Configurar multicast na fase 1 do LISP

Contents

Introduction

Este documento descreve que na fase 1 da implementação multicast sobre LISP (Locator/ID Separation Protocol), é usada a replicação de entrada. Significa que o núcleo do localizador de roteamento unicast (RLOC) é usado para transportar informações de identidade (EID) multicast.

Prerequisites

Requirements

A Cisco recomenda que você tenha conhecimento de LISP e multicast.

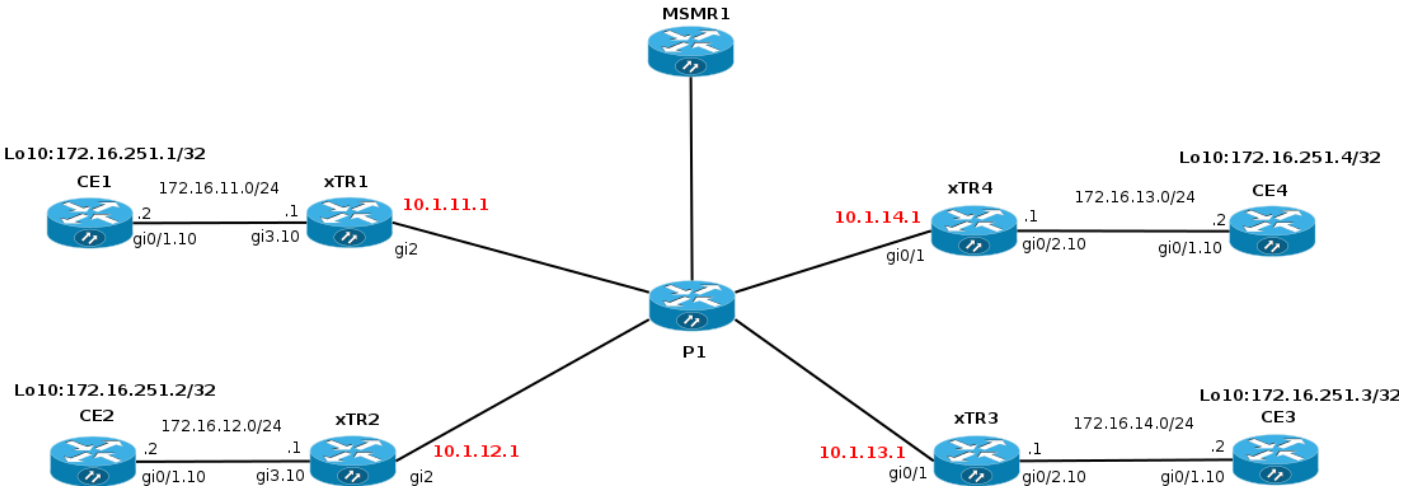
Componentes Utilizados

Este documento não se restringe a versões de software e hardware específicas.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Configurar

Diagrama de Rede



Configurações

A fase 1 suporta replicação de head-end unicast de pacotes multicast.

- O suporte da Fase 1 começa no XE 3.13 e no Cisco IOS® 15.4(2)T.
- A Fase 1 suporta EIDs IPv4 sobre RLOCs IPv4 (transporte) iniciados no XE 3.13 e no Cisco IOS® 15.4(2)T.
- A Fase 1 suporta EIDs IPv6 sobre RLOCs IPv4 (transporte) começa no Polaris 16.6.1 em vrf padrão somente para LISP com encapsulamento VXLAN para Acesso Definido por Software (SDA).
- A Fase 1 suporta o EID Virtual Routing and Forwarding (VRFs) (segmentação) com IIDs (através do suporte a PIM VRF).
- A Fase 1 oferece suporte a qualquer modelo de Multicast de Origem (ASM - Source Multicast) e Multicast Específico de Origem (SSM - Source Specific Multicast).
- A fase 1 suporta apenas a configuração do Route Processor (RP) estático.
- A fase 1 não suporta redundância RP.
- A fase 1 suporta várias combinações de locais de origem e de recepção com capacidade LISP e não-LISP.
- O multicast LISP NÃO é suportado como uma solução LISP Mobility Data Center Interconnect (DCI).

Supõe-se que o multicast já esteja configurado na rede (pim sparse-mode/rp).

Para habilitar o multicast sobre LISP, você deve adicionar "ip pim sparse-mode" em uma interface LISP0 ou LISP0.xx. Ao habilitar o PIM em uma interface LISP, ele é incluído no RPF. As informações de RPF para prefixos alcançáveis via sites LISP consistem em um túnel LISP e um vizinho representado por um endereço RLOC de um site upstream.

Somente mensagens de junção/remoção podem ser enviadas por túneis LISP. As mensagens de saudação do PIM não são trocadas entre sites. As mensagens de junção/remoção de PIM são encapsuladas por unicast para um xTR de upstream (RP ou origem). As mensagens Join/prune não são vistas por outros xTRs/PxTRs. Não há um analógico de MDT padrão em MVPN.

O PIM deve ser ativado em interfaces de túnel LISP para processamento multicast.

A virtualização de EID usa LISP Instance-IDs em conjunto com VRFs EID. Uma interface LISP0.x onde x=IID é criada para cada ID de instância de VRF/LISP do EID.

```
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/   Nbr    Query  DR         DR
                                          Mode   Count  Intvl  Prior
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
```

Nenhum vizinho por meio de uma interface LISP é visto porque não há fontes/receptores ativos e os PIM Hello não são trocados entre pares.

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

SSM

Vamos configurar a interface lo10 no CE2 para participar de um grupo. Aciona um (S,G) Join porque um grupo e uma origem são especificados.

```
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
```

O mroute (S,G) é criado em 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
```

Vamos verificar o que acontece no xTR2.

O comando debug ip pim está ativado no xTR2.

O (S,G) Join do CE2 é recebido.

```
*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 é o EID de xTR1 e ainda não está presente no RIB. Por causa disso, a pesquisa de RPF falhou para o IP de origem 172.16.251.1. Aciona a pesquisa de LISP. A interface RPF é o túnel LISP.

```
*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
```

Depois disso, um (S,G) Join é criado e enviado através da interface LISP para a origem através do 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)
```

Uma união é encapsulada no cabeçalho de LISP unicast. O IP origem do pacote encapsulado é um RLOC da interface através da qual o pacote é enviado. O IP de destino é o endereço RLOC do xTR que tem acessibilidade ao EID da origem multicast.

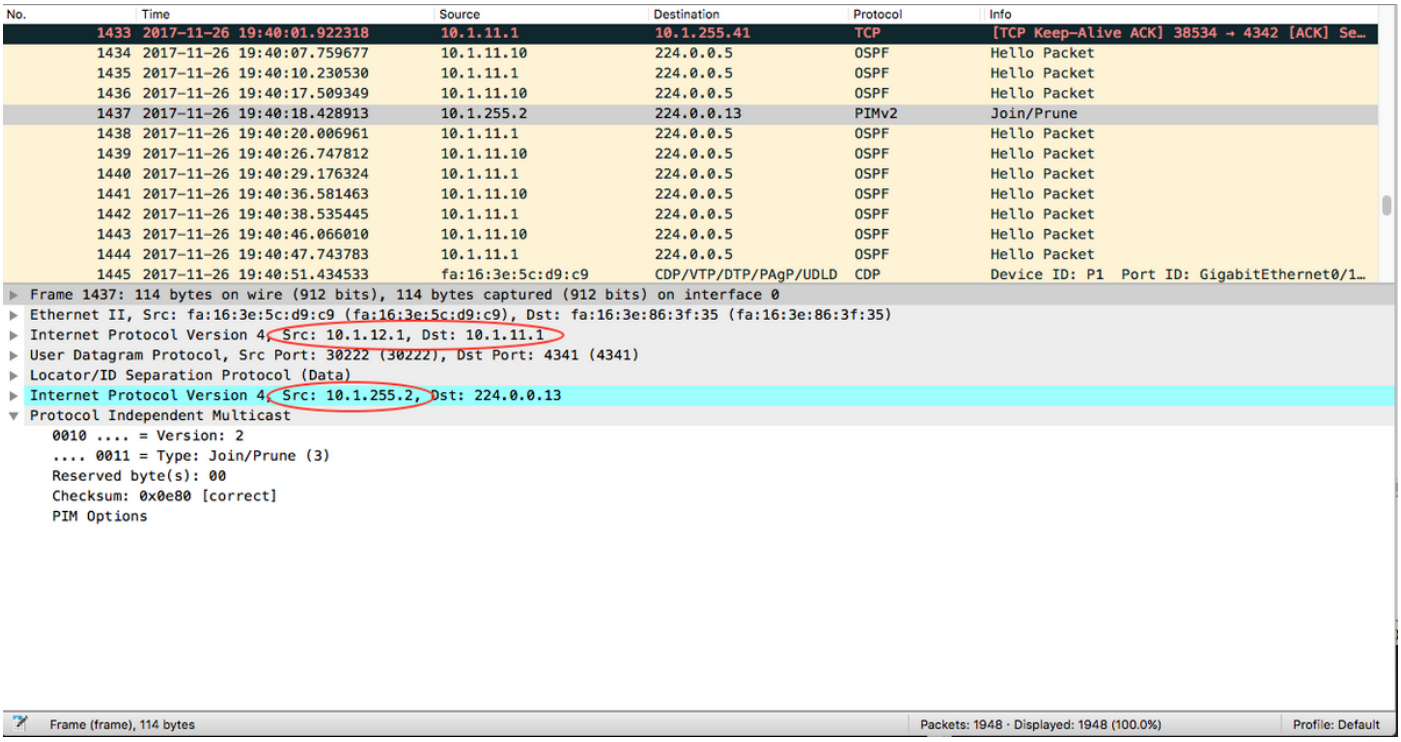
```
xTR2#sh ip lisp map-cache 172.16.251.1
LISP IPv4 Mapping Cache for EID-table default (IID 0), 4 entries

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
```

Para poder enviar um Join, você precisa ter um vizinho PIM. Uma vez obtidas informações de RPF, o PIM cria explicitamente um vizinho para o RLOC correspondente. O vizinho não é criado

da maneira usual porque os PIM Hello não estão passando pelo túnel LISP.

```
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 /
```

Uma captura do Wireshark do pacote multicast é como mostrado na imagem.



O IP de origem e destino externo são RLOCs locais e remotos. É esperado que você use a replicação unicast.

O IP de origem interno foi retirado da interface LISP0.

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

O IP de destino interno é o endereço multicast 224.0.0.13 usado para mensagens PIM.

Em xTR2 para o mroute (172.16.251.1, 232.1.1.10), um IIL é a interface LISP0 e um OIL aponta para 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
```

No xTR1, uma união do xTR2 foi recebida e uma rota (S,G) foi criada.

```
*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
```

O xTR1 upstream deve rastrear cada RLOC downstream para o qual uma mensagem de união foi recebida.

O xTR deve lembrar o conjunto de RLOCs para os quais replicar pacotes.

Uma entrada ($_{EIDs}$,G) no xTR de upstream, portanto, procura o seguinte encapsulamento unicast:

(EID_s,G)

A Eth0/0

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
```

Note: O xTR1 não tem um vizinho PIM por meio da 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          Interface                Uptime/Expires    Ver   DR
Address                                                            Prio/Mode
172.16.11.2       GigabitEthernet3.10      04:25:32/00:01:37 v2    1 / DR S P G
```

No CE1, uma união para um (S,G) foi recebida e um mroute foi criado.

```
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
```

O tráfego multicast está fluindo como esperado.

```
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
```

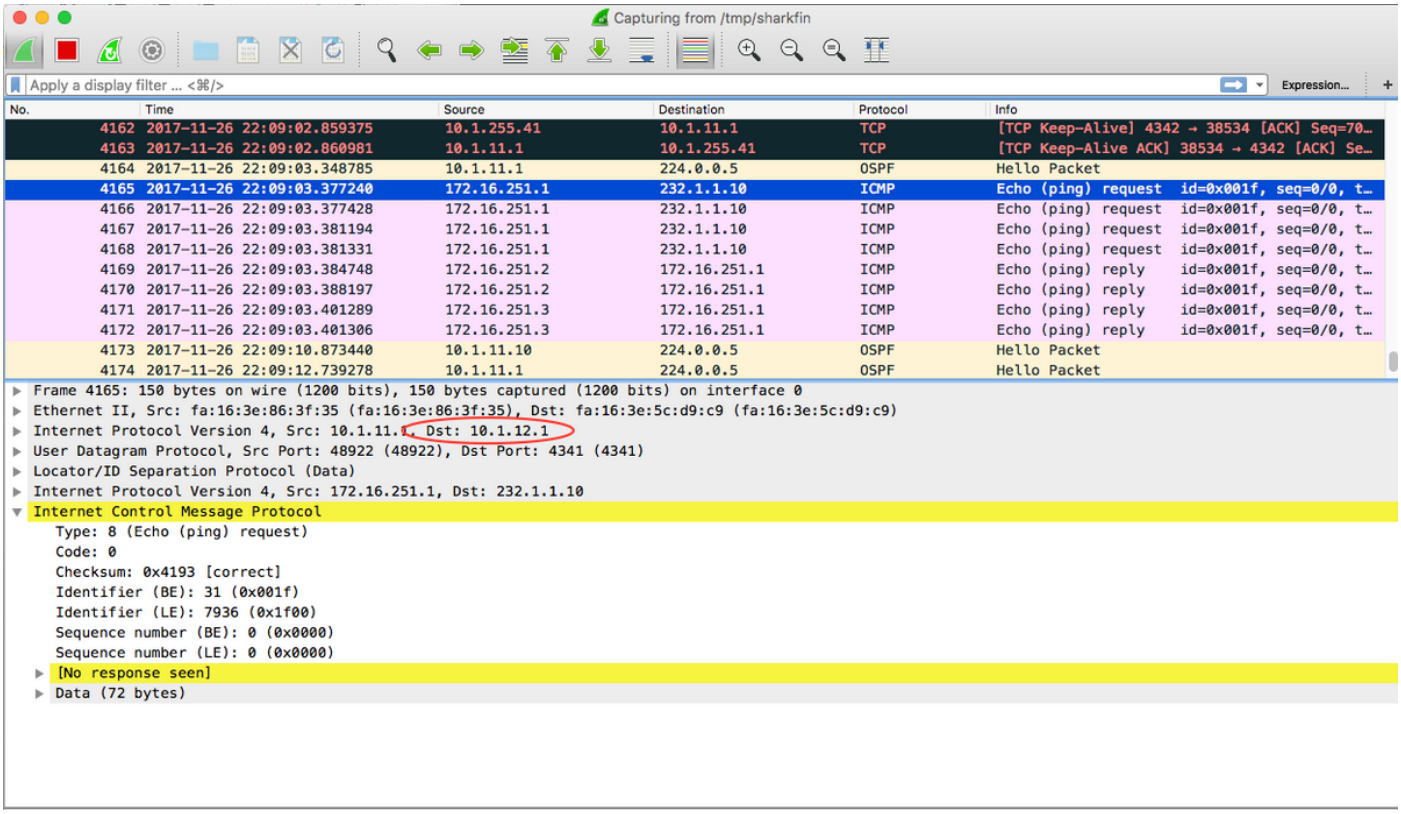
Vamos adicionar mais um receptor em CE3.

Uma entrada adicional em um OIL para o novo RLOC é adicionada em um MRIB e um MFIB.

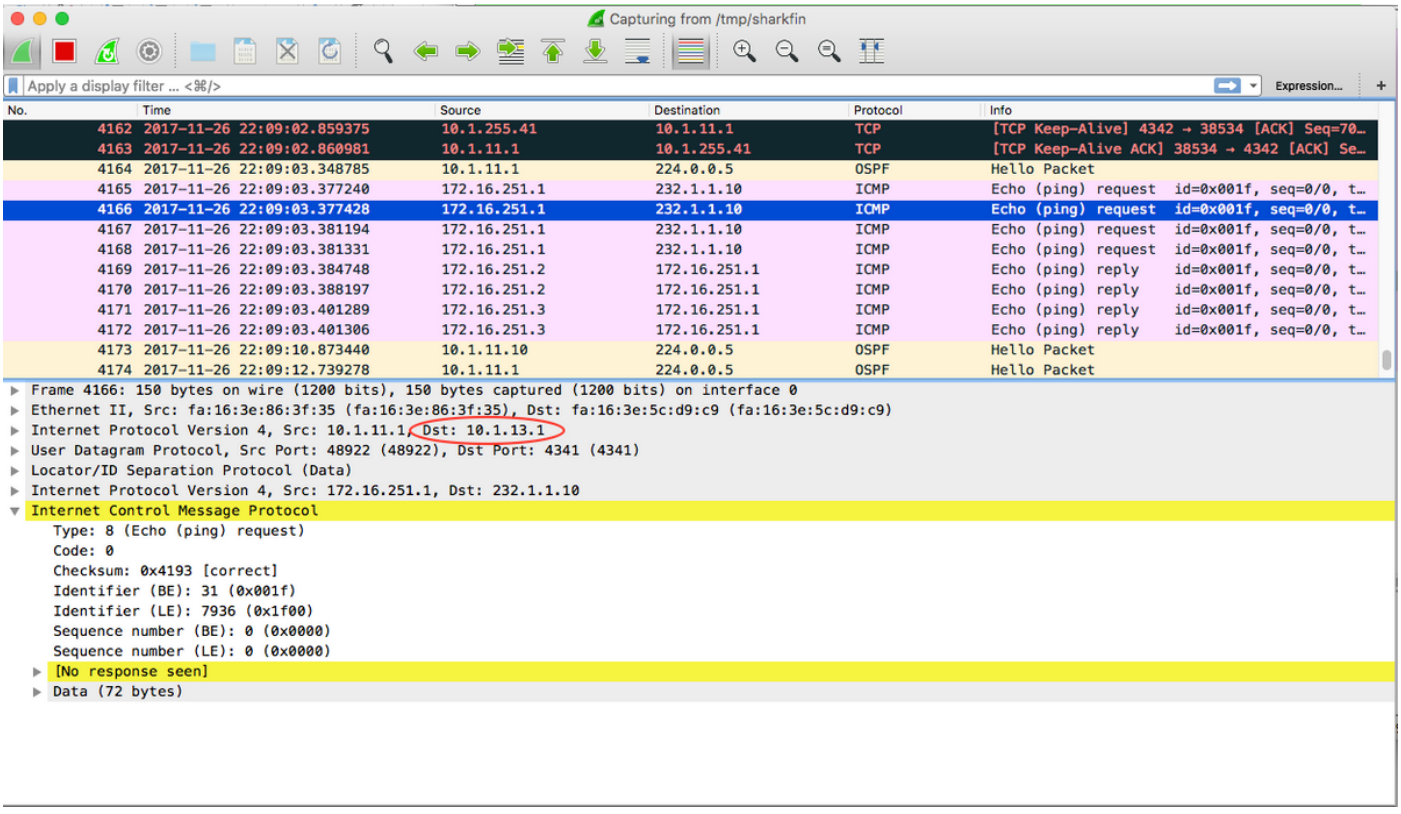
```
xTR1#sh ip mro 232.1.1.10
<…skip…>
(172.16.251.1, 232.1.1.10), 02:28:36/00:03:25, flags: sT
  Incoming interface: GigabitEthernet3.10, RPF nbr 172.16.11.2
  Outgoing interface list:
    LISP0, 10.1.13.1, Forward/Sparse, 00:01:34/00:02:57
    LISP0, 10.1.12.1, Forward/Sparse, 02:28:36/00:03:25

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
```

Se você começar a enviar tráfego para 232.1.1.10 na interface central, como mostrado na imagem.



O destino do pacote encapsulado é o RLOC para xTR2, como mostrado na imagem.



O IP de destino do pacote é o RLOC de xTR3.

O fluxo multicast é replicado em dois fluxos unicast e enviado pelo núcleo.

ASM

Note: Somente um RP estático é suportado. Não há suporte para redundância de RP.

Origem Registros Primeiro

Vamos enviar multicast do CE1 para o grupo 225.1.1.10. O CE1 é o FHR (First Hop Router), portanto ele disparará uma mensagem de registro unicast para o RP (CE4). Como você não tem nenhum receptor, CE1 recebeu uma parada de registro e cria entradas de rota.

```
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
```

Em um lado RP, também era esperada uma imagem. Depois de receber uma mensagem de registro do CE1, o RP (CE4) envia uma parada de registro novamente e cria as rotas necessárias.

```
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
```

Considere que uma interface de origem de registro deve estar no intervalo EID, caso contrário, o LISP não será acionado. Por padrão, seria o endereço IP da interface de saída.

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

Para xTR1 e xTR4, nada mudou porque o tráfego multicast ainda não foi recebido.

Receptor vem primeiro

Vamos configurar um receptor na interface Lo10 no dispositivo CE3.

```
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
```

Um (*,Join) é acionado e um mroute é criado. Tudo é esperado.

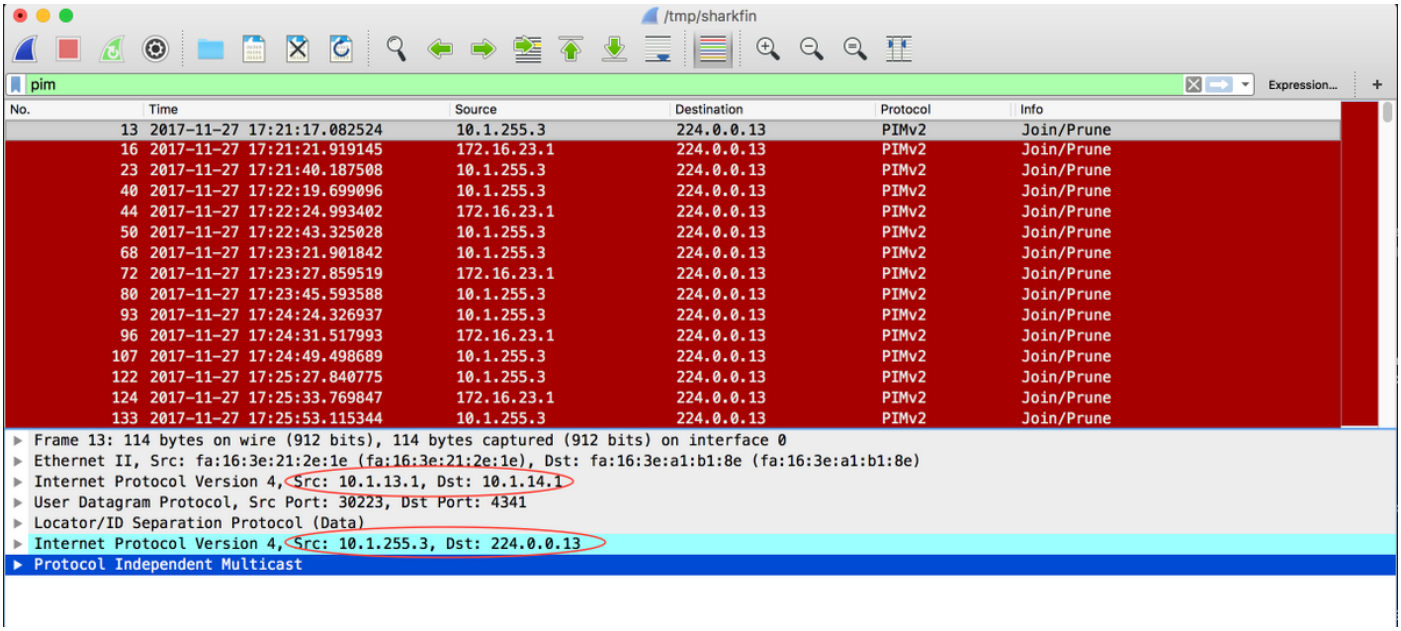
```
CE3#
*Nov 27 14:48:46.271: PIM(0): Check RP 172.16.251.4 into the (*, 225.1.1.10) entry
*Nov 27 14:48:46.272: PIM(0): Building Triggered (*,G) Join / (S,G,RP-bit) Prune message for
225.1.1.10
*Nov 27 14:48:46.272: PIM(0): Upstream mode for (*, 225.1.1.10) changed from 0 to 1
*Nov 27 14:48:46.274: 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
```

Um (*,225.1.1.10) Join é recebido por xTR3. Um (*,G) Join é enviado ao RP. O xTR3 verifica o RLOC para o RP (172.16.251.4). Como pode ser acessado por meio do LISP, o vizinho PIM para o RLOC apropriado é criado. Nesse caso, é 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          Interface                Uptime/Expires    Ver   DR
Address                                                            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 /
```

Vamos verificar uma captura do Wireshark como mostrado na imagem.



A origem IP externa é o RLOC local e o destino IP externo é o RLOC remoto. A origem interna é o endereço IP usado para a interface LISP0. O endereço IP de destino interno é o endereço multicast PIM regular 224.0.0.13.

Será criado um mroute (*,G). Uma interface/RPF de entrada para o RP é a interface LISP0.

```
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)
```

No xTR4, uma (*,G) Join é recebida do túnel LISP. Um mroute apropriado é criado.

```
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
```

Nesse caso, um vizinho PIM não é criado no xTR4. O vizinho PIM para CE4 está presente apenas.

```
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
```

Do ponto de vista do RP, tudo é esperado. Um mroute (*,G) é criado.

```
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
```

Switchover de árvore de caminho mais curto (SPT)

Supõe-se que a árvore compartilhada já foi criada.

O CE1 começa a enviar o tráfego para o 225.1.1.10 a partir do Lo10 de origem (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
```

O primeiro pacote multicast é encapsulado na mensagem de registro unicast e enviado ao 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).
```

O pacote de registro é desencapsulado no RP e enviado pela árvore compartilhada para o Receptor.

```
.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).
```

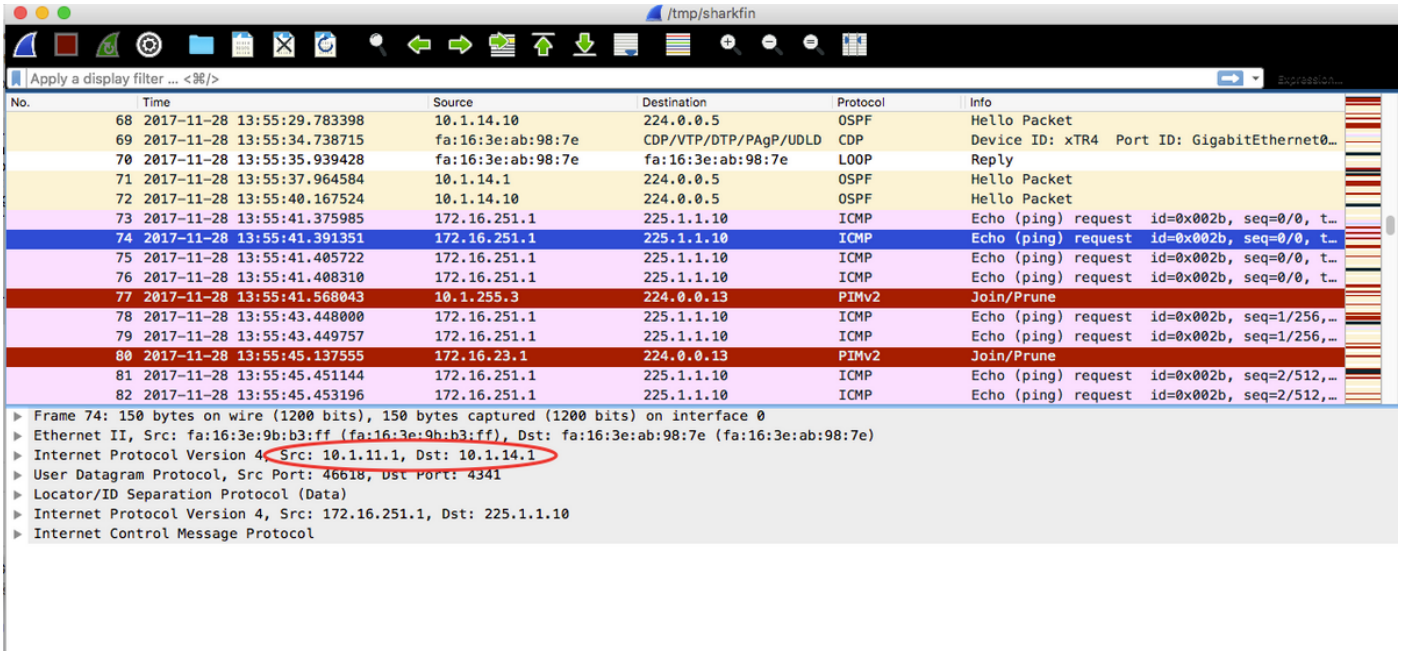
Devido à correspondência entre a interface de saída de um (*,G) e uma interface de entrada para um (S,G), um temporizador de junção de proxy é iniciado para um (S,G), o flag X é definido. É uma situação específica da topologia (RP-on-a-stick).

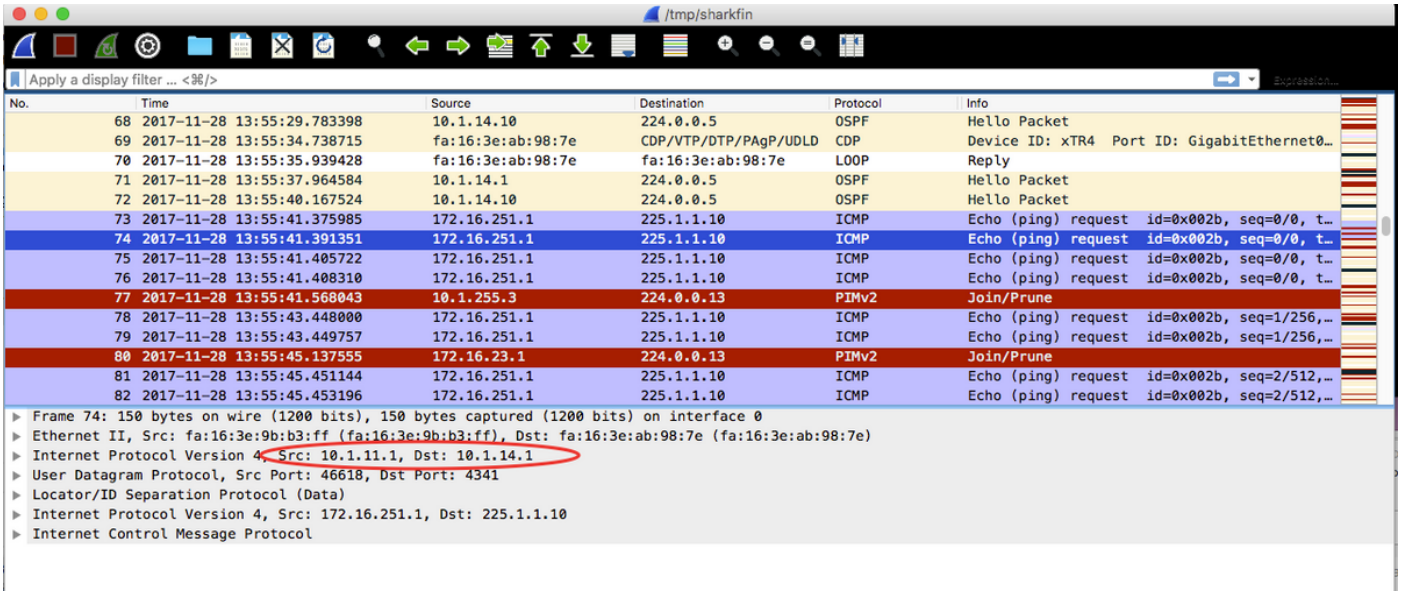
```
CE4#sh ip mro
<…skip…>
(*, 225.1.1.10), 00:00:37/stopped, RP 172.16.251.4, flags: S
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    GigabitEthernet0/1.10, Forward/Sparse, 00:00:37/00:02:52

(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
```

Portanto, CE4 envia uma (S,G) Join para a origem e não envia uma (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)
```

Ao mesmo tempo, o tráfego multicast desencapsulado é enviado através de uma árvore compartilhada para os receptores, como mostrado nas imagens.





A captura de pacotes foi realizada na interface xTR4 g0/1.

No primeiro pacote, o IP SRC e o DST externos são 10.1.11.1 e 10.1.14.1.

No segundo pacote, o IP SRC externo e o DST são 10.1.14.1 e 10.1.13.1, respectivamente.

Depois de receber pacotes multicast, o LHR CE3 está iniciando o switchover de SPT. Uma rota para (S,G) é criada e as flags J e T são definidas. Um (S,G) Join é enviado para a origem.

```
.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
```

O xTR3 está recebendo um (S,G) Join do CE3. Ele está verificando RPF para a Origem 172.16.251.1. Ele está acionando uma pesquisa de LISP e cria um vizinho de PIM para o RLOC 10.1.11.1 adicionalmente ao vizinho de PIM para o RLOC 10.1.14.1. Uma rota para (S,G) com um flag T é criada. A (S,G) Join é enviada para a Origem 172.16.255.1 através do 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          Interface                Uptime/Expires    Ver   DR
Address                                                            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
```

As interfaces RPF para um (*,G) e um (S,G) se tornam diferentes - uma árvore compartilhada (RLOC 10.1.14.1) e SPT (RLOC 10.1.11.1). Aciona uma mensagem de remoção (S,G) com RPT-bit e S-bit Join de xTR3 para o 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          Interface                Uptime/Expires    Ver   DR
Address                                                            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 /
```

O xTR1 recebe um (S,G) Join do xTR3 para essa compilação SPT. Um RPF para (*,G) é o RP que pode ser alcançado via LISP. Um vizinho PIM para uma verificação RPF é criado para o RLOC 10.1.14.1. São criadas rotas (*,G) e a (S,G).

```
.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
```

Além disso, o xTR1 recebe um (S,G) Join do RP. Uma OIL LISP0 através do RLOC 10.1.14.1 é adicionada ao (S,G).

```
.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
```

O xTR4 recebe uma ameixa (S,G) do xTR3. LISP0 a 10.1.13.1 está excluída de um OIL.

```
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 /
```

O RP (CE4) recebe um (S,G) Prune com bit RPT definido. O RP deve remover a origem da árvore compartilhada. O RP inicia um (S,G) Prune em direção à origem.

```
.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
```

O xTR4 recebe um (S,G) Prune iniciado pelo RP e o envia ao FHR (CE1). Gi0/2.10 está excluída de um 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
```

O xTR1 recebe um (S,G) Prune de xTR4 e remove o LISP0 por meio do RLOC 10.1.14.1 do OIL.

```
.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
```

Agora você tem um estado final.

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

Verificar

No momento, não há procedimento de verificação disponível para esta configuração.

Troubleshoot

Atualmente, não existem informações disponíveis específicas sobre Troubleshooting para esta configuração.

Fonte

- RFC 6831 O LISP para ambientes multicast