/Z.
```

```
CE2(config)#int lo10
```

```
CE2(config-if)#ip igmp join-group 232.1.1.10 source 172.16.251.1
```

```
*Nov 26 18:28:55.471: PIM(0): Insert (172.16.251.1,232.1.1.10) join in nbr 172.16.12.1's queue  
*Nov 26 18:28:55.491: PIM(0): Building Join/Prune packet for nbr 172.16.12.1  
*Nov 26 18:28:55.491: PIM(0): Adding v2 (172.16.251.1/32, 232.1.1.10), S-bit Join  
*Nov 26 18:28:55.492: PIM(0): Send v2 join/prune to 172.16.12.1 (GigabitEthernet0/1.10)  
*Nov 26 18:28:56.856: PIM(0): Send v2 join/prune to 172.16.12.1 (GigabitEthernet0/1.1)
```

在CE2上建立(S, G)mroute。

```
CE2#sh ip mro 232.1.1.10
```

```
<...skip...>
```

```
(172.16.251.1, 232.1.1.10), 00:00:16/00:02:45, flags: sLTI  
Incoming interface: GigabitEthernet0/1.10, RPF nbr 172.16.12.1  
Outgoing interface list:  
Loopback10, Forward/Sparse, 00:00:14/00:02:45
```

檢查xTR2上發生了什麼情況。

Debug ip pim is enabled on xTR2。

接收來自CE2的(S, G)連線。

```
*Nov 26 18:38:19.641: PIM(0): Received v2 Join/Prune on GigabitEthernet3.10 from 172.16.12.2, to us  
*Nov 26 18:38:19.641: PIM(0): Join-list: (172.16.251.1/32, 232.1.1.10), S-bit set
```

172.16.251.1是來自xTR1的EID，尚未出現在RIB中。因此，源IP 172.16.251.1的RPF查詢失敗。它觸發LISP查詢。因此，RPF介面是LISP隧道。

```

*Nov 26 18:38:19.641: PIM(0): RPF Lookup failed for 172.16.251.1
*Nov 26 18:38:19.643: PIM(0): Add GigabitEthernet3.10/172.16.12.2 to (172.16.251.1, 232.1.1.10),
Forward state, by PIM SG Join
*Nov 26 18:38:19.650: PIM(0): Insert (172.16.251.1,232.1.1.10) join in nbr 10.1.11.1's queue

```

```

xTR2#sh ip rpf 172.16.251.1

```

```

RPF information for ? (172.16.251.1)
  RPF interface: LISP0
  RPF neighbor: ? (10.1.11.1)
  RPF route/mask: 172.16.251.1/32
  RPF type: unicast ()
  Doing distance-preferred lookups across tables
  RPF topology: ipv4 multicast base

```

然後，建立(S, G)連線，並通過LISP介面通過RLOC 10.1.11.1傳送到源。

```

*Nov 26 18:38:19.650: PIM(0): Building Join/Prune packet for nbr 10.1.11.1
*Nov 26 18:38:19.650: PIM(0): Adding v2 (172.16.251.1/32, 232.1.1.10), S-bit Join
*Nov 26 18:38:19.650: PIM(0): Adding LISP Unicast transport attribute in join/prune to 10.1.11.1
(LISP0)
*Nov 26 18:38:19.650: PIM(0): Send v2 join/prune to 10.1.11.1 (LISP0)

```

加入被封裝到單播LISP報頭中。封裝資料包的源IP是傳送資料包所經過的介面的RLOC。目的IP是xTR的RLOC地址，該xTR可到達組播源的EID。

```

xTR2#sh ip lisp map-cache 172.16.251.1

```

```

LISP IPv4 Mapping Cache for EID-table default (IID 0), 4 entries

172.16.251.1/32, uptime: 02:18:16, expires: 21:41:44, via map-reply, complete
  Sources: map-reply
  State: complete, last modified: 02:18:16, map-source: 10.1.11.1
  Idle, Packets out: 41(4838 bytes) (~ 01:21:15 ago)
  Locator    Uptime      State      Pri/Wgt
  10.1.11.1  02:18:16   up         100/100
    Last up-down state change:      02:18:16, state change count: 1
    Last route reachability change: 02:18:16, state change count: 1
    Last priority / weight change:   never/never
    RLOC-probing loc-status algorithm:
      Last RLOC-probe sent:         never

```

為了能夠傳送加入，您需要有一個PIM鄰居。一旦獲取了RPF資訊，PIM將顯式建立到相應RLOC的鄰居。鄰居不是以常規方式建立的，因為PIM Hello不會通過LISP隧道。

```

xTR2#sh ip pim nei

```

```

PIM Neighbor Table
Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,
      P - Proxy Capable, S - State Refresh Capable, G - GenID Capable,
      L - DR Load-balancing Capable
Neighbor      Interface          Uptime/Expires   Ver   DR
Address                               Prio/Mode
172.16.12.2   GigabitEthernet3.10 01:57:04/00:01:30 v2    1 / DR S P G
10.1.11.1     LISP0                00:00:48/00:01:10 v2    0 /

```

組播資料包的wireshark捕獲如下圖所示。

| No. | Time | Source | Destination | Protocol | Info |
|------|----------------------------|-------------------|-----------------------|----------|---|
| 1433 | 2017-11-26 19:40:01.922318 | 10.1.11.1 | 10.1.255.41 | TCP | [TCP Keep-Alive ACK] 38534 → 4342 [ACK] Se... |
| 1434 | 2017-11-26 19:40:07.759677 | 10.1.11.10 | 224.0.0.5 | OSPF | Hello Packet |
| 1435 | 2017-11-26 19:40:10.230530 | 10.1.11.1 | 224.0.0.5 | OSPF | Hello Packet |
| 1436 | 2017-11-26 19:40:17.509349 | 10.1.11.10 | 224.0.0.5 | OSPF | Hello Packet |
| 1437 | 2017-11-26 19:40:18.428913 | 10.1.255.2 | 224.0.0.13 | PIMv2 | Join/Prune |
| 1438 | 2017-11-26 19:40:20.006961 | 10.1.11.1 | 224.0.0.5 | OSPF | Hello Packet |
| 1439 | 2017-11-26 19:40:26.747812 | 10.1.11.10 | 224.0.0.5 | OSPF | Hello Packet |
| 1440 | 2017-11-26 19:40:29.176324 | 10.1.11.1 | 224.0.0.5 | OSPF | Hello Packet |
| 1441 | 2017-11-26 19:40:36.581463 | 10.1.11.10 | 224.0.0.5 | OSPF | Hello Packet |
| 1442 | 2017-11-26 19:40:38.535445 | 10.1.11.1 | 224.0.0.5 | OSPF | Hello Packet |
| 1443 | 2017-11-26 19:40:46.066010 | 10.1.11.10 | 224.0.0.5 | OSPF | Hello Packet |
| 1444 | 2017-11-26 19:40:47.743783 | 10.1.11.1 | 224.0.0.5 | OSPF | Hello Packet |
| 1445 | 2017-11-26 19:40:51.434533 | fa:16:3e:5c:d9:c9 | CDP/VTP/DTP/PAgP/UDLD | CDP | Device ID: P1 Port ID: GigabitEthernet0/1... |

▶ Frame 1437: 114 bytes on wire (912 bits), 114 bytes captured (912 bits) on interface 0
 ▶ Ethernet II, Src: fa:16:3e:5c:d9:c9 (fa:16:3e:5c:d9:c9), Dst: fa:16:3e:86:3f:35 (fa:16:3e:86:3f:35)
 ▶ Internet Protocol Version 4, Src: 10.1.12.1, Dst: 10.1.11.1
 ▶ User Datagram Protocol, Src Port: 30222 (30222), Dst Port: 4341 (4341)
 ▶ Locator/ID Separation Protocol (Data)
 ▶ Internet Protocol Version 4, Src: 10.1.255.2, Dst: 224.0.0.13
 ▼ Protocol Independent Multicast
 0010 = Version: 2
 0011 = Type: Join/Prune (3)
 Reserved byte(s): 00
 Checksum: 0x0e80 [correct]
 PIM Options

Frame (frame), 114 bytes Packets: 1948 · Displayed: 1948 (100.0%) Profile: Default

外部源IP和目標IP是本地和遠端RLOC。這是您使用單播複製時的預期結果。

內部源IP從LISP0介面獲取。

```
xTR2#sh int LISP0 | i unn
Interface is unnumbered. Using address of Loopback0 (10.1.255.2)
```

內部目標IP是用於PIM消息的組播地址224.0.0.13。

在(172.16.251.1, 232.1.1.10)的xTR2上，IIL是LISP0介面和OIL指向CE2。

```
xTR2#show ip mroute
<...skip...>
(172.16.251.1, 232.1.1.10), 00:00:36/00:02:55, flags: sT
  Incoming interface: LISP0, RPF nbr 10.1.11.1
  Outgoing interface list:
    GigabitEthernet3.10, Forward/Sparse, 00:00:36/00:02:55
```

```
xTR2#sh ip mfib
<...skip...>
(172.16.251.1,232.1.1.10) Flags: HW
  SW Forwarding: 0/0/0/0, Other: 0/0/0
  HW Forwarding: 0/0/0/0, Other: 0/0/0
  LISP0 Flags: A
  GigabitEthernet3.10 Flags: F NS
  Pkts: 0/0
```

在xTR1上，收到來自xTR2的加入，並建立了(S, G)mroute。

```
*Nov 26 18:38:19.464: PIM(0): Received v2 Join/Prune on LISP0 from 10.1.255.2
*Nov 26 18:38:19.464: PIM(0): J/P Transport Attribute, Transport Type: Unicast, to us
*Nov 26 18:38:19.464: PIM(0): Join-list: (172.16.251.1/32, 232.1.1.10), S-bit set
*Nov 26 18:38:19.467: PIM(0): Add LISP0/10.1.12.1 to (172.16.251.1, 232.1.1.10), Forward state,
```

by PIM SG Join

```
*Nov 26 18:38:19.467: PIM(0): Insert (172.16.251.1,232.1.1.10) join in nbr 172.16.11.2's queue
*Nov 26 18:38:19.467: PIM(0): Building Join/Prune packet for nbr 172.16.11.2
*Nov 26 18:38:19.467: PIM(0): Adding v2 (172.16.251.1/32, 232.1.1.10), S-bit Join
*Nov 26 18:38:19.467: PIM(0): Send v2 join/prune to 172.16.11.2 (GigabitEthernet3.10)
```

xTR1#sh ip mroute

<...skip...>

```
(172.16.251.1, 232.1.1.10), 00:01:00/00:03:28, flags: sT
  Incoming interface: GigabitEthernet3.10, RPF nbr 172.16.11.2
  Outgoing interface list:
    LISP0, 10.1.12.1, Forward/Sparse, 00:01:00/00:03:28 <<<< LISP in OIL
```

上游xTR1必須跟蹤已收到加入消息的每個下游RLOC。

xTR必須記住要向其複製資料包的RLOC集。

因此，上游xTR上的(EIDs,G)條目對於單播封裝如下所示：

(EID)_s,G)

Eth0/0

F LISP0,nextthop = RLOC1

F LISP0,nextthop = RLOC2

xTR1#sh ip mfib

<...skip...>

```
(172.16.251.1,232.1.1.10) Flags: HW
  SW Forwarding: 0/0/0/0, Other: 0/0/0
  HW Forwarding: 0/0/0/0, Other: 0/0/0
  GigabitEthernet3.10 Flags: A
  LISP0, 10.1.12.1 Flags: F NS <<<<
  Pkts: 0/0
```

附註：xTR1沒有通過介面LISP0的PIM鄰居。

xTR1# sh ip pim nei

PIM Neighbor Table

Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,
P - Proxy Capable, S - State Refresh Capable, G - GenID Capable,
L - DR Load-balancing Capable

| Neighbor Address | Interface | Uptime/Expires | Ver | DR Prio/Mode |
|------------------|---------------------|-------------------|-----|--------------|
| 172.16.11.2 | GigabitEthernet3.10 | 04:25:32/00:01:37 | v2 | 1 / DR S P G |

在CE1上，接收了(S, G)的加入，並建立了mroute。

CE1#sh ip mro

<...skip...>

```
(172.16.251.1, 232.1.1.10), 02:16:45/00:03:08, flags: sT
  Incoming interface: Loopback10, RPF nbr 0.0.0.0
```

```
Outgoing interface list:
  GigabitEthernet0/1.10, Forward/Sparse, 02:16:45/00:03:08
```

組播流量像預期一樣流動。

```
CE1#ping 232.1.1.10 so lo10 rep 5
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 232.1.1.10, timeout is 2 seconds:
Packet sent with a source address of 172.16.251.1

Reply to request 0 from 172.16.251.2, 11 ms
Reply to request 0 from 172.16.251.2, 15 ms
Reply to request 1 from 172.16.251.2, 14 ms
Reply to request 1 from 172.16.251.2, 15 ms
Reply to request 2 from 172.16.251.2, 12 ms
Reply to request 2 from 172.16.251.2, 16 ms
Reply to request 3 from 172.16.251.2, 9 ms
Reply to request 3 from 172.16.251.2, 13 ms
Reply to request 4 from 172.16.251.2, 9 ms
Reply to request 4 from 172.16.251.2, 9 ms
```

讓我們在CE3上再新增一個接收器。

在MRIB和MFIB中新增用於新RLOC的附加入口在油中。

```
xTR1#sh ip mro 232.1.1.10
<...skip...>
(172.16.251.1, 232.1.1.10), 02:28:36/00:03:25, flags: sT
  Incoming interface: GigabitEthernet3.10, RPF nbr 172.16.11.2
  Outgoing interface list:
    LISP0, 10.1.13.1, Forward/Sparse, 00:01:34/00:02:57
    LISP0, 10.1.12.1, Forward/Sparse, 02:28:36/00:03:25
```

```
xTR1#sh ip mfib 232.1.1.10
<...skip...>
(172.16.251.1,232.1.1.10) Flags: HW
  SW Forwarding: 0/0/0/0, Other: 0/0/0
  HW Forwarding: 10/0/118/0, Other: 0/0/0
  GigabitEthernet3.10 Flags: A
  LISP0, 10.1.13.1 Flags: F NS
    Pkts: 0/0
  LISP0, 10.1.12.1 Flags: F NS
    Pkts: 0/0
```

如果您開始將流量傳送到核心介面上的232.1.1.10，如下圖所示。

| No. | Time | Source | Destination | Protocol | Info |
|------|----------------------------|--------------|--------------|----------|---|
| 4162 | 2017-11-26 22:09:02.859375 | 10.1.255.41 | 10.1.11.1 | TCP | [TCP Keep-Alive] 4342 → 38534 [ACK] Seq=70... |
| 4163 | 2017-11-26 22:09:02.860981 | 10.1.11.1 | 10.1.255.41 | TCP | [TCP Keep-Alive ACK] 38534 → 4342 [ACK] Se... |
| 4164 | 2017-11-26 22:09:03.348785 | 10.1.11.1 | 224.0.0.5 | OSPF | Hello Packet |
| 4165 | 2017-11-26 22:09:03.377240 | 172.16.251.1 | 232.1.1.10 | ICMP | Echo (ping) request id=0x001f, seq=0/0, t... |
| 4166 | 2017-11-26 22:09:03.377428 | 172.16.251.1 | 232.1.1.10 | ICMP | Echo (ping) request id=0x001f, seq=0/0, t... |
| 4167 | 2017-11-26 22:09:03.381194 | 172.16.251.1 | 232.1.1.10 | ICMP | Echo (ping) request id=0x001f, seq=0/0, t... |
| 4168 | 2017-11-26 22:09:03.381331 | 172.16.251.1 | 232.1.1.10 | ICMP | Echo (ping) request id=0x001f, seq=0/0, t... |
| 4169 | 2017-11-26 22:09:03.384748 | 172.16.251.2 | 172.16.251.1 | ICMP | Echo (ping) reply id=0x001f, seq=0/0, t... |
| 4170 | 2017-11-26 22:09:03.388197 | 172.16.251.2 | 172.16.251.1 | ICMP | Echo (ping) reply id=0x001f, seq=0/0, t... |
| 4171 | 2017-11-26 22:09:03.401289 | 172.16.251.3 | 172.16.251.1 | ICMP | Echo (ping) reply id=0x001f, seq=0/0, t... |
| 4172 | 2017-11-26 22:09:03.401306 | 172.16.251.3 | 172.16.251.1 | ICMP | Echo (ping) reply id=0x001f, seq=0/0, t... |
| 4173 | 2017-11-26 22:09:10.873440 | 10.1.11.10 | 224.0.0.5 | OSPF | Hello Packet |
| 4174 | 2017-11-26 22:09:12.739278 | 10.1.11.1 | 224.0.0.5 | OSPF | Hello Packet |

▶ Frame 4165: 150 bytes on wire (1200 bits), 150 bytes captured (1200 bits) on interface 0
 ▶ Ethernet II, Src: fa:16:3e:86:3f:35 (fa:16:3e:86:3f:35), Dst: fa:16:3e:5c:d9:c9 (fa:16:3e:5c:d9:c9)
 ▶ Internet Protocol Version 4, Src: 10.1.11.1, Dst: 10.1.12.1
 ▶ User Datagram Protocol, Src Port: 48922 (48922), Dst Port: 4341 (4341)
 ▶ Locator/ID Separation Protocol (Data)
 ▶ Internet Protocol Version 4, Src: 172.16.251.1, Dst: 232.1.1.10
 ▼ Internet Control Message Protocol
 Type: 8 (Echo (ping) request)
 Code: 0
 Checksum: 0x4193 [correct]
 Identifier (BE): 31 (0x001f)
 Identifier (LE): 7936 (0x1f00)
 Sequence number (BE): 0 (0x0000)
 Sequence number (LE): 0 (0x0000)
 ▶ [No response seen]
 ▶ Data (72 bytes)

封裝封包的目的地是xTR2的RLOC，如下圖所示。

| No. | Time | Source | Destination | Protocol | Info |
|------|----------------------------|--------------|--------------|----------|---|
| 4162 | 2017-11-26 22:09:02.859375 | 10.1.255.41 | 10.1.11.1 | TCP | [TCP Keep-Alive] 4342 → 38534 [ACK] Seq=70... |
| 4163 | 2017-11-26 22:09:02.860981 | 10.1.11.1 | 10.1.255.41 | TCP | [TCP Keep-Alive ACK] 38534 → 4342 [ACK] Se... |
| 4164 | 2017-11-26 22:09:03.348785 | 10.1.11.1 | 224.0.0.5 | OSPF | Hello Packet |
| 4165 | 2017-11-26 22:09:03.377240 | 172.16.251.1 | 232.1.1.10 | ICMP | Echo (ping) request id=0x001f, seq=0/0, t... |
| 4166 | 2017-11-26 22:09:03.377428 | 172.16.251.1 | 232.1.1.10 | ICMP | Echo (ping) request id=0x001f, seq=0/0, t... |
| 4167 | 2017-11-26 22:09:03.381194 | 172.16.251.1 | 232.1.1.10 | ICMP | Echo (ping) request id=0x001f, seq=0/0, t... |
| 4168 | 2017-11-26 22:09:03.381331 | 172.16.251.1 | 232.1.1.10 | ICMP | Echo (ping) request id=0x001f, seq=0/0, t... |
| 4169 | 2017-11-26 22:09:03.384748 | 172.16.251.2 | 172.16.251.1 | ICMP | Echo (ping) reply id=0x001f, seq=0/0, t... |
| 4170 | 2017-11-26 22:09:03.388197 | 172.16.251.2 | 172.16.251.1 | ICMP | Echo (ping) reply id=0x001f, seq=0/0, t... |
| 4171 | 2017-11-26 22:09:03.401289 | 172.16.251.3 | 172.16.251.1 | ICMP | Echo (ping) reply id=0x001f, seq=0/0, t... |
| 4172 | 2017-11-26 22:09:03.401306 | 172.16.251.3 | 172.16.251.1 | ICMP | Echo (ping) reply id=0x001f, seq=0/0, t... |
| 4173 | 2017-11-26 22:09:10.873440 | 10.1.11.10 | 224.0.0.5 | OSPF | Hello Packet |
| 4174 | 2017-11-26 22:09:12.739278 | 10.1.11.1 | 224.0.0.5 | OSPF | Hello Packet |

▶ Frame 4166: 150 bytes on wire (1200 bits), 150 bytes captured (1200 bits) on interface 0
 ▶ Ethernet II, Src: fa:16:3e:86:3f:35 (fa:16:3e:86:3f:35), Dst: fa:16:3e:5c:d9:c9 (fa:16:3e:5c:d9:c9)
 ▶ Internet Protocol Version 4, Src: 10.1.11.1, Dst: 10.1.13.1
 ▶ User Datagram Protocol, Src Port: 48922 (48922), Dst Port: 4341 (4341)
 ▶ Locator/ID Separation Protocol (Data)
 ▶ Internet Protocol Version 4, Src: 172.16.251.1, Dst: 232.1.1.10
 ▼ Internet Control Message Protocol
 Type: 8 (Echo (ping) request)
 Code: 0
 Checksum: 0x4193 [correct]
 Identifier (BE): 31 (0x001f)
 Identifier (LE): 7936 (0x1f00)
 Sequence number (BE): 0 (0x0000)
 Sequence number (LE): 0 (0x0000)
 ▶ [No response seen]
 ▶ Data (72 bytes)

資料包的目的地IP是xTR3的RLOC。

組播流被複製到兩個單播流中，並通過核心傳送。

ASM

附註：僅支援靜態RP。不支援RP冗餘。

源暫存器優先

讓我們將組播從CE1傳送到組225.1.1.10。CE1是第一跳路由器(FHR)，因此它會觸發到RP(CE4)的單播註冊消息。由於沒有接收器，CE1收到一個Register-Stop並建立mroute條目。

```
CE1#ping 225.1.1.10 so lo10
```

```
Type escape sequence to abort.
```

```
Sending 1, 100-byte ICMP Echos to 225.1.1.10, timeout is 2 seconds:
```

```
Packet sent with a source address of 172.16.251.1
```

```
*Nov 27 14:29:04.083: PIM(0): Check RP 172.16.251.4 into the (*, 225.1.1.10) entry
```

```
*Nov 27 14:29:04.084: PIM(0): Building Triggered (*,G) Join / (S,G,RP-bit) Prune message for 225.1.1.10
```

```
*Nov 27 14:29:04.089: PIM(0): Adding register encap tunnel (Tunnel0) as forwarding interface of (172.16.251.1, 225.1.1.10).
```

```
*Nov 27 14:29:04.112: PIM(0): Received v2 Register-Stop on GigabitEthernet0/1.10 from 172.16.251.4
```

```
*Nov 27 14:29:04.112: PIM(0): for source 172.16.251.1, group 225.1.1.10
```

```
*Nov 27 14:29:04.113: PIM(0): Removing register encap tunnel (Tunnel0) as forwarding interface of (172.16.251.1, 225.1.1.10).
```

```
*Nov 27 14:29:04.113: PIM(0): Clear Registering flag to 172.16.251.4 for (172.16.251.1/32, 225.1.1.10).
```

```
CE1#sh ip mro 225.1.1.10
```

```
<...skip...>
```

```
(*, 225.1.1.10), 00:02:16/stopped, RP 172.16.251.4, flags: SPF  
Incoming interface: GigabitEthernet0/1.10, RPF nbr 172.16.11.1  
Outgoing interface list: Null
```

```
(172.16.251.1, 225.1.1.10), 00:02:16/00:00:43, flags: PFT  
Incoming interface: Loopback10, RPF nbr 0.0.0.0  
Outgoing interface list: Null
```

在RP端也預期圖片。收到來自CE1的Register消息後，RP(CE4)將傳送Register-Stop消息並建立必要的路由。

```
CE4#
```

```
*Nov 27 14:24:06.810: PIM(0): Received v2 Register on GigabitEthernet0/1.10 from 172.16.251.1
```

```
*Nov 27 14:24:06.810: for 172.16.251.1, group 225.1.1.10
```

```
*Nov 27 14:24:06.811: PIM(0): Check RP 172.16.251.4 into the (*, 225.1.1.10) entry
```

```
*Nov 27 14:24:06.812: PIM(0): Adding register decap tunnel (Tunnel0) as accepting interface of (*, 225.1.1.10).
```

```
*Nov 27 14:24:06.814: PIM(0): Adding register decap tunnel (Tunnel0) as accepting interface of (172.16.251.1, 225.1.1.10).
```

```
*Nov 27 14:24:06.815: PIM(0): Send v2 Register-Stop to 172.16.251.1 for 172.16.251.1, group 225.1.1.10
```

```
CE4#
```

```
*Nov 27 14:24:11.207: PIM(0): Building Periodic (*,G) Join / (S,G,RP-bit) Prune message for 224.0.1.40
```

```
CE4#sh ip mro 225.1.1.10
```

```
<...skip...>
```

```
(*, 225.1.1.10), 00:00:31/stopped, RP 172.16.251.4, flags: SP  
Incoming interface: Null, RPF nbr 0.0.0.0  
Outgoing interface list: Null
```

```
(172.16.251.1, 225.1.1.10), 00:00:31/00:02:28, flags: P
  Incoming interface: GigabitEthernet0/1.10, RPF nbr 172.16.14.1
  Outgoing interface list: Null
```

考慮註冊源介面應位於EID範圍內，否則將不會觸發LISP。預設情況下，它是傳出介面的IP地址。

```
CE1#sh run | i source
ip pim register-source Loopback10
```

對於xTR1和xTR4，由於尚未接收組播流量，因此未進行任何更改。

接收者優先

讓我們配置裝置CE3上的介面Lo10上的接收器。

```
CE3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
CE3(config)#int lo10
CE3(config-if)#ip igmp join-group 225.1.1.10
CE3(config-if)#end
```

將觸發(*,Join)並建立mroute。一切都是意料之中。

```
CE3#
*Nov 27 14:48:46.271: PIM(0): Check RP 172.16.251.4 into the (*, 225.1.1.10) entry
*Nov 27 14:48:46.272: PIM(0): Building Triggered (*,G) Join / (S,G,RP-bit) Prune message for
225.1.1.10
*Nov 27 14:48:46.272: PIM(0): Upstream mode for (*, 225.1.1.10) changed from 0 to 1
*Nov 27 14:48:46.274: PIM(0): Insert (*,225.1.1.10) join in nbr 172.16.13.1's queue
*Nov 27 14:48:46.275: PIM(0): Building Triggered (*,G) Join / (S,G,RP-bit) Prune message for
225.1.1.10
*Nov 27 14:48:46.284: PIM(0): Building Join/Prune packet for nbr 172.16.13.1
*Nov 27 14:48:46.284: PIM(0): Adding v2 (172.16.251.4/32, 225.1.1.10), WC-bit, RPT-bit, S-bit
Join
*Nov 27 14:48:46.285: PIM(0): Send v2 join/prune to 172.16.13.1 (GigabitEthernet0/1.10)
```

```
CE3#sh ip mro
< ...skip...>
(*, 225.1.1.10), 00:26:23/00:02:42, RP 172.16.251.4, flags: SJCL
  Incoming interface: GigabitEthernet0/1.10, RPF nbr 172.16.13.1
  Outgoing interface list:
    Loopback10, Forward/Sparse, 00:26:23/00:02:42

(*, 224.0.1.40), 21:32:32/00:02:03, RP 172.16.251.4, flags: SJPCL
  Incoming interface: GigabitEthernet0/1.10, RPF nbr 172.16.13.1
  Outgoing interface list: Null
```

xTR3接收(*,225.1.1.10)加入。將(*,G)加入傳送到RP。xTR3檢查RLOC以查詢RP(172.16.251.4)。由於可以通過LISP訪問，因此會建立到相應RLOC的PIM鄰居。在本例中為10.1.14.1。

```
xTR3#
*Nov 27 14:30:23.229: PIM(0): Received v2 Join/Prune on GigabitEthernet0/2.10 from 172.16.13.2,
to us
*Nov 27 14:30:23.229: PIM(0): Join-list: (*, 225.1.1.10), RPT-bit set, WC-bit set, S-bit set
```

```

*Nov 27 14:30:23.231: PIM(0): Check RP 172.16.251.4 into the (*, 225.1.1.10) entry
*Nov 27 14:30:23.233: PIM(0): Add GigabitEthernet0/2.10/172.16.13.2 to (*, 225.1.1.10), Forward
state, by PIM *G Join
*Nov 27 14:30:23.247: PIM(0): Building Triggered (*,G) Join / (S,G,RP-bit) Prune message for
225.1.1.10
*Nov 27 14:30:23.247: PIM(0): Upstream mode for (*, 225.1.1.10) changed from 0 to 1
*Nov 27 14:30:23.248: PIM(0): Insert (*,225.1.1.10) join in nbr 10.1.14.1's queue
xTR3#
*Nov 27 14:30:23.259: PIM(0): Building Join/Prune packet for nbr 10.1.14.1
*Nov 27 14:30:23.259: PIM(0): Adding v2 (172.16.251.4/32, 225.1.1.10), WC-bit, RPT-bit, S-bit
Join
*Nov 27 14:30:23.260: PIM(0): Send v2 join/prune to 10.1.14.1 (LISP0)

```

```
xTR3#sh ip pim nei
```

```
PIM Neighbor Table
```

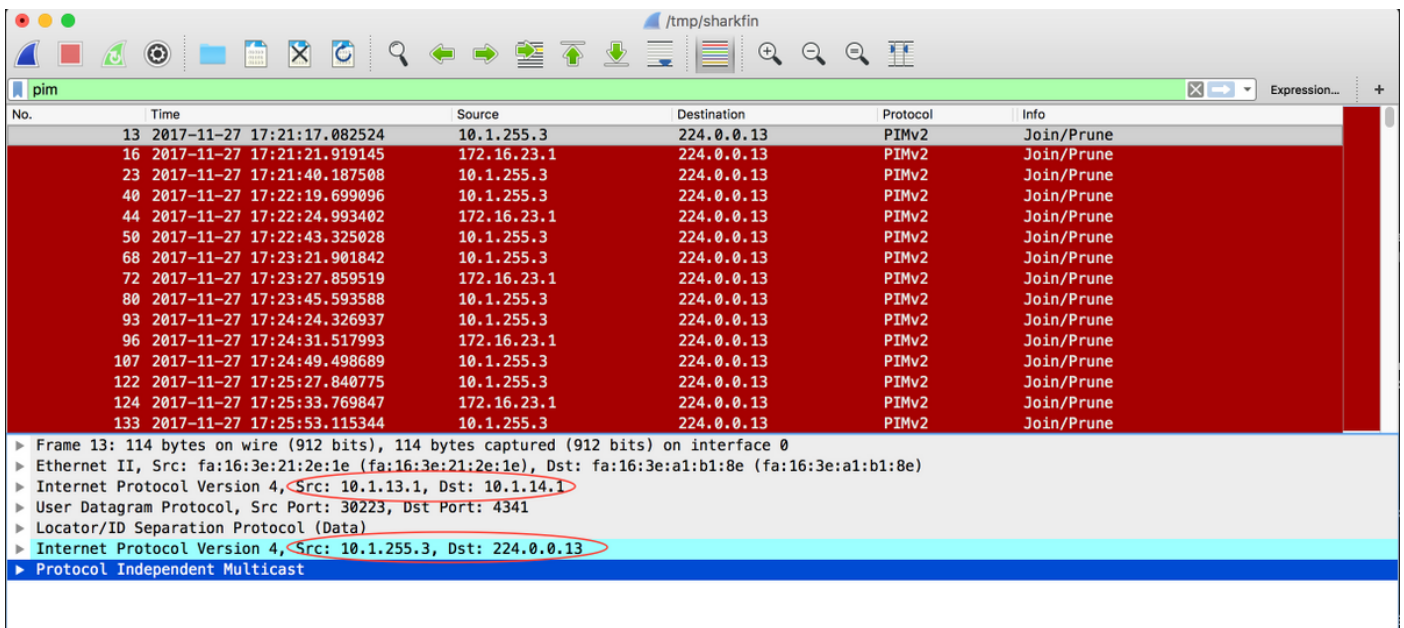
```

Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,
      P - Proxy Capable, S - State Refresh Capable, G - GenID Capable,
      L - DR Load-balancing Capable

```

| Neighbor Address | Interface | Uptime/Expires | Ver | DR Prio/Mode |
|------------------|-----------------------|-------------------|-----|--------------|
| 172.16.13.2 | GigabitEthernet0/2.10 | 21:54:17/00:01:27 | v2 | 1 / DR S P G |
| 10.1.14.1 | LISP0 | 00:26:16/00:01:35 | v2 | 0 / |

如下圖所示，讓我們檢查wireshark捕獲。



外部IP來源是本地RLOC，而外部IP目的地是遠端RLOC。內部來源是為LISP0介面獲取的IP地址。內部目標IP地址是常規PIM組播地址224.0.0.13。

將建立一個(*,G)mroute。RP的傳入介面/RPF是LISP0介面。

```
xTR3#sh ip mro 225.1.1.10
```

```
<...skip...>
```

```

(*, 225.1.1.10), 00:42:51/00:03:25, RP 172.16.251.4, flags: S
Incoming interface: LISP0, RPF nbr 10.1.14.1
Outgoing interface list:
GigabitEthernet0/2.10, Forward/Sparse, 00:42:51/00:03:25

```

```
xTR3#sh int LISP0 | i address
```

```
Interface is unnumbered. Using address of Loopback0 (10.1.255.3)
```

在xTR4上，從LISP隧道接收一個(*,G)連線。建立適當的mroute。

```
xTR4#
*Nov 27 14:38:20.880: PIM(0): Received v2 Join/Prune on LISP0 from 10.1.255.3, to us
*Nov 27 14:38:20.881: PIM(0): Join-list: (*, 225.1.1.10), RPT-bit set, WC-bit set, S-bit set
*Nov 27 14:38:20.883: PIM(0): Check RP 172.16.251.4 into the (*, 225.1.1.10) entry
*Nov 27 14:38:20.883: PIM(0): Building Triggered (*,G) Join / (S,G,RP-bit) Prune message for
225.1.1.10
*Nov 27 14:38:20.884: PIM(0): Add LISP0/10.1.13.1 to (*, 225.1.1.10), Forward state, by PIM *G
Join
*Nov 27 14:38:20.885: PIM(0): Building Triggered (*,G) Join / (S,G,RP-bit) Prune message for
225.1.1.10
*Nov 27 14:38:20.885: PIM(0): Upstream mode for (*, 225.1.1.10) changed from 0 to 1
xTR4#
*Nov 27 14:38:20.885: PIM(0): Insert (*,225.1.1.10) join in nbr 172.16.14.2's queue
*Nov 27 14:38:20.886: PIM(0): Building Join/Prune packet for nbr 172.16.14.2
*Nov 27 14:38:20.886: PIM(0): Adding v2 (172.16.251.4/32, 225.1.1.10), WC-bit, RPT-bit, S-bit
Join
*Nov 27 14:38:20.887: PIM(0): Send v2 join/prune to 172.16.14.2 (GigabitEthernet0/2.10)

xTR4#sh ip mro 225.1.1.10
<...skip...>
(*, 225.1.1.10), 00:45:05/00:02:56, RP 172.16.251.4, flags: S
  Incoming interface: GigabitEthernet0/2.10, RPF nbr 172.16.14.2
  Outgoing interface list:
    LISP0, 10.1.13.1, Forward/Sparse, 00:45:05/00:02:56
```

在這種情況下，不會在xTR4上建立PIM鄰居。只有CE4的PIM鄰居存在。

```
xTR4#sh ip pim nei
PIM Neighbor Table
Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,
      P - Proxy Capable, S - State Refresh Capable, G - GenID Capable,
      L - DR Load-balancing Capable
Neighbor      Interface                Uptime/Expires    Ver   DR
Address                                     Prio/Mode
172.16.14.2   GigabitEthernet0/2.10    22:00:37/00:01:20 v2    1 / DR S P G
```

從RP的角度來看，一切都是預期的。建立一個(*,G)mroute。

```
CE4#
*Nov 27 14:41:55.907: PIM(0): Building Periodic (*,G) Join / (S,G,RP-bit) Prune message for
224.0.1.40
CE4#
*Nov 27 14:42:11.841: PIM(0): Received v2 Join/Prune on GigabitEthernet0/1.10 from 172.16.14.1,
to us
*Nov 27 14:42:11.841: PIM(0): Join-list: (*, 225.1.1.10), RPT-bit set, WC-bit set, S-bit set
*Nov 27 14:42:11.844: PIM(0): Check RP 172.16.251.4 into the (*, 225.1.1.10) entry
*Nov 27 14:42:11.845: PIM(0): Adding register decap tunnel (Tunnel0) as accepting interface of
(*, 225.1.1.10).
*Nov 27 14:42:11.846: PIM(0): Add GigabitEthernet0/1.10/172.16.14.1 to (*, 225.1.1.10), Forward
state, by PIM *G Join

CE4#sh ip mro
<...skip...>
(*, 225.1.1.10), 00:00:11/00:03:18, RP 172.16.251.4, flags: S
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
```

```
GigabitEthernet0/1.10, Forward/Sparse, 00:00:11/00:03:18
(*, 224.0.1.40), 21:00:55/00:02:53, RP 172.16.251.4, flags: SJCL
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
GigabitEthernet0/1.10, Forward/Sparse, 21:00:55/00:02:53
```

最短路徑樹(SPT)切換

假設已生成共用樹。

CE1開始將流量從源Lo10(172.16.251.1)傳送到225.1.10。

```
CE1#ping 225.1.1.10 so lo10
```

```
Type escape sequence to abort.
Sending 1, 100-byte ICMP Echos to 225.1.1.10, timeout is 2 seconds:
Packet sent with a source address of 172.16.251.1
Reply to request 0 from 172.16.251.3, 77 ms
```

第一個組播資料包被封裝到單播註冊消息中並傳送到RP。

```
.Nov 30 00:00:50.931: PIM(0): Check RP 172.16.251.4 into the (*, 225.1.1.10) entry
.Nov 30 00:00:50.932: MRT(0): (*,225.1.1.10), RPF change from /0.0.0.0 to
GigabitEthernet0/1.10/172.16.11.1
.Nov 30 00:00:50.932: PIM(0): Building Triggered (*,G) Join / (S,G,RP-bit) Prune message for
225.1.1.10
.Nov 30 00:00:50.933: MRT(0): Create (*,225.1.1.10), RPF (GigabitEthernet0/1.10, 172.16.11.1,
90/3072)
.Nov 30 00:00:50.936: MRT(0): Reset the z-flag for (172.16.251.1, 225.1.1.10)
.Nov 30 00:00:50.937: MRT(0): (172.16.251.1,225.1.1.10), RPF install from /0.0.0.0 to
Loopback10/0.0.0.0
.Nov 30 00:00:50.937: PIM(0): Adding register encap tunnel (Tunnel0) as forwarding interface of
(172.16.251.1, 225.1.1.10).
```

暫存器資料包在RP上解封，並通過共用樹傳送到接收器。

```
.Nov 30 00:00:51.540: PIM(0): Received v2 Register on GigabitEthernet0/1.10 from 172.16.251.1
.Nov 30 00:00:51.541: for 172.16.251.1, group 225.1.1.10
.Nov 30 00:00:51.542: PIM(0): Adding register decap tunnel (Tunnel0) as accepting interface of
(172.16.251.1, 225.1.1.10).
```

由於(*,G)的傳出介面和(S, G)的傳入介面之間的匹配，為(S, G)啟動代理加入計時器，因此設定標誌X。這是拓撲特定的情況(單臂路由器)。

```
CE4#sh ip mro
```

```
<...skip...>
(*, 225.1.1.10), 00:00:37/stopped, RP 172.16.251.4, flags: S
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
GigabitEthernet0/1.10, Forward/Sparse, 00:00:37/00:02:52
(172.16.251.1, 225.1.1.10), 00:00:26/00:02:33, flags: PX Incoming interface:
GigabitEthernet0/1.10, RPF nbr 172.16.14.1 Outgoing interface list: Null
```

因此CE4向源裝置傳送(S, G)連線，而不傳送(S, G)修剪。

```
.Nov 30 00:00:51.544: PIM(0): Insert (172.16.251.1,225.1.1.10) join in nbr 172.16.14.1's queue
.Nov 30 00:00:51.546: PIM(0): Building Join/Prune packet for nbr 172.16.14.1
.Nov 30 00:00:51.546: PIM(0): Adding v2 (172.16.251.1/32, 225.1.1.10), S-bit Join
.Nov 30 00:00:51.547: PIM(0): Send v2 join/prune to 172.16.14.1 (GigabitEthernet0/1.10)
```

同時，解除封裝的組播流量通過共用樹傳送到接收器，如圖所示。

| No. | Time | Source | Destination | Protocol | Info |
|-----|----------------------------|-------------------|-----------------------|----------|--|
| 68 | 2017-11-28 13:55:29.783398 | 10.1.14.10 | 224.0.0.5 | OSPF | Hello Packet |
| 69 | 2017-11-28 13:55:34.738715 | fa:16:3e:ab:98:7e | CDP/VTP/DTP/PagP/UDLD | CDP | Device ID: xTR4 Port ID: GigabitEthernet0... |
| 70 | 2017-11-28 13:55:35.939428 | fa:16:3e:ab:98:7e | fa:16:3e:ab:98:7e | L2MP | Reply |
| 71 | 2017-11-28 13:55:37.964584 | 10.1.14.1 | 224.0.0.5 | OSPF | Hello Packet |
| 72 | 2017-11-28 13:55:40.167524 | 10.1.14.10 | 224.0.0.5 | OSPF | Hello Packet |
| 73 | 2017-11-28 13:55:41.375985 | 172.16.251.1 | 225.1.1.10 | ICMP | Echo (ping) request id=0x002b, seq=0/0, t... |
| 74 | 2017-11-28 13:55:41.391351 | 172.16.251.1 | 225.1.1.10 | ICMP | Echo (ping) request id=0x002b, seq=0/0, t... |
| 75 | 2017-11-28 13:55:41.405722 | 172.16.251.1 | 225.1.1.10 | ICMP | Echo (ping) request id=0x002b, seq=0/0, t... |
| 76 | 2017-11-28 13:55:41.408310 | 172.16.251.1 | 225.1.1.10 | ICMP | Echo (ping) request id=0x002b, seq=0/0, t... |
| 77 | 2017-11-28 13:55:41.568043 | 10.1.255.3 | 224.0.0.13 | PIMv2 | Join/Prune |
| 78 | 2017-11-28 13:55:43.448000 | 172.16.251.1 | 225.1.1.10 | ICMP | Echo (ping) request id=0x002b, seq=1/256,... |
| 79 | 2017-11-28 13:55:43.449757 | 172.16.251.1 | 225.1.1.10 | ICMP | Echo (ping) request id=0x002b, seq=1/256,... |
| 80 | 2017-11-28 13:55:45.137555 | 172.16.23.1 | 224.0.0.13 | PIMv2 | Join/Prune |
| 81 | 2017-11-28 13:55:45.451144 | 172.16.251.1 | 225.1.1.10 | ICMP | Echo (ping) request id=0x002b, seq=2/512,... |
| 82 | 2017-11-28 13:55:45.453196 | 172.16.251.1 | 225.1.1.10 | ICMP | Echo (ping) request id=0x002b, seq=2/512,... |

▶ Frame 74: 150 bytes on wire (1200 bits), 150 bytes captured (1200 bits) on interface 0
 ▶ Ethernet II, Src: fa:16:3e:9b:b3:ff (fa:16:3e:9b:b3:ff), Dst: fa:16:3e:ab:98:7e (fa:16:3e:ab:98:7e)
 ▶ Internet Protocol Version 4, Src: 10.1.11.1, Dst: 10.1.14.1
 ▶ User Datagram Protocol, Src Port: 46618, Dst Port: 4341
 ▶ Locator/ID Separation Protocol (Data)
 ▶ Internet Protocol Version 4, Src: 172.16.251.1, Dst: 225.1.1.10
 ▶ Internet Control Message Protocol

| No. | Time | Source | Destination | Protocol | Info |
|-----|----------------------------|-------------------|-----------------------|----------|--|
| 68 | 2017-11-28 13:55:29.783398 | 10.1.14.10 | 224.0.0.5 | OSPF | Hello Packet |
| 69 | 2017-11-28 13:55:34.738715 | fa:16:3e:ab:98:7e | CDP/VTP/DTP/PagP/UDLD | CDP | Device ID: xTR4 Port ID: GigabitEthernet0... |
| 70 | 2017-11-28 13:55:35.939428 | fa:16:3e:ab:98:7e | fa:16:3e:ab:98:7e | L2MP | Reply |
| 71 | 2017-11-28 13:55:37.964584 | 10.1.14.1 | 224.0.0.5 | OSPF | Hello Packet |
| 72 | 2017-11-28 13:55:40.167524 | 10.1.14.10 | 224.0.0.5 | OSPF | Hello Packet |
| 73 | 2017-11-28 13:55:41.375985 | 172.16.251.1 | 225.1.1.10 | ICMP | Echo (ping) request id=0x002b, seq=0/0, t... |
| 74 | 2017-11-28 13:55:41.391351 | 172.16.251.1 | 225.1.1.10 | ICMP | Echo (ping) request id=0x002b, seq=0/0, t... |
| 75 | 2017-11-28 13:55:41.405722 | 172.16.251.1 | 225.1.1.10 | ICMP | Echo (ping) request id=0x002b, seq=0/0, t... |
| 76 | 2017-11-28 13:55:41.408310 | 172.16.251.1 | 225.1.1.10 | ICMP | Echo (ping) request id=0x002b, seq=0/0, t... |
| 77 | 2017-11-28 13:55:41.568043 | 10.1.255.3 | 224.0.0.13 | PIMv2 | Join/Prune |
| 78 | 2017-11-28 13:55:43.448000 | 172.16.251.1 | 225.1.1.10 | ICMP | Echo (ping) request id=0x002b, seq=1/256,... |
| 79 | 2017-11-28 13:55:43.449757 | 172.16.251.1 | 225.1.1.10 | ICMP | Echo (ping) request id=0x002b, seq=1/256,... |
| 80 | 2017-11-28 13:55:45.137555 | 172.16.23.1 | 224.0.0.13 | PIMv2 | Join/Prune |
| 81 | 2017-11-28 13:55:45.451144 | 172.16.251.1 | 225.1.1.10 | ICMP | Echo (ping) request id=0x002b, seq=2/512,... |
| 82 | 2017-11-28 13:55:45.453196 | 172.16.251.1 | 225.1.1.10 | ICMP | Echo (ping) request id=0x002b, seq=2/512,... |

▶ Frame 74: 150 bytes on wire (1200 bits), 150 bytes captured (1200 bits) on interface 0
 ▶ Ethernet II, Src: fa:16:3e:9b:b3:ff (fa:16:3e:9b:b3:ff), Dst: fa:16:3e:ab:98:7e (fa:16:3e:ab:98:7e)
 ▶ Internet Protocol Version 4, Src: 10.1.11.1, Dst: 10.1.14.1
 ▶ User Datagram Protocol, Src Port: 46618, Dst Port: 4341
 ▶ Locator/ID Separation Protocol (Data)
 ▶ Internet Protocol Version 4, Src: 172.16.251.1, Dst: 225.1.1.10
 ▶ Internet Control Message Protocol

在xTR4 g0/1介面上捕獲資料包。

在第一個資料包中，外部IP SRC和DST分別為10.1.11.1和10.1.14.1。

在第二封包中，外部IP SRC和DST分別為10.1.14.1和10.1.13.1。

收到組播資料包後，LHR CE3正在啟動SPT切換。為(S, G)建立Mroute並設定標誌J和T。向源傳送(S, G)連線。

```
.Nov 30 00:00:51.765: MRT(0): Set 'L' flag for (172.16.251.1, 225.1.1.10)
.Nov 30 00:00:51.766: MRT(0): Reset the z-flag for (172.16.251.1, 225.1.1.10)
.Nov 30 00:00:51.766: MRT(0): (172.16.251.1,225.1.1.10), RPF install from /0.0.0.0 to
```

```
GigabitEthernet0/1.10/172.16.13.1
.Nov 30 00:00:51.767: MRT(0): Set the T-flag for (172.16.251.1, 225.1.1.10)
.Nov 30 00:00:51.768: PIM(0): Insert (172.16.251.1,225.1.1.10) join in nbr 172.16.13.1's queue
.Nov 30 00:00:51.768: MRT(0): Create (172.16.251.1,225.1.1.10), RPF (GigabitEthernet0/1.10,
172.16.13.1, 90/3072)
.Nov 30 00:00:51.769: MRT(0): WAVL Insert interface: Loopback10 in (172.16.251.1,225.1.1.10)
Successful
.Nov 30 00:00:51.770: MRT(0): set min mtu for (172.16.251.1, 225.1.1.10) 18010->18010
.Nov 30 00:00:51.771: MRT(0): Add Loopback10/225.1.1.10 to the olist of (172.16.251.1,
225.1.1.10), Forward state - MAC not built
.Nov 30 00:00:51.771: MRT(0): Set the J-flag for (172.16.251.1, 225.1.1.10)
.Nov 30 00:00:51.780: PIM(0): Building Join/Prune packet for nbr 172.16.13.1
.Nov 30 00:00:51.780: PIM(0): Adding v2 (172.16.251.1/32, 225.1.1.10), S-bit Join
.Nov 30 00:00:51.781: PIM(0): Send v2 join/prune to 172.16.13.1 (GigabitEthernet0/1.10)
```

CE3#sh ip mro

<...skip...>

```
(* , 225.1.1.10), 00:01:36/stopped, RP 172.16.251.4, flags: SJCL
Incoming interface: GigabitEthernet0/1.10, RPF nbr 172.16.13.1
Outgoing interface list:
Loopback10, Forward/Sparse, 00:01:36/00:02:48
```

```
(172.16.251.1, 225.1.1.10), 00:00:25/00:02:34, flags: LJT Incoming interface:
GigabitEthernet0/1.10, RPF nbr 172.16.13.1 Outgoing interface list: Loopback10, Forward/Sparse,
00:00:25/00:02:48
```

xTR3正在從CE3接收(S, G)加入。它正在檢查源172.16.251.1的RPF。它觸發LISP查詢，並且建立指向RLOC 10.1.11.1的PIM鄰居，以及指向RLOC 10.1.14.1的PIM鄰居。為(S, G)建立帶標誌T的Mroute。通過LISP0 RLOC 10.1.11.1將(S, G)連線傳送到源172.16.255.1

```
.Nov 30 00:00:51.104: PIM(0): Received v2 Join/Prune on GigabitEthernet0/2.10 from 172.16.13.2,
to us
.Nov 30 00:00:51.105: PIM(0): Join-list: (172.16.251.1/32, 225.1.1.10), S-bit set
.Nov 30 00:00:51.105: PIM(0): RPF Lookup failed for 172.16.251.1
.Nov 30 00:00:51.108: MRT(0): Reset the z-flag for (172.16.251.1, 225.1.1.10)
.Nov 30 00:00:51.108: MRT(0): Create (172.16.251.1,225.1.1.10), RPF (unknown, 0.0.0.0, 0/0)
.Nov 30 00:00:51.109: MRT(0): WAVL Insert interface: GigabitEthernet0/2.10 in
(172.16.251.1,225.1.1.10) Successful
.Nov 30 00:00:51.110: MRT(0): set min mtu for (172.16.251.1, 225.1.1.10) 18010->1500
.Nov 30 00:00:51.110: MRT(0): Add GigabitEthernet0/2.10/225.1.1.10 to the olist of
(172.16.251.1, 225.1.1.10), Forward state - MAC built
.Nov 30 00:00:51.111: PIM(0): Add GigabitEthernet0/2.10/172.16.13.2 to (172.16.251.1,
225.1.1.10), Forward state, by PIM SG Join
.Nov 30 00:00:51.111: MRT(0): Add GigabitEthernet0/2.10/225.1.1.10 to the olist of
(172.16.251.1, 225.1.1.10), Forward state - MAC built
.Nov 30 00:00:51.112: MRT(0): Set the PIM interest flag for (172.16.251.1, 225.1.1.10)
.Nov 30 00:00:51.128: MRT(0): (172.16.251.1,225.1.1.10), RPF change from /0.0.0.0 to
LISP0/10.1.11.1
.Nov 30 00:00:51.130: MRT(0): Set the T-flag for (172.16.251.1, 225.1.1.10)
.Nov 30 00:00:51.130: PIM(0): Insert (172.16.251.1,225.1.1.10) join in nbr 10.1.11.1's queue
.Nov 30 00:00:51.134: PIM(0): Building Join/Prune packet for nbr 10.1.11.1
.Nov 30 00:00:51.134: PIM(0): Adding v2 (172.16.251.1/32, 225.1.1.10), S-bit Join
.Nov 30 00:00:51.135: PIM(0): Send v2 join/prune to 10.1.11.1 (LISP0)
```

xTR3#sh ip pim nei

PIM Neighbor Table

```
Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,
P - Proxy Capable, S - State Refresh Capable, G - GenID Capable,
L - DR Load-balancing Capable
```

| Neighbor Address | Interface | Uptime/Expires | Ver | DR Prio/Mode |
|------------------|-----------------------|-------------------|-----|--------------|
| 172.16.13.2 | GigabitEthernet0/2.10 | 2d16h/00:01:20 | v2 | 1 / DR S P G |
| 10.1.11.1 | LISP0 | 00:00:19/00:01:39 | v2 | 0 / |

10.1.14.1 LISP0 1d18h/00:01:39 v2 0 /

xTR3#sh ip mro

<...skip...>

(* , 225.1.1.10), 00:01:29/stopped, RP 172.16.251.4, flags: S
Incoming interface: LISP0, RPF nbr 10.1.14.1
Outgoing interface list:
GigabitEthernet0/2.10, Forward/Sparse, 00:01:29/00:02:57

(172.16.251.1, 225.1.1.10), 00:00:19/00:02:40, flags: T
Incoming interface: LISP0, RPF nbr 10.1.11.1
Outgoing interface list:
GigabitEthernet0/2.10, Forward/Sparse, 00:00:19/00:03:10

(* ,G)和(S , G)的RPF介面變得不同 — 共用樹(RLOC 10.1.14.1)和SPT(RLOC 10.1.11.1)。從xTR3到RP觸發(S , G)修整消息，其中包含RPT位和S位連線。

.Nov 30 00:00:51.209: PIM(0): Insert (172.16.251.1,225.1.1.10) sgr prune in nbr 10.1.14.1's queue
.Nov 30 00:00:51.212: PIM(0): Building Join/Prune packet for nbr 10.1.14.1
.Nov 30 00:00:51.212: PIM(0): Adding v2 (172.16.251.4/32, 225.1.1.10), WC-bit, RPT-bit, S-bit Join
.Nov 30 00:00:51.213: PIM(0): Adding v2 (172.16.251.1/32, 225.1.1.10), RPT-bit, S-bit Prune
.Nov 30 00:00:51.214: PIM(0): Send v2 join/prune to 10.1.14.1 (LISP0)

xTR3#sh ip pim nei

PIM Neighbor Table

Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,
P - Proxy Capable, S - State Refresh Capable, G - GenID Capable,
L - DR Load-balancing Capable

| Neighbor Address | Interface | Uptime/Expires | Ver | DR Prio/Mode |
|------------------|-----------------------|-------------------|-----|--------------|
| 172.16.13.2 | GigabitEthernet0/2.10 | 4d09h/00:01:19 | v2 | 1 / DR S P G |
| 10.1.11.1 | LISP0 | 00:00:58/00:01:02 | v2 | 0 / |
| 10.1.14.1 | LISP0 | 3d11h/00:01:34 | v2 | 0 / |

xTR1收到來自xTR3的(S , G)連線，用於觸發SPT生成。(* ,G)的RPF是可通過LISP訪問的RP。為RLOC 10.1.14.1建立了RPF檢查的PIM鄰居。建立了a(* ,G)和a(S , G)路由。

.Nov 30 00:00:55.281: PIM(0): Received v2 Join/Prune on LISP0 from 10.1.255.3
.Nov 30 00:00:55.281: PIM(0): J/P Transport Attribute, Transport Type: Unicast, to us
.Nov 30 00:00:55.282: PIM(0): Join-list: (172.16.251.1/32, 225.1.1.10), S-bit set
.Nov 30 00:00:55.283: PIM(0): Check RP 172.16.251.4 into the (* , 225.1.1.10) entry
.Nov 30 00:00:55.283: MRT(0): Create (* ,225.1.1.10), RPF (unknown, 0.0.0.0, 0/0)
.Nov 30 00:00:55.284: MRT(0): Reset the z-flag for (172.16.251.1, 225.1.1.10)
.Nov 30 00:00:55.284: MRT(0): (172.16.251.1,225.1.1.10), RPF install from /0.0.0.0 to GigabitEthernet3.10/172.16.11.2
.Nov 30 00:00:55.284: MRT(0): Create (172.16.251.1,225.1.1.10), RPF (GigabitEthernet3.10, 172.16.11.2, 90/130816)
.Nov 30 00:00:55.285: MRT(0): WAVL Insert LISP interface: LISP0 in (172.16.251.1,225.1.1.10)
Next-hop: 10.1.13.1 Outer-source: 0.0.0.0 Successful
.Nov 30 00:00:55.285: MRT(0): set min mtu for (172.16.251.1, 225.1.1.10) 18010->17892
.Nov 30 00:00:55.285: MRT(0): Set the T-flag for (172.16.251.1, 225.1.1.10)
.Nov 30 00:00:55.286: MRT(0): Add LISP0/10.1.13.1 to the olist of (172.16.251.1, 225.1.1.10), Forward state - MAC not built
.Nov 30 00:00:55.286: PIM(0): Add LISP0/10.1.13.1 to (172.16.251.1, 225.1.1.10), Forward state, by PIM SG Join
.Nov 30 00:00:55.286: MRT(0): Add LISP0/10.1.13.1 to the olist of (172.16.251.1, 225.1.1.10),

Forward state - MAC not built

此外，xTR1從RP接收(S，G)連線。將經由RLOC 10.1.14.1的油LISP0新增到(S，G)中。

```
.Nov 30 00:00:55.295: PIM(0): Received v2 Join/Prune on LISP0 from 172.16.251.14
.Nov 30 00:00:55.295: PIM(0): J/P Transport Attribute, Transport Type: Unicast, to us
.Nov 30 00:00:55.295: PIM(0): Join-list: (172.16.251.1/32, 225.1.1.10), S-bit set
.Nov 30 00:00:55.295: MRT(0): WAVL Insert LISP interface: LISP0 in (172.16.251.1,225.1.1.10)
Next-hop: 10.1.14.1 Outer-source: 0.0.0.0 Successful
.Nov 30 00:00:55.296: MRT(0): set min mtu for (172.16.251.1, 225.1.1.10) 17892->17892
.Nov 30 00:00:55.296: MRT(0): Add LISP0/10.1.14.1 to the olist of (172.16.251.1, 225.1.1.10),
Forward state - MAC not built
.Nov 30 00:00:55.296: PIM(0): Add LISP0/10.1.14.1 to (172.16.251.1, 225.1.1.10), Forward state,
by PIM SG Join
.Nov 30 00:00:55.297: MRT(0): Add LISP0/10.1.14.1 to the olist of (172.16.251.1, 225.1.1.10),
Forward state - MAC not built
```

xTR1#sh ip mro

```
(* , 225.1.1.10), 00:00:27/stopped, RP 172.16.251.4, flags: SP
Incoming interface: LISP0, RPF nbr 10.1.14.1
Outgoing interface list: Null
```

```
(172.16.251.1, 225.1.1.10), 00:00:27/00:02:31, flags: T
Incoming interface: GigabitEthernet3.10, RPF nbr 172.16.11.2
Outgoing interface list:
LISP0, 10.1.14.1, Forward/Sparse, 00:00:27/00:03:01
LISP0, 10.1.13.1, Forward/Sparse, 00:00:27/00:03:01
```

xTR4收到來自xTR3的(S，G)修剪。LISP0到10.1.13.1不包括在油中。

```
Nov 30 00:00:50.771: PIM(0): Received v2 Join/Prune on LISP0 from 10.1.255.3, to us
Nov 30 00:00:50.772: PIM(0): Join-list: (* , 225.1.1.10), RPT-bit set, WC-bit set, S-bit set
Nov 30 00:00:50.774: PIM(0): Update LISP0/10.1.13.1 to (* , 225.1.1.10), Forward state, by PIM *G
Join
Nov 30 00:00:50.774: MRT(0): Update LISP0/10.1.13.1 in the olist of (* , 225.1.1.10), Forward
state - MAC not built
Nov 30 00:00:50.775: PIM(0): Prune-list: (172.16.251.1/32, 225.1.1.10) RPT-bit set
Nov 30 00:00:50.776: PIM(0): Prune LISP0/10.1.13.1 from (172.16.251.1/32, 225.1.1.10)
Nov 30 00:00:50.776: MRT(0): Delete LISP0/10.1.13.1 from the olist of (172.16.251.1, 225.1.1.10)
- deleted
```

xTR4#sh ip mro

<...skip...>

```
(* , 225.1.1.10), 00:07:47/00:03:04, RP 172.16.251.4, flags: S
Incoming interface: GigabitEthernet0/2.10, RPF nbr 172.16.14.2
Outgoing interface list:
LISP0, 10.1.13.1, Forward/Sparse, 00:07:47/00:03:04
```

```
(172.16.251.1, 225.1.1.10), 00:00:26/00:02:33, flags:
Incoming interface: LISP0, RPF nbr 10.1.11.1
Outgoing interface list:
GigabitEthernet0/2.10, Forward/Sparse, 00:00:26/00:03:03
```

xTR4#sh ip pim nei

PIM Neighbor Table

```
Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,
      P - Proxy Capable, S - State Refresh Capable, G - GenID Capable,
      L - DR Load-balancing Capable
Neighbor          Interface          Uptime/Expires    Ver    DR
```

| Address | | | | Prio/Mode |
|-------------|-----------------------|-------------------|----|--------------|
| 172.16.14.2 | GigabitEthernet0/2.10 | 4d09h/00:01:16 | v2 | 1 / DR S P G |
| 10.1.11.1 | LISP0 | 00:00:26/00:01:33 | v2 | 0 / |

RP(CE4)接收已設定RPT位的(S , G)修剪。RP應該修剪共用樹中的源。RP向源啟動(S , G)修剪。

```
.Nov 30 00:01:34.811: PIM(0): Received v2 Join/Prune on GigabitEthernet0/1.10 from 172.16.14.1,
to us
.Nov 30 00:01:34.813: PIM(0): Prune-list: (172.16.251.1/32, 225.1.1.10) RPT-bit set
.Nov 30 00:01:34.818: MRT(0): Set the T-flag for (172.16.251.1, 225.1.1.10)
.Nov 30 00:01:34.818: PIM(0): Removing register decap tunnel (Tunnel0) as accepting interface of
(172.16.251.1, 225.1.1.10).
.Nov 30 00:01:34.819: PIM(0): Installing GigabitEthernet0/1.10 as accepting interface for
(172.16.251.1, 225.1.1.10).
.Nov 30 00:01:34.899: PIM(0): Insert (172.16.251.1,225.1.1.10) join in nbr 172.16.14.1's queue
.Nov 30 00:01:34.902: PIM(0): Building Join/Prune packet for nbr 172.16.14.1
.Nov 30 00:01:34.903: PIM(0): Adding v2 (172.16.251.1/32, 225.1.1.10), S-bit Join
.Nov 30 00:01:34.903: PIM(0): Send v2 join/prune to 172.16.14.1 (GigabitEthernet0/1.10)
.Nov 30 00:01:39.398: PIM(0): Insert (172.16.251.1,225.1.1.10) prune in nbr 172.16.14.1's queue
.Nov 30 00:01:39.399: PIM(0): Building Join/Prune packet for nbr 172.16.14.1
.Nov 30 00:01:39.401: PIM(0): Adding v2 (172.16.251.1/32, 225.1.1.10), S-bit Prune
.Nov 30 00:01:39.402: PIM(0): Send v2 join/prune to 172.16.14.1 (GigabitEthernet0/1.10)
```

CE4#sh ip mro

```
<...skip...>
(172.16.251.1, 225.1.1.10), 00:00:57/00:02:45, flags: PT
Incoming interface: GigabitEthernet0/1.10, RPF nbr 172.16.14.1
Outgoing interface list: Null
```

xTR4收到RP發起的(S , G)修剪，並將其傳送到FHR(CE1)。Gi0/2.10不屬於OIL。

```
Nov 30 00:01:38.620: PIM(0): Received v2 Join/Prune on GigabitEthernet0/2.10 from 172.16.14.2,
to us
Nov 30 00:01:38.621: PIM(0): Prune-list: (172.16.251.1/32, 225.1.1.10)
Nov 30 00:01:38.622: PIM(0): Prune GigabitEthernet0/2.10/225.1.1.10 from (172.16.251.1/32,
225.1.1.10)
Nov 30 00:01:38.622: MRT(0): Delete GigabitEthernet0/2.10/225.1.1.10 from the olist of
(172.16.251.1, 225.1.1.10)
Nov 30 00:01:38.624: MRT(0): Reset the PIM interest flag for (172.16.251.1, 225.1.1.10)
Nov 30 00:01:38.625: MRT(0): set min mtu for (172.16.251.1, 225.1.1.10) 1500->18010
Nov 30 00:01:38.626: PIM(0): Insert (172.16.251.1,225.1.1.10) prune in nbr 10.1.11.1's queue -
deleted
Nov 30 00:01:38.628: PIM(0): Building Join/Prune packet for nbr 10.1.11.1
Nov 30 00:01:38.629: PIM(0): Adding v2 (172.16.251.1/32, 225.1.1.10), S-bit Prune
Nov 30 00:01:38.630: PIM(0): Send v2 join/prune to 10.1.11.1 (LISP0)
```

xTR4#sh ip mro

```
<...skip...>
(*, 225.1.1.10), 00:08:19/00:02:32, RP 172.16.251.4, flags: S
Incoming interface: GigabitEthernet0/2.10, RPF nbr 172.16.14.2
Outgoing interface list:
LISP0, 10.1.13.1, Forward/Sparse, 00:08:19/00:02:32
(172.16.251.1, 225.1.1.10), 00:00:57/00:02:02, flags: PT
Incoming interface: LISP0, RPF nbr 10.1.11.1
Outgoing interface list: Null
```

xTR1從xTR4收到(S , G)修剪，並從OIL中通過RLOC 10.1.14.1移除LISP0。

```
.Nov 30 00:01:47.450: PIM(0): Received v2 Join/Prune on LISP0 from 172.16.251.14
.Nov 30 00:01:47.450: PIM(0): J/P Transport Attribute, Transport Type: Unicast, to us
.Nov 30 00:01:47.450: PIM(0): Prune-list: (172.16.251.1/32, 225.1.1.10)
.Nov 30 00:01:47.451: PIM(0): Prune LISP0/10.1.14.1 from (172.16.251.1/32, 225.1.1.10)
.Nov 30 00:01:47.451: MRT(0): Delete LISP0/10.1.14.1 from the olist of (172.16.251.1,
225.1.1.10) - deleted
```

xTR1#sh ip mro

```
<...skip...>
(*, 225.1.1.10), 00:01:02/stopped, RP 172.16.251.4, flags: SP
  Incoming interface: LISP0, RPF nbr 10.1.14.1
  Outgoing interface list: Null

(172.16.251.1, 225.1.1.10), 00:01:02/00:01:57, flags: T
  Incoming interface: GigabitEthernet3.10, RPF nbr 172.16.11.2
  Outgoing interface list:
    LISP0, 10.1.13.1, Forward/Sparse, 00:01:02/00:02:27
```

現在，你有一個最終狀態。

FHR(CE1)

CE1#sh ip mro

```
<...skip...>
(*, 225.1.1.10), 00:01:46/stopped, RP 172.16.251.4, flags: SPF
  Incoming interface: GigabitEthernet0/1.10, RPF nbr 172.16.11.1
  Outgoing interface list: Null

(172.16.251.1, 225.1.1.10), 00:01:46/00:03:09, flags: FT
  Incoming interface: Loopback10, RPF nbr 0.0.0.0
  Outgoing interface list:
    GigabitEthernet0/1.10, Forward/Sparse, 00:01:46/00:02:39, A
```

xTR1

xTR1#sh ip mro

```
<...skip...>
(*, 225.1.1.10), 00:01:02/stopped, RP 172.16.251.4, flags: SP
  Incoming interface: LISP0, RPF nbr 10.1.14.1
  Outgoing interface list: Null

(172.16.251.1, 225.1.1.10), 00:01:02/00:01:57, flags: T
  Incoming interface: GigabitEthernet3.10, RPF nbr 172.16.11.2
  Outgoing interface list:
    LISP0, 10.1.13.1, Forward/Sparse, 00:01:02/00:02:27
```

xTR1#sh ip pim nei

PIM Neighbor Table

Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,
P - Proxy Capable, S - State Refresh Capable, G - GenID Capable,
L - DR Load-balancing Capable

| Neighbor Address | Interface | Uptime/Expires | Ver | DR Prio/Mode |
|------------------|---------------------|-------------------|-----|--------------|
| 172.16.11.2 | GigabitEthernet3.10 | 16:23:01/00:01:29 | v2 | 1 / DR S P G |
| 10.1.14.1 | LISP0 | 00:01:02/00:01:55 | v2 | 0 / |

LHR(CE3)

CE3#sh ip mro

```
<...skip...>
(*, 225.1.1.10), 00:10:10/stopped, RP 172.16.251.4, flags: SJCL
  Incoming interface: GigabitEthernet0/1.10, RPF nbr 172.16.13.1
  Outgoing interface list:
    Loopback10, Forward/Sparse, 00:10:10/00:02:24

(172.16.251.1, 225.1.1.10), 00:01:46/00:01:13, flags: LJT
  Incoming interface: GigabitEthernet0/1.10, RPF nbr 172.16.13.1
  Outgoing interface list:
    Loopback10, Forward/Sparse, 00:01:46/00:02:24
```

xTR3

xTR3#sh ip mro

```
<...skip...>
(*, 225.1.1.10), 00:09:05/00:03:15, RP 172.16.251.4, flags: S
  Incoming interface: LISP0, RPF nbr 10.1.14.1
  Outgoing interface list:
    GigabitEthernet0/2.10, Forward/Sparse, 00:09:05/00:03:15

(172.16.251.1, 225.1.1.10), 00:01:44/00:01:15, flags: T
  Incoming interface: LISP0, RPF nbr 10.1.11.1
  Outgoing interface list:
    GigabitEthernet0/2.10, Forward/Sparse, 00:01:44/00:03:15
```

xTR3#sh ip pim nei

PIM Neighbor Table

Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,
P - Proxy Capable, S - State Refresh Capable, G - GenID Capable,
L - DR Load-balancing Capable

| Neighbor Address | Interface | Uptime/Expires | Ver | DR Prio/Mode |
|------------------|-----------------------|-------------------|-----|--------------|
| 172.16.13.2 | GigabitEthernet0/2.10 | 4d09h/00:01:30 | v2 | 1 / DR S P G |
| 10.1.11.1 | LISP0 | 00:01:44/00:01:14 | v2 | 0 / |
| 10.1.14.1 | LISP0 | 3d11h/00:01:46 | v2 | 0 / |

RP(CE4)

CE4#sh ip mro

```
<...skip...>
(*, 225.1.1.10), 00:09:10/00:03:17, RP 172.16.251.4, flags: S
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    GigabitEthernet0/1.10, Forward/Sparse, 00:09:10/00:03:17

(172.16.251.1, 225.1.1.10), 00:01:45/00:02:35, flags: PT
  Incoming interface: GigabitEthernet0/1.10, RPF nbr 172.16.14.1
  Outgoing interface list: Null
```

xTR4

xTR4#sh ip mro

```
<...skip...>
(*, 225.1.1.10), 00:09:05/00:02:44, RP 172.16.251.4, flags: S
  Incoming interface: GigabitEthernet0/2.10, RPF nbr 172.16.14.2
```

```
Outgoing interface list:
  LISP0, 10.1.13.1, Forward/Sparse, 00:09:05/00:02:44
```

```
(172.16.251.1, 225.1.1.10), 00:01:44/00:01:15, flags: PT
  Incoming interface: LISP0, RPF nbr 10.1.11.1
  Outgoing interface list: Null
```

```
xTR4#sh ip pim nei
```

```
PIM Neighbor Table
```

```
Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,
      P - Proxy Capable, S - State Refresh Capable, G - GenID Capable,
      L - DR Load-balancing Capable
```

| Neighbor Address | Interface | Uptime/Expires | Ver | DR Prio/Mode |
|------------------|-----------------------|-------------------|-----|--------------|
| 172.16.14.2 | GigabitEthernet0/2.10 | 4d09h/00:01:25 | v2 | 1 / DR S P G |
| 10.1.11.1 | LISP0 | 00:01:44/00:01:47 | v2 | 0 / |

驗證

目前沒有適用於此組態的驗證程序。

疑難排解

目前尚無適用於此組態的具體疑難排解資訊。

來源

- RFC 6831用於組播環境的LISP