Verifique o multicast nativo na malha de acesso SD

Contents

Introdução

Este documento descreve como verificar o Multicast Nativo na estrutura SD-Access (SDA).

Pré-requisitos

Requisitos

A Cisco recomenda que você tenha conhecimento destes tópicos:

- Encaminhamento de Internet Protocol (IP)
- ID do localizador/protocolo de separação (LISP)
- Protocol Independent Multicast (PIM) Modo escasso

Componentes Utilizados

- C9000v no Cisco IOS® XE 17.10.1
- Cisco Catalyst Center versão 2.3.5.3

As informações neste documento foram criadas a partir de dispositivos em um ambiente de laboratório específico. Todos os dispositivos utilizados neste documento foram iniciados com uma configuração (padrão) inicial. Se a rede estiver ativa, certifique-se de que você entenda o impacto potencial de qualquer comando.

Este documento também pode ser usado com as seguintes versões de hardware e software:

- C9200
- C9300
- C9400
- C9500
- C9600
- Cisco IOS® XE 16.12 e posterior

Informações de Apoio

O SDA Native Multicast é uma forma de multicast de sobreposição, que é usado para transportar o tráfego multicast entre os dispositivos de estrutura, encapsulando o tráfego multicast em outro grupo multicast. O Multicast nativo pode rotear o tráfego multicast entre origens e receptores que estão na mesma VLAN ou em VLAN diferente (o multicast da mesma VLAN pode ser roteado). O tráfego multicast entre origens e recebimentos no mesmo Fabric Edge (FE) não é encaminhado usando multicast de sobreposição (encapsulamento VXLAN), mas é roteado localmente pelo FE. O multicast nativo não pode rotear o tráfego de multicast para grupos que correspondam a 224.0.0.0/24 ou a Time To Live (TTL) =1, eles são tratados por meio da inundação de Camada 2 (L2). O Multicast Nativo pode ser configurado para encaminhar Qualquer Multicast de Origem (ASM), Multicast Específico de Origem (SSM) ou uma combinação de ambos. O multicast nativo depende do multicast subjacente.

Observação: os comandos da plataforma (feed) podem variar. O comando pode ser "show platform fed <ative|standby>" versus "show platform fed switch <ative|standby>". Se a sintaxe anotada nos exemplos não for analisada, tente a variante.

Topologia
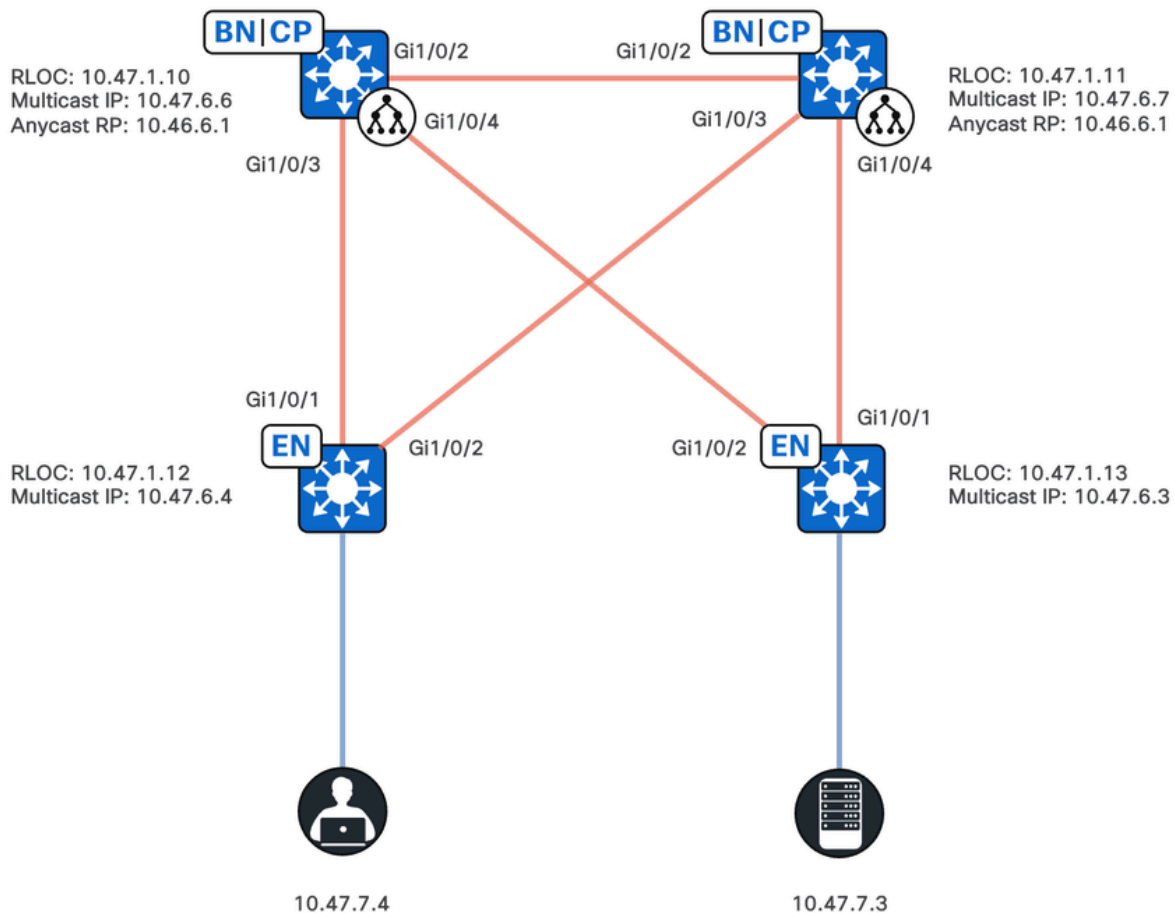
Topologia de rede

Nesta topologia:

- Os IDs de localizador remoto (RLOC) 10.47.1.10 e 10.47.1.10 são colocados em qualquer lugar e também funcionam como Anycast Rendezvous Point (RP) com Multicast Source Discovery Protocol (MSDP) entre os dois na Virtual Network (VN) ou Virtual Routing and Forwarding (VRF).
- 10.47.1.12 e 10.47.1.3 são nós FE
- 10.47.7.4 é o receptor multicast
- 10.47.7.3 é a origem multicast
- 239.0.0.5 é o GDA (Group Destination Address, endereço de destino de grupo) multicast

Configuração

Supõe-se que o Cisco Catalyst Center seja usado para provisionar a estrutura SDA com estas configurações:

- A implementação do modo de replicação é multicast nativo
- O modo multicast é Any Source Multicast (ASM)
- Anycast Rendezvous Point (RP) com Multicast Source Discovery Protocol (MSDP)

configurado no Collocated Anywhere Borders
- O Multicast de Sobreposição foi configurado manualmente ou como parte da Automação de LAN inicial, o Multicast Nativo depende do Multicast de Sobreposição para funcionar corretamente.

Configuração da borda da estrutura (10.47.1.12)

```
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
```

Configuração da borda da estrutura (10.47.1.13)

```
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
```

Configuração RP (10.47.1.10) de borda/anycast colocado em qualquer lugar

```
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
```

Configuração RP (10.47.1.10) de borda/anycast colocado em qualquer lugar

```
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
```

Verificação do plano de controle

A verificação do Protocol Independent Multicast (PIM) ocorre nesta seção, começando com a validação da criação (S,G) no First Hop Router (FHR)

FHR (S,G) Criação

A origem multicast, 10.47.7.3, envia pacotes multicast UDP para 239.0.0.5. Verifique se IP Device-Tracking (IPDT), Cisco Express Forwarding (CEF) e Reverse Path Forwarding (RPF) apontam corretamente para a origem de multicast. Além disso, certifique-se de que a SVI de gateway anycast seja o roteador designado (DR) PIM para esse segmento.

Use o comando "show device-tracking database address <ip address>" para garantir que haja uma entrada IPDT válida

```
<#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)
```

Use o comando "show ip cef vrf <VN Name> <ip address>" e verifique se a origem de multicast está diretamente conectada

<#root>

Edge-2#

show ip cef vrf blue_vn 10.47.7.3

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

Em seguida, use o comando "show ip rpf vrf <VN> <ip address>" para garantir que a interface RPF seja a VLAN de origem, não 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
```

Use o comando "show ip pim vrf <VN name> interface vlan <vlan> detail | incluir DR|enabled" para validar se o nó FE é o PIM DR para o segmento e é o 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
```

Use o comando "show ip mroute vrf <VN name> <multicast group address>" para validar a criação (S,G). (S,G) terá uma lista de interface de saída (OIL) nula porque não houve um receptor ou roteador PIM interessado que se juntou ao 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

Registro FHR (S,G)

O FHR registra a origem unicast para o RP Anycast, usando a interface configurada como Mensagens de Registro PIM de "origem registrada".

- Cabeçalho externo, RLOC para RLOC (10.47.1.13 a 10.47.1.10)

- Cabeçalho interno, Loopback para Loopback (10.47.6.3 a 10.47.6.1)
- Multicast real

<#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
```

Relatório de Associação LHR IGMP

O receptor multicast envia um Relatório/Junção de Associação IGMP para indicar o interesse no recebimento de tráfego multicast, que cria o Snooping IGMP e entradas de Grupo IGMP no Roteador de Último Salto (LHR). Use o comando "show ip igmp snooping groups vlan <vlan id> <group destination address>" bem como "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
```

Em seguida, certifique-se de que o LHR seja realmente o PIM DR para esse segmento, use o comando "show ip pim vrf <VN name> interface vlan <vlan> detail | incluir DR|habilitado"

<#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
```

Criação de sobreposição de LHR (*,G)

À medida que o LHR recebe o Relatório de Associação IGMP, ele também cria o estado PIM, especificamente (*,G) você pode usar o comando "show ip mroute vrf <VN Name><overlay group> verbose" para ver o estado (*,G)

<#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

Mapeamento LHR (*,G) no Grupo Subjacente do SSM

Do (*,G), deriva-se a base SSM (S,G). A origem é RP RPF e Grupo é o mapeamento de sobreposição.

<#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

Borda/RP Cria (*,G) em Sobreposição e (S,G) em Sobreposição

O LHR envia uma Junção PIM (*,G) na Sobreposição, você pode usar o comando "show ip mroute vrf <VN name> <overlay group> verbose" para exibir o (*,G) na Sobreposição

<#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

No Underlay, você pode usar o comando "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 cria (S,G) a partir do MSDP SA-Cache

O FHR registrou a origem de multicast para Border-2. Border-2 anuncia a origem de multicast para Border-1 via MSDP. Você pode usar o comando "show ip msdp vrf <VN Name> summary" para exibir o status MSDP.

<#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

Use o comando "show ip msdp vrf <VN Name> peer <Peer Address> accept-SAs" para ver as SAs aceitas do peer

<#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

Use o comando "show ip mroute vrf <VN Name> <group destination address> verbose" para ver (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

Sobreposição de Borda (S,G) cria Sobreposição (S,G)

Border-1 cria a Sobreposição (S,G) como resultado da Sobreposição (S,G), você pode usar o comando "show ip mroute <group destination address>" para ver informações adicionais.

Há dois (S,G)s, para o FHR e para ele mesmo. O Null0 OIL para 10.47.1.13, 232.0.2.245 indica desencapsulamento, o Null0 como um IIF para 10.47.1.10 indica encapsulamento.

<#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 Recebe (S,G) Junção em Sobreposição e Sobreposição

O Border/RP envia PIM (S,G) Joins em direção ao FHR, você pode usar o comando "show ip mroute" para obter informações. Na Sobreposição, use "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), 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

Na subjacência, use "show ip mroute <underlay group address>"

<#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

O LHR recebe o tráfego multicast ao longo da árvore compartilhada

Depois que o LHR recebe o tráfego de multicast encapsulado ao longo da árvore compartilhada do RP, ele desencapsula o tráfego de multicast como o OIL na subjacência (S,G) é Null0 e, em seguida, cria uma entrada (S,G) na sobreposição. Você pode usar os comandos "show ip mroute <underlay group address>" e "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

No campo Sobrepor "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

Agora, o LHR se junta à SPT (Shortest Path Tree, Árvore de caminho mais curto) e remove a árvore compartilhada, por meio de PIM (S,G) Joins na Sobreposição e na Sobreposição. Depois que o LHR remove a Árvore compartilhada, o RP OIL para (S,G) não inclui mais o LHR. Vá para o RP e use o comando "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

Como a estrutura (S,G) não tem mais um mapeamento de subjacência, mesmo que o tráfego para 239.0.0.5 seja recebido através da subjacência, o RP não o reencapsula para qualquer LHR, que remove a árvore compartilhada. No entanto, a estrutura (S,G) para a Árvore de origem e a Árvore compartilhada ainda existe. Vá até o RP e verifique o grupo Underlay com o comando "show ip mroute <underlay group address>"

<#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:
```

Se o RP tiver removido todo o(s) seu(s) ÓLEO(s), ele também será removido do ÓLEO FHR, e o

ÓLEO FHR incluirá somente LHR(s). Vá para o FHR e use o comando "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

Verificação do plano de dados (independente de plataforma)

Pode haver vários problemas que podem impedir a origem de multicast ou o receptor de multicast de enviar/receber o tráfego. Esta seção se concentra na validação de problemas que podem afetar a origem e o receptor multicast, com ênfase em problemas que não estão relacionados à programação de hardware.

Criação de FHR (S,G)

Para que o FHR crie (S,G) e verifique se SISF, LISP, CEF e RPF são válidos e corretos, use o comando "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)
```

 O SISF é utilizado pelo LISP, use o comando "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
```

 Programas LISP CEF, use o comando "show ip cef vrf <VN Name> <ip address>" e certifique-se de que seja o próximo salto na VLAN, sem apontar para 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
```

Por fim, verifique se o RPF está apontando corretamente e diz que está conectado diretamente.

<#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
```

 Se não houver uma entrada válida no SISF/IPDT, isso resultará em nenhum mapeamento de banco de dados LISP no FHR, o que resulta em CEF e RPF apontando para a(s) borda(s). Se a origem multicast envia tráfego, o RPF aponta para a interface incorreta, o que resulta em falha do RPF, (S,G) não é formado.

<#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
```

Para evitar isso, trate a origem de multicast como um host silencioso, onde as vinculações de transmissão direcionada por IP, inundação, SISF estático/IPDT podem superar esse problema.

Registro de Origem

O registro PIM é um fluxo de pacote unicast, que usa LISP/VXLAN como qualquer outro pacote unicast. Existem vários requisitos para validar se o FHR pode registrar corretamente a origem de multicast para o RP Anycast.

Primeiro, verifique se o RP Anycast está configurado corretamente para o GDA.

<#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

Verifique se o túnel PIM Register está formado.

<#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)

Verifique se há acessibilidade de IP para o RP Anycast

<#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
```

Verificação no lado do receptor

- Verifique se o receptor multicast está enviando um IGMP MR.
- Certifique-se de que o Snooping IGMP esteja habilitado. As VLANs somente L2 são o único tipo de VLAN que não tem o Snooping IGMP habilitado
- Verifique se não há uma ACL de porta, ACL de VLAN, ACL de porta roteada configurada que descartaria o IGMP MR.
- Validar a versão do IGMP MR; por padrão, é IGMPv2, se o receptor multicast for IGMPv3, isso exigirá "ip igmp version 3"
- Certifique-se de que a opção "ip option drop" não esteja configurada

Verificação LHR PIM (*,G)

- Certifique-se de que o LHR seja o DR PIM para a sub-rede/segmento do receptor
- Certifique-se de que não haja nenhum "ip multicast group-range" configurado
- Verifique se não há uma ACL de porta, ACL de VLAN, ACL de porta roteada configurada que descartaria o IGMP MR.
- Certifique-se de que não haja CPU alta ou Política de Plano de Controle (CoPP) descartando o IGMP MR.

Verificação de Árvore Compartilhada PIM LHR

Verifique se há um RP configurado para o grupo

<#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:
```

Verifique se o RPF para o RP Anycast está correto

<#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
```

Encaminhamento de MFIB - Verificação da origem de multicast nativo (sobreposição)

Você pode usar o comando "show ip mfib vrf <VN Name> <overlay group address> <unicast source> verbose" para obter informações adicionais sobre o encaminhamento de pacotes.

<#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:

450000000000004000001184BC0A2F010DE80002F5000012B50000000008400000000100400BA25CDF4AD38BA25CDF4AD380000

Pkts: 0/0/0 Rate: 0 pps

Encaminhamento de MFIB - Verificação do lado da origem de multicast nativo (subjacência)

Use "show ip mroute <underlay group address> <RLOC of FHR>" para exibir o grupo Underlay

<#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
```

Encaminhamento MFIB - Multicast nativo (pós-desencapsulamento)

Quando o tráfego multicast chega ao LHR encapsulado com um IP de origem de 10.47.1.13 e um endereço de destino de 232.0.2.245, ele é roteado para a interface de saída Null0. Esta ação dispara o desencapsulamento do pacote.

<#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
```

Após o desencapsulamento, o LHR identifica que o endereço IP destino verdadeiro é 239.0.0.5 no VNI 4100, originado com um IP origem de 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
```

Use o comando "show ip igmp snooping groups vlan <VLAN>" para ver quais portas receberão tráfego multicast.

<#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
```

Verificação do plano de dados (dependente da plataforma)

Programação de hardware Mroute - IOS mroute

A programação de hardware usa esta cadeia: IOS, depois FMAN RP, para FMAN FP e, em seguida, FED. Verifique o IOS primeiro, com os comandos "show ip mroute vrf <Nome VN> <endereço de grupo de sobreposição> verbose" e "show ip mroute <endereço de grupo de subcamada> verbose"

<#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:
```

Na subjacência

<#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:
```

Programação de hardware Mroute - IOS MFIB

Verifique o Overlay e o Underlay MFIB com os comandos "show ip mfib vrf <VN Name> <overlay group address> verbose" e "show ip mroute <underlay group address> verbose"

Na página Sobreposição,

<#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
```

Na subjacência

<#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
```

Programação de hardware Mroute - FMAN RP

Para validar FMAN RP, primeiro capture o ID do VRF.

<#root>

Edge-1#

show vrf detail blue_vn | include Id

VRF blue_vn (

VRF Id = 2

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

Em seguida, use o valor de índice VRF para os próximos comandos. Para validar a Sobreposição (*,G), use o comando "show platform software ip switch ative 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
```

Para validar a Sobreposição (S,G), use o comando "show platform software ip switch ative 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
```

Para validar a Sobreposição (S,G), use o comando "show platform software ip switch ative 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
```

Para validar a Sobreposição (S,G), use o comando "show platform software ip switch ative 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
```

Programação de hardware Mroute - FMAN FP

Para validar a Sobreposição (*,G), use o comando "show platform software ip switch ative 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)

Para validar a Sobreposição (S,G), use o comando "show platform software ip switch ative f0 mfib vrf index <VRF ID> group address <overlay group address> <unicast source>"

<#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)

Para validar a subjacência (S,G) para a sobreposição (*,G), use o comando ""show platform software ip switch ative 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)
```

Para validar a Sobreposição (S,G), use o comando "show platform software ip switch ative 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)
```

Programação de hardware Mroute - FMAN FP Database

Para validar o objeto FMAN FP, use o comando "show platform software object-manager switch ative f0 object <object ID> parent"

Por exemplo, para validar a Sobreposição (*,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
```

Para validar a Sobreposição (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
```

O mlist é uma combinação da interface de entrada (IIF) e da lista da interface de saída (OIL) separada do mroute em um objeto diferente. Para validar o mlist, use o comando "show platform software mlist switch ative 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)

Programação de hardware Mroute - FED

Para validar a Sobreposição (S,G), use o comando "show platform software fed switch ative ip mfib vrf <VN Name> <overlay group address> <Unicast Source>"

<#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 )
```

Para validar o Underlay (S,G), use o comando "show platform software fed switch ative ip mfib <underlay group address> <RLOC of FHR>"

<#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

Em seguida, o Índice de destino (DI) é validado para a Sobreposição e a Sobreposição (S,G).
Você pode usar o comando "show platform hardware fed switch ative fwd-asic abstraction print-resource-handle <Manipulador de DI> 1"

Para a sobreposição (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 00 0
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
==============================================================
```

Para a subjacência (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 0
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
================================================================
```