在LISP阶段1上配置组播

目录

简介

本文档介绍在定位器/ID分离协议(LISP)上的组播实施第1阶段，使用入口复制。这意味着单播路由定位器(RLOC)核心用于传输身份信息(EID)组播。

先决条件

要求

思科建议您了解LISP和组播。

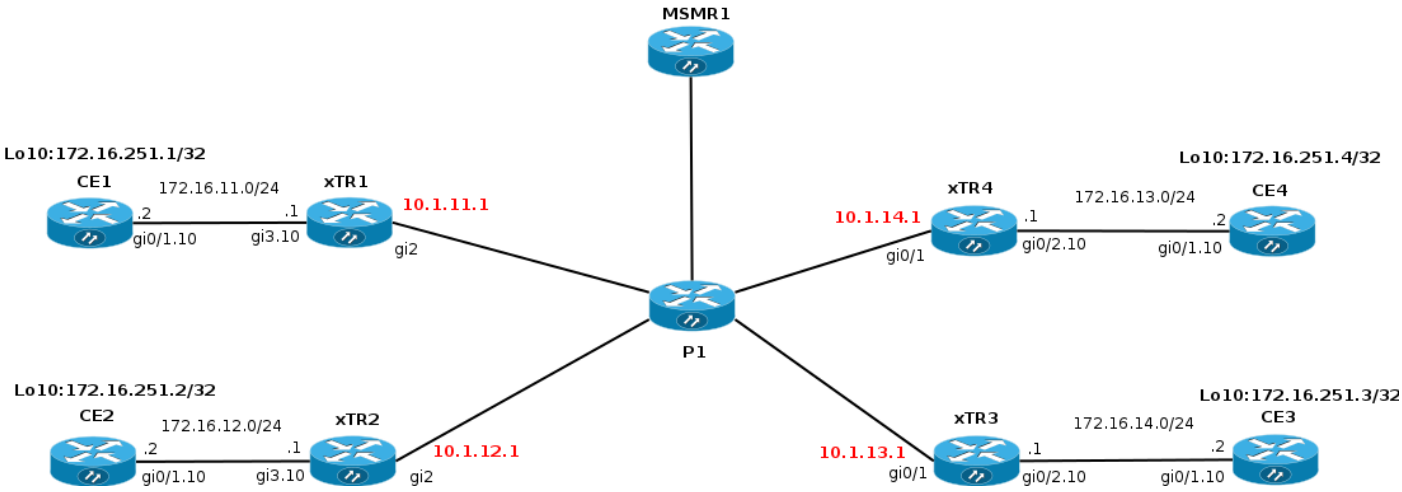
使用的组件

本文档不限于特定的软件和硬件版本。

本文档中的信息都是基于特定实验室环境中的设备编写的。本文档中使用的所有设备最初均采用原始（默认）配置。如果您使用的是真实网络，请确保您已经了解所有命令的潜在影响。

配置

网络图



配置

第1阶段支持组播数据包的单播头端复制。

- 第1阶段支持从XE 3.13和Cisco IOS® 15.4(2)T开始。
- 第1阶段支持IPv4 RLOC上的IPv4 EID（传输）从XE 3.13和Cisco IOS® 15.4(2)T开始。
- 第1阶段支持IPv6 EID over IPv4 RLOCs（传输）从Polaris 16.6.1开始，默认vrf仅用于LISP，VXLAN封装用于软件定义访问(SDA)。
- 第1阶段支持EID虚拟路由和转发(VRF)（分段）和IID（通过PIM VRF支持）。
- 第1阶段支持任何源组播(ASM)和源特定组播(SSM)模型。
- 第1阶段仅支持静态路由处理器(RP)配置。
- 第1阶段不支持RP冗余。
- 第1阶段支持LISP和非LISP源站点和接收站点的各种组合。
- LISP组播不作为LISP移动数据中心互联(DCI)解决方案受支持。

假设组播已在网络上配置(pim sparse-mode/rp)。

要启用LISP组播，必须在LISP0或LISP0.xx接口下添加“ip pim sparse-mode”。通过在LISP接口上启用PIM，RPF中包含PIM。通过LISP站点可到达的前缀的RPF信息包括LISP隧道和由上游站点的RLOC地址表示的邻居。

仅允许通过LISP隧道发送加入/修剪消息。站点之间不交换PIM Hello消息。PIM加入/修剪消息单播封装到上游xTR（RP或源）。 其他xTR/PxTR看不到加入/修剪消息。MVPN中没有默认MDT的模拟。

必须在LISP隧道接口下启用PIM以进行组播处理。

EID虚拟化将LISP实例ID与EID VRF结合使用。为每个EID VRF/LISP实例ID创建x=IID的接口LISP0.x。

```
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
```

由于没有活动源/接收器，并且对等体之间不交换PIM Hello，因此无法通过LISP接口看到邻居。

```
xTR1#sh ip pim nei
PIM Neighbor Table
Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,
      P - Proxy Capable, S - State Refresh Capable, G - GenID Capable,
      L - DR Load-balancing Capable
Neighbor          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

让我们在CE2上配置接口lo10以加入组。它触发(S，G)连接，因为已指定组和源。

```
CE2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
CE2(config)#int lo10
CE2(config-if)#ip igmp join-group 232.1.1.10 source 172.16.251.1

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

(S，G)路由在CE2上创建。

```
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
```

让我们检查xTR2上发生的情况。

已在xTR2上启用调试ip pim。

从CE2接收(S，G)加入。

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

172.16.251.1是来自xTR1的EID，但尚未出现在RIB中。因此，源IP 172.16.251.1的RPF查找失败。它触发LISP查找。因此RPF接口是LISP隧道。

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

```
xTR2#sh ip rpf 172.16.251.1
RPF information for ? (172.16.251.1)
  RPF interface: LISP0
  RPF neighbor: ? (10.1.11.1)
  RPF route/mask: 172.16.251.1/32
  RPF type: unicast ()
  Doing distance-preferred lookups across tables
  RPF topology: ipv4 multicast base
```

之后，将建立(S，G)连接，并通过LISP接口通过RLOC 10.1.11.1发送到源。

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

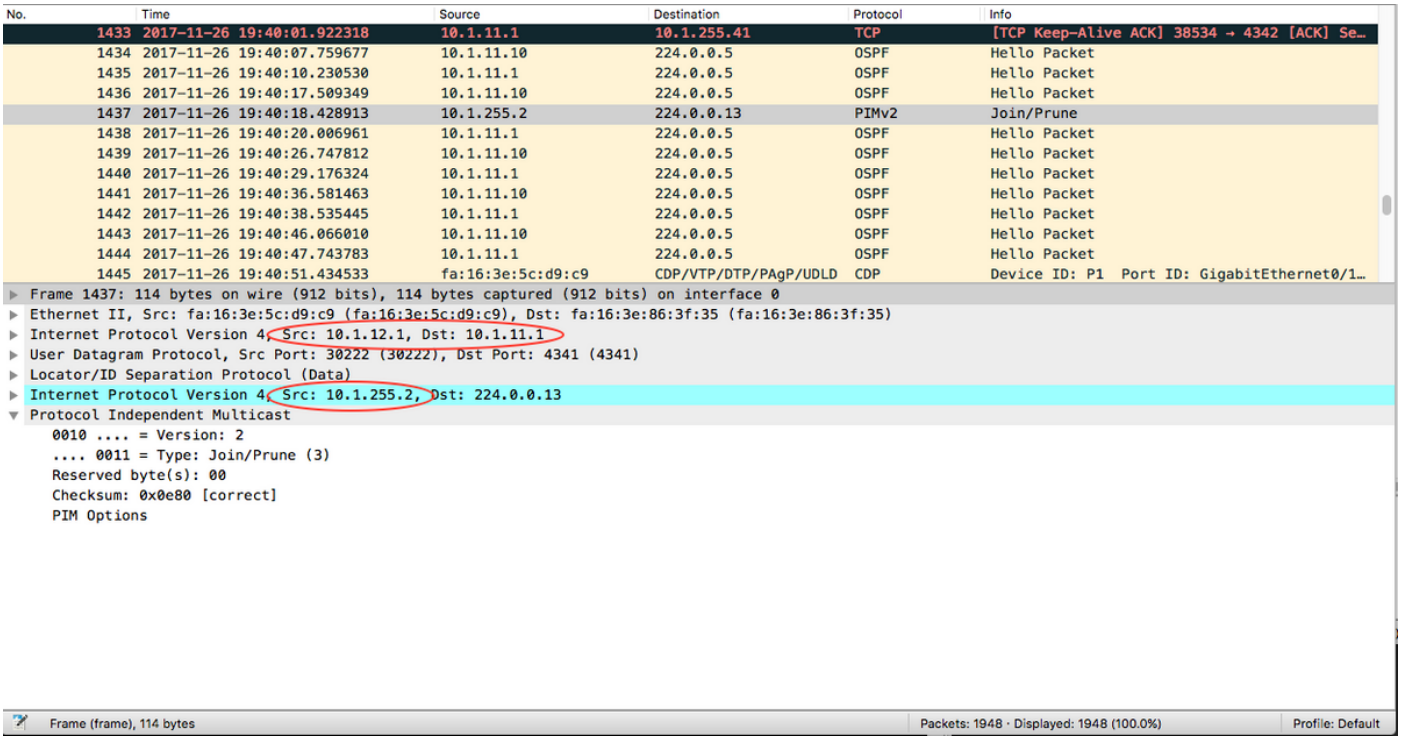
加入封装到单播LISP报头中。封装数据包的源IP是发送数据包的接口的RLOC。目的IP是xTR的RLOC地址，该地址可访问组播源的EID。

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

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

要能够发送加入，您需要有PIM邻居。获取RPF信息后，PIM将显式创建与相应RLOC的邻居。邻居不是以常规方式创建的，因为PIM Hello未通过LISP隧道。

```
xTR2#sh ip pim nei
PIM Neighbor Table
Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,
      P - Proxy Capable, S - State Refresh Capable, G - GenID Capable,
      L - DR Load-balancing Capable
Neighbor          Interface               Uptime/Expires    Ver   DR
Address                                                           Prio/Mode
172.16.12.2       GigabitEthernet3.10     01:57:04/00:01:30 v2    1 / DR S P G
10.1.11.1         LISP0                   00:00:48/00:01:10 v2    0 /
```

组播数据包的Wireshark捕获如图所示。



外部源IP和目的IP是本地和远程RLOC。在使用单播复制时，应使用该命令。

内部源IP来自LISP0接口。

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

内部目标IP是组播地址224.0.0.13，用于PIM消息。

在(172.16.251.1、232.1.1.10)路由的xTR2上，IIL是LISP0接口，OIL指向CE2。

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

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

在xTR1上，收到来自xTR2的加入，并创建(S，G)mroute。

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

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

```
xTR1#sh ip mroute
<…skip…>
(172.16.251.1, 232.1.1.10), 00:01:00/00:03:28, flags: sT
  Incoming interface: GigabitEthernet3.10, RPF nbr 172.16.11.2
  Outgoing interface list:
    LISP0, 10.1.12.1, Forward/Sparse, 00:01:00/00:03:28 <<<< LISP in OIL
```

上游xTR1必须跟踪收到加入消息的每个下游RLOC。

xTR必须记住要将数据包复制到的RLOC集。

因此，上游xTR的(EIDs,G)条目对单播封装的显示如下：

(EIDs,G)

A Eth0/0

F LISP0，下一跳= RLOC1

F LISP0，下一跳= 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
```

注意：xTR1没有通过接口LISP0的PIM邻居。

```
xTR1# sh ip pim nei
PIM Neighbor Table
Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,
      P - Proxy Capable, S - State Refresh Capable, G - GenID Capable,
      L - DR Load-balancing Capable
Neighbor          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
```

在CE1上，收到(S，G)的加入，并创建了mroute。

```
CE1#sh ip mro
<…skip…>
(172.16.251.1, 232.1.1.10), 02:16:45/00:03:08, flags: sT
  Incoming interface: Loopback10, RPF nbr 0.0.0.0
```

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

组播流量正如预期流动。

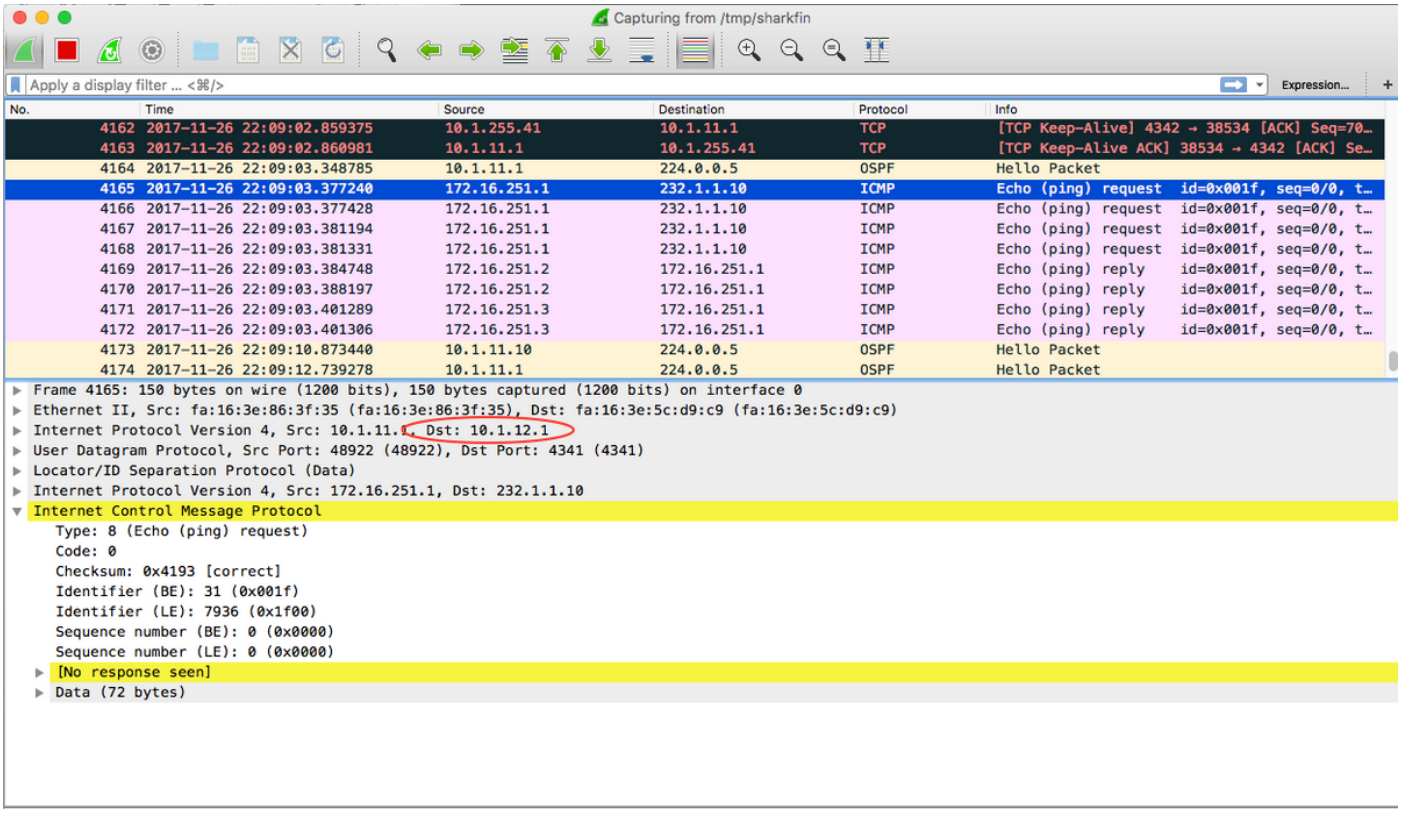
```
CE1#ping 232.1.1.10 so lo10 rep 5
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 232.1.1.10, timeout is 2 seconds:
Packet sent with a source address of 172.16.251.1

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
```

让我们在CE3上再添加一个接收器。

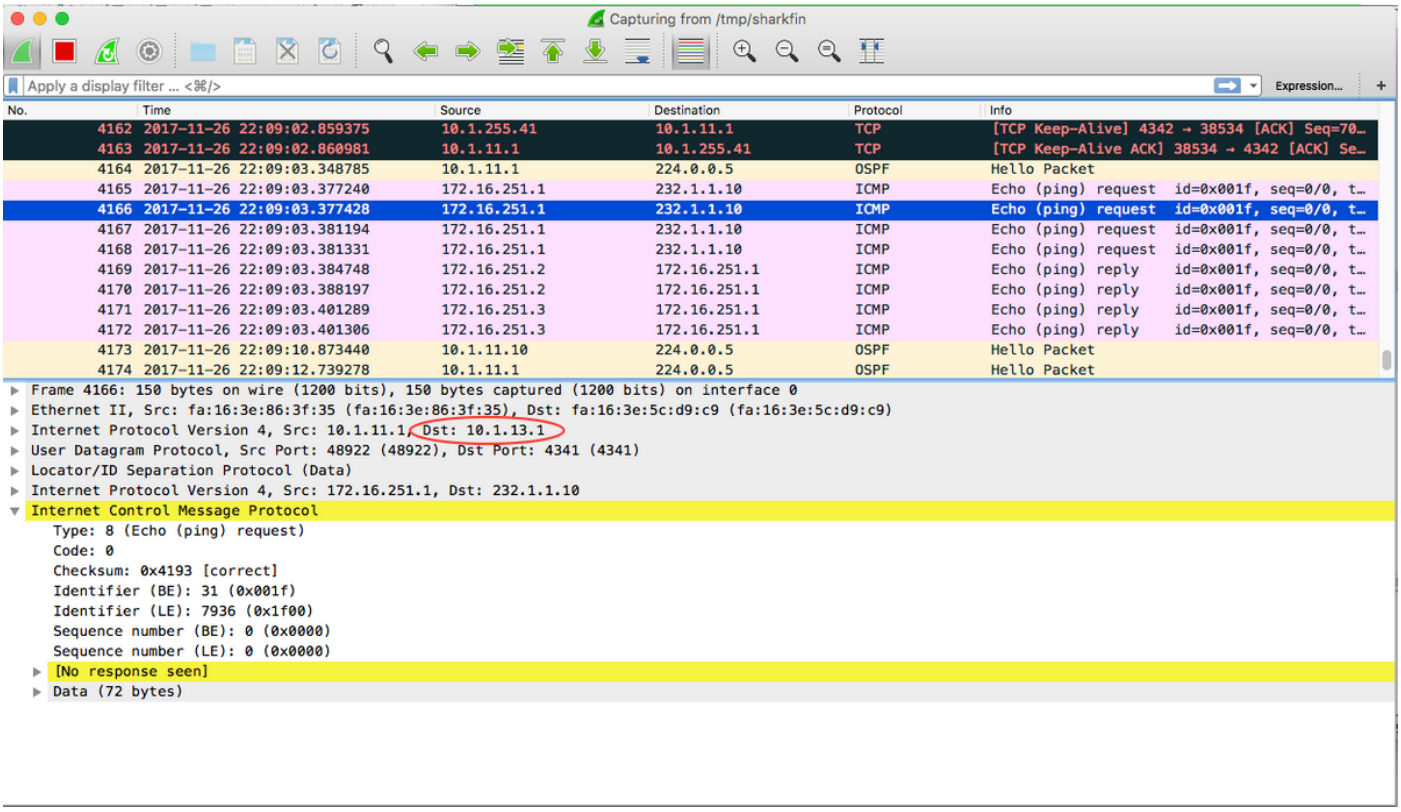
在OIL中为新RLOC添加的附加条目添加到MRIB和MFIB中。

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

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

如图所示，如果开始向核心接口上的232.1.1.10发送流量。



如图所示，封装数据包的目的地是xTR2的RLOC。



数据包的目的IP是xTR3的RLOC。

组播流被复制到两个单播流中，并通过核心层发送出去。

ASM

注意：仅支持静态RP。不支持RP冗余。

源注册首先

让我们将组播从CE1发送到组225.1.1.10。CE1是第一跳路由器(FHR)，因此它会向RP(CE4)触发单播注册消息。 由于您没有任何接收器，CE1收到Register-Stop并创建mroute条目。

```
CE1#ping 225.1.1.10 so lo10
Type escape sequence to abort.
Sending 1, 100-byte ICMP Echos to 225.1.1.10, timeout is 2 seconds:
Packet sent with a source address of 172.16.251.1

*Nov 27 14:29:04.083: PIM(0): Check RP 172.16.251.4 into the (*, 225.1.1.10) entry
*Nov 27 14:29:04.084: PIM(0): Building Triggered (*,G) Join / (S,G,RP-bit) Prune message for
225.1.1.10
*Nov 27 14:29:04.089: PIM(0): Adding register encap tunnel (Tunnel0) as forwarding interface of
(172.16.251.1, 225.1.1.10).
*Nov 27 14:29:04.112: PIM(0): Received v2 Register-Stop on GigabitEthernet0/1.10 from
172.16.251.4
*Nov 27 14:29:04.112: PIM(0):   for source 172.16.251.1, group 225.1.1.10
*Nov 27 14:29:04.113: PIM(0): Removing register encap tunnel (Tunnel0) as forwarding interface
of (172.16.251.1, 225.1.1.10).
*Nov 27 14:29:04.113: PIM(0): Clear Registering flag to 172.16.251.4 for (172.16.251.1/32,
225.1.1.10).

CE1#sh ip mro 225.1.1.10
<…skip…>
(*, 225.1.1.10), 00:02:16/stopped, RP 172.16.251.4, flags: SPF
  Incoming interface: GigabitEthernet0/1.10, RPF nbr 172.16.11.1
  Outgoing interface list: Null

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

在RP端，也需要图片。从CE1收到注册消息后，RP(CE4)将发回注册停止消息并创建必要的路由。

```
CE4#
*Nov 27 14:24:06.810: PIM(0): Received v2 Register on GigabitEthernet0/1.10 from 172.16.251.1
*Nov 27 14:24:06.810:      for 172.16.251.1, group 225.1.1.10
*Nov 27 14:24:06.811: PIM(0): Check RP 172.16.251.4 into the (*, 225.1.1.10) entry
*Nov 27 14:24:06.812: PIM(0): Adding register decap tunnel (Tunnel0) as accepting interface of
(*, 225.1.1.10).
*Nov 27 14:24:06.814: PIM(0): Adding register decap tunnel (Tunnel0) as accepting interface of
(172.16.251.1, 225.1.1.10).
*Nov 27 14:24:06.815: PIM(0): Send v2 Register-Stop to 172.16.251.1 for 172.16.251.1, group
225.1.1.10
CE4#
*Nov 27 14:24:11.207: PIM(0): Building Periodic (*,G) Join / (S,G,RP-bit) Prune message for
224.0.1.40

CE4#sh ip mro 225.1.1.10
<…skip…>
(*, 225.1.1.10), 00:00:31/stopped, RP 172.16.251.4, flags: SP
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list: Null

(172.16.251.1, 225.1.1.10), 00:00:31/00:02:28, flags: P
```

```
  Incoming interface: GigabitEthernet0/1.10, RPF nbr 172.16.14.1
  Outgoing interface list: Null
```

请考虑注册源接口应在EID范围内，否则不会触发LISP。默认情况下，它是传出接口的IP地址。

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

对于xTR1和xTR4，由于尚未接收组播流量，因此没有更改任何内容。

接收器优先

让我们在设备CE3的接口Lo10上配置接收器。

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

触发(*,Join)并创建mroute。一切皆有希望。

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

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

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

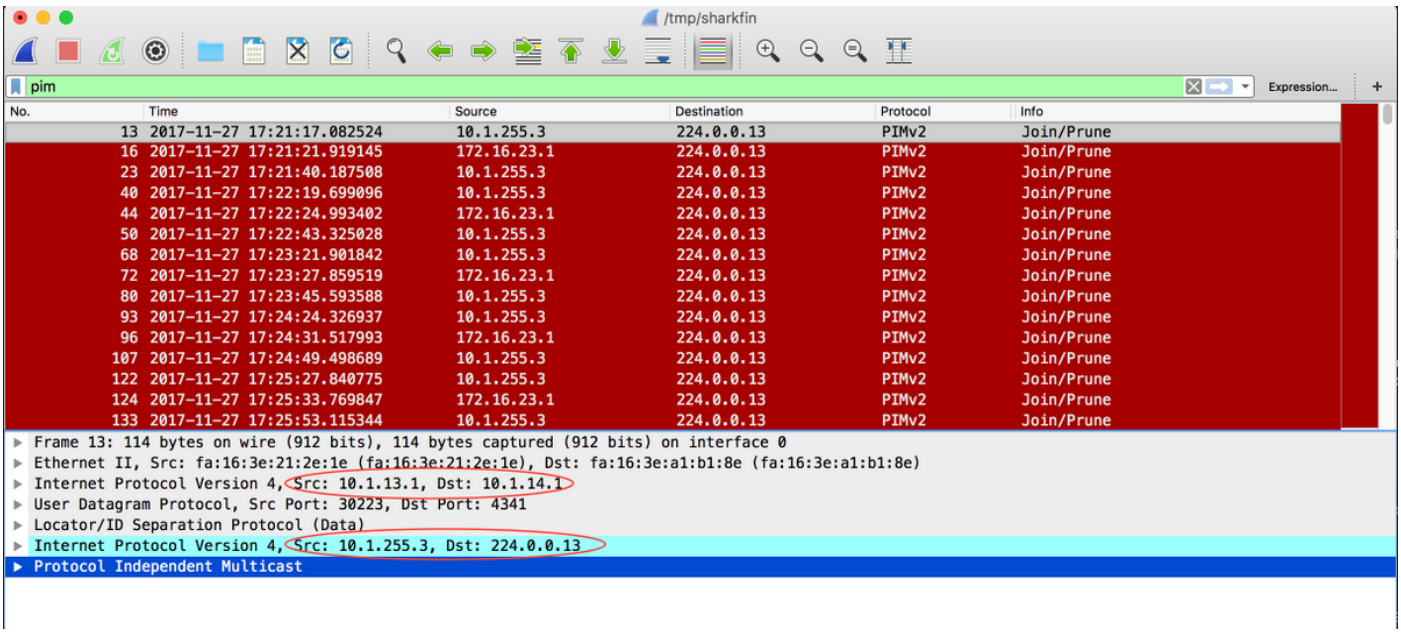
xTR3接收(*,225.1.1.10)加入。(*,G)加入被发送到RP。xTR3检查RLOC的RP(172.16.251.4)。 由于可以通过LISP访问，因此会创建到相应RLOC的PIM邻居。在本例中是 10.1.14.1。

```
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 /
```

让我们检查一下图中所示的Wireshark捕获。



外部IP源是本地RLOC，外部IP目标是远程RLOC。内部源是LISP0接口采用的IP地址。内部目标IP地址是常规PIM组播地址224.0.0.13。

将创建(*,G)mroute。RP的传入接口/RPF是LISP0接口。

```
xTR3#sh ip mro 225.1.1.10
<…skip…>
(*, 225.1.1.10), 00:42:51/00:03:25, RP 172.16.251.4, flags: S
  Incoming interface: LISP0, RPF nbr 10.1.14.1
  Outgoing interface list:
    GigabitEthernet0/2.10, Forward/Sparse, 00:42:51/00:03:25

xTR3#sh int LISP0 | i address
  Interface is unnumbered. Using address of Loopback0 (10.1.255.3)
```

在xTR4上，从LISP隧道接收(*,G)连接。创建适当的mroute。

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

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

在这种情况下，xTR4上未创建PIM邻居。仅存在到CE4的PIM邻居。

```
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
```

从RP的角度来看，一切都是期望的。将创建(*,G)mroute。

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

CE4#sh ip mro
<…skip…>
(*, 225.1.1.10), 00:00:11/00:03:18, RP 172.16.251.4, flags: S
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    GigabitEthernet0/1.10, Forward/Sparse, 00:00:11/00:03:18
```

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

最短路径树(SPT)切换

假设已构建共享树。

CE1开始从源Lo10(172.16.251.1)向225.1.1.10发送流量。

```
CE1#ping 225.1.1.10 so lo10
Type escape sequence to abort.
Sending 1, 100-byte ICMP Echos to 225.1.1.10, timeout is 2 seconds:
Packet sent with a source address of 172.16.251.1
Reply to request 0 from 172.16.251.3, 77 ms
```

第一个组播数据包封装到单播寄存器消息中，并发送到RP。

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

寄存器数据包在RP上解封并通过共享树发送到接收方。

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

由于(*,G)的传出接口与(S，G)的传入接口之间的匹配，因此为(S，G)启动代理加入计时器，设置标志X。这是拓扑特定情况（单臂RP）。

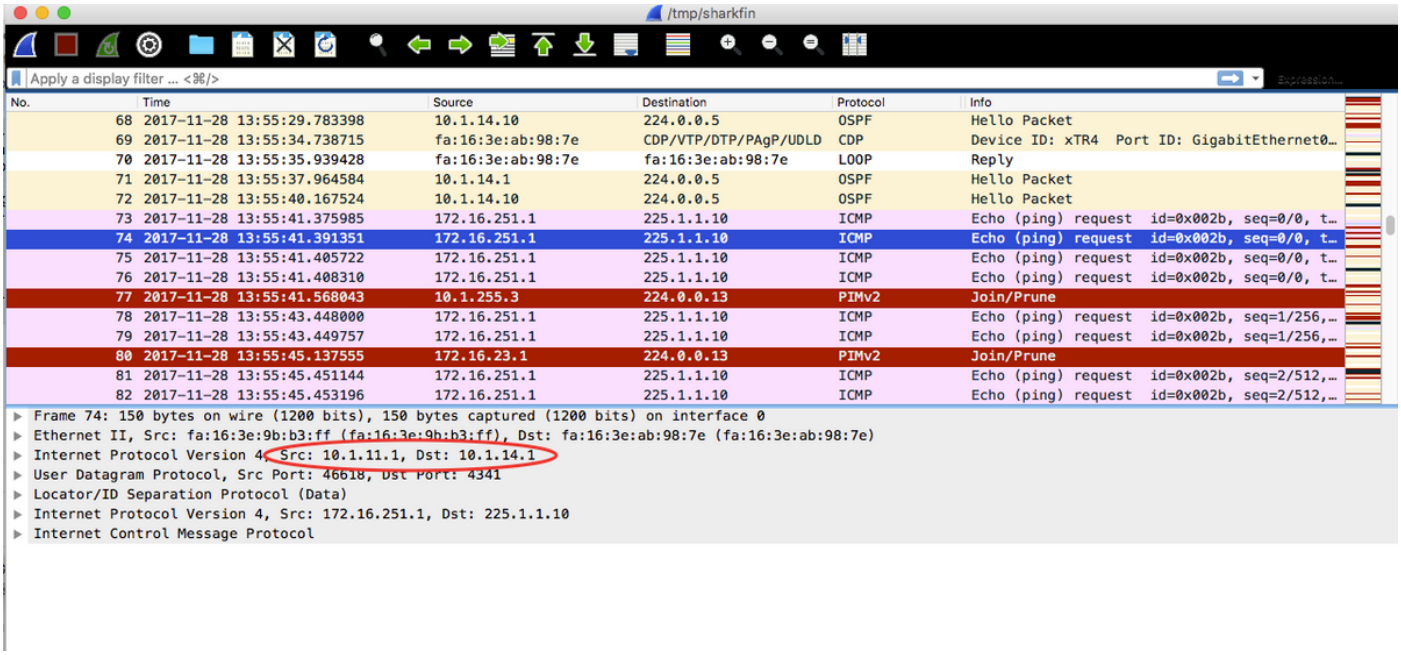
```
CE4#sh ip mro
<…skip…>
(*, 225.1.1.10), 00:00:37/stopped, RP 172.16.251.4, flags: S
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    GigabitEthernet0/1.10, Forward/Sparse, 00:00:37/00:02:52

(172.16.251.1, 225.1.1.10), 00:00:26/00:02:33, flags: PX Incoming interface:
GigabitEthernet0/1.10, RPF nbr 172.16.14.1 Outgoing interface list: Null
```

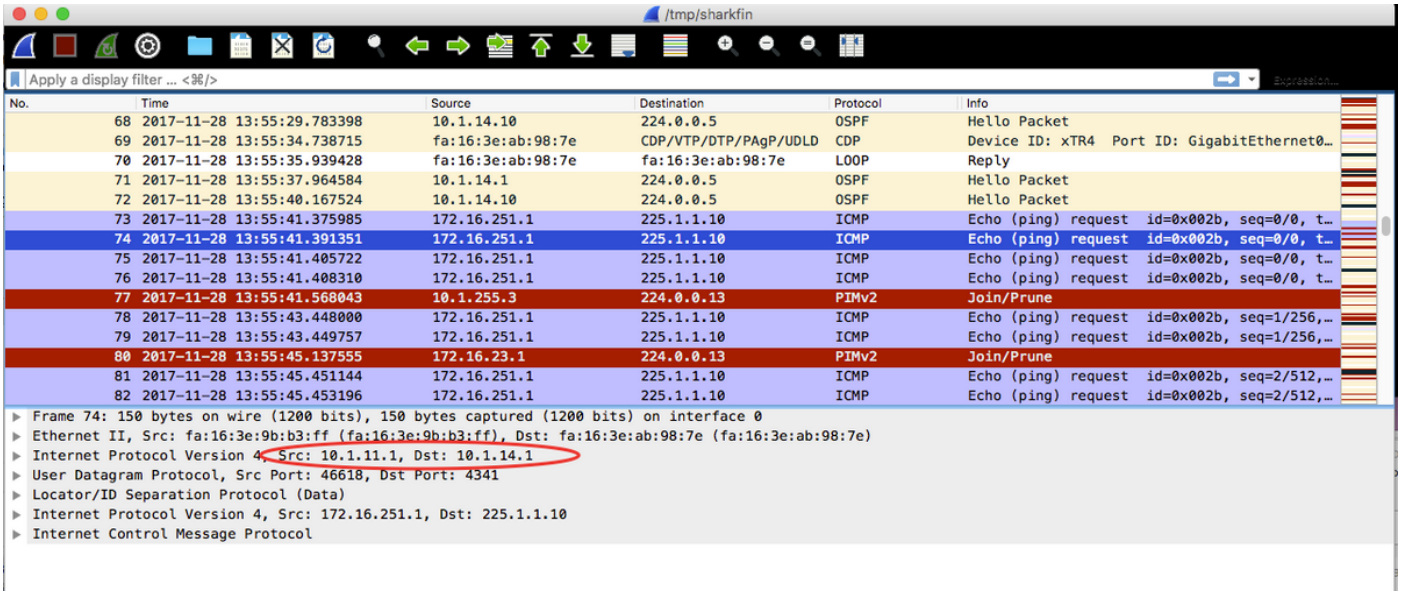
因此CE4向源发送(S，G)加入，而不发送(S，G)修剪。

```
.Nov 30 00:00:51.544: PIM(0): Insert (172.16.251.1,225.1.1.10) join in nbr 172.16.14.1's queue
.Nov 30 00:00:51.546: PIM(0): Building Join/Prune packet for nbr 172.16.14.1
```

```
.Nov 30 00:00:51.546: PIM(0):  Adding v2 (172.16.251.1/32, 225.1.1.10), S-bit Join
.Nov 30 00:00:51.547: PIM(0): Send v2 join/prune to 172.16.14.1 (GigabitEthernet0/1.10)
```

同时，解封的组播流量通过共享树发送到接收器，如图所示。





数据包捕获是在xTR4 g0/1接口上进行的。

在第一个数据包中，外部IP SRC和DST分别为10.1.11.1和10.1.14.1。

在第二个数据包中，外部IP SRC和DST分别为10.1.14.1和10.1.13.1。

在收到组播数据包后，LHR CE3正在启动SPT切换。创建(S，G)的Mroute并设置标记J和T。向源发送A(S，G)加入。

```
.Nov 30 00:00:51.765: MRT(0): Set 'L' flag for (172.16.251.1, 225.1.1.10)
.Nov 30 00:00:51.766: MRT(0): Reset the z-flag for (172.16.251.1, 225.1.1.10)
.Nov 30 00:00:51.766: MRT(0): (172.16.251.1,225.1.1.10), RPF install from  /0.0.0.0 to
GigabitEthernet0/1.10/172.16.13.1
.Nov 30 00:00:51.767: MRT(0): Set the T-flag for (172.16.251.1, 225.1.1.10)
```

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

```
CE3#sh ip mro
<…skip…>
(*, 225.1.1.10), 00:01:36/stopped, RP 172.16.251.4, flags: SJCL
  Incoming interface: GigabitEthernet0/1.10, RPF nbr 172.16.13.1
  Outgoing interface list:
    Loopback10, Forward/Sparse, 00:01:36/00:02:48

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

xTR3正在从CE3接收(S，G)连接。它正在检查源172.16.251.1的RPF。它正在触发LISP查找，并创建到RLOC 10.1.11.1的PIM邻居，此外还与RLOC邻居10.1.14.1.为(S，G)创建带有标志T的Mroute。A(S，G)连接通过LISP0 RLOC 10.1.11.1发送到源172.16.255.1

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

```
xTR3#sh ip pim nei
PIM Neighbor Table
Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,
      P - Proxy Capable, S - State Refresh Capable, G - GenID Capable,
      L - DR Load-balancing Capable
Neighbor          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
```

(*,G)和(S，G)的RPF接口变得不同 — 共享树(RLOC 10.1.14.1)和SPT(RLOC 10.1.11.1)。 它触发从xTR3到RP的RPT位和S位加入的(S，G)修剪消息。

```
.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 /
```

xTR1从xTR3接收一个(S，G)加入，用于触发SPT构建。(*,G)的RPF是可通过LISP访问的RP。为RLOC 10.1.14.1创建RPF检查的PIM邻居。创建(*,G)和(S，G)mroutes。

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

此外，xTR1从RP接收(S，G)加入。通过RLOC 10.1.14.1的OIL LISP0会添加到(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
```

xTR4从xTR3接收(S，G)修剪。LISP0到10.1.13.1从OIL排除。

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

```
xTR4#sh ip mro
<…skip…>
(*, 225.1.1.10), 00:07:47/00:03:04, RP 172.16.251.4, flags: S
  Incoming interface: GigabitEthernet0/2.10, RPF nbr 172.16.14.2
  Outgoing interface list:
    LISP0, 10.1.13.1, Forward/Sparse, 00:07:47/00:03:04

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

```
xTR4#sh ip pim nei
PIM Neighbor Table
Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,
      P - Proxy Capable, S - State Refresh Capable, G - GenID Capable,
      L - DR Load-balancing Capable
Neighbor          Interface                Uptime/Expires    Ver   DR
Address                                                            Prio/Mode
172.16.14.2       GigabitEthernet0/2.10    4d09h/00:01:16    v2    1 / DR S P G
```

```
10.1.11.1         LISP0                    00:00:26/00:01:33 v2    0 /
```

RP(CE4)接收具有RPT位集的(S，G)修剪。RP应修剪共享树中的源。RP向源发起(S，G)修剪。

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

```
CE4#sh ip mro
<…skip…>
(172.16.251.1, 225.1.1.10), 00:00:57/00:02:45, flags: PT
  Incoming interface: GigabitEthernet0/1.10, RPF nbr 172.16.14.1
  Outgoing interface list: Null
```

xTR4接收由RP发起的(S，G)修剪并将其发送到FHR(CE1)。 Gi0/2.10不包括在OIL中。

```
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从xTR4接收(S，G)修剪，并通过RLOC 10.1.14.1从OIL删除LISP0。

```
.Nov 30 00:01:47.450: PIM(0): Received v2 Join/Prune on LISP0 from 172.16.251.14
```

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

```
xTR1#sh ip mro
<…skip…>
(*, 225.1.1.10), 00:01:02/stopped, RP 172.16.251.4, flags: SP
  Incoming interface: LISP0, RPF nbr 10.1.14.1
  Outgoing interface list: Null

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

现在你有了最终状态。

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 /
```

验证

当前没有可用于此配置的验证过程。

故障排除

目前没有针对此配置的故障排除信息。

源

- RFC 6831组播环境的LISP