

Multicast voor LISP Fase 1 configureren

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Inleiding

Dit document beschrijft dat in fase 1 van de multicast-implementatie via Locator/ID Separation Protocol (LISP), ingangsreplicatie wordt gebruikt. Het betekent dat de kern van het unicast Routing Locator (RLOC) wordt gebruikt voor het transport van informatie over identiteit (EID) in multicast.

Voorwaarden

Vereisten

Cisco raadt u aan kennis te hebben over LISP en multicast.

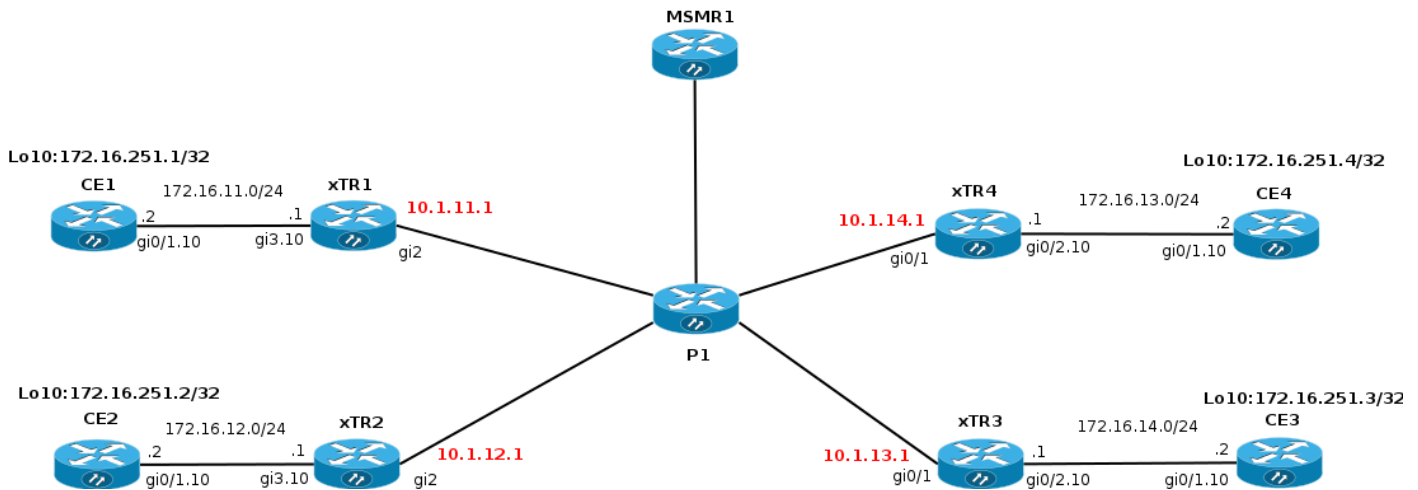
Gebruikte componenten

Dit document is niet beperkt tot specifieke software- en hardware-versies.

De informatie in dit document is gebaseerd op de apparaten in een specifieke laboratoriumomgeving. Alle apparaten die in dit document worden beschreven, hadden een opgeschoonde (standaard)configuratie. Als uw netwerk live is, moet u de potentiële impact van elke opdracht begrijpen.

Configureren

Netwerkdigram



Configuraties

Fase 1 ondersteunt eenasthead-end replicatie van multicast pakketten.

- Ondersteuning van fase 1 begint bij XE 3.13 en Cisco IOS: 15.4(2)T.
- Fase 1 ondersteunt IPv4 EID's via IPv4 RLOC's (transport) begint in XE 3.13 en Cisco IOS® 15.4(2)T.
- Fase 1 ondersteunt IPv6-EID's via IPv4 RLOC's (transport) begint in Polaris 16.6.1 in standaard vrf alleen voor LISP met VXLAN-insluiting voor softwaregedefinieerde toegang (SDA).
- Fase 1 ondersteunt EID Virtual Routing and Forwarding (VRF's) (segmentatie) met IDD's (via PIM VRF-ondersteuning).
- Fase 1 ondersteunt alle Source Multicast (ASM)- en Source Specific Multicast (SSM)-modellen.
- Fase 1 ondersteunt alleen de statische routeprocessor (RP)-configuratie.
- Fase 1 ondersteunt RP redundantie niet.
- Fase 1 ondersteunt verschillende combinaties van LISP- en niet-LISP-kabelbronnen en ontvangersites.
- LISP Multicast wordt NIET ondersteund als een LISP Mobility Data Center Interconnect-oplossing (DCI).

Er wordt aangenomen dat multicast al op het netwerk is geconfigureerd (im sparse-mode/rp).

Om multicast via LISP te kunnen inschakelen moet u "IP PIM SSE-mode" onder een LISP0 of een LISP0.xx-interface toevoegen. Door PIM op een LISP-interface in te schakelen, is het in PDF-bestand opgenomen. De RPF-informatie voor prefixes die via LISP-sites bereikbaar zijn, bestaat uit een LISP-tunnel en een buurman die wordt vertegenwoordigd door een RLOC-adres van een upstream-site.

U mag alleen berichten toevoegen of afdrukken via LISP-tunnels. PIM Hallo berichten worden niet tussen sites uitgewisseld. PIM sluit zich aan/pune berichten zijn unicast-ingekapseld aan een upstream xTR (RP of Bron). Samenvoegen/afdrukken-berichten worden niet gezien door andere xTR's/PxTR's. Er is geen analoge modem voor standaard MDT in VPN.

PIM moet worden ingeschakeld onder een LISP-tunnelinterface voor multicast verwerking.

EID gebruikt LISP-Instantie-ID's in combinatie met EID-VRF's. Een interface LISP0.x waarbij x=IID wordt gecreëerd voor elke EID VRF/LISP-Instantie-ID.

```
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

Geen burens via een LISP-interface worden gezien omdat er geen actieve bronnen/ontvangers zijn en PIM Hallo's niet tussen gelijken worden uitgewisseld.

```
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

Laten we interface lo10 op CE2 configureren om zich aan te sluiten bij een groep. Het veroorzaakt een (S,G) toetreedt omdat een groep en een bron worden gespecificeerd.

```
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)
```

De (S,G) route wordt gecreëerd op CE2.

```
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
```

Laten we eens kijken wat er bij xTR2 gebeurt.

Debug ip pim is ingeschakeld op xTR2.

De (S,G) aansluiting bij CE2 wordt ontvangen.

```
*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 is het EID van xTR1 en nog niet aanwezig in het RIB. Daarom is de raadpleging van de RPF mislukt voor de bron-IP 172.16.251.1. Het veroorzaakt de raadpleging van de LISP. De RPF-interface is de LISP-tunnel.

```
*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
```

Daarna wordt er een (S,G) verbinding gebouwd en via de LISP-interface naar de bron gestuurd via RLOC 10.1.11.1.

```
*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)
```

Een bewerking is opgenomen in de eenmalig LISP-header. De bron IP van het ingekapselde pakket is een RLOC van de interface waardoor het pakket wordt verzonden. Het bestemming IP is het RLOC-adres van de xTR dat bereikbaar is voor de EID van de multicast bron.

```
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
```

Om een Join te kunnen verzenden moet je een PIM buurman hebben. Zodra RPF-informatie is verkregen, creëert PIM expliciet een buurman aan de corresponderende RLOC. De buurman

wordt niet op de gebruikelijke wijze gecreëerd omdat PIM Hallo's niet door de LISP-tunnel gaan.

```
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 Address	Interface	Uptime/Expires	Ver	DR 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 /

Een draadgaar-opname van het multicast pakket is zoals in de afbeelding weergegeven.

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: 0x0e00 [correct]

PIM Options

De router Bron en Bestemming IP zijn lokale en verre RLOCs. Het wordt verwacht zoals u eenastreplicatie gebruikt.

De binnenbron IP is afkomstig van de LISP0 interface.

```
xTR2#sh int LISP0 | i unn
```

```
Interface is unnumbered. Using address of Loopback0 (10.1.255.2)
```

De binnenbestemming IP is multicast adres 24.0.0.13 dat voor PIM berichten wordt gebruikt.

Op xTR2 voor de (172.16.251.1, 232.1.1.10) route is een IIL de LISP0 interface en een OIL wijst op 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
```

Op xTR1 werd een verbinding van xTR2 ontvangen en werd een route (S,G) gecreëerd.

```
*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
```

Upstream xTR1 moet elke downstream RLOC volgen waarvoor een gezamenlijke bericht is ontvangen.

De xTR moet de reeks RLOCs onthouden om pakketten naar te repliceren.

Een (EID_S,G)-vermelding in de upstream xTR ziet er daarom als volgt uit voor eenastinsluiting:

(EID_S, G)

A th0/0

F LISP0, nexthop = RLOC1

F LISP0, nexthop = 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
```

Opmerking: xTR1 heeft geen PIM buurman via de interface LISP0.

```
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

Op CE1 werd een verbinding voor een verbinding (S,G) ontvangen en werd een route gecreëerd.

```
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
```

Multicastverkeer stroomt zoals verwacht.

```
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
```

Laten we nog één ontvanger op CE3 toevoegen.

Een extra vermelding in een OLIE voor de nieuwe RLOC wordt toegevoegd in een MRIB en een MFIB.

```
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

Als u verkeer naar de 232.1.1.10 wilt verzenden op de kerninterface zoals in de afbeelding.

The screenshot shows a Wireshark capture of network traffic. The main pane displays a list of packets. Packet 4165 is highlighted in blue, showing an ICMP Echo (ping) request from source 172.16.251.1 to destination 232.1.1.10. The details pane below shows the structure of this packet: Type: 8 (Echo (ping) request), Code: 0, Checksum: 0x4193 [correct], Identifier (BE): 31 (0x001f), Identifier (LE): 7936 (0x1f00), Sequence number (BE): 0 (0x0000), and Sequence number (LE): 0 (0x0000). A yellow highlight is under the 'No response seen' status.

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

De bestemming van het ingekapselde pakket is RLOC voor xTR2 zoals in de afbeelding weergegeven.

The screenshot shows a Wireshark capture of network traffic. The main pane displays a list of packets. Packet 4166 is highlighted in blue, showing an ICMP Echo (ping) request from source 172.16.251.1 to destination 232.1.1.10. The details pane below shows the structure of this packet: Type: 8 (Echo (ping) request), Code: 0, Checksum: 0x4193 [correct], Identifier (BE): 31 (0x001f), Identifier (LE): 7936 (0x1f00), Sequence number (BE): 0 (0x0000), and Sequence number (LE): 0 (0x0000). A yellow highlight is under the 'No response seen' status.

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

Het bestemming IP voor het pakket is RLOC van xTR3.

Multicaststroom wordt in twee eenaststromen gerepliceerd en wordt over de kern uitgezonden.

ASM

Opmerking: Een Static-RP wordt alleen ondersteund. Een RP redundantie wordt niet ondersteund.

Eerste bronregisters

Laten we multicast vanuit CE1 naar groep 225.1.1.10 verzenden. CE1 is de First Hop Router (FHR), zodat er een bericht van het éénastregister naar de RP (CE4) zal worden geactiveerd. Aangezien u geen ontvangers hebt, heeft CE1 een register-Stop ontvangen en creëert de route invoer.

```
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
```

Aan een RP-zijde werd ook een verwacht beeld verwacht. Nadat u een bericht van het Register van CE1 ontvangt, wordt RP (CE4) een terug van het Register-Stop en creëert noodzakelijke routes.

```
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
```

Houd er rekening mee dat er een interface van de bron moet zijn in het EID-bereik, anders wordt de LISP niet geactiveerd. Standaard zou het IP-adres van de uitgaande interface zijn.

```
CE1#sh run | i source
```

```
ip pim register-source Loopback10
```

Voor xTR1 en xTR4 is er niets veranderd omdat het multicast verkeer nog niet is ontvangen.

Ontvanger komt eerst

Laten we een ontvanger op de interface Lo10 op het apparaat CE3 configureren.

```
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
```

A (*,Join) wordt geactiveerd en een route wordt gecreëerd. Alles wordt verwacht.

```
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

A (*,225.1.1.10) Join wordt ontvangen door xTR3. A (*,G) Join wordt naar de RP gestuurd. xTR3 controleert de RLOC voor de RP (172.16.251.4). Aangezien deze via de LISP bereikbaar is, wordt de PIM buurman bij de juiste RLOC gecreëerd. In dit geval is het 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 /

Laten we een haaienopname controleren zoals in de afbeelding.

The screenshot shows a network traffic capture tool interface. The main window displays a list of captured packets. The selected packet (No. 133) is a PIMv2 Join/Prune packet. The packet details pane shows the following information:

- Frame 13: 114 bytes on wire (912 bits), 114 bytes captured (912 bits) on interface 0
- Ethernet II, Src: fa:16:3e:21:2e:1e (fa:16:3e:21:2e:1e), Dst: fa:16:3e:a1:b1:8e (fa:16:3e:a1:b1:8e)
- Internet Protocol Version 4, Src: 10.1.13.1, Dst: 10.1.14.1
- User Datagram Protocol, Src Port: 30223, Dst Port: 4341
- Locator/ID Separation Protocol (Data)
- Internet Protocol Version 4, Src: 10.1.255.3, Dst: 224.0.0.13
- Protocol Independent Multicast

De externe IP-bron is de lokale RLOC en de externe IP-bestemming is de externe RLOC. De

binnenbron is het IP adres dat voor de LISP0 interface is genomen. Het binnenste bestemming IP-adres is het normale PIM multicast adres 24.0.0.13.

Er wordt een route (*,G) aangemaakt. Een inkomende interface/RPF voor RP is de LISP0 interface.

```
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)
```

Op xTR4 a (*,G) wordt Join ontvangen van de LISP-tunnel. Er wordt een geschikte route gecreëerd.

```
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
```

Een PIM buurman wordt in dit geval niet op xTR4 gecreëerd. De PIM buurman aan CE4 is aanwezig.

```
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
```

Vanuit het RP-perspectief wordt alles verwacht. Er wordt een route (*,G) aangemaakt.

```
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
```

SPT-switch (Shortest Path Tree)

De gedeelde boom is waarschijnlijk al gebouwd.

CE1 begint het verkeer van de bron Lo10 naar 225.1.1.10 te sturen (172.16.251.1).

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
```

Het eerste multicast pakket wordt ingekapseld in het bericht van het éénastregister en naar de RP verzonden.

```
.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).
```

Het registratiepakket is ontleed op RP en verzonden over de gedeelde boom naar de ontvanger.

```
.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).
```

Omdat er een match is tussen een uitgaande interface voor een (*,G) en een inkomende interface voor een (S,G), wordt een proxy-nieuwtimer gestart voor een (S,G), wordt vlag X ingesteld. Het is een topologie-specifieke situatie (RP-on-a-stick).

```
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
```

Dus stuurt CE4 een (S,G) aansluiting bij de bron en stuurt geen (S,G) prune.

```
.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)
```

Tegelijkertijd wordt gedecapsuleerd multicast verkeer via een gedeelde boom naar ontvangers gestuurd zoals in de beelden.

The screenshot shows a network traffic capture tool interface. The top part displays a list of captured packets with columns for No., Time, Source, Destination, Protocol, and Info. The bottom part shows a detailed view of a selected frame (Frame 74), including Ethernet II, Internet Protocol Version 4, User Datagram Protocol, and Internet Control Message Protocol details.

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	LOOP	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

De pakketvastlegging is genomen op de xTR4 g0/1-interface.

In het eerste pakket zijn de oorspronkelijke IP SRC en DST 10.1.11.1 en 10.1.14.1.

In het tweede pakket zijn de oorspronkelijke IP SRC en DST respectievelijk 10.1.14.1 en 10.1.13.1.

Nadat u multicast pakketten hebt ontvangen, start LHR CE3 de SPT-omschakeling. Er wordt een Mroute voor (S,G) aangemaakt en de vlaggen J en T worden ingesteld. A (S,G) Samenvoegen wordt naar de Bron gestuurd.

```
.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 ontvangt een aansluiting (S,G) van CE3. Het controleert RPF op Bron 172.16.251.1. Het

brengt een raadpleging van de LISP in werking en creëert een PIM buurman aan de RLOC 10.1.11.1 naast de PIM buurman aan de RLOC 10.1.14. 1. Er wordt een route voor (S,G) met vlag T aangemaakt. A (S,G) Join wordt aan de Bron 172.16.255.1 toegezonden via LISP0 RLOC 10.1.11.1

```
.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

RPF-interfaces voor a (*,G) en a (S,G) worden anders - een gedeelde boom (RLOC 10.1.14.1) en SPT (RLOC 10.1.11.1). Het veroorzaakt een (S,G) Prunbericht met RPT-bit en S-bit Join van xTR3 tot de RP.

```
.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 ontvangt een (S,G) verbinding van xTR3 voor die triggers SPT bouwt. Een RPF voor (*,G) is de RP die via LISP bereikbaar is. Er wordt een PIM-buurman voor een VPF-test gecreëerd op RLOC 10.1.14.1. A (*,G) en een (S,G)-route.

```
.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
```

Ook xTR1 ontvangt een (S,G) toetreders van de RP. Aan de (S,G) wordt een OLIELIJST 0 toegevoegd via de RLOC 10.1.14.1.

```
.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 ontvangt een (S,G) prune van de xTR3. LISP0 tot 10.1.13.1 is van een OLIE uitgesloten.

```
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 Address	Interface	Uptime/Expires	Ver	DR 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 /

De RP (CE4) ontvangt een (S,G) Prune met RPT-bit set. De RP zou de bron uit de gedeelde boom moeten snoeien. Het RP start een (S,G) afdruk naar de bron.

```
.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 ontvangt een door de RP geïnitieerde (S,G) Prune en stuurt deze naar de FHR (CE1). Gi0/2.10 is van een OLIE uitgesloten.

```
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 ontvangt een (S,G) Prune uit xTR4 en verwijdert LISP0 via de RLOC 10.1.14.1 uit de OLIE.

```
.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
```

Nu heb je een laatste staat.

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          Interface          Uptime/Expires    Ver  DR
Address
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          Interface          Uptime/Expires    Ver  DR
Address
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 /
```

Verifiëren

Er is momenteel geen verificatieprocedure beschikbaar voor deze configuratie.

Problemen oplossen

Er is momenteel geen specifieke troubleshooting-informatie beschikbaar voor deze configuratie.

Bron

- RFC 6831: LISP for Multicast Environment