验证SD访问交换矩阵中的本地组播

目录

简介

本文档介绍如何验证SD-Access (SDA)交换矩阵中的本地组播。

先决条件

要求

Cisco 建议您了解以下主题：

- Internet协议(IP)转发
- 定位器ID/分离协议(LISP)
- 协议无关组播(PIM)稀疏模式

使用的组件

- Cisco IOS® XE 17.10.1上的C9000v
- 思科Catalyst Center版本2.3.5.3

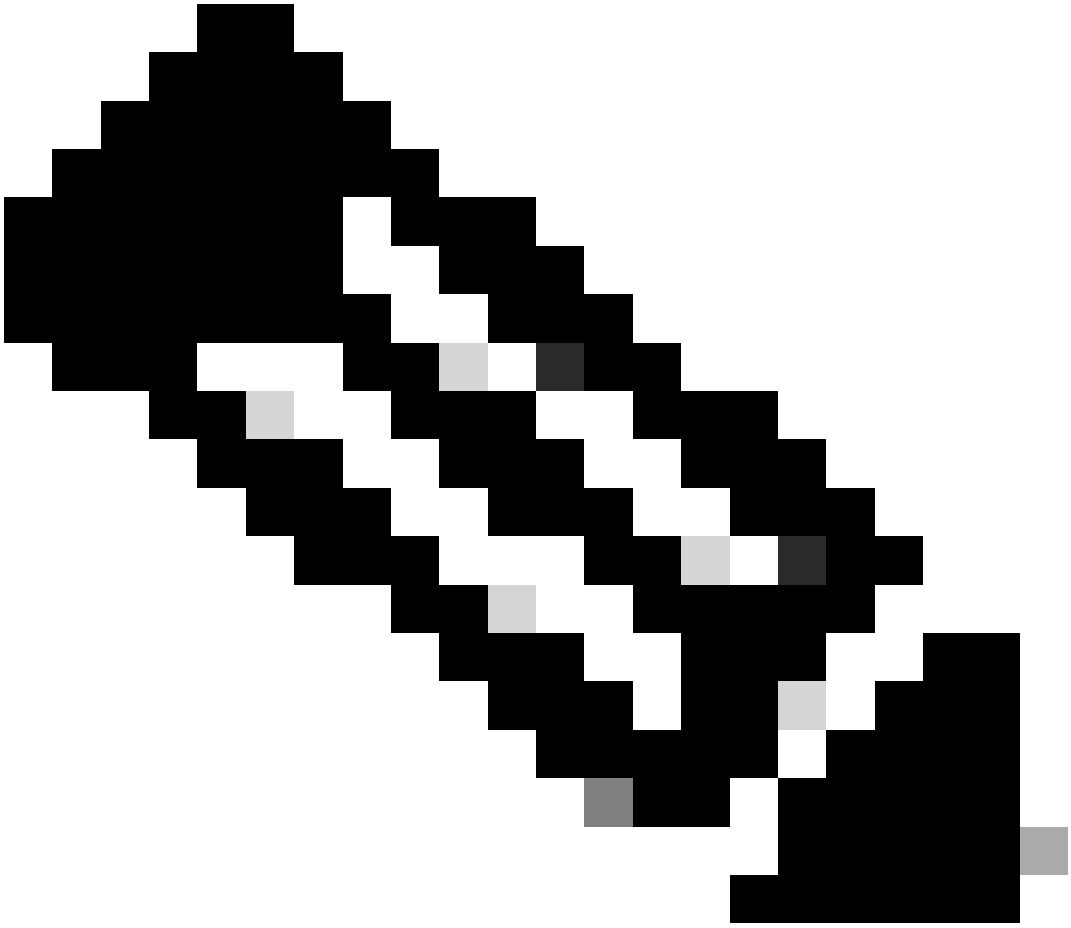
本文档中的信息都是基于特定实验室环境中的设备编写的。本文档中使用的所有设备最初均采用原始（默认）配置。如果您的网络处于活动状态，请确保您了解所有命令的潜在影响。

本文档也可用于以下硬件和软件版本：

- C9200
- C9300
- C9400
- C9500
- C9600
- Cisco IOS® XE 16.12及更高版本

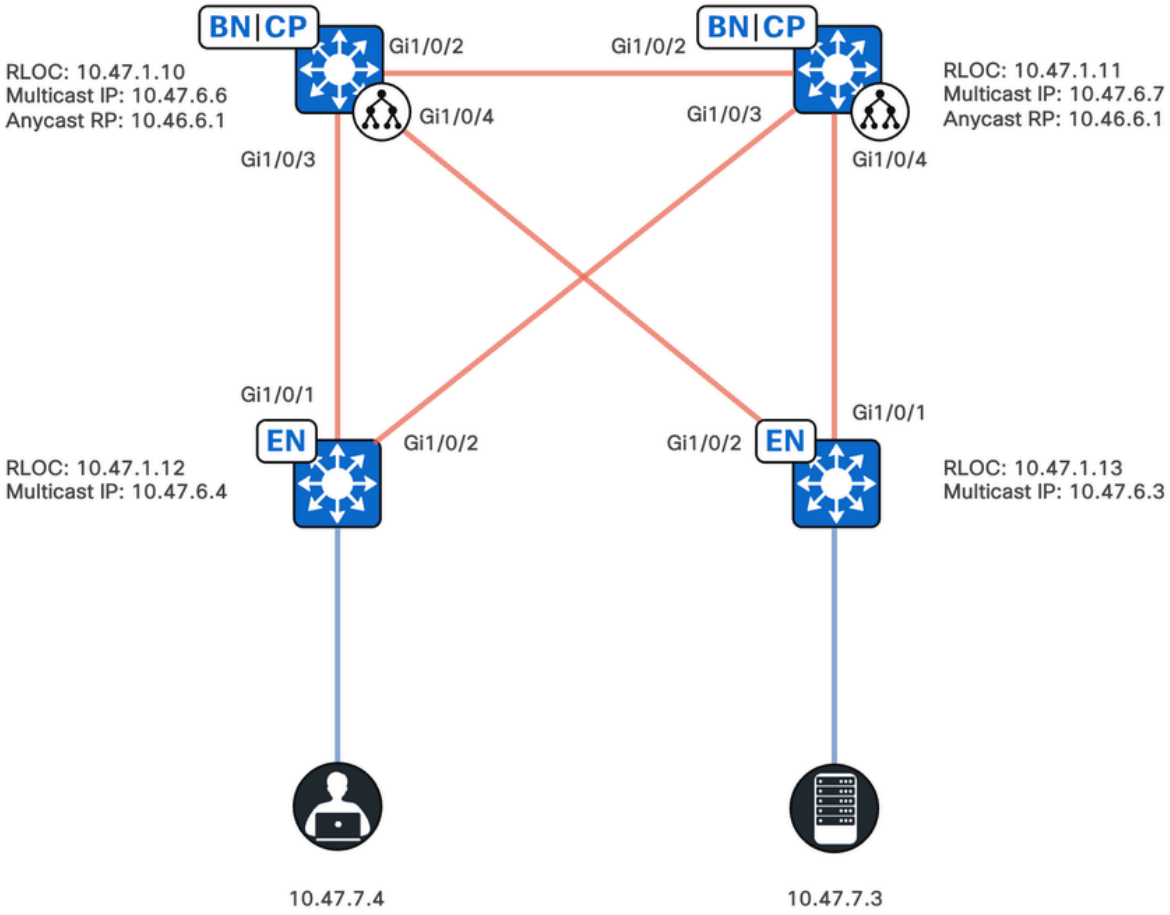
背景信息

SDA本地组播是一种重叠组播，用于在交换矩阵设备之间传送组播流量，将组播流量封装到另一个组播组中。本地组播可以在位于同一VLAN或不同VLAN的源和接收器之间路由组播流量（可以路由同一VLAN组播）。同一交换矩阵边缘(FE)上源和接收之间的组播流量不会使用重叠组播（VXLAN封装）转发，而是由FE进行本地路由。本地组播无法路由与224.0.0.0/24或Time To Live (TTL) =1匹配的组的组播流量，这些流量通过第2层(L2)泛洪处理。本地组播可配置为转发任意源组播(ASM)、源特定组播(SSM)或二者的组合。本地组播依赖于底层组播。



注意：平台(fed)命令可能有所不同。命令可以是“show platform fed <active|standby>”和“show platform fed switch <active|standby>".如果示例中注明的语法未解析出，请尝试该变体。

拓扑



网络拓扑

在此拓扑中：

- 远程定位器ID (RLOC) 10.47.1.10和10.47.1.10位于任意位置边界，还用作任播交汇点(RP)，在虚拟网络(VN)或虚拟路由和转发(VRF)中二者之间使用组播源发现协议(MSDP)。
- 10.47.1.12和10.47.1.3是FE节点
- 10.47.7.4是组播接收器
- 10.47.7.3是组播源
- 239.0.0.5是组播组目的地址(GDA)

配置

假设Cisco Catalyst Center用于调配具有以下设置的SDA交换矩阵：

- 复制模式实施是本地组播
- 组播模式是任何源组播(ASM)
- 任播交汇点(RP)与组播源发现协议(MSDP)在并置任意位置边界上配置
- 底层组播是手动配置的，或者是作为初始LAN自动化的一部分配置的，本地组播依靠底层组播正常运行。

交换矩阵边缘(10.47.1.12)配置

```
ip access-list standard ASM_ACL_IPV4_blue_vn_10.47.6.1
permit 239.0.0.0 0.0.0.255
ip multicast-routing vrf blue_vn
interface LISP0.4100
ip pim lisp transport multicast
ip pim lisp core-group-range 232.0.0.1 1000
interface Vlan1025
ip pim passive
exit
interface Loopback4100
vrf forwarding blue_vn
ip address 10.47.6.4 255.255.255.255
ip pim sparse-mode
ip pim vrf blue_vn rp-address 10.47.6.1 ASM_ACL_IPV4_blue_vn_10.47.6.1
ip pim vrf blue_vn register-source Loopback4100
ip pim vrf blue_vn ssm default
router lisp
service ipv4
etr map-server 10.47.1.11 key ******
etr map-server 10.47.1.10 key ******
etr map-server 10.47.1.10 proxy-reply
etr map-server 10.47.1.11 proxy-reply
service ethernet
etr map-server 10.47.1.11 key ******
etr map-server 10.47.1.10 key ******
etr map-server 10.47.1.10 proxy-reply
etr map-server 10.47.1.11 proxy-reply
instance-id-range 8188 , 8190 , 8192 , 8193 override
remote-rloc-probe on-route-change
service ethernet
eid-table vlan 1025 , 1026 , 1028 , 2727
database-mapping mac locator-set rloc_222e1707-175d-4019-a783-060404f8bc2f
instance-id 4099
service ipv4
sgt
instance-id 4100
service ipv4
sgt
database-mapping 10.47.6.4/32 locator-set rloc_222e1707-175d-4019-a783-060404f8bc2f
instance-id 8188
service ethernet
eid-table vlan 1025
dynamic-eid detection multiple-addr bridged-vm
instance-id 8190
service ethernet
eid-table vlan 1026
dynamic-eid detection multiple-addr bridged-vm
instance-id 8192
service ethernet
eid-table vlan 1028
dynamic-eid detection multiple-addr bridged-vm
ip domain lookup source-interface Loopback0
ip domain lookup
ip multicast vrf blue_vn multipath
```

交换矩阵边缘(10.47.1.13)配置

```
ip access-list standard ASM_ACL_IPV4_blue_vn_10.47.6.1
permit 239.0.0.0 0.0.0.255
ip multicast-routing vrf blue_vn
interface LISP0.4100
ip pim lisp transport multicast
ip pim lisp core-group-range 232.0.0.1 1000
interface Vlan1025
ip pim passive
exit
interface Loopback4100
vrf forwarding blue_vn
ip address 10.47.6.3 255.255.255.255
ip pim sparse-mode
ip pim vrf blue_vn rp-address 10.47.6.1 ASM_ACL_IPV4_blue_vn_10.47.6.1
ip pim vrf blue_vn register-source Loopback4100
ip pim vrf blue_vn ssm default
router lisp
service ipv4
etr map-server 10.47.1.11 key ******
etr map-server 10.47.1.10 key ******
etr map-server 10.47.1.10 proxy-reply
etr map-server 10.47.1.11 proxy-reply
service ethernet
etr map-server 10.47.1.11 key ******
etr map-server 10.47.1.10 key ******
etr map-server 10.47.1.10 proxy-reply
etr map-server 10.47.1.11 proxy-reply
instance-id-range 8188 , 8190 , 8192 , 8193 override
remote-rloc-probe on-route-change
service ethernet
eid-table vlan 1025 , 1026 , 1028 , 2727
database-mapping mac locator-set rloc_691b1fe4-5264-44c2-bb1b-0903b3eb2c51
instance-id 4099
service ipv4
sgt
instance-id 4100
service ipv4
sgt
database-mapping 10.47.6.3/32 locator-set rloc_691b1fe4-5264-44c2-bb1b-0903b3eb2c51
instance-id 8188
service ethernet
eid-table vlan 1025
dynamic-eid detection multiple-addr bridged-vm
instance-id 8190
service ethernet
eid-table vlan 1026
dynamic-eid detection multiple-addr bridged-vm
instance-id 8192
service ethernet
eid-table vlan 1028
dynamic-eid detection multiple-addr bridged-vm
ip domain lookup source-interface Loopback0
ip domain lookup
ip multicast vrf blue_vn multipath
```

并置随处边界/任意播RP (10.47.1.10)配置

```
ip access-list standard ASM_ACL_IPV4_blue_vn_10.47.6.1
permit 239.0.0.0 0.0.0.255
ip multicast-routing vrf blue_vn
interface LISP0.4100
ip pim lisp transport multicast
ip pim lisp core-group-range 232.0.0.1 1000
interface Vlan3001
ip pim sparse-mode
exit
interface Loopback4100
vrf forwarding blue_vn
ip address 10.47.6.1 255.255.255.255
ip pim sparse-mode
interface Loopback4600
vrf forwarding blue_vn
ip address 10.47.6.6 255.255.255.255
ip pim sparse-mode
ip pim vrf blue_vn rp-address 10.47.6.1 ASM_ACL_IPV4_blue_vn_10.47.6.1
ip pim vrf blue_vn register-source Loopback4100
ip pim vrf blue_vn ssm default
ip msdp vrf blue_vn cache-sa-state
ip msdp vrf blue_vn originator-id Loopback4600
ip msdp vrf blue_vn peer 10.47.6.7 connect-source Loopback4600
ip msdp originator-id Loopback4600
router bgp 69420
address-family ipv4 vrf blue_vn
aggregate-address 10.47.6.0 255.255.255.0 summary-only
network 10.47.6.1 mask 255.255.255.255
router lisp
service ipv4
etr map-server 10.47.1.11 key ******
etr map-server 10.47.1.10 key ******
etr map-server 10.47.1.10 proxy-reply
etr map-server 10.47.1.11 proxy-reply
service ethernet
etr map-server 10.47.1.11 key ******
etr map-server 10.47.1.10 key ******
etr map-server 10.47.1.10 proxy-reply
etr map-server 10.47.1.11 proxy-reply
instance-id 4099
service ipv4
sgt
route-export site-registrations
route-import database bgp 69420 route-map DENY-red_vn locator-set rloc_9080ed56-a6c6-482d-9f46-28eda0e1
distance site-registrations 250
map-cache site-registration
instance-id 4100
service ipv4
map-cache 10.47.6.7/32 10.47.1.11 priority 1 weight 100
sgt
route-export site-registrations
route-import database bgp 69420 route-map DENY-blue_vn locator-set rloc_9080ed56-a6c6-482d-9f46-28eda0e
distance site-registrations 250
map-cache site-registration
database-mapping 10.47.6.6/32 locator-set rloc_9080ed56-a6c6-482d-9f46-28eda0e18501
database-mapping 10.47.6.1/32 locator-set rloc_9080ed56-a6c6-482d-9f46-28eda0e18501
site site_uci
authentication-key ******
eid-record instance-id 4100 10.47.6.0/24 accept-more-specifics
```

并置随处边界/任意播RP (10.47.1.10)配置

```
ip access-list standard ASM_ACL_IPV4_blue_vn_10.47.6.1
permit 239.0.0.0 0.0.0.255
ip multicast-routing vrf blue_vn
interface LISP0.4100
ip pim lisp transport multicast
ip pim lisp core-group-range 232.0.0.1 1000
interface Vlan3001
ip pim sparse-mode
exit
interface Loopback4100
vrf forwarding blue_vn
ip address 10.47.6.1 255.255.255.255
ip pim sparse-mode
interface Loopback4600
vrf forwarding blue_vn
ip address 10.47.6.6 255.255.255.255
ip pim sparse-mode
ip pim vrf blue_vn rp-address 10.47.6.1 ASM_ACL_IPV4_blue_vn_10.47.6.1
ip pim vrf blue_vn register-source Loopback4100
ip pim vrf blue_vn ssm default
ip msdp vrf blue_vn cache-sa-state
ip msdp vrf blue_vn originator-id Loopback4600
ip msdp vrf blue_vn peer 10.47.6.7 connect-source Loopback4600
ip msdp originator-id Loopback4600
router bgp 69420
address-family ipv4 vrf blue_vn
aggregate-address 10.47.6.0 255.255.255.0 summary-only
network 10.47.6.1 mask 255.255.255.255
router lisp
service ipv4
etr map-server 10.47.1.11 key ******
etr map-server 10.47.1.10 key ******
etr map-server 10.47.1.10 proxy-reply
etr map-server 10.47.1.11 proxy-reply
service ethernet
etr map-server 10.47.1.11 key ******
etr map-server 10.47.1.10 key ******
etr map-server 10.47.1.10 proxy-reply
etr map-server 10.47.1.11 proxy-reply
instance-id 4099
service ipv4
sgt
route-export site-registrations
route-import database bgp 69420 route-map DENY-red_vn locator-set rloc_9080ed56-a6c6-482d-9f46-28eda0e1
distance site-registrations 250
map-cache site-registration
instance-id 4100
service ipv4
map-cache 10.47.6.7/32 10.47.1.11 priority 1 weight 100
sgt
route-export site-registrations
route-import database bgp 69420 route-map DENY-blue_vn locator-set rloc_9080ed56-a6c6-482d-9f46-28eda0e
distance site-registrations 250
map-cache site-registration
database-mapping 10.47.6.6/32 locator-set rloc_9080ed56-a6c6-482d-9f46-28eda0e18501
database-mapping 10.47.6.1/32 locator-set rloc_9080ed56-a6c6-482d-9f46-28eda0e18501
```

```
site site_uci
authentication-key ******
eid-record instance-id 4100 10.47.6.0/24 accept-more-specifics
```

控制平面验证

在本部分中验证协议无关组播(PIM)，首先验证第一跳路由器(FHR)上创建的(S，G)

FHR (S，G)生成

组播源10.47.7.3向239.0.0.5发送UDP组播数据包。验证IP设备跟踪(IPDT)、思科快速转发(CEF)和反向路径转发(RPF)是否正确指向组播源。此外，请确保任播网关SVI是此网段的PIM指定路由器(DR)。

使用命令“show device-tracking database address <ip address>”确保存在有效的IPDT条目

<#root>

Edge-2#

show device-tracking database address 10.47.7.3

```
Codes: L - Local, S - Static, ND - Neighbor Discovery, ARP - Address Resolution Protocol, DH4 - IPv4 DH
Preflevel flags (prlvl):
0001:MAC and LLA match 0002:Orig trunk 0004:Orig access
0008:Orig trusted trunk 0010:Orig trusted access 0020:DHCP assigned
0040:Cga authenticated 0080:Cert authenticated 0100:Statically assigned
    Network Layer Address Link Layer Address Interface vlan prlvl age  state          Time left
DH4 10.47.7.3             5254.0012.521d     Gi1/0/4   1025 0024  166s
```

REACHABLE

```
 81 s try 0(2276 s)
```

使用命令“show ip cef vrf <VN Name> <ip address>”并确保直接连接组播源

<#root>

Edge-2#

show ip cef vrf blue_vn 10.47.7.3

```
10.47.7.3/32
nexthop 10.47.7.3 Vlan1025
```

然后，使用命令“show ip rpf vrf <VN> <ip address>”确保RPF接口是源所在的VLAN，而不是LISP。

<#root>

Edge-1#

show ip rpf vrf blue_vn 10.47.7.3

RPF information for (10.47.7.2)
RPF interface: Vlan1025
RPF neighbor: ? (

10.47.7.3

) - directly connected
RPF route/mask: 10.47.7.3/32
RPF type:

unicast (lisp)

Doing distance-preferred lookups across tables
Multicast Multipath enabled.
RPF topology: ipv4 multicast base, originated from ipv4 unicast base

使用命令“show ip pim vrf <VN name> interface vlan <vlan> detail | include DR|enabled”验证FE节点是网段的PIM DR还是FHR。

<#root>

Edge-2#

show ip pim vrf blue_vn interface vlan 1025 detail | include DR|enabled

PIM: enabled
PIM DR: 10.47.7.1 (this system)
PIM State-Refresh processing: enabled
PIM Non-DR-Join: FALSE

使用命令“show ip mroute vrf <VN name> <multicast group address>”验证(S，G)创建。(S，G)将具有空传出接口列表(OIL)，因为没有感兴趣的接收方或PIM路由器加入FHR。

<#root>

Edge-2#

show ip mroute vrf blue_vn 239.0.0.5

IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
L - Local, P - Pruned, R - RP-bit set, F - Register flag,
T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
U - URD, I - Received Source Specific Host Report,
Z - Multicast Tunnel, z - MDT-data group sender,

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

(*, 239.0.0.5), 00:00:10/stopped, RP 10.47.6.1, flags: SPFl
Incoming interface: LISP0.4100, RPF nbr 10.47.1.10
Outgoing interface list: Null

(
```

10.47.7.3

,

239.0.0.5

```
), 00:00:10/00:02:50, flags: PFT
Incoming interface: Vlan1025, RPF nbr 0.0.0.0
Outgoing interface list:
```

Null

FHR (S，G)注册

FHR使用配置为“registered-source” PIM Register Messages的接口将单播源注册到任播RP。

- 外部信头，RLOC到RLOC（10.47.1.13到10.47.1.10）
- 内部报头，环回至环回（10.47.6.3至10.47.6.1）
- 实际组播

<#root>

```
Edge-2#
```

show ip pim vrf blue_vn tunnel

```
Tunnel1
Type : PIM Encap
RP : 10.47.6.1
Source : 10.47.6.3
State : UP
Last event : Created (00:42:43)

Edge-2#
```

show ip cef vrf blue_vn 10.47.6.1

```
10.47.6.1/32
```

```
nexthop

10.47.1.10

 LISP0.4100

<-- FHR happened to register to this RP


nexthop 10.47.1.11 LISP0.4100
```

LHR IGMP成员报告

组播接收方发送IGMP成员报告/加入以表明接收组播流量的兴趣，这会在最后一跳路由器(LHR)上创建IGMP监听和IGMP组条目。使用命令“show ip igmp snooping groups vlan <vlan id> <group destination address>”以及“show ip igmp vrf <VN Name> groups <group>”

```
<#root>

Edge-1#

show ip igmp snooping groups vlan 1025 239.0.0.5


Vlan Group     Type Version Port List
------------------------------------------------------------------------
1025 239.0.0.5 igmp v2      Gi1/0/5

Edge-1#

show ip igmp vrf blue_vn groups 239.0.0.5


IGMP Connected Group Membership
Group Address Interface Uptime   Expires  Last Reporter Group Accounted
239.0.0.5     Vlan1025  00:02:01 00:02:58 10.47.7.4
```

接下来，请确保LHR实际是此分段的PIM DR，使用命令“show ip pim vrf <VN name> interface vlan <vlan> detail | include DR|enabled”

```
<#root>

Edge-1#

show ip pim vrf blue_vn interface vlan 1025 detail | include DR|enabled


PIM: enabled

PIM DR: 10.47.7.1 (this system)


PIM State-Refresh processing: enabled
PIM Non-DR-Join: FALSE
```

创建LHR (*，G)重叠

当LHR收到IGMP成员身份报告时，它还会创建PIM状态，具体而言(*，G)，您可以使用命令“show ip mroute vrf <VN Name><overlay group> verbose”查看(*，G)状态

<#root>

Edge-1#

show ip mroute vrf blue_vn 239.0.0.5 verbose

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

(*, 239.0.0.5), 1w3d/stopped, RP

10.47.6.1

, flags: SJCl

<-- Anycast RP IP address

Incoming interface: LISP0.4100,

RPF nbr 10.47.1.10

, LISP: [

10.47.1.10

,

232.0.2.245

]

<-- RPF neighbor to reach the Anycast RP, Overlay Group 239.0.0.5 is mapped to Underlay Group 232.0.2.24

Outgoing interface list:

Vlan1025

, Forward/Sparse-Dense, 1w3d/00:02:31, Pkts:0, flags:

<-- IGMP Membership Report/PIM Join received in VLAN 1025, multicast traffic is sent into VLAN 1025

底层SSM组中的LHR (*，G)映射

从(*，G)导出衬底SSM(S，G)。源是RP RPF，组是重叠映射。

<#root>

Edge-1#

show ip mroute 232.0.2.245 10.47.1.10

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

(

10.47.1.10, 232.0.2.245

), 2d01h/00:02:28, flags: sT

<-- 10.47.1.10 in this example is the RPF IP/neighbor to get to the RP, 232.0.2.245 is the Underlay Grou

Incoming interface:

GigabitEthernet1/0/1

, RPF nbr 10.47.1.0

<-- RPF interface to reach 10.47.1.10

Outgoing interface list:

Null0

, Forward/Dense, 2d01h/stopped, flags:

<-- The Outgoing Interface List (OIL) is Null0, and in Native Multicast, this is treated as a De-Encapsu

边界/RP在重叠中创建(*，G)，在底层中创建(S，G)

LHR在重叠中发送PIM (*，G) Join，您可以使用命令“show ip mroute vrf <VN name> <overlay group> verbose”查看重叠中的(*，G)

<#root>

Border-1#

show ip mroute vrf blue_vn 239.0.0.5 verbose

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

(

***, 239.0.0.5**

), 2d01h/00:03:05, RP 10.47.6.1, flags: Sp
Incoming interface:

Null

,

RPF nbr 0.0.0.0

```
Outgoing interface list:
LISP0.4100, (
```

10.47.1.10, 232.0.2.245

), Forward/Sparse, 2d01h/stopped, Pkts:0, flags: p

10.47.1.12

, 2d01h/00:03:05

<-- This is the RLOC of Edge-1, which is the LHR

在下层中，您可以使用命令“show ip mroute <underlay group address> <RP RLOC>”

<#root>

Border-1#

show ip mroute 232.0.2.245 10.47.1.10

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

(

10.47.1.10

,

232.0.2.245

), 2d01h/00:03:13, flags: sT
Incoming interface:

Null0

,

RPF nbr 0.0.0.0

Outgoing interface list:

GigabitEthernet1/0/3

, Forward/Sparse, 2d01h/00:03:13, flags:

<-- Interface that connects to Edge-1, which is the LHR, a PIM Join was received off this interface

Border-1从MSDP SA缓存创建(S，G)

FHR恰好将组播源注册到Border-2。Border-2通过MSDP向Border-1通告组播源。您可以使用命令show ip msdp vrf <VN Name> summary查看MSDP状态。

<#root>

Border-1#

show ip msdp vrf blue_vn summary

MSDP Peer Status Summary
Peer Address AS   State Uptime/ Reset SA   Peer Name
                         Downtime Count Count
10.47.6.7   23456 Up   2d02h   1   1

使用命令“show ip msdp vrf <VN Name> peer <Peer Address> accepted-SAs”查看从对等体接收的SA

<#root>

Border-1#

show ip msdp vrf blue_vn peer 10.47.6.7 accepted-SAs

MSDP SA accepted from peer 10.47.6.7 (?)

239.0.0.5

10.47.7.3

(?) RP:

10.47.6.7 <-- 239.0.0.5 is the Overlay Group, 10.47.7.3 is the multicast source, 10.47.6.7 is the IP add

使用命令“show ip mroute vrf <VN Name> <group destination address> verbose”查看(S，G)

<#root>

Border-1#

show ip mroute vrf blue_vn 239.0.0.5 verbose

IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
L - Local, P - Pruned, R - RP-bit set, F - Register flag,
T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
U - URD, I - Received Source Specific Host Report,
Z - Multicast Tunnel, z - MDT-data group sender,
Y - Joined MDT-data group, y - Sending to MDT-data group,
G - Received BGP C-Mroute, g - Sent BGP C-Mroute,
N - Received BGP Shared-Tree Prune, n - BGP C-Mroute suppressed,
Q - Received BGP S-A Route, q - Sent BGP S-A Route,
V - RD & Vector, v - Vector, p - PIM Joins on route,
x - VxLAN group, c - PFP-SA cache created entry,

```
* - determined by Assert, # - iif-starg configured on rpf intf,
e - encap-helper tunnel flag, l - LISP decap ref count contributor
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
t - LISP transit group
Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 239.0.0.5), 2d02h/00:03:27, RP 10.47.6.1, flags: Sp
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
LISP0.4100, (10.47.1.10, 232.0.2.245), Forward/Sparse, 2d02h/stopped, Pkts:0, flags: p
10.47.1.12, 2d02h/00:03:27

(
10.47.7.3
,
239.0.0.5
), 00:18:26/00:02:50, flags: PTA
<-- True multicast source


Incoming interface: LISP0.4100, RPF nbr 10.47.1.13, LISP: [
10.47.1.13
,
232.0.2.245
]
<-- RLOC of Edge-2, which is FHR, and 232.0.2.245 is the Underlay multicast group


Outgoing interface list:
10.47.1.12, 00:00:05/00:03:24
<-- RLOC of Edge-1
```

边界重叠(S，G)创建底层(S，G)

Border-1根据重叠(S，G)创建基础(S，G)，您可以使用命令“show ip mroute <组目标地址>”查看其他信息。

对于FHR和它本身，有两个(S，G)s。10.47.1.13、232.0.2.245的Null0 OIL表示解封，10.47.1.10的IIF的Null0表示封装。

```
<#root>

Border-1#
show ip mroute 232.0.2.245


IP Multicast Routing Table
```

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

(

10.47.1.13

,

232.0.2.245

), 00:02:34/00:00:25, flags: sPT

<-- RLOC of the FHR, underlay multicast group IP

Incoming interface: GigabitEthernet1/0/4, RPF nbr 10.47.1.3 <-- RPF interface towards the FHR

Outgoing interface list: Null <-- Indicates decapsulation

(

10.47.1.10

,

232.0.2.245

), 2d02h/00:02:41, flags: sT

<-- RLOC of Border-1, underlay multicast group IP

Incoming interface: Null0, RPF nbr 0.0.0.0 <-- Indicates encapsulation

Outgoing interface list:

GigabitEthernet1/0/3, Forward/Sparse, 2d02h/00:02:41, flags: <-- where multicast traffic is sent

FHR在重叠和底层接收(S，G)加入

边界/RP向FHR发送PIM (S，G)加入，您可以使用“show ip mroute”命令获取信息。在重叠中，使用“show ip mroute vrf <VN Name> <重叠组地址”

<#root>

Edge-2#

show ip mroute vrf blue_vn 239.0.0.5

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

(*, 239.0.0.5), 1w3d/stopped, RP 10.47.6.1, flags: SPFl
Incoming interface: LISP0.4100, RPF nbr 10.47.1.10
Outgoing interface list: Null

(
```

10.47.7.3

,

239.0.0.5

), 1w3d/00:01:23, flags: FT

<-- Multicast source, true multicast group

```
Incoming interface: Vlan1025, RPF nbr 0.0.0.0
Outgoing interface list:
LISP0.4100, (
```

10.47.1.13

,

232.0.2.245

), Forward/Sparse, 19:12:56/stopped, flags:

<-- FHR RLOC, underlay group IP

10.47.1.10, 00:00:09/00:03:19 <-- Border/RP RLOC

在底层中，使用show ip mroute <底层组地址>

<#root>

Edge-2#

show ip mroute 232.0.2.245

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

(

10.47.1.13

,

232.0.2.245

), 1w3d/00:03:01, flags: sT

<-- RLOC of the FHR, Underlay multicast group

Incoming interface: Null0, RPF nbr 0.0.0.0 <-- Indicates encapsulation

Outgoing interface list:

GigabitEthernet1/0/1

, Forward/Sparse, 00:01:42/00:03:01, flags:

<-- Where the multicast traffic is forwarded

LHR沿共享树接收组播流量

LHR从RP接收沿共享树封装的组播流量后，将组播流量解封，因为底层(S，G)中的OIL为Null0，然后在重叠中创建一个(S，G)条目。您可以使用命令“show ip mroute <underlay group address>”和“show ip mroute vrf <VN Name> <overlay group address”

<#root>

Edge-1#

show ip mroute 232.0.2.245

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

(

10.47.1.10

,

232.0.2.245

), 2d03h/00:00:36, flags: sT

<-- RLOC of the RP, Underlay group

Incoming interface:

GigabitEthernet1/0/1, RPF nbr 10.47.1.0 <-- RPF interface towards the RP

Outgoing interface list:

Null0, Forward/Dense, 2d03h/stopped, flags: <-- Indicates Decapsulation

在重叠“show ip mroute vrf <VN Name> <overlay group address>”

<#root>

Edge-1#

show ip mroute vrf blue_vn 239.0.0.5

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

(*, 239.0.0.5), 1w3d/stopped, RP 10.47.6.1, flags: SJCl
Incoming interface: LISP0.4100, RPF nbr 10.47.1.10
Outgoing interface list:
Vlan1025, Forward/Sparse-Dense, 1w3d/00:02:03, flags:

(
```

10.47.7.3, 239.0.0.5

```
), 00:01:21/00:01:38, flags: JTl
```

<-- Multicast Source, Overlay Group

```
Incoming interface: LISP0.4100, RPF nbr 10.47.1.13, LISP:
 [
```

10.47.1.13, 232.0.2.245

```
]
```

<-- RLOC of the FHR, Underlay Group

```
Outgoing interface list:
```

Vlan1025

```
, Forward/Sparse-Dense, 00:01:21/00:02:03, flags:
```

<-- Multicast traffic is fowarded into VLAN 1025

现在，LHR通过PIM (S，G)在重叠和底层加入最短路径树(SPT)并修剪共享树。在LHR修剪共享树后，(S，G)的RP OIL不再包括LHR。转到RP并使用命令“show ip mroute vrf <VN Name> <overlay group address>”

<#root>

```
Border-1#
```

show ip mroute vrf blue_vn 239.0.0.5

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

(*, 239.0.0.5), 2d04h/00:03:10, RP 10.47.6.1, flags: S
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
LISP0.4100, (10.47.1.10, 232.0.2.245), Forward/Sparse, 2d04h/stopped, flags:

(10.47.7.3, 239.0.0.5), 00:14:17/00:02:42, flags: PT
Incoming interface: LISP0.4100, RPF nbr 10.47.1.13
```

Outgoing interface list: Null

由于(S，G)结构不再具有底层映射，即使通过底层接收到239.0.0.5的流量，RP也不会将其重新封装到任何LHR中，从而修剪共享树。但是，源树和共享树的(S，G)结构仍然存在。转到RP并使用命令“show ip mroute <underlay group address>”检查Underlay组

<#root>

```
Border-1#
```

show ip mroute 232.0.2.245

```
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
L - Local, P - Pruned, R - RP-bit set, F - Register flag,
T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
U - URD, I - Received Source Specific Host Report,
Z - Multicast Tunnel, z - MDT-data group sender,
Y - Joined MDT-data group, y - Sending to MDT-data group,
G - Received BGP C-Mroute, g - Sent BGP C-Mroute,
N - Received BGP Shared-Tree Prune, n - BGP C-Mroute suppressed,
Q - Received BGP S-A Route, q - Sent BGP S-A Route,
V - RD & Vector, v - Vector, p - PIM Joins on route,
x - VxLAN group, c - PFP-SA cache created entry,
```

```
* - determined by Assert, # - iif-starg configured on rpf intf,
e - encap-helper tunnel flag, l - LISP decap ref count contributor
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
t - LISP transit group
Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode

(10.47.1.13, 232.0.2.245), 00:01:07/00:01:52, flags: sPT
Incoming interface: GigabitEthernet1/0/4, RPF nbr 10.47.1.3
Outgoing interface list: Null

(10.47.1.10, 232.0.2.245), 2d04h/00:03:23, flags: sT
Incoming interface: Null0, RPF nbr 0.0.0.0
Outgoing interface list:
GigabitEthernet1/0/3, Forward/Sparse, 2d04h/00:03:23, flags:
```

如果RP删除了其所有OIL，也从FHR OIL中剪除了自己，并且FHR OIL仅包括LHR。转到FHR并使用命令“show ip mroute vrf <VN Name> <overlay group address>”

<#root>

```
Edge-2#

show ip mroute vrf blue_vn 239.0.0.5


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

(*, 239.0.0.5), 1w4d/stopped, RP 10.47.6.1, flags: SPFl
Incoming interface: LISP0.4100, RPF nbr 10.47.1.10
Outgoing interface list: Null

(

10.47.7.3

,

239.0.0.5

), 1w3d/00:01:25, flags: FT
```

<-- Multicast Source, Overlay Group

```
Incoming interface: Vlan1025, RPF nbr 0.0.0.0
Outgoing interface list:
LISP0.4100, (
```

10.47.1.13, 232.0.2.245

```
), Forward/Sparse, 20:16:48/stopped, flags:
```

<-- RLOC of the LHR, Underlay Group

数据平面验证（独立于平台）

可能有多种问题阻止组播源或组播接收器发送/接收流量。本节重点介绍如何验证会影响组播源和组播接收器的问题，重点介绍与硬件编程无关的问题。

FHR (S，G)创建

要让FHR创建(S，G)验证SISF、LISP、CEF和RPF是否都有效且正确，请使用命令“show device-tracking database address <IPv4 address>”

<#root>

```
Edge-2#
```

show device-tracking database address 10.47.7.3

```
Codes: L - Local, S - Static, ND - Neighbor Discovery, ARP - Address Resolution Protocol, DH4 - IPv4 DH
Preflevel flags (prlvl):
0001:MAC and LLA match 0002:Orig trunk 0004:Orig access
0008:Orig trusted trunk 0010:Orig trusted access 0020:DHCP assigned
0040:Cga authenticated 0080:Cert authenticated 0100:Statically assigned
    Network Layer Address Link Layer Address Interface vlan prlvl age state     Time left
DH4 10.47.7.3             5254.0012.521d     Gi1/0/4   1025 0024  16s REACHABLE 232 s try 0(84662 s)
```

LISP利用SISF，请使用命令“show lisp instance-id <L3 LISP Instance ID> ipv4 database <IP/32>”

<#root>

```
Edge-2#
```

show lisp instance-id 4100 ipv4 database 10.47.7.3/32

```
LISP ETR IPv4 Mapping Database for LISP 0 EID-table vrf blue_vn (IID 4100), LSBs: 0x1
Entries total 1, no-route 0, inactive 0, do-not-register 1
```

10.47.7.3/32

```
, dynamic-eid blue-IPV4, inherited from default locator-set rloc_691b1fe4-5264-44c2-bb1b-0903b3eb2c51
Uptime: 5w0d, Last-change: 5w0d
```

```
Domain-ID: local
Service-Insertion: N/A
Locator Pri/Wgt Source State
10.47.1.13 10/10 cfg-intf site-self, reachable
Map-server Uptime ACK Domain-ID
10.47.1.10 2d04h Yes 0
10.47.1.11 2d15h Yes 0

Edge-2#
```

show ip lisp instance-id 4100 forwarding eid local 10.47.7.3

```
Prefix
10.47.7.3/32
```

LISP对CEF进行编程，请使用命令“show ip cef vrf <VN Name> <ip address>”并确保其是VLAN中的下一跳，而不是指向LISP。

<#root>

```
Edge-2#
```

show ip cef vrf blue_vn 10.47.7.3

```
10.47.7.3/32
nexthop 10.47.7.3 Vlan1025
```

最后，确保RPF正确指向，并指示直接连接。

<#root>

```
Edge-2#
```

show ip rpf vrf blue_vn 10.47.7.3

```
RPF information for (10.47.7.3)
RPF interface: Vlan1025
RPF neighbor: ?
```

(10.47.7.3) - directly connected

```
RPF route/mask: 10.47.7.3/32
RPF type: unicast (lisp)
Doing distance-preferred lookups across tables
Multicast Multipath enabled.
RPF topology: ipv4 multicast base, originated from ipv4 unicast base
```

如果SISF/IPDT中没有有效条目，则会导致FHR上没有LISP数据库映射，从而导致CEF和RPF指向边框。如果组播源发送流量，则RPF指向不正确的接口，从而导致RPF故障，则不会形成(S，G)。

<#root>

Edge-2#

show device-tracking database address 10.47.7.3

Codes: L - Local, S - Static, ND - Neighbor Discovery, ARP - Address Resolution Protocol, DH4 - IPv4 DH
Preflevel flags (prlvl):
0001:MAC and LLA match 0002:Orig trunk 0004:Orig access
0008:Orig trusted trunk 0010:Orig trusted access 0020:DHCP assigned
0040:Cga authenticated 0080:Cert authenticated 0100:Statically assigned
Network Layer Address Link Layer Address Interface vlan prlvl age state Time left

Edge-2#

show lisp instance-id 4100 ipv4 database 10.47.7.3/32

% No database-mapping entry for 10.47.7.3/32.

Edge-2#

show ip cef vrf blue_vn 10.47.7.3

10.47.7.0/24
nexthop 10.47.1.10

LISP0.4100 <-- Result of a LISP Negative Map-Reply, so the LISP interface is now the RPF interface

nexthop 10.47.1.11

LISP0.4100 <-- Result of a LISP Negative Map-Reply, so the LISP interface is now the RPF interface

Edge-2#

show ip rpf vrf blue_vn 10.47.7.3

RPF information for (10.47.7.3)
RPF interface:

LISP0.4100

RPF neighbor: ? (

10.47.1.11

)
RPF route/mask: 10.47.7.3/32
RPF type: unicast ()
Doing distance-preferred lookups across tables
Multicast Multipath enabled.
RPF topology: ipv4 multicast base

要防止出现这种情况，请将组播源视为静默主机，其中IP定向广播、泛洪、静态SISF/IPDT绑定可以解决此问题。

源注册

PIM注册是单播数据包流，它像使用任何其他单播数据包一样使用LISP/VXLAN。有若干请求可验证FHR是否能够将组播源正确注册到任播RP。

首先，请确保为GDA正确配置任播RP。

```
<#root>

Edge-2#

show ip pim vrf blue_vn rp 239.0.0.5


Group: 239.0.0.5, RP: 10.47.6.1, uptime 1w4d, expires never
```

确保PIM寄存器隧道已形成。

```
<#root>

Edge-2#

show ip pim vrf blue_vn tunnel


Tunnel1
Type : PIM Encap

RP : 10.47.6.1 <-- This is from "ip pim vrf blue_vn rp-address 10.47.6.1 ASM_ACL_IPV4_blue_vn_10.47.6.1'


Source : 10.47.6.3 <-- This is from ip pim vrf blue_vn register-source Loopback4100


State : UP
Last event : Created (1w4d)
```

确保任意播RP具有IP可达性

```
<#root>

Edge-2#

show ip cef vrf blue_vn 10.47.6.1


10.47.6.1/32
nexthop

10.47.1.10

 LISP0.4100
```

<-- RLOC of Border-1

nexthop

10.47.1.11

LISP0.4100

<-- RLOC of Border-2

Edge-2#

ping vrf blue_vn 10.47.6.1 source lo4100

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.47.6.1, timeout is 2 seconds:
Packet sent with a source address of 10.47.6.3
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/3 ms
```

接收方验证

- 确保组播接收器正在发送IGMP MR。
- 确保已启用IGMP监听。仅L2 VN是唯一没有启用IGMP监听的VN类型
- 确保没有配置会丢弃IGMP MR的端口ACL、VLAN ACL、路由端口ACL。
- 验证IGMP MR的版本，如果组播接收器是IGMPv3，则默认情况下是IGMPv2，需要“ip igmp version 3”
- 确保未配置“ip option drop”

LHR PIM (*，G)验证

- 确保LHR是接收方子网/网段的PIM DR
- 确保没有配置“ip multicast group-range”
- 确保没有配置会丢弃IGMP MR的端口ACL、VLAN ACL、路由端口ACL。
- 确保没有丢弃该IGMP MR的高CPU或控制平面策略(CoPP)。

LHR PIM共享树验证

确保为组配置了RP

<#root>

Edge-1#

show ip mroute vrf blue_vn 239.0.0.5

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

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

(*, 239.0.0.5), 1w3d/stopped, RP
```

10.47.6.1

```
, flags: SJCl
```

<-- Anycast RP address

```
Incoming interface: LISP0.4100, RPF nbr 10.47.1.10
Outgoing interface list:
Vlan1025, Forward/Sparse-Dense, 1w3d/00:02:36, flags:
```

确保任意播RP的RPF是正确的

<#root>

```
Edge-1#
```

show ip cef vrf blue_vn 10.47.6.1

```
10.47.6.1/32
nexthop 10.47.1.10 LISP0.4100
nexthop 10.47.1.11 LISP0.4100

Edge-1#
```

show ip rpf vrf blue_vn 10.47.6.1

```
RPF information for (10.47.6.1)
RPF interface: LISP0.4100
RPF neighbor: ? (10.47.1.10)
RPF route/mask: 10.47.6.1/32
RPF type: unicast ()
Doing distance-preferred lookups across tables
Multicast Multipath enabled.
RPF topology: ipv4 multicast base
```

MFIB转发-本地组播（重叠）源端验证

您可以使用命令“show ip mfib vrf <VN Name> <overlay group address> <unicast source> verbose”获取有关数据包转发的其他信息。

<#root>

Edge-2#

show ip mfib vrf blue_vn 239.0.0.5 10.47.7.3 verbose

```
Entry Flags: C - Directly Connected, S - Signal, IA - Inherit A flag,
ET - Data Rate Exceeds Threshold, K - Keepalive
DDE - Data Driven Event, HW - Hardware Installed
ME - MoFRR ECMP entry, MNE - MoFRR Non-ECMP entry, MP - MFIB
MoFRR Primary, RP - MRIB MoFRR Primary, P - MoFRR Primary
MS - MoFRR Entry in Sync, MC - MoFRR entry in MoFRR Client,
e - Encap helper tunnel flag.
I/O Item Flags: IC - Internal Copy, NP - Not platform switched,
NS - Negate Signalling, SP - Signal Present,
A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB Forward,
MA - MFIB Accept, A2 - Accept backup,
RA2 - MRIB Accept backup, MA2 - MFIB Accept backup
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts: Total/RPF failed/Other drops
I/O Item Counts: HW Pkt Count/FS Pkt Count/PS Pkt Count Egress Rate in pps
VRF blue_vn
(10.47.7.3,239.0.0.5) Flags: K HW DDE
0x530 OIF-IC count: 0, OIF-A count: 1
SW Forwarding: 0/0/0/0, Other: 0/0/0
HW Forwarding: 352467143981268992/0/19/0, Other: 0/0/0
Vlan1025 Flags: RA A MA
LISP0.4100, (
```

10.47.1.13

,

232.0.2.245

) Flags: RF F NS

<-- RLOC of FHR, Underlay Group IP address

CEF: Adjacency with MAC:

450000000000400000118 4BC0A2F010DE80002F5000012B5000000000840000000100400BA25CDF4AD38BA25CDF4AD380000

Pkts: 0/0/0 Rate: 0 pps

MFIB转发-本地组播（底层）源端验证

使用show ip mroute <underlay group address> <RLOC of FHR>查看底层组

<#root>

Edge-2#

show ip mroute 232.0.2.245 10.47.1.13

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

(

10.47.1.13

,

232.0.2.245

), 1w4d/00:03:17, flags: sT

<-- RLOC of the FHR, Underlay Group

Incoming interface:

Null0

, RPF nbr 0.0.0.0

<-- Indicates Encapsulation

Outgoing interface list:

GigabitEthernet1/0/1, Forward/Sparse, 00:00:26/00:03:17, flags <-- Where the multicast traffic is forwar

Edge-2#

show ip mfib 232.0.2.245 10.47.1.13 verbo

se
Entry Flags: C - Directly Connected, S - Signal, IA - Inherit A flag,
ET - Data Rate Exceeds Threshold, K - Keepalive
DDE - Data Driven Event, HW - Hardware Installed
ME - MoFRR ECMP entry, MNE - MoFRR Non-ECMP entry, MP - MFIB
MoFRR Primary, RP - MRIB MoFRR Primary, P - MoFRR Primary
MS - MoFRR Entry in Sync, MC - MoFRR entry in MoFRR Client,
e - Encap helper tunnel flag.
I/O Item Flags: IC - Internal Copy, NP - Not platform switched,
NS - Negate Signalling, SP - Signal Present,
A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB Forward,
MA - MFIB Accept, A2 - Accept backup,

```
RA2 - MRIB Accept backup, MA2 - MFIB Accept backup
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts: Total/RPF failed/Other drops
I/O Item Counts: HW Pkt Count/FS Pkt Count/PS Pkt Count Egress Rate in pps
Default
(
```

10.47.1.13,232.0.2.245

```
) Flags: K HW
0x348 OIF-IC count: 0, OIF-A count: 1
SW Forwarding: 0/0/0/0, Other: 0/0/0
HW Forwarding:
```

5268151634814304256

```
/0/1/0, Other: 0/0/0
```

Null0

```
 Flags: RA A MA
GigabitEthernet1/0/1 Flags: RF F NS
CEF: Adjacency with MAC: 01005E0002F552540017FE730800
Pkts: 0/0/0 Rate: 0 pps
```

MFIB转发-本地组播（解封后）

当组播流量到达LHR时，封装的源IP地址为10.47.1.13，目的地址为232.0.2.245，组播流量被路由到Null0传出接口。此操作会触发数据包解封。

<#root>

```
Edge-1#
```

show ip mroute 232.0.2.245 10.47.1.13

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

10.47.1.13

,

232.0.2.245

), 00:38:22/00:00:37, flags: sT
Incoming interface: GigabitEthernet1/0/2, RPF nbr 10.47.1.4
Outgoing interface list:

Null0

, Forward/Dense, 00:01:12/stopped, flags:

Edge-1#

show ip mfib 232.0.2.245 10.47.1.13 verbose

Entry Flags: C - Directly Connected, S - Signal, IA - Inherit A flag,
ET - Data Rate Exceeds Threshold, K - Keepalive
DDE - Data Driven Event, HW - Hardware Installed
ME - MoFRR ECMP entry, MNE - MoFRR Non-ECMP entry, MP - MFIB
MoFRR Primary, RP - MRIB MoFRR Primary, P - MoFRR Primary
MS - MoFRR Entry in Sync, MC - MoFRR entry in MoFRR Client,
e - Encap helper tunnel flag.
I/O Item Flags: IC - Internal Copy, NP - Not platform switched,
NS - Negate Signalling, SP - Signal Present,
A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB Forward,
MA - MFIB Accept, A2 - Accept backup,
RA2 - MRIB Accept backup, MA2 - MFIB Accept backup
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts: Total/RPF failed/Other drops
I/O Item Counts: HW Pkt Count/FS Pkt Count/PS Pkt Count Egress Rate in pps
Default
(

10.47.1.13,232.0.2.245

) Flags: K HW
0x77 OIF-IC count: 0, OIF-A count: 1
SW Forwarding: 0/0/0/0, Other: 0/0/0
HW Forwarding: 0/0/0/0, Other: 0/0/0

GigabitEthernet1/0/2

Flags: RA A MA

Null0, LISPv4 Decap Flags: RF F NS

CEF: OCE (lisp decap)

Pkts: 0/0/0 Rate: 0 pps

解封后，LHR在VNI 4100内将实际目的IP地址标识为239.0.0.5，源IP地址为10.47.7.3

<#root>

Edge-1#

show ip mroute vrf blue_vn 239.0.0.5

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

(*, 239.0.0.5), 1w3d/stopped, RP 10.47.6.1, flags: SJCl
Incoming interface: LISP0.4100, RPF nbr 10.47.1.10
Outgoing interface list:
Vlan1025, Forward/Sparse-Dense, 1w3d/00:02:01, flags:

(
```

10.47.7.3

,

239.0.0.5

```
), 00:01:29/00:01:30, flags: JTl
Incoming interface: LISP0.4100, RPF nbr 10.47.1.13
Outgoing interface list:
```

Vlan1025

```
, Forward/Sparse-Dense, 00:01:29/00:02:01, flags:

Edge-1#
```

show ip mfib vrf blue_vn 239.0.0.5 10.47.7.3

```
Entry Flags: C - Directly Connected, S - Signal, IA - Inherit A flag,
ET - Data Rate Exceeds Threshold, K - Keepalive
DDE - Data Driven Event, HW - Hardware Installed
ME - MoFRR ECMP entry, MNE - MoFRR Non-ECMP entry, MP - MFIB
MoFRR Primary, RP - MRIB MoFRR Primary, P - MoFRR Primary
MS - MoFRR Entry in Sync, MC - MoFRR entry in MoFRR Client,
e - Encap helper tunnel flag.
I/O Item Flags: IC - Internal Copy, NP - Not platform switched,
NS - Negate Signalling, SP - Signal Present,
A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB Forward,
MA - MFIB Accept, A2 - Accept backup,
RA2 - MRIB Accept backup, MA2 - MFIB Accept backup
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts: Total/RPF failed/Other drops
I/O Item Counts: HW Pkt Count/FS Pkt Count/PS Pkt Count Egress Rate in pps
VRF blue_vn
```

(

10.47.7.3,239.0.0.5

) Flags: HW

<-- Unicast Source and Overlay Group

SW Forwarding: 0/0/0/0, Other: 2/1/1
HW Forwarding: 0/0/0/0, Other: 0/0/0

LISP0.4100 Flags: A <-- Incoming Interface

Vlan1025 Flags: F NS <-- Outgoing Interface

Pkts: 0/0/0 Rate: 0 pps

使用命令“show ip igmp snooping groups vlan <VLAN>”查看哪些端口将接收组播流量。

<#root>

Edge-1#

show ip igmp snooping groups vlan 1025

```
Vlan Group     Type Version Port List
------------------------------------------------------------------------
1025 239.0.0.5 igmp v2      Gi1/0/5
```

数据平面验证（取决于平台）

Mroute硬件编程- IOS mroute

硬件编程使用以下链：IOS、FMAN RP、FMAN FP、FED。首先使用show ip mroute vrf <VN Name> <overlay group address> verbose命令和show ip mroute <underlay group address> verbose命令验证IOS

<#root>

Edge-1#

show ip mroute vrf blue_vn 239.0.0.5 verbose

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

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

(

*, 239.0.0.5

), 1w3d/stopped, RP 10.47.6.1, flags: SJCl
Incoming interface: LISP0.4100, RPF nbr 10.47.1.10, LISP: [10.47.1.10, 232.0.2.245]
Outgoing interface list:
Vlan1025, Forward/Sparse-Dense, 1w3d/00:02:58, Pkts:0, flags:

(

10.47.7.3, 239.0.0.5

), 00:02:19/00:00:40, flags: JTl
Incoming interface: LISP0.4100, RPF nbr 10.47.1.13, LISP: [10.47.1.13, 232.0.2.245]
Outgoing interface list:
Vlan1025, Forward/Sparse-Dense, 00:02:19/00:02:58, Pkts:0, flags:
```

基础

<#root>

```
Edge-1#

show ip mroute 232.0.2.245 verbose


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

```
(
```

10.47.1.13, 232.0.2.245

```
), 01:18:55/00:02:04, flags: sT
Incoming interface: GigabitEthernet1/0/2, RPF nbr 10.47.1.4
LISP EID ref count: 1, Underlay ref timer: 00:05:13
Outgoing interface list:
Null0, Forward/Dense, 00:01:46/stopped, Pkts:0, flags:
(
```

10.47.1.10, 232.0.2.245

```
), 2d06h/00:02:59, flags: sT
Incoming interface: GigabitEthernet1/0/1, RPF nbr 10.47.1.0
LISP EID ref count: 1, Underlay ref timer: 00:05:12
Outgoing interface list:
Null0, Forward/Dense, 2d06h/stopped, Pkts:0, flags:
```

Mroute硬件编程- IOS MFIB

使用命令“show ip mfib vrf <VN Name> <overlay group address> verbose”和“show ip mroute <underlay group address> verbose”验证重叠和底层MFIB

在重叠中

<#root>

```
Edge-1#
```

show ip mfib vrf blue_vn 239.0.0.5 verbose

```
Entry Flags: C - Directly Connected, S - Signal, IA - Inherit A flag,
ET - Data Rate Exceeds Threshold, K - Keepalive
DDE - Data Driven Event, HW - Hardware Installed
ME - MoFRR ECMP entry, MNE - MoFRR Non-ECMP entry, MP - MFIB
MoFRR Primary, RP - MRIB MoFRR Primary, P - MoFRR Primary
MS - MoFRR Entry in Sync, MC - MoFRR entry in MoFRR Client,
e - Encap helper tunnel flag.
I/O Item Flags: IC - Internal Copy, NP - Not platform switched,
NS - Negate Signalling, SP - Signal Present,
A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB Forward,
MA - MFIB Accept, A2 - Accept backup,
RA2 - MRIB Accept backup, MA2 - MFIB Accept backup
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts: Total/RPF failed/Other drops
I/O Item Counts: HW Pkt Count/FS Pkt Count/PS Pkt Count Egress Rate in pps
VRF blue_vn
(
```

***,239.0.0.5**

```
) Flags: C K HW
0x6D OIF-IC count: 0, OIF-A count: 1
SW Forwarding: 0/0/0/0, Other: 0/0/0
HW Forwarding: 16218869633044709376/0/0/0, Other: 0/0/0
LISP0.4100 Flags: RA A MA NS
```

```
Vlan1025 Flags: RF F NS
CEF: Adjacency with MAC: 01005E00000500000C9FFB870800
Pkts: 0/0/0 Rate: 0 pps
(
```

10.47.7.3,239.0.0.5

```
) Flags: K HW DDE
0x7B OIF-IC count: 0, OIF-A count: 1
SW Forwarding: 0/0/0/0, Other: 2/0/2
HW Forwarding: 0/0/0/0, Other: 0/0/0
LISP0.4100 Flags: RA A MA
Vlan1025 Flags: RF F NS
CEF: Adjacency with MAC: 01005E00000500000C9FFB870800
Pkts: 0/0/0 Rate: 0 pps
```

基础

<#root>

Edge-1#

show ip mfib 232.0.2.245 verbose

```
Entry Flags: C - Directly Connected, S - Signal, IA - Inherit A flag,
ET - Data Rate Exceeds Threshold, K - Keepalive
DDE - Data Driven Event, HW - Hardware Installed
ME - MoFRR ECMP entry, MNE - MoFRR Non-ECMP entry, MP - MFIB
MoFRR Primary, RP - MRIB MoFRR Primary, P - MoFRR Primary
MS - MoFRR Entry in Sync, MC - MoFRR entry in MoFRR Client,
e - Encap helper tunnel flag.
I/O Item Flags: IC - Internal Copy, NP - Not platform switched,
NS - Negate Signalling, SP - Signal Present,
A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB Forward,
MA - MFIB Accept, A2 - Accept backup,
RA2 - MRIB Accept backup, MA2 - MFIB Accept backup
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts: Total/RPF failed/Other drops
I/O Item Counts: HW Pkt Count/FS Pkt Count/PS Pkt Count Egress Rate in pps
Default
(
```

10.47.1.10,232.0.2.245

```
) Flags: K HW
0x18 OIF-IC count: 0, OIF-A count: 1
SW Forwarding: 0/0/0/0, Other: 0/0/0
HW Forwarding: 8384858081233731584/0/0/0, Other: 0/0/0
GigabitEthernet1/0/1 Flags: RA A MA
Null0, LISPv4 Decap Flags: RF F NS
CEF: OCE (lisp decap)
Pkts: 0/0/0 Rate: 0 pps
(
```

10.47.1.13,232.0.2.245

```
) Flags: K HW
0x77 OIF-IC count: 0, OIF-A count: 1
SW Forwarding: 0/0/0/0, Other: 0/0/0
```

```
HW Forwarding: 0/0/0/0, Other: 0/0/0
GigabitEthernet1/0/2 Flags: RA A MA
Null0, LISPv4 Decap Flags: RF F NS
CEF: OCE (lisp decap)
Pkts: 0/0/0 Rate: 0 pps
```

Mroute硬件编程- FMAN RP

要验证FMAN RP，请首先捕获VRF ID。

<#root>

```
Edge-1#
```

show vrf detail blue_vn | include Id

```
VRF blue_vn (
```

VRF Id = 2

```
); default RD <not set>; default VPNID <not set>
```

接下来，使用下一命令的VRF索引值。要验证重叠(*，G)，请使用命令“show platform software ip switch active r0 mfib vrf index <VRF Index> group <overlay group address>/32”

<#root>

```
Edge-1#
```

show platform software ip switch active r0 mfib vrf index 2 group 239.0.0.5/32

```
Route flags:
S - Signal; C - Directly connected;
IA - Inherit A Flag; L - Local;
BR - Bidir route
*, 239.0.0.5/32 --> OBJ_INTF_LIST (0x6d)
Obj id: 0x6d, Flags: C
OM handle: 0x348030b738
```

要验证重叠(S，G)，请使用命令“show platform software ip switch active r0 mfib vrf index 2 group address <overlay group address> <unicast source>”

<#root>

```
Edge-1#
```

show platform software ip switch active r0 mfib vrf index 2 group address 239.0.0.5 10.47.7.3

```
Route flags:
S - Signal; C - Directly connected;
IA - Inherit A Flag; L - Local;
BR - Bidir route
239.0.0.5, 10.47.7.3/64 --> OBJ_INTF_LIST (0x7f)
Obj id: 0x7f, Flags: unknown
OM handle: 0x34803a3800
```

要验证重叠(*，G)的衬底(S，G)，请使用命令“show platform software ip switch active r0 mfib group address <underlay group address> <RP address>”

<#root>

```
Edge-1#
```

show platform software ip switch active r0 mfib group address 232.0.2.245 10.47.1.10

```
Route flags:
S - Signal; C - Directly connected;
IA - Inherit A Flag; L - Local;
BR - Bidir route
232.0.2.245, 10.47.1.10/64 --> OBJ_INTF_LIST (0x18)
Obj id: 0x18, Flags: unknown
OM handle: 0x34803b9be8
```

要验证重叠(S，G)的衬底(S，G)，请使用命令“show platform software ip switch active r0 mfib group address <underlay group address> <RLOC of FHR>”

<#root>

```
Edge-1#
```

show platform software ip switch active r0 mfib group address 232.0.2.245 10.47.1.13

```
Route flags:
S - Signal; C - Directly connected;
IA - Inherit A Flag; L - Local;
BR - Bidir route
232.0.2.245, 10.47.1.13/64 --> OBJ_INTF_LIST (0x77)
Obj id: 0x77, Flags: unknown
OM handle: 0x348026b988
```

Mroute硬件编程- FMAN FP

要验证重叠(*，G)，请使用命令“show platform software ip switch active f0 mfib vrf index <VRF ID> group <overlay group address>”

<#root>

```
Edge-1#
```

show platform software software ip switch active f0 mfib vrf index 2 group 239.0.0.5/32

```
Route flags:
S - Signal; C - Directly connected;
IA - Inherit A Flag; L - Local;
BR - Bidir route
*, 239.0.0.5/32 --> OBJ_INTF_LIST (0x6d)
Obj id: 0x6d, Flags: C
aom id:
```

100880

```
, HW handle: (nil) (created)
```

要验证重叠(S，G)，请使用show platform software ip switch active f0 mfib vrf index <VRF ID> group address <overlay group address> <unicast source>命令

<#root>

```
Edge-1#
```

show platform software ip switch active f0 mfib vrf index 2 group address 239.0.0.5 10.47.7.3

```
Route flags:
S - Signal; C - Directly connected;
IA - Inherit A Flag; L - Local;
BR - Bidir route
239.0.0.5, 10.47.7.3/64 --> OBJ_INTF_LIST (0x8f)
Obj id: 0x8f, Flags: unknown
aom id:
```

161855

```
, HW handle: (nil) (created)
```

要验证重叠(*，G)的衬底(S，G)，请使用命令""show platform software ip switch active f0 mfib group address <underlay group address> <RP address>"

<#root>

```
Edge-1#
```

show platform ip switch active f0 mfib group address 232.0.2.245 10.47.1.10

```
Route flags:
S - Signal; C - Directly connected;
IA - Inherit A Flag; L - Local;
BR - Bidir route
232.0.2.245, 10.47.1.10/64 --> OBJ_INTF_LIST (0x18)
Obj id: 0x18, Flags: unknown
aom id:
```

138716

, HW handle: (nil) (created)

要验证重叠(S，G)的衬底(S，G)，请使用命令“show platform software ip switch active f0 mfib group address <underlay group address> <RLOC of FHR>”

<#root>

Edge-1#

show platform software ip switch active f0 mfib group address 232.0.2.245 10.47.1.13

Route flags:
S - Signal; C - Directly connected;
IA - Inherit A Flag; L - Local;
BR - Bidir route
232.0.2.245, 10.47.1.13/64 --> OBJ_INTF_LIST (0x5)
Obj id: 0x5, Flags: unknown
aom id:

161559

, HW handle: (nil) (created)

Mroute硬件编程- FMAN FP数据库

要验证FMAN FP对象，请使用命令“show platform software object-manager switch active f0 object <object ID> parents”

例如，要验证重叠(*，G)

<#root>

Edge-1#

show platform software object-manager switch active f0 object 100880 parents

Object identifier: 100605
Description: ipv4_mcast table 2 (

blue_vn

), vrf id 2
Status: Done
Object identifier: 100878
Description:

mlist 109

Status: Done

验证重叠(S，G)

<#root>

Edge-1#

show platform software object-manager switch active f0 object 161855 parents

Object identifier: 100605
Description: ipv4_mcast table 2 (blue_vn), vrf id 2
Status: Done
Object identifier: 161854
Description:

mlist 143

Status: Done

mlist是传入接口(IIF)和传出接口列表(OIL)的组合，后者与其他对象中的mroute分开。要验证mlist，请使用命令“show platform software mlist switch active f0 index <index>”

<#root>

Edge-1#

show platform software mlist switch active f0 index 109

Multicast List entries
OCE Flags:
NS - Negate Signalling; IC - Internal copy;
A - Accept; F - Forward;
OCE Type OCE Flags Interface

0xf8000171 OBJ_ADJACENCY NS, A LISP0.4100

<-- Incoming Interface for (*,G)

0xf80001f1 OBJ_ADJACENCY NS, F Vlan1025

<-- Outgoing Interface for (S,G)

<#root>

Edge-1#

show platform software mlist switch active f0 index 143

Multicast List entries
OCE Flags:
NS - Negate Signalling; IC - Internal copy;
A - Accept; F - Forward;

```
OCE Type OCE Flags Interface
------------------------------------------------------------------------------
0xf8000171 OBJ_ADJACENCY A LISP0.4100
```

<-- Outgoing Interface for (S,G)

```
0xf80001f1 OBJ_ADJACENCY NS, F Vlan1025
```

<-- Incoming Interface for (S,G)

Mroute硬件编程- FED

要验证重叠(S，G)，请使用show platform software fed switch active ip mfib vrf <VN Name> <overlay group address> <Unicast Source>命令

<#root>

```
Edge-1#
```

show platform software fed switch active ip mfib vrf blue_vn 239.0.0.5 10.47.7.3

```
Multicast (S,G) Information
VRF : 2
Source Address : 10.47.7.3
HTM Handler : 0x7f0efe53a638
SI Handler : 0x7f0efe50ec68
DI Handler :
```

0x7f0efe530768

```
REP RI handler : 0x7f0efe5387e8
Flags :
Packet count : 0
State : 4
RPF :
LISP0.4100 A
OIF :
Vlan1025 F NS
LISP0.4100 A
(Adj: 0xf8000171 )
```

要验证底层(S，G)，请使用show platform software fed switch active ip mfib <underlay group address> <RLOC of FHR>命令

<#root>

```
Edge-1#
```

show platform software fed switch active ip mfib 232.0.2.245 10.47.1.13

```
Multicast (S,G) Information
```

```
VRF : 0
Source Address : 10.47.1.13
HTM Handler : 0x7f0efe512408
SI Handler : 0x7f0efe5158f8
DI Handler :
```

0x7f0efe525538

```
REP RI handler : 0x7f0efe52ca18
Flags :
Packet count : 0
State : 4
RPF :
GigabitEthernet1/0/2 A
OIF :
LISP0 LISP Decap F NS
GigabitEthernet1/0/2 A
```

接下来，会验证重叠和底层(S，G)的目标索引(DI)，您可以使用命令“show platform hardware fed switch active fwd-asic abstraction print-resource-handle <DI Handler> 1”

对于重叠(S，G)

<#root>

```
Edge-1#
```

show platform hardware fed switch active fwd-asic abs print-resource-handle 0x7f0efe512408 1

```
Handle:0x7f0efe530768 Res-Type:ASIC_RSC_DI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_L3_MULTICA
priv_ri/priv_si Handle: (nil)Hardware Indices/Handles: index0:0x5279 mtu_index/l3u_ri_index0:0x0 index1
Cookie length: 56
00 00 00 00 00 00 00 00 02 00 00 00 03 07 2f 0a 05 00 00 ef 00 00 00 00 00 00 00 00 00 00 00 00 00 00
Detailed Resource Information (ASIC_INSTANCE# 0)
----------------------------------------
Destination index = 0x5279
pmap = 0x00000000 0x00000010
```

pmap_intf : [GigabitEthernet1/0/5] <-- From IGMP Snooping

```
cmi = 0x0
rcp_pmap = 0x0
al_rsc_cmi
CPU Map Index (CMI) [0]
ctiLo0 = 0
ctiLo1 = 0
ctiLo2 = 0
cpuQNum0 = 0
cpuQNum1 = 0
cpuQNum2 = 0
npuIndex = 0
stripSeg = 0
copySeg = 0
Detailed Resource Information (ASIC_INSTANCE# 1)
----------------------------------------
Destination index = 0x5279
pmap = 0x00000000 0x00000000
```

```
cmi = 0x0
rcp_pmap = 0x0
al_rsc_cmi
CPU Map Index (CMI) [0]
ctiLo0 = 0
ctiLo1 = 0
ctiLo2 = 0
cpuQNum0 = 0
cpuQNum1 = 0
cpuQNum2 = 0
npuIndex = 0
stripSeg = 0
copySeg = 0
================================================================
```

对于底层(S，G)

<#root>

```
Edge-1#

show platform hardware fed switch active fwd-asic abs print-resource-handle 0x7f0efe525538 1


Handle:0x7f0efe525538 Res-Type:ASIC_RSC_DI Res-Switch-Num:255 Asic-Num:255 Feature-ID:AL_FID_L3_MULTICA
00 00 00 00 00 00 00 00 00 00 00 00 0d 01 2f 0a f5 02 00 e8 00 00 00 00 00 00 00 00 00 00 00 00 00 00
Detailed Resource Information (ASIC_INSTANCE# 0)
----------------------------------------
Destination index = 0x5284

pmap = 0x00000000 0x00000000 <-- Expected since this is the Underlay, and recirculation is required to s


cmi = 0x0

rcp_pmap = 0x1 <-- Indicates recirculation is required


al_rsc_cmi
CPU Map Index (CMI) [0]
ctiLo0 = 0
ctiLo1 = 0
ctiLo2 = 0
cpuQNum0 = 0
cpuQNum1 = 0
cpuQNum2 = 0
npuIndex = 0
stripSeg = 0
copySeg = 0
Detailed Resource Information (ASIC_INSTANCE# 1)
----------------------------------------
Destination index = 0x5284
pmap = 0x00000000 0x00000000
cmi = 0x0
rcp_pmap = 0x0
al_rsc_cmi
CPU Map Index (CMI) [0]
ctiLo0 = 0
ctiLo1 = 0
ctiLo2 = 0
```

```
cpuQNum0 = 0
cpuQNum1 = 0
cpuQNum2 = 0
npuIndex = 0
stripSeg = 0
copySeg = 0
================================================================
```

关于此翻译
思科采用人工翻译与机器翻译相结合的方式将此文档翻译成不同语言，希望全球的用户都能通过各自的语言得到支持性的内容。

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