

Casos Práticos: Multicast L3 na estrutura da ACI

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Introduction

O roteamento multicast da camada 3 é suportado na estrutura da ACI, começando pela versão 2.0 e exigindo switches EX (por exemplo, N9K-C93180YC-EX). Antes da versão 2.0, a ACI oferecia suporte apenas a multicast L2 no domínio da bridge. Essa ainda é uma opção válida em 2.0 e pode ser usada para switches não EX.

Na versão 2.0 da ACI, os recursos de roteamento multicast suportados incluem: PIM ASM, PIM SSM, RP estático, PIM AutoRP e PIM BSR.

Neste documento, descrevemos uma solução validada para um cenário real de implantação de cliente para roteamento multicast L3 na estrutura da ACI. A versão da ACI selecionada é 2.1(1h). Essa versão não suporta RP na estrutura, portanto, um RP externo é necessário para PIM ASM.

Requisitos do projeto

O cliente exige uma solução completa para o roteamento multicast L3 dentro e fora da estrutura. O cenário de implantação tem os seguintes requisitos:

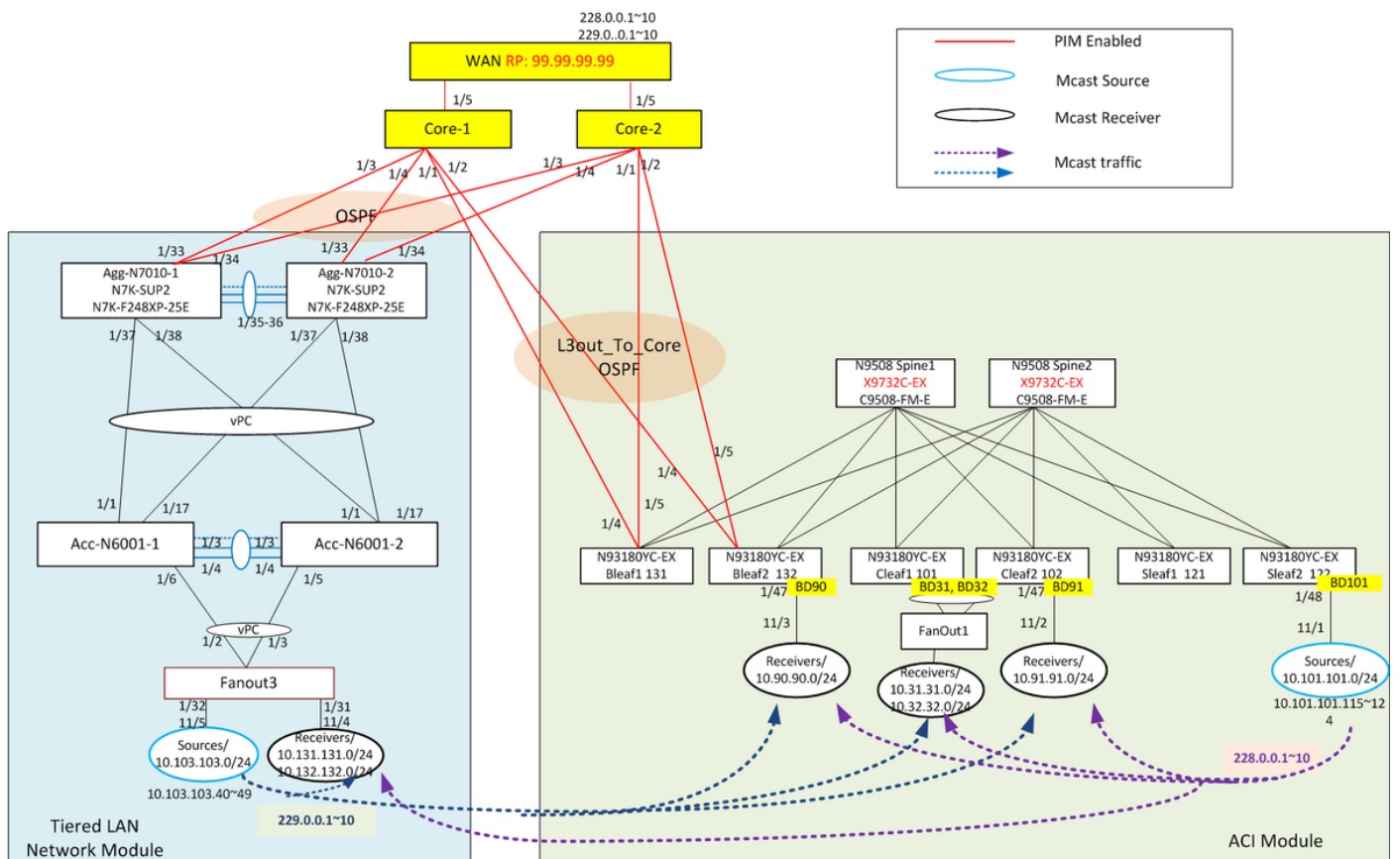
- Um VRF implantado para todos os usuários.

Note: O multicast requer L3out dedicado para cada VRF. Se houver vários VRFs na estrutura, o L3out compartilhado não é suportado para o roteamento multicast.

- Receptores em malha com fontes externas
- Fontes na malha com receptores externos
- Fontes e receptores na malha
- RP estático ou RP automático

Solução

Revisão da topologia



Na topologia, há dois componentes principais: o módulo ACI e o módulo de rede LAN hierárquica. Ambos os módulos são conectados aos dispositivos principais por meio de links L3 ponto a ponto que executam OSPF e PIM. No módulo ACI, a rede roteada externa é chamada de L3out-to-Core associada ao VRF common:default. Ele inclui os quatro links das duas folhas de borda para os dispositivos centrais. O módulo de rede LAN hierárquica, conhecido como externo à estrutura, consiste na camada de acesso tradicional e na camada de agregação com vPC.

Os fluxos multicast de L3 são executados na estrutura da ACI e na rede LAN antiga através da camada do núcleo. Para o cenário de RP estático, o RP é implantado no dispositivo de borda da WAN.

Usamos geradores de tráfego Spirent (STC) para simular fontes internas e externas e receptores. As portas Spirent são conectadas a diferentes locais no módulo ACI e no módulo de rede LAN hierárquica. Os destinatários enviam mensagens de associação de IGMP v2.

Fontes internas conectadas ao Sleaf2: os IPs origem são 10.101.101.115~124, enviando para endereços de grupo: 228.0.0.1~10

Receptores internos conectados a Bleaf1, Cleaf1 e Cleaf2: Os BDs habilitados para multicast são BD90, BD91, BD31, BD32, grupos interessados: 228.0.0.1~10 e 229.0.0.1~10.

Fontes externas conectadas à camada de acesso na rede LAN: os IPs origem são 10.103.103.40~49, enviando para endereços de grupo: 229.0.0.1~10.

Receptores externos conectados à camada de acesso na rede LAN: vlan131, vlan132, grupos interessados: 228.0.0.1~10.

Configuração

Passo 0: Configure o RP no dispositivo de WAN simulado conectado ao núcleo, ative o modo escasso de PIM nos dispositivos de rede LAN hierárquica.

```
!!!! RP configuration

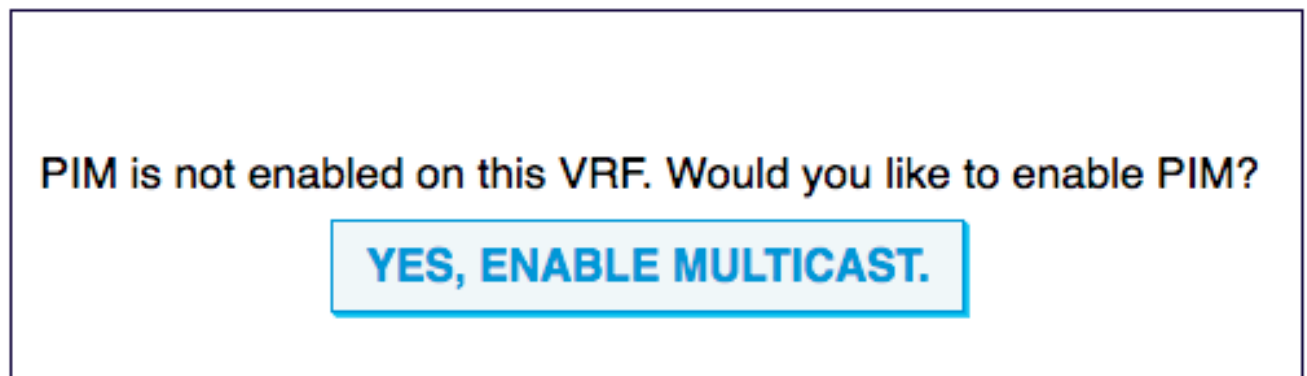
ip pim rp-address 99.99.99.99 group-list 224.0.0.0/4
ip pim ssm range 232.0.0.0/8

interface loopback99
  ip address 99.99.99.99/32
  ip router ospf 65017 area 0.0.0.0
  ip pim sparse-mode

interface Ethernet2/1
  ip pim sparse-mode

interface Ethernet2/2
  ip pim sparse-mode
```

Etapa 1: Habilitar multicast no VRF. Em Espaço de espaço de espaço, navegue para Rede > VRFs > Multicast, no painel de trabalho, clique na manteiga para ativar o Multicast.



Etapa 2: Habilitar multicast nos níveis BD e L3out, habilitar IGMP para BDs do receptor. Navegue até Networking > VRFs > VRF name > Multicast, no painel de trabalho, selecione Configuration > Interface tab, clique em "+" para adicionar os domínios de ponte onde o tráfego multicast é esperado. Habilitar política IGMP para BD habilitado para multicast.

Em seguida, clique em "+" para adicionar L3out para este VRF. Quando o multicast é ativado para um L3out, ele habilita o PIM em todas as interfaces sob o L3out e todas as folhas de borda desse L3out são habilitadas com o roteamento multicast. Selecione a política PIM para grupos de interface L3out.

Aqui suponha que os BDs e L3out já estejam provisionados.

Bridge Domains

BD	IGMP Policy
Zone_C/BD91	common/default
Zone_A/BD31	common/default
Zone_A/BD32	common/default
Zone_C/BD90	common/default
Zone_C/BD101	common/default

Interfaces

L3 Out	Interface Group	Interface	IGMP Policy	PIM Policy
L3Out_To_Core	L3Out_To_Core1	pod-1/131[eth1/4] pod-1/132[eth1/4]	common/default	common/default
	L3_out_To_Core2	pod-1/131[eth1/5] pod-1/132[eth1/5]	common/default	common/default

Anexar a política IGMP aos BDs faz dele um pesquisador IGMP também. A política IGMP é configurada em Espaço > Rede > Políticas de Protocolo > Interface IGMP. A política de IGMP padrão tem os seguintes parâmetros onde você pode definir intervalos de consulta. Se nenhuma política for especificada, a interface usará a política padrão.

IGMP Interface Policy - default

Name: **default**

Description: optional

Control: Allow v3 ASM
 Fast Leave
 Report Link Local Groups

Group Timeout (sec): 260

Query Interval (sec): 125

Query Response Interval (sec): 10

Last Member Count: 2

Last Member Response Time (sec): 1

Version: **Version 2** | Version 3

Startup Query Count: 2

Startup Query Interval (sec): 31

Querier Timeout (sec): 255

Robustness Variable: 2

State Limit Route Map: select an option

Maximum Multicast Entries: select an option

Reserved Multicast Entries: select an option

Report Policy Route Map: select an option

Static Report Route Map: select an option

A política PIM também é configurada em Espaço > Rede > Políticas de Protocolo > PIM.

A política de PIM padrão tem os seguintes parâmetros onde você pode definir intervalos de saudação.

The screenshot shows the 'Edit Interface Policy' configuration page in the Cisco SD-WAN GUI. The left sidebar shows the navigation tree with 'Networking' and 'PIM Policies' highlighted. The main configuration area shows the following settings:

- Name: default
- Auth Type: MD5 HMAC authentication (selected) / No authentication
- Control State:
 - Multicast Domain Boundary
 - Passive
 - Strict RFC Compliant
- Designated Router Delay (seconds): 3
- Designated Router Priority: 1
- Hello Interval (milliseconds): 30000
- Join-Prune Interval Policy (seconds): 60
- Interface-level Inbound Join-Prune Filter Policy: select an option
- Interface-level Outbound Join-Prune Filter Policy: select an option
- Interface-level Neighbor Filter Policy: select an option

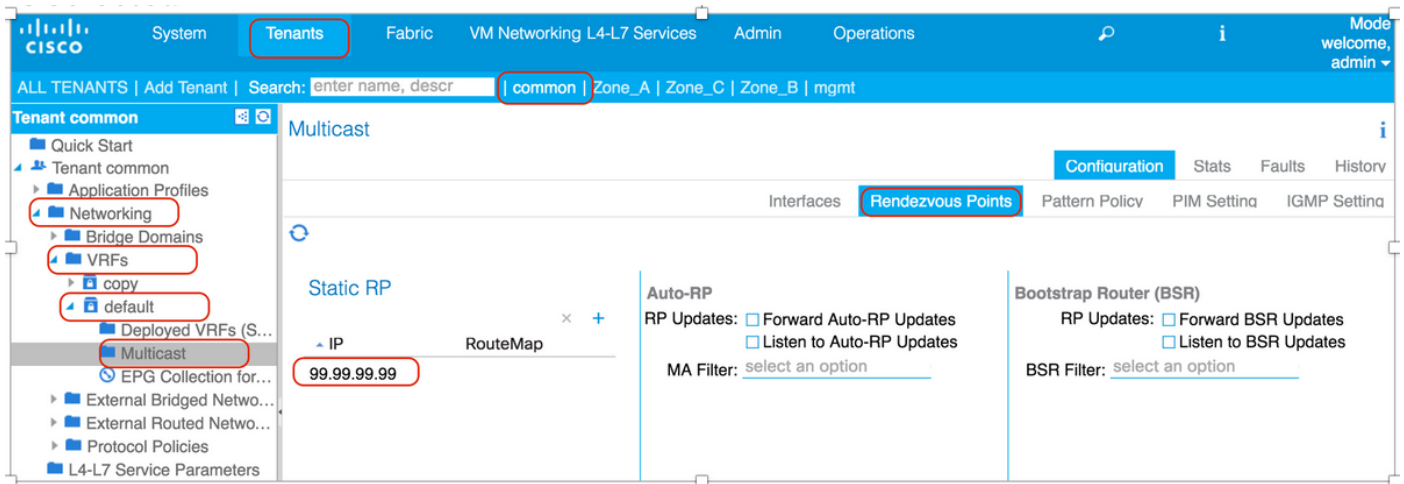
L3Outs na folha de borda devem ser configurados com endereços de loopback ativados no perfil do nó.

The screenshot shows the 'Logical Node Profile - L3Out_To_Core_NP' configuration page. The left sidebar shows the navigation tree with 'External Routed Networks' and 'L3Out_To_Core' highlighted. The main configuration area shows the following settings:

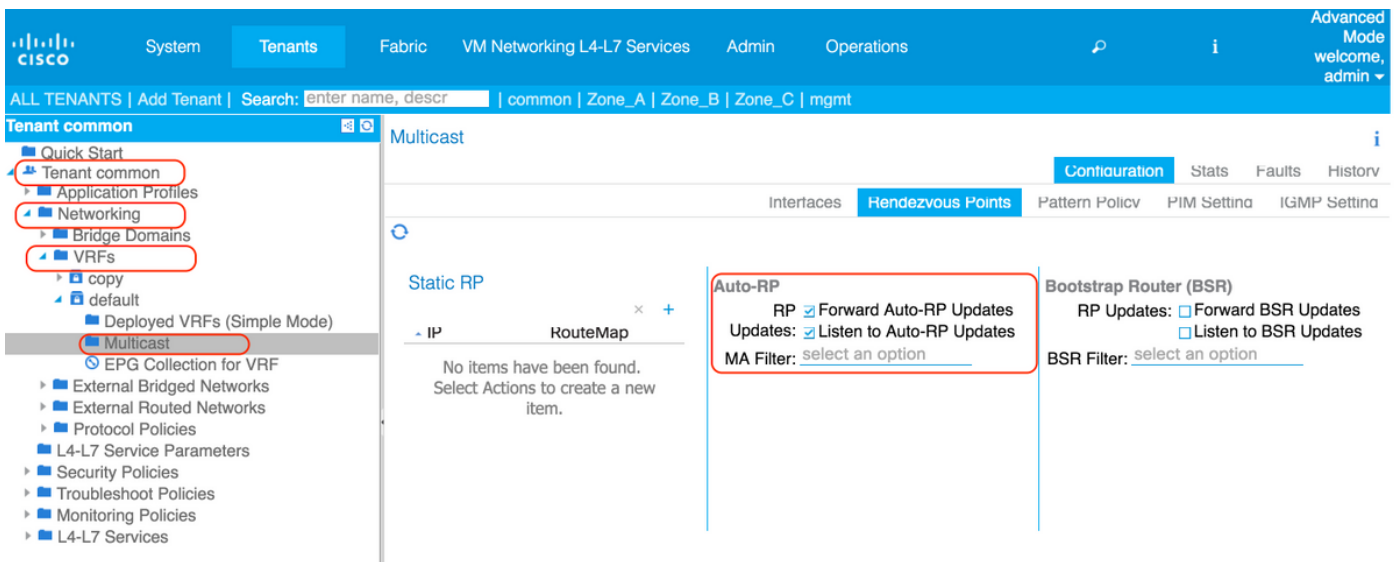
- Name: L3Out_To_Core_NP
- Description: optional
- Alias: [empty field]
- Target DSCP: Unspecified
- Nodes:

Node ID	Router ID	Static Routes	Loopback Address
topology/pod-1/node-131	131.131.131.1		131.131.131.1
topology/pod-1/node-132	132.132.132.1		132.132.132.1

Passo 3: Configurar RP para PIM ASM. Navegue até Espaço > VRF > Multicast, no painel de trabalho, selecione Configuração > Pontos de encontro. Neste exemplo, o RP estático é selecionado. Clique em "+" para adicionar o RP.



Para a configuração do RP automático, marque as caixas "Forward AutoRP updates" (Encaminhar atualizações do RP automático) e "Listen to AutoRP Updates" (Ouvir atualizações do RP automático) na página "Rendezvous Points" (Pontos de encontro).



Fora da estrutura da ACI, as configurações AUTO-RP nas plataformas NX-OS permanecem as mesmas.

```
!!! On RP candidate
```

```
ip pim send-rp-announce loopback99 group-list 224.0.0.0/4
ip pim send-rp-discovery loopback99 scope 32
```

```
!!! On RP listeners:
```

```
ip pim auto-rp listen forward
```

Etapa 4: Definir as configurações de PIM necessárias. Navegue para Espaço >VRF -> Multicast, no painel de trabalho, selecione Configuração > configurações PIM, observe o endereço VRF GIPo 225.1.192.0/32 que é atribuído pelo APIC do pool de endereços de grupo multicast. O VRF GIPo será usado como o endereço IP do grupo externo para tráfego multicast para BDs habilitados com PIM.

Quando o modo de **Convergência Rápida** estiver ativado (o padrão é desabilitado), todas as folhas de borda habilitadas com PIM enviarão associações para a rede externa, mas apenas uma folha de borda encaminhará o tráfego para a estrutura para evitar duplicatas. A folha de fronteira

que encaminha o tráfego para o grupo é o **encaminhador designado** para o grupo. A habilitação da convergência rápida ajuda a reduzir a duração da queda de pacotes para fluxos de multicast com fontes externas e receptores internos, quando há uma alteração do vencedor da distribuição devido à folha de borda está inativa. Não há latência obtida ao se juntar à árvore PIM do novo vencedor da faixa. Isso ocorre ao custo do uso de largura de banda adicional nos links externos dos vencedores sem faixa, já que toda a borda deixa o tráfego de recebimento da fonte externa.

Sobre os vencedores da distribuição - Atualmente a ACI usa um hash BSR (Bootstrap Router) para calcular o vencedor da distribuição BL. O hash é calculado usando o S,G e o IP de loopback da folha. A partir do ACI 3.0(1), não há como influenciar a eleição do vencedor da distribuição para o usuário.

The screenshot displays the Cisco ACI GUI for configuring Multicast settings. The navigation tree on the left shows the path: Tenant common > Networking > VRFs > default > Multicast. The main configuration area is titled 'Multicast' and includes tabs for 'Configuration', 'Stats', 'Faults', and 'History'. The 'PIM Setting' section is expanded, showing the following configuration:

- VRF GIPO address: 225.1.192.0/32
- Control State: Fast Convergence, Strict RFC Compliant
- MTU port: 1500
- Resource Policy: RouteMap (select an option)
- Maximum Limit: (dropdown)
- Reserved Multicast Entries: (dropdown)

Etapa 5: Criar contrato necessário para permitir o tráfego multicast:

- Origem e Receptor dentro da estrutura (contrato não necessário)
- Receptor dentro da malha, fonte externa (contrato não necessário)
- Fonte de estrutura interna, receptor externo (contrato obrigatório)*

*O contrato não é obrigatório se o BD for implantado na folha de fronteira

No nosso caso, temos receptores fora da estrutura, aplicamos contrato entre L3out_to_Core e mcast source no EPG101.

The screenshot shows the Cisco SD-WAN configuration interface. The top navigation bar includes 'System', 'Tenants', 'Fabric', 'VM Networking', 'L4-L7 Services', 'Admin', and 'Operations'. The 'Tenants' tab is active, and the 'common' tenant is selected. The left sidebar shows a tree view with 'Security Policies' and 'Contracts' expanded, and 'shared_l3out' selected. The main area displays a topology diagram with nodes for 'L3Out_To...', 'EPG101(App...)', and 'Contract shared_l3out'.

Verificar

Verificação de PIM

Quando o VRF é ativado para o roteamento multicast, uma interface de estrutura (túnel) é criada para o roteamento multicast dentro da estrutura. Os pacotes de plano de controle PIM são enviados através das interfaces de estrutura dentro da estrutura. O destino do túnel será o endereço multicast GiPo VRF. Nos switches de folha de borda, a origem do túnel será a interface de loopback na folha de borda. Nos switches leaf não-fronteiriços, a origem do túnel será um endereço de loopback (127.0.0.100).

As folhas de borda enviam saudações de PIM na interface de estrutura. As interfaces L3Out executam o PIM no modo normal, incluindo enviar e receber saudações, selecionar DR, etc. Folhas não-fronteiriças executadas em modo passivo na interface de estrutura; eles escutam as saudações do PIM das folhas de borda, mas não enviam saudações do PIM. Folhas não-borda não aparecerão na saída para "show ip pim neighbor".

!!!!!! **Border Leaf Node bleaf1** !!!!!

```
bleaf1# show ip pim neighbor
```

```
PIM Neighbor information for Dom:common:default
Neighbor      Interface      Uptime          Expires          DRPriority
Bidir        BFDState
132.132.132.1/32  tunnel16      06:20:40        00:01:21        1
no           n/a
10.1.20.25/32    eth1/5        06:23:12        00:01:35        1
yes          n/a
10.1.20.1/32    eth1/4        06:23:12        00:01:24        1
yes          n/a
```

```
bleaf1# show interface tunnel 16
Tunnel16 is up
    MTU 9000 bytes, BW 0 Kbit
```



```
Transport protocol is in VRF "common:default"
Tunnel protocol/transport is ipvlan
Tunnel source 131.131.131.1
Tunnel destination 225.1.192.0/32
Last clearing of "show interface" counters never
Tx
0 packets output, 1 minute output rate 0 packets/sec
Rx
0 packets input, 1 minute input rate 0 packets/sec
```

bleaf1#

!!!! Border Leaf Node bleaf2 !!!!

bleaf2# show ip pim neighbor

```
PIM Neighbor information for Dom:common:default
Neighbor          Interface          Uptime          Expires          DRPriority
Bidir      BFDState
131.131.131.1/32  tunnel16          06:23:26        00:01:30        1
no          n/a
10.1.20.29/32   eth1/5            06:38:26        00:01:43        1
yes         n/a
10.1.20.5/32   eth1/4            06:38:27        00:01:20        1
yes         n/a
```

bleaf2# show interface tunnel 16

```
Tunnel16 is up
  MTU 9000 bytes, BW 0 Kbit
  Transport protocol is in VRF "common:default"
  Tunnel protocol/transport is ipvlan
  Tunnel source 132.132.132.1
  Tunnel destination 225.1.192.0/32
  Last clearing of "show interface" counters never
  Tx
  0 packets output, 1 minute output rate 0 packets/sec
  Rx
  0 packets input, 1 minute input rate 0 packets/sec
```

bleaf2#

!!!! RP !!!!

bleaf1# show ip pim rp vrf all

```
PIM RP Status Information for VRF:"common:default"
BSR: Not Operational
Auto-RP RPA: 192.168.1.2/32
RP: 99.99.99.99, uptime: 26d21h, expires: 00:02:38,
  priority: 0, RP-source: 192.168.1.2 (A), group-map: None, group ranges:
  224.0.0.0/4
```

bleaf1#

bleaf2# show ip pim rp vrf all

```
PIM RP Status Information for VRF:"common:default"
BSR: Not Operational
Auto-RP RPA: 192.168.1.2/32
RP: 99.99.99.99, uptime: 26d21h, expires: 00:02:38,
  priority: 0, RP-source: 192.168.1.2 (A), group-map: None, group ranges:
  224.0.0.0/4
```

bleaf2#

!!!! Non border leaf Node !!!!

cleaf1# show ip pim neighbor

```
PIM Neighbor information for Dom:common:default
Neighbor      Interface      Uptime          Expires          DRPriority
Bidir         BFDState
132.132.132.1/32 tunnel16      06:32:43       00:01:37       1
no            n/a
131.131.131.1/32 tunnel16      06:32:43       00:01:17       1
no            n/a
```

cleaf1# show interface tunnel 16

```
Tunnel16 is up
  MTU 9000 bytes, BW 0 Kbit
  Transport protocol is in VRF "common:default"
  Tunnel protocol/transport is ipvlan
  Tunnel source 127.0.0.100/32
  Tunnel destination 225.1.192.0/32
  Last clearing of "show interface" counters never
  Tx
  0 packets output, 1 minute output rate 0 packets/sec
  Rx
  0 packets input, 1 minute input rate 0 packets/sec
```

cleaf1#

cleaf2# show ip pim neighbor vrf all

```
PIM Neighbor information for Dom:common:default
Neighbor      Interface      Uptime          Expires          DRPriority
Bidir         BFDState
132.132.132.1/32 tunnel16      06:33:17       00:01:33       1
no            n/a
131.131.131.1/32 tunnel16      06:33:17       00:01:41       1
no            n/a
```

cleaf2# show interface tunnel 16 Tunnel16 is up MTU 9000 bytes, BW 0 Kbit Transport protocol is in VRF "common:default" Tunnel protocol/transport is ipvlan Tunnel source 127.0.0.100/32

```
Tunnel destination 225.1.192.0/32
  Last clearing of "show interface" counters never
  Tx
  0 packets output, 1 minute output rate 0 packets/sec
  Rx
  0 packets input, 1 minute input rate 0 packets/sec
```

cleaf2#

!!!!!! Core Router !!!!!

N7K-core-1# show ip pim neighbor

PIM Neighbor Status for VRF "default"

```
Neighbor      Interface      Uptime          Expires          DR      Bidir-  BFD
              Priority Capable State
10.1.20.2     Ethernet1/1    3d22h          00:01:43        1       no      n/a
10.1.20.6     Ethernet1/2    3d22h          00:01:36        1       no      n/a
10.1.20.10    Ethernet1/3    2w6d           00:01:30        1       yes     n/a
10.1.20.14    Ethernet1/4    2w6d           00:01:18        1       yes     n/a
10.1.20.42    Ethernet1/5    2w6d           00:01:28        1       yes     n/a
```

N7K-core-1#

N7K-core-2# sh ip pim neighbor

PIM Neighbor Status for VRF "default"

```
Neighbor      Interface      Uptime          Expires          DR      Bidir-  BFD
              Priority Capable State
10.1.20.26    Ethernet1/1    3d22h          00:01:23        1       no      n/a
10.1.20.30    Ethernet1/2    3d22h          00:01:17        1       no      n/a
```

```

10.1.20.18      Ethernet1/3      2w6d      00:01:38  1      yes      n/a
10.1.20.22      Ethernet1/4      2w6d      00:01:41  1      yes      n/a
10.1.20.46      Ethernet1/5      2w6d      00:01:17  1      yes      n/a
N7K-core-2#

```

Verificação de Folha de Borda Ativa

Se houver mais de uma folha de borda ativada com o roteamento multicast, o APIC escolhe um vencedor de faixa para cada endereço de grupo em todas as folhas de borda ativas. A folha de borda que é a vencedora da distribuição de um grupo é responsável por enviar junções de PIM em nome da estrutura e encaminhar o tráfego multicast para a estrutura.

O vencedor da distribuição do grupo decide sobre o despachante designado. Se o vencedor da distribuição tiver acesso à raiz, o vencedor da distribuição também será o DF. Se o vencedor da distribuição não tiver conectividade externa com a raiz, então esse BL escolhe um DF enviando um PIM join pela interface de estrutura.

```

!!!! Enter into vsh mode to execute the command !!!!!
bleaf2# vsh
Cisco iNX-OS Debug Shell
This shell should only be used for internal commands and exists
for legacy reasons. User should use ibash infrastructure as this
will be deprecated.
bleaf2# show ip pim internal stripe-winner 228.0.0.1 vrf common:default
PIM Stripe Winner info for VRF "common:default" (BL count: 2)
(*, 228.0.0.1)
BLs: 132.132.132.1 hash: 2081913316 (local)
      131.131.131.1 hash: 1024236260
Winner: 132.132.132.1 best_hash: 2081913316
bleaf2#
bleaf2#
bleaf2# show ip pim internal stripe-winner 229.0.0.1 vrf common:default
PIM Stripe Winner info for VRF "common:default" (BL count: 2)
(*, 229.0.0.1)
BLs: 132.132.132.1 hash: 1595374052 (local)
      131.131.131.1 hash: 2047646436
Winner: 131.131.131.1 best_hash: 2047646436
bleaf2#

```

Verificação de convergência rápida

```

!!! Verify if fast convergence is enabled
bleaf1# show fabric multicast vrf common:default
Fabric Multicast Enabled VRFs
VRF Name          VRF      Vprime      VN-Seg      VRF      Conv      Tunnel
                  ID        If           ID           Role     Mode      IP
common:default    4        Tunnel16    2162688     BL       Fast      131.131.131.1
bleaf1#

```

!!! None-border leaf

```

cleaf1# show fabric multicast vrf common:default
Fabric Multicast Enabled VRFs
VRF Name          VRF      Vprime      VN-Seg      VRF      Conv      Tunnel
                  ID        If           ID           Role     Mode      IP
common:default    4        Tunnel16    2162688     Leaf     Fast      127.0.0.100
cleaf1#

```

Verificação IGMP

!!!! Bleaf2 receiving IGMP membership join !!!!

bleaf2# show ip igmp groups vrf common:default

Type: S - Static, D - Dynamic, L - Local, T - SSM Translated

Displaying Groups for vrf:common:default

Group Address	Type	Interface	Uptime	Expires	Last Reporter
228.0.0.1	D	vlan25	25d23h	00:02:20	10.90.90.71
229.0.0.1	D	vlan25	25d23h	00:02:24	10.90.90.71
228.0.0.2	D	vlan25	25d23h	00:02:27	10.90.90.72
229.0.0.2	D	vlan25	25d23h	00:02:20	10.90.90.72
228.0.0.3	D	vlan25	25d23h	00:02:25	10.90.90.73
229.0.0.3	D	vlan25	25d23h	00:02:25	10.90.90.73
228.0.0.4	D	vlan25	25d23h	00:02:26	10.90.90.74
229.0.0.4	D	vlan25	25d23h	00:02:25	10.90.90.74
228.0.0.5	D	vlan25	25d23h	00:02:28	10.90.90.75
229.0.0.5	D	vlan25	25d23h	00:02:20	10.90.90.75
228.0.0.6	D	vlan25	25d23h	00:02:22	10.90.90.76
229.0.0.6	D	vlan25	25d23h	00:02:26	10.90.90.76
228.0.0.7	D	vlan25	25d23h	00:02:25	10.90.90.77
229.0.0.7	D	vlan25	25d23h	00:02:19	10.90.90.77
228.0.0.8	D	vlan25	25d23h	00:02:22	10.90.90.78
229.0.0.8	D	vlan25	25d23h	00:02:25	10.90.90.78
228.0.0.9	D	vlan25	25d23h	00:02:27	10.90.90.79
229.0.0.9	D	vlan25	25d23h	00:02:20	10.90.90.79
228.0.0.10	D	vlan25	25d23h	00:02:20	10.90.90.80
229.0.0.10	D	vlan25	25d23h	00:02:21	10.90.90.80

bleaf2#

bleaf2# show ip igmp snooping groups vlan 25

Type: S - Static, D - Dynamic, R - Router port, F - Fabricpath core port

Vlan	Group Address	Ver	Type	Port list
25	*/*	-	R	Vlan25
25	228.0.0.1	v2	D	Eth1/47
25	228.0.0.2	v2	D	Eth1/47
25	228.0.0.3	v2	D	Eth1/47
25	228.0.0.4	v2	D	Eth1/47
25	228.0.0.5	v2	D	Eth1/47
25	228.0.0.6	v2	D	Eth1/47
25	228.0.0.7	v2	D	Eth1/47
25	228.0.0.8	v2	D	Eth1/47
25	228.0.0.9	v2	D	Eth1/47
25	228.0.0.10	v2	D	Eth1/47
25	229.0.0.1	v2	D	Eth1/47
25	229.0.0.2	v2	D	Eth1/47
25	229.0.0.3	v2	D	Eth1/47
25	229.0.0.4	v2	D	Eth1/47
25	229.0.0.5	v2	D	Eth1/47
25	229.0.0.6	v2	D	Eth1/47
25	229.0.0.7	v2	D	Eth1/47
25	229.0.0.8	v2	D	Eth1/47
25	229.0.0.9	v2	D	Eth1/47
25	229.0.0.10	v2	D	Eth1/47

bleaf2#

!!!! cleaf2 receivng IGMP membership join !!!!

cleaf2# show ip igmp groups vrf common:default

Type: S - Static, D - Dynamic, L - Local, T - SSM Translated

Displaying Groups for vrf:common:default

Group Address	Type	Interface	Uptime	Expires	Last Reporter
---------------	------	-----------	--------	---------	---------------

```

228.0.0.1      D      vlan9      25d23h      00:03:37      10.32.32.120
228.0.0.1      D      vlan30     25d23h      00:04:17      10.91.91.71
228.0.0.1      D      vlan3      11d23h      00:03:18      10.31.31.123
229.0.0.1      D      vlan9      25d23h      00:03:41      10.32.32.121
229.0.0.1      D      vlan30     25d23h      00:02:22      10.91.91.71
229.0.0.1      D      vlan3      11d23h      00:03:16      10.31.31.120
228.0.0.2      D      vlan9      25d23h      00:03:38      10.32.32.123
228.0.0.2      D      vlan30     25d23h      00:02:15      10.91.91.72
228.0.0.2      D      vlan3      11d23h      00:03:16      10.31.31.122
229.0.0.2      D      vlan9      25d23h      00:03:37      10.32.32.123
229.0.0.2      D      vlan30     25d23h      00:02:16      10.91.91.72
229.0.0.2      D      vlan3      11d23h      00:03:16      10.31.31.124
228.0.0.3      D      vlan9      25d23h      00:03:41      10.32.32.120
228.0.0.3      D      vlan30     25d23h      00:04:18      10.91.91.73
228.0.0.3      D      vlan3      11d23h      00:03:18      10.31.31.120
229.0.0.3      D      vlan9      25d23h      00:03:38      10.32.32.121
229.0.0.3      D      vlan30     25d23h      00:04:17      10.91.91.73
229.0.0.3      D      vlan3      11d23h      00:03:18      10.31.31.122
<.....>

```

cleaf2#

cleaf2# show ip igmp snooping vlan 3

IGMP Snooping information for vlan 3

IGMP snooping enabled

Lookup mode: IP

Optimised Multicast Flood (OMF) enabled

IGMP querier present, address: 10.31.31.1, version: 2, i/f Vlan3

Switch-querier disabled

IGMPv3 Explicit tracking enabled

IGMPv2 Fast leave disabled

IGMPv1/v2 Report suppression enabled

IGMPv3 Report suppression enabled

Link Local Groups suppression enabled

Router port detection using PIM Hellos, IGMP Queries

Number of router-ports: 1

Number of groups: 20

VLAN vPC function enabled

Active ports:

Eth1/2	Eth1/3	Po3	Po4
--------	--------	-----	-----

cleaf2# show ip igmp snooping groups vlan 3

Type: S - Static, D - Dynamic, R - Router port, F - Fabricpath core port

Vlan	Group Address	Ver	Type	Port list
3	*/*	-	R	Vlan3
3	228.0.0.1	v2	D	Po4
3	228.0.0.2	v2	D	Po4
3	228.0.0.3	v2	D	Po4
3	228.0.0.4	v2	D	Po4
3	228.0.0.5	v2	D	Po4
3	228.0.0.6	v2	D	Po4
3	228.0.0.7	v2	D	Po4
3	228.0.0.8	v2	D	Po4
3	228.0.0.9	v2	D	Po4
3	228.0.0.10	v2	D	Po4
3	229.0.0.1	v2	D	Po4
3	229.0.0.2	v2	D	Po4
3	229.0.0.3	v2	D	Po4
3	229.0.0.4	v2	D	Po4
3	229.0.0.5	v2	D	Po4
3	229.0.0.6	v2	D	Po4
3	229.0.0.7	v2	D	Po4
3	229.0.0.8	v2	D	Po4
3	229.0.0.9	v2	D	Po4
3	229.0.0.10	v2	D	Po4

```
cleaf2#
```

Verificação de MRIB

O nó de folha sleaf2, que é o FHR, tem fontes multicast diretamente conectadas. Seu vizinho RPF é 10.0.176.64 em spine1. A interface de entrada é a interface de estrutura (tunnel16) que está fazendo peering com a folha de borda via PIM.

Para simplificar, a saída mostrada é para um endereço IP multicast de cada intervalo de grupo: 228.0.0.1 para fontes internas e 229.0.0.1 para fontes externas.

```
!!!! FHR of mcast sources in fabric
sleaf2# show ip mroute vrf common:default
IP Multicast Routing Table for VRF "common:default"

(10.101.101.115/32, 228.0.0.1/32), uptime: 00:17:54, ip pim
  Incoming interface: Tunnel16, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 0)

(10.101.101.116/32, 228.0.0.1/32), uptime: 00:17:54, ip pim
  Incoming interface: Tunnel16, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 0)

(10.101.101.117/32, 228.0.0.1/32), uptime: 00:17:54, ip pim
  Incoming interface: Tunnel16, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 0)

(.....)

(*, 232.0.0.0/8), uptime: 4d00h, pim ip
  Incoming interface: Null, RPF nbr: 0.0.0.0
  Outgoing interface list: (count: 0)

sleaf2# show ip pim neighbor vrf common:default

PIM Neighbor information for Dom:common:default
Neighbor      Interface      Uptime          Expires          DRPriority
Bidir        BFDState
131.131.131.1/32  tunnel16      04:01:06        00:01:23         1
no           n/a
132.132.132.1/32  tunnel16      04:01:06        00:01:32         1
no           n/a
sleaf2#

sleaf2# show interface tunnel 16
Tunnel16 is up
  MTU 9000 bytes, BW 0 Kbit
  Transport protocol is in VRF "common:default"
  Tunnel protocol/transport is ipvlan
  Tunnel source 127.0.0.100/32
  Tunnel destination 225.1.192.0/32
  Last clearing of "show interface" counters never
  Tx
  0 packets output, 1 minute output rate 0 packets/sec
  Rx
  0 packets input, 1 minute input rate 0 packets/sec

sleaf2#
```

Os receptores para 228.0.0.1 estão ligados ao bleaf2 (nó 132), cleaf1 (Nó 101) e cleaf2 (Nó 102).

O Bleaf2 encaminha o mcast para o grupo 228.0.0.1 para receptores internos via túnel 16, e receptores externos via L3out para os dispositivos centrais.

!!!!!! Bleaf2 !!!!!

```
bleaf2# show ip mroute 228.0.0.1 vrf common:default
IP Multicast Routing Table for VRF "common:default"
```

```
(*, 228.0.0.1/32), uptime: 3w5d, ngmvpn ip pim igmp
  Incoming interface: Ethernet1/4, RPF nbr: 10.1.20.5
  Outgoing interface list: (count: 2) (Fabric OIF)
    Vlan25, uptime: 3w5d, igmp
    Tunnel16, uptime: 3w5d, ngmvpn
```

```
(10.101.101.115/32, 228.0.0.1/32), uptime: 3w5d, pim mrrib ip ngmvpn
  Incoming interface: Tunnel16, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 2) (Fabric OIF)
    Vlan25, uptime: 3w5d, mrrib
    Tunnel16, uptime: 3w5d, mrrib, ngmvpn, (RPF)
```

```
(10.101.101.116/32, 228.0.0.1/32), uptime: 3w5d, ip mrrib pim ngmvpn
  Incoming interface: Tunnel16, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 3) (Fabric OIF)
    Ethernet1/5, uptime: 00:04:36, pim
    Vlan25, uptime: 3w5d, mrrib
    Tunnel16, uptime: 3w5d, mrrib, ngmvpn, (RPF)
```

```
(10.101.101.117/32, 228.0.0.1/32), uptime: 3w5d, pim mrrib ip ngmvpn
  Incoming interface: Tunnel16, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 2) (Fabric OIF)
    Vlan25, uptime: 3w5d, mrrib
    Tunnel16, uptime: 3w5d, mrrib, ngmvpn, (RPF)
```

```
(10.101.101.118/32, 228.0.0.1/32), uptime: 3w5d, ip mrrib pim ngmvpn
  Incoming interface: Tunnel16, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 3) (Fabric OIF)
    Ethernet1/5, uptime: 00:04:36, pim
    Vlan25, uptime: 3w5d, mrrib
    Tunnel16, uptime: 3w5d, mrrib, ngmvpn, (RPF)
```

```
(10.101.101.119/32, 228.0.0.1/32), uptime: 3w5d, pim mrrib ip ngmvpn
  Incoming interface: Tunnel16, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 2) (Fabric OIF)
    Vlan25, uptime: 3w5d, mrrib
    Tunnel16, uptime: 3w5d, mrrib, ngmvpn, (RPF)
```

```
(10.101.101.120/32, 228.0.0.1/32), uptime: 3w5d, mrrib ip pim ngmvpn
  Incoming interface: Tunnel16, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 2) (Fabric OIF)
    Vlan25, uptime: 3w5d, mrrib
    Tunnel16, uptime: 3w5d, mrrib, ngmvpn, (RPF)
```

```
(10.101.101.121/32, 228.0.0.1/32), uptime: 3w5d, mrrib ip pim ngmvpn
  Incoming interface: Tunnel16, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 2) (Fabric OIF)
    Vlan25, uptime: 3w5d, mrrib
    Tunnel16, uptime: 3w5d, mrrib, ngmvpn, (RPF)
```

```
(10.101.101.122/32, 228.0.0.1/32), uptime: 3w5d, pim mrrib ip ngmvpn
  Incoming interface: Tunnel16, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 2) (Fabric OIF)
    Vlan25, uptime: 3w5d, mrrib
    Tunnel16, uptime: 3w5d, mrrib, ngmvpn, (RPF)
```

```
(10.101.101.123/32, 228.0.0.1/32), uptime: 3w5d, ip mrib pim ngmvpn
Incoming interface: Tunnel16, RPF nbr: 10.0.176.64 (pervasive)
Outgoing interface list: (count: 3) (Fabric OIF)
Ethernet1/5, uptime: 00:04:36, pim
Vlan25, uptime: 3w5d, mrib
Tunnel16, uptime: 3w5d, mrib, ngmvpn, (RPF)
```

```
(10.101.101.124/32, 228.0.0.1/32), uptime: 3w5d, ip mrib pim ngmvpn
Incoming interface: Tunnel16, RPF nbr: 10.0.176.64 (pervasive)
Outgoing interface list: (count: 3) (Fabric OIF)
Ethernet1/5, uptime: 1d00h, pim
Vlan25, uptime: 3w5d, mrib
Tunnel16, uptime: 3w5d, mrib, ngmvpn, (RPF)
```

```
bleaf2#
```

```
bleaf2# show interface vlan25
```

```
Vlan25 is up, line protocol is up
Hardware EtherSVI, address is 0000.0c07.ac5a
Internet Address is 10.90.90.1/24
MTU 9000 bytes, BW 10000000 Kbit, DLY 1 usec
reliability 255/255, txload 1/255, rxload 1/255
Carrier delay is 10 sec
Encapsulation ARPA, loopback not set
Keepalive not supported
ARP type: ARPA
Last clearing of "show interface" counters never
30 seconds input rate 0 bits/sec, 0 packets/sec
30 seconds output rate 0 bits/sec, 0 packets/sec
Load-Interval #2: 5 minute (300 seconds)
input rate 0 bps, 0 pps; output rate 0 bps, 0 pps
L3 Switched:
input: 0 pkts, 0 bytes - output: 0 pkts, 0 bytes
L3 in Switched:
ucast: 0 pkts, 0 bytes - mcast: 0 pkts, 0 bytes
L3 out Switched:
ucast: 0 pkts, 0 bytes - mcast: 0 pkts, 0 bytes
```

```
bleaf2#
```

O Bleaf1 encaminha o grupo de 228.0.0.1 para fora através da interface L3out, mas não encaminha para a estrutura através das interfaces de estrutura, já que não é o vencedor da distribuição para 228.0.0.1

```
!!!! Bleaf1 !!!!
```

```
!!!!
```

```
bleaf1# show ip mroute 228.0.0.1 vrf common:default
IP Multicast Routing Table for VRF "common:default"
```

```
(10.101.101.115/32, 228.0.0.1/32), uptime: 3w4d, mrib ip pim
Incoming interface: Tunnel14, RPF nbr: 10.0.176.64 (pervasive)
Outgoing interface list: (count: 1)
Ethernet1/5, uptime: 1d01h, pim
```

```
(10.101.101.116/32, 228.0.0.1/32), uptime: 3w5d, pim mrib ip
Incoming interface: Tunnel14, RPF nbr: 10.0.176.64 (pervasive)
Outgoing interface list: (count: 1)
Ethernet1/4, uptime: 1d01h, pim
```

```
(10.101.101.117/32, 228.0.0.1/32), uptime: 3w5d, pim mrib ip
Incoming interface: Tunnel14, RPF nbr: 10.0.176.64 (pervasive)
```



```

Outgoing interface list: (count: 1)
  Ethernet1/5, uptime: 1d01h, pim
(10.101.101.118/32, 228.0.0.1/32), uptime: 3w5d, mrib ip pim
  Incoming interface: Tunnel14, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 1)
    Ethernet1/4, uptime: 1d01h, pim
(10.101.101.119/32, 228.0.0.1/32), uptime: 3w5d, mrib ip pim
  Incoming interface: Tunnel14, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 1)
    Ethernet1/5, uptime: 1d01h, pim
(10.101.101.120/32, 228.0.0.1/32), uptime: 3w5d, pim mrib ip
  Incoming interface: Tunnel14, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 1)
    Ethernet1/4, uptime: 1d01h, pim
(10.101.101.121/32, 228.0.0.1/32), uptime: 3w5d, pim mrib ip
  Incoming interface: Tunnel14, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 1)
    Ethernet1/4, uptime: 1d01h, pim
(10.101.101.122/32, 228.0.0.1/32), uptime: 1d01h, ip mrib pim
  Incoming interface: Tunnel14, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 1)
    Ethernet1/5, uptime: 1d01h, pim
(10.101.101.123/32, 228.0.0.1/32), uptime: 3w5d, pim mrib ip
  Incoming interface: Tunnel14, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 1)
    Ethernet1/4, uptime: 1d01h, pim

```

bleaf1#

Bleaf1 é o enrolador ativo de folha/faixa do limite do grupo 229.0.0.1. o bleaf1 recebe o multicast para o grupo 229.0.0.1 através do dispositivo de núcleo externo e, em seguida, encaminha para receptores internos em BD90, BD91, BD31, BD32. (observe que o ID da vlan é apenas interno para o nó folha como o GW pervasivo).

!!!!! bleaf1 !!!!!

```

bleaf1# show ip mroute 229.0.0.1 vrf common:default IP Multicast Routing Table for VRF
"common:default" (*, 229.0.0.1/32), uptime: 3w5d, ngmvpn ip pim Incoming interface: Ethernet1/5,
RPF nbr: 10.1.20.25 Outgoing interface list: (count: 1) (Fabric OIF) Tunnel14, uptime: 3w5d,
ngmvpn (10.103.103.40/32, 229.0.0.1/32), uptime: 1d01h, ip mrib pim Incoming interface:
Ethernet1/5, RPF nbr: 10.1.20.25 Outgoing interface list: (count: 1) Tunnel14, uptime: 1d01h,
mrib (10.103.103.41/32, 229.0.0.1/32), uptime: 1d01h, ip mrib pim Incoming interface:
Ethernet1/4, RPF nbr: 10.1.20.1 Outgoing interface list: (count: 1) Tunnel14, uptime: 1d01h,
mrib (10.103.103.42/32, 229.0.0.1/32), uptime: 1d01h, ip mrib pim Incoming interface:
Ethernet1/5, RPF nbr: 10.1.20.25 Outgoing interface list: (count: 1) Tunnel14, uptime: 1d01h,
mrib (10.103.103.43/32, 229.0.0.1/32), uptime: 1d01h, ip mrib pim Incoming interface:
Ethernet1/5, RPF nbr: 10.1.20.25 Outgoing interface list: (count: 1) Tunnel14, uptime: 1d01h,
mrib (10.103.103.44/32, 229.0.0.1/32), uptime: 1d01h, ip mrib pim Incoming interface:
Ethernet1/5, RPF nbr: 10.1.20.25 Outgoing interface list: (count: 1) Tunnel14, uptime: 1d01h,
mrib (10.103.103.45/32, 229.0.0.1/32), uptime: 1d01h, ip mrib pim Incoming interface:
Ethernet1/5, RPF nbr: 10.1.20.25 Outgoing interface list: (count: 1) Tunnel14, uptime: 1d01h,
mrib (10.103.103.46/32, 229.0.0.1/32), uptime: 1d01h, ip mrib pim Incoming interface:
Ethernet1/5, RPF nbr: 10.1.20.25 Outgoing interface list: (count: 1) Tunnel14, uptime: 1d01h,
mrib (10.103.103.47/32, 229.0.0.1/32), uptime: 1d01h, ip mrib pim Incoming interface:

```

```
Ethernet1/4, RPF nbr: 10.1.20.1 Outgoing interface list: (count: 1) Tunnel14, uptime: 1d01h,
mrib (10.103.103.48/32, 229.0.0.1/32), uptime: 1d01h, ip mrib pim Incoming interface:
Ethernet1/4, RPF nbr: 10.1.20.1 Outgoing interface list: (count: 1) Tunnel14, uptime: 1d01h,
mrib (10.103.103.49/32, 229.0.0.1/32), uptime: 1d01h, ip mrib pim Incoming interface:
Ethernet1/4, RPF nbr: 10.1.20.1 Outgoing interface list: (count: 1) Tunnel14, uptime: 1d01h,
mrib bleaf1#
```

```
!!!! bleaf2 !!!!!
```

```
bleaf2# show ip mroute 229.0.0.1 vrf common:default IP Multicast Routing Table for VRF
"common:default" (*, 229.0.0.1/32), uptime: 3w5d, ip pim igmp Incoming interface: Ethernet1/4,
RPF nbr: 10.1.20.5 Outgoing interface list: (count: 1) Vlan25, uptime: 3w5d, igmp
(10.103.103.40/32, 229.0.0.1/32), uptime: 1d01h, ip mrib pim Incoming interface: Ethernet1/4,
RPF nbr: 10.1.20.5 Outgoing interface list: (count: 1) (Fabric Forwarding Loser) Vlan25, uptime:
1d01h, mrib (10.103.103.41/32, 229.0.0.1/32), uptime: 1d01h, ip mrib pim Incoming interface:
Ethernet1/4, RPF nbr: 10.1.20.5 Outgoing interface list: (count: 1) (Fabric Forwarding Loser)
Vlan25, uptime: 1d01h, mrib (10.103.103.42/32, 229.0.0.1/32), uptime: 1d01h, ip mrib pim
Incoming interface: Ethernet1/5, RPF nbr: 10.1.20.29 Outgoing interface list: (count: 1) (Fabric
Forwarding Loser) Vlan25, uptime: 1d01h, mrib (10.103.103.43/32, 229.0.0.1/32), uptime: 1d01h,
ip mrib pim Incoming interface: Ethernet1/5, RPF nbr: 10.1.20.29 Outgoing interface list:
(count: 1) (Fabric Forwarding Loser) Vlan25, uptime: 1d01h, mrib (10.103.103.44/32,
229.0.0.1/32), uptime: 1d01h, ip mrib pim Incoming interface: Ethernet1/5, RPF nbr: 10.1.20.29
Outgoing interface list: (count: 1) (Fabric Forwarding Loser) Vlan25, uptime: 1d01h, mrib
(10.103.103.45/32, 229.0.0.1/32), uptime: 1d01h, ip mrib pim Incoming interface: Ethernet1/4,
RPF nbr: 10.1.20.5 Outgoing interface list: (count: 1) (Fabric Forwarding Loser) Vlan25, uptime:
1d01h, mrib (10.103.103.46/32, 229.0.0.1/32), uptime: 1d01h, ip mrib pim Incoming interface:
Ethernet1/5, RPF nbr: 10.1.20.29 Outgoing interface list: (count: 1) (Fabric Forwarding Loser)
Vlan25, uptime: 1d01h, mrib (10.103.103.47/32, 229.0.0.1/32), uptime: 1d01h, ip mrib pim
Incoming interface: Ethernet1/4, RPF nbr: 10.1.20.5 Outgoing interface list: (count: 1) (Fabric
Forwarding Loser) Vlan25, uptime: 1d01h, mrib (10.103.103.48/32, 229.0.0.1/32), uptime: 1d01h,
ip mrib pim Incoming interface: Ethernet1/5, RPF nbr: 10.1.20.29 Outgoing interface list:
(count: 1) (Fabric Forwarding Loser) Vlan25, uptime: 1d01h, mrib (10.103.103.49/32,
229.0.0.1/32), uptime: 1d01h, ip mrib pim Incoming interface: Ethernet1/4, RPF nbr: 10.1.20.5
Outgoing interface list: (count: 1) (Fabric Forwarding Loser) Vlan25, uptime: 1d01h, mrib
bleaf2#
```

A Cleaf1 e a Cleaf2 não-borda têm receptores em BD31, BD32, BD91. Não há suporte para instalação de nó de folha não-borda (*, G) apenas, (S,G).

```
cleaf1# show ip mroute 228.0.0.1 vrf common:default
IP Multicast Routing Table for VRF "common:default"
```

```
(*, 228.0.0.1/32), uptime: 3w5d, igmp ip pim
Incoming interface: Tunnel14, RPF nbr: 10.0.80.91
Outgoing interface list: (count: 2)
Vlan4, uptime: 1w5d, igmp
Vlan7, uptime: 3w5d, igmp
```

```
cleaf1# show ip mroute 229.0.0.1 vrf common:default
IP Multicast Routing Table for VRF "common:default"
```

```
(*, 229.0.0.1/32), uptime: 3w5d, igmp ip pim
Incoming interface: Tunnel14, RPF nbr: 10.0.80.91
Outgoing interface list: (count: 2)
Vlan4, uptime: 1w5d, igmp
Vlan7, uptime: 3w5d, igmp
```

```
cleaf1#
```

```
cleaf1# show interface vlan 4
Vlan4 is up, line protocol is up
Hardware EtherSVI, address is 0000.0c07.ac1f
```

Internet Address is 10.31.31.1/24

MTU 9000 bytes, BW 10000000 Kbit, DLY 1 usec
reliability 255/255, txload 1/255, rxload 1/255
Carrier delay is 10 sec
Encapsulation ARPA, loopback not set
Keepalive not supported
ARP type: ARPA
Last clearing of "show interface" counters never
30 seconds input rate 0 bits/sec, 0 packets/sec
30 seconds output rate 0 bits/sec, 0 packets/sec
Load-Interval #2: 5 minute (300 seconds)
input rate 0 bps, 0 pps; output rate 0 bps, 0 pps
L3 Switched:
input: 0 pkts, 0 bytes - output: 0 pkts, 0 bytes
L3 in Switched:
ucast: 0 pkts, 0 bytes - mcast: 0 pkts, 0 bytes
L3 out Switched:
ucast: 0 pkts, 0 bytes - mcast: 0 pkts, 0 bytes

cleaf1# show interface vlan 7

Vlan7 is up, line protocol is up
Hardware EtherSVI, address is 0000.0c07.ac20

Internet Address is 10.32.32.1/24

MTU 9000 bytes, BW 10000000 Kbit, DLY 1 usec
reliability 255/255, txload 1/255, rxload 1/255
Carrier delay is 10 sec
Encapsulation ARPA, loopback not set
Keepalive not supported
ARP type: ARPA
Last clearing of "show interface" counters never
30 seconds input rate 0 bits/sec, 0 packets/sec
30 seconds output rate 0 bits/sec, 0 packets/sec
Load-Interval #2: 5 minute (300 seconds)
input rate 0 bps, 0 pps; output rate 0 bps, 0 pps
L3 Switched:
input: 0 pkts, 0 bytes - output: 0 pkts, 0 bytes
L3 in Switched:
ucast: 0 pkts, 0 bytes - mcast: 0 pkts, 0 bytes
L3 out Switched:
ucast: 0 pkts, 0 bytes - mcast: 0 pkts, 0 bytes

cleaf1#

!!!! Non-border leaf node has (*, G) only, (S,G) is not supported.

cleaf2# show ip mroute 228.0.0.1 vrf common:default
IP Multicast Routing Table for VRF "common:default"

(*, 228.0.0.1/32), uptime: 3w5d, igmp ip pim
Incoming interface: Tunnell16, RPF nbr: 10.0.80.91
Outgoing interface list: (count: 3)
Vlan3, uptime: 1w5d, igmp
Vlan30, uptime: 3w5d, igmp
Vlan9, uptime: 3w5d, igmp

cleaf2# show ip mroute 229.0.0.1 vrf common:default
IP Multicast Routing Table for VRF "common:default"

(*, 229.0.0.1/32), uptime: 3w5d, igmp ip pim
Incoming interface: Tunnell16, RPF nbr: 10.0.80.91
Outgoing interface list: (count: 3)
Vlan3, uptime: 1w5d, igmp
Vlan30, uptime: 3w5d, igmp

Vlan9, uptime: 3w5d, igmp

cleaf2#

cleaf2# show interface vlan 3

Vlan3 is up, line protocol is up

Hardware EtherSVI, address is 0000.0c07.ac1f

Internet Address is 10.31.31.1/24

MTU 9000 bytes, BW 10000000 Kbit, DLY 1 usec

reliability 255/255, txload 1/255, rxload 1/255

Carrier delay is 10 sec

Encapsulation ARPA, loopback not set

Keepalive not supported

ARP type: ARPA

Last clearing of "show interface" counters never

30 seconds input rate 0 bits/sec, 0 packets/sec

30 seconds output rate 0 bits/sec, 0 packets/sec

Load-Interval #2: 5 minute (300 seconds)

input rate 0 bps, 0 pps; output rate 0 bps, 0 pps

L3 Switched:

input: 0 pkts, 0 bytes - output: 0 pkts, 0 bytes

L3 in Switched:

ucast: 0 pkts, 0 bytes - mcast: 0 pkts, 0 bytes

L3 out Switched:

ucast: 0 pkts, 0 bytes - mcast: 0 pkts, 0 bytes

cleaf2# show interface vlan 30

Vlan30 is up, line protocol is up

Hardware EtherSVI, address is 0000.0c07.ac5b

Internet Address is 10.91.91.1/24

MTU 9000 bytes, BW 10000000 Kbit, DLY 1 usec

reliability 255/255, txload 1/255, rxload 1/255

Carrier delay is 10 sec

Encapsulation ARPA, loopback not set

Keepalive not supported

ARP type: ARPA

Last clearing of "show interface" counters never

30 seconds input rate 0 bits/sec, 0 packets/sec

30 seconds output rate 0 bits/sec, 0 packets/sec

Load-Interval #2: 5 minute (300 seconds)

input rate 0 bps, 0 pps; output rate 0 bps, 0 pps

L3 Switched:

input: 0 pkts, 0 bytes - output: 0 pkts, 0 bytes

L3 in Switched:

ucast: 0 pkts, 0 bytes - mcast: 0 pkts, 0 bytes

L3 out Switched:

ucast: 0 pkts, 0 bytes - mcast: 0 pkts, 0 bytes

cleaf2# show interface vlan 9

Vlan9 is up, line protocol is up

Hardware EtherSVI, address is 0000.0c07.ac20

Internet Address is 10.32.32.1/24

MTU 9000 bytes, BW 10000000 Kbit, DLY 1 usec

reliability 255/255, txload 1/255, rxload 1/255

Carrier delay is 10 sec

Encapsulation ARPA, loopback not set

Keepalive not supported

ARP type: ARPA

Last clearing of "show interface" counters never

30 seconds input rate 0 bits/sec, 0 packets/sec

30 seconds output rate 0 bits/sec, 0 packets/sec

Load-Interval #2: 5 minute (300 seconds)

input rate 0 bps, 0 pps; output rate 0 bps, 0 pps

L3 Switched:

```
input: 0 pkts, 0 bytes - output: 0 pkts, 0 bytes
L3 in Switched:
  ucast: 0 pkts, 0 bytes - mcast: 0 pkts, 0 bytes
L3 out Switched:
  ucast: 0 pkts, 0 bytes - mcast: 0 pkts, 0 bytes
```

cleaf2#

Nos roteadores centrais, N7K-core-1 e N7K-core-2 são compartilhamento de carga para fluxos multicast originados em redes LAN, se a convergência rápida não estiver habilitada, apenas uma folha de borda (bleaf1) está enviando união para a origem.

!!!! Sources in LAN network !!!!

!!!! N7K-core-1 !!!!

N7K-core-1# show ip mroute 229.0.0.1

IP Multicast Routing Table for VRF "default"

```
(10.103.103.41/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/3, RPF nbr: 10.1.20.10
  Outgoing interface list: (count: 1)
    Ethernet1/1, uptime: 1d01h, pim
```

```
(10.103.103.42/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/5, RPF nbr: 10.1.20.42
  Outgoing interface list: (count: 0)
```

```
(10.103.103.43/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/5, RPF nbr: 10.1.20.42
  Outgoing interface list: (count: 0)
```

```
(10.103.103.44/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/5, RPF nbr: 10.1.20.42
  Outgoing interface list: (count: 0)
```

```
(10.103.103.46/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/5, RPF nbr: 10.1.20.42
  Outgoing interface list: (count: 0)
```

```
(10.103.103.47/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/4, RPF nbr: 10.1.20.14
  Outgoing interface list: (count: 1)
    Ethernet1/1, uptime: 1d01h, pim
```

```
(10.103.103.48/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/3, RPF nbr: 10.1.20.10
  Outgoing interface list: (count: 1)
    Ethernet1/1, uptime: 1d01h, pim
```

```
(10.103.103.49/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/3, RPF nbr: 10.1.20.10
  Outgoing interface list: (count: 1)
    Ethernet1/1, uptime: 1d01h, pim
```

N7K-core-1#

!!!! N7K-core-2 !!!!

N7K-core-2# show ip mroute 229.0.0.1

IP Multicast Routing Table for VRF "default"

```
(*, 229.0.0.1/32), uptime: 3w5d, pim ip
```

```
Incoming interface: Ethernet1/5, RPF nbr: 10.1.20.46
Outgoing interface list: (count: 1)
  Ethernet1/1, uptime: 3w5d, pim
(10.103.103.40/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/3, RPF nbr: 10.1.20.18
  Outgoing interface list: (count: 1)
    Ethernet1/1, uptime: 1d01h, pim
(10.103.103.41/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/4, RPF nbr: 10.1.20.22
  Outgoing interface list: (count: 0)
(10.103.103.42/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/3, RPF nbr: 10.1.20.18
  Outgoing interface list: (count: 1)
    Ethernet1/1, uptime: 1d01h, pim
(10.103.103.43/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/4, RPF nbr: 10.1.20.22
  Outgoing interface list: (count: 1)
    Ethernet1/1, uptime: 1d01h, pim
(10.103.103.44/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/3, RPF nbr: 10.1.20.18
  Outgoing interface list: (count: 1)
    Ethernet1/1, uptime: 1d01h, pim
(10.103.103.45/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/4, RPF nbr: 10.1.20.22
  Outgoing interface list: (count: 1)
    Ethernet1/1, uptime: 1d01h, pim
(10.103.103.46/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/3, RPF nbr: 10.1.20.18
  Outgoing interface list: (count: 1)
    Ethernet1/1, uptime: 1d01h, pim
(10.103.103.47/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/4, RPF nbr: 10.1.20.22
  Outgoing interface list: (count: 0)
(10.103.103.48/32, 229.0.0.1/32), uptime: 00:53:01, pim mrib ip
  Incoming interface: Ethernet1/5, RPF nbr: 10.1.20.46
  Outgoing interface list: (count: 0)
(10.103.103.49/32, 229.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/4, RPF nbr: 10.1.20.22
  Outgoing interface list: (count: 0)
```

N7K-core-2#

!!!!!! Sources in ACI !!!!!

!!!!!! N7K-core-1 !!!!!

```
N7K-core-1# show ip mroute 228.0.0.1
IP Multicast Routing Table for VRF "default"
```

```
(*, 228.0.0.1/32), uptime: 3w5d, pim ip
  Incoming interface: Ethernet1/5, RPF nbr: 10.1.20.42
  Outgoing interface list: (count: 2)
    Ethernet1/3, uptime: 3w5d, pim
```

```
Ethernet1/2, uptime: 3w5d, pim
(10.101.101.115/32, 228.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/2, RPF nbr: 10.1.20.6
  Outgoing interface list: (count: 0)
(10.101.101.116/32, 228.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/1, RPF nbr: 10.1.20.2
  Outgoing interface list: (count: 1)
    Ethernet1/3, uptime: 1d01h, pim
(10.101.101.117/32, 228.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/5, RPF nbr: 10.1.20.42
  Outgoing interface list: (count: 0)
(10.101.101.118/32, 228.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/1, RPF nbr: 10.1.20.2
  Outgoing interface list: (count: 1)
    Ethernet1/3, uptime: 1d01h, pim
(10.101.101.119/32, 228.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/2, RPF nbr: 10.1.20.6
  Outgoing interface list: (count: 0)
(10.101.101.120/32, 228.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/1, RPF nbr: 10.1.20.2
  Outgoing interface list: (count: 1)
    Ethernet1/3, uptime: 1d01h, pim
(10.101.101.121/32, 228.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/1, RPF nbr: 10.1.20.2
  Outgoing interface list: (count: 1)
    Ethernet1/3, uptime: 1d01h, pim
(10.101.101.122/32, 228.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/2, RPF nbr: 10.1.20.6
  Outgoing interface list: (count: 0)
(10.101.101.123/32, 228.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/1, RPF nbr: 10.1.20.2
  Outgoing interface list: (count: 1)
    Ethernet1/3, uptime: 1d01h, pim
(10.101.101.124/32, 228.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/5, RPF nbr: 10.1.20.42
  Outgoing interface list: (count: 0)
```

```
N7K-core-1#
N7K-core-1#
```

```
!!!! N7K-core-2 !!!!
```

```
N7K-core-2# show ip mroute 228.0.0.1
IP Multicast Routing Table for VRF "default"
```

```
(*, 228.0.0.1/32), uptime: 3w5d, pim ip
  Incoming interface: Ethernet1/5, RPF nbr: 10.1.20.46
  Outgoing interface list: (count: 1)
    Ethernet1/4, uptime: 3w5d, pim
(10.101.101.115/32, 228.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/1, RPF nbr: 10.1.20.26
  Outgoing interface list: (count: 2)
    Ethernet1/4, uptime: 00:02:03, pim
    Ethernet1/3, uptime: 1d01h, pim
```

```
(10.101.101.116/32, 228.0.0.1/32), uptime: 00:01:28, pim mrib ip
  Incoming interface: Ethernet1/2, RPF nbr: 10.1.20.30
  Outgoing interface list: (count: 1)
    Ethernet1/4, uptime: 00:00:57, pim

(10.101.101.117/32, 228.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/1, RPF nbr: 10.1.20.26
  Outgoing interface list: (count: 2)
    Ethernet1/4, uptime: 00:02:03, pim
    Ethernet1/3, uptime: 1d01h, pim

(10.101.101.118/32, 228.0.0.1/32), uptime: 00:01:28, pim mrib ip
  Incoming interface: Ethernet1/2, RPF nbr: 10.1.20.30
  Outgoing interface list: (count: 1)
    Ethernet1/4, uptime: 00:00:57, pim

(10.101.101.119/32, 228.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/1, RPF nbr: 10.1.20.26
  Outgoing interface list: (count: 2)
    Ethernet1/4, uptime: 00:02:03, pim
    Ethernet1/3, uptime: 1d01h, pim

(10.101.101.122/32, 228.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/1, RPF nbr: 10.1.20.26
  Outgoing interface list: (count: 2)
    Ethernet1/4, uptime: 00:02:03, pim
    Ethernet1/3, uptime: 1d01h, pim

(10.101.101.123/32, 228.0.0.1/32), uptime: 00:01:28, pim mrib ip
  Incoming interface: Ethernet1/2, RPF nbr: 10.1.20.30
  Outgoing interface list: (count: 1)
    Ethernet1/4, uptime: 00:00:57, pim

(10.101.101.124/32, 228.0.0.1/32), uptime: 1d01h, pim mrib ip
  Incoming interface: Ethernet1/2, RPF nbr: 10.1.20.30
  Outgoing interface list: (count: 2)
    Ethernet1/3, uptime: 1d01h, pim
    Ethernet1/4, uptime: 1d01h, pim
```

N7K-core-2#

Referências

[Roteamento multicast da ACI 2.0](#)