

Caso aziendale: Multicast L3 in ACI Fabric

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Introduzione

Il routing multicast di layer 3 è supportato nel fabric ACI a partire dalla versione 2.0 e richiede switch EX (ad esempio N9K-C93180YC-EX). Prima della release 2.0, ACI supportava solo multicast L2 all'interno del dominio bridge. Questa opzione è ancora valida nella versione 2.0 e può essere utilizzata per switch non EX.

In ACI release 2.0, le funzioni di routing multicast supportate includono: PIM ASM, PIM SSM, Static RP, PIM Auto-RP e PIM BSR.

In questo documento viene descritta una soluzione convalidata per uno scenario di implementazione reale del cliente per il routing multicast L3 su fabric ACI. La versione ACI selezionata è 2.1(1h). Questa release non supporta RP nella struttura, pertanto è necessario un RP esterno per PIM ASM.

Requisiti di progettazione

Il cliente richiede una soluzione end-to-end per il routing multicast L3 all'interno e all'esterno del fabric. Lo scenario di distribuzione presenta i requisiti seguenti:

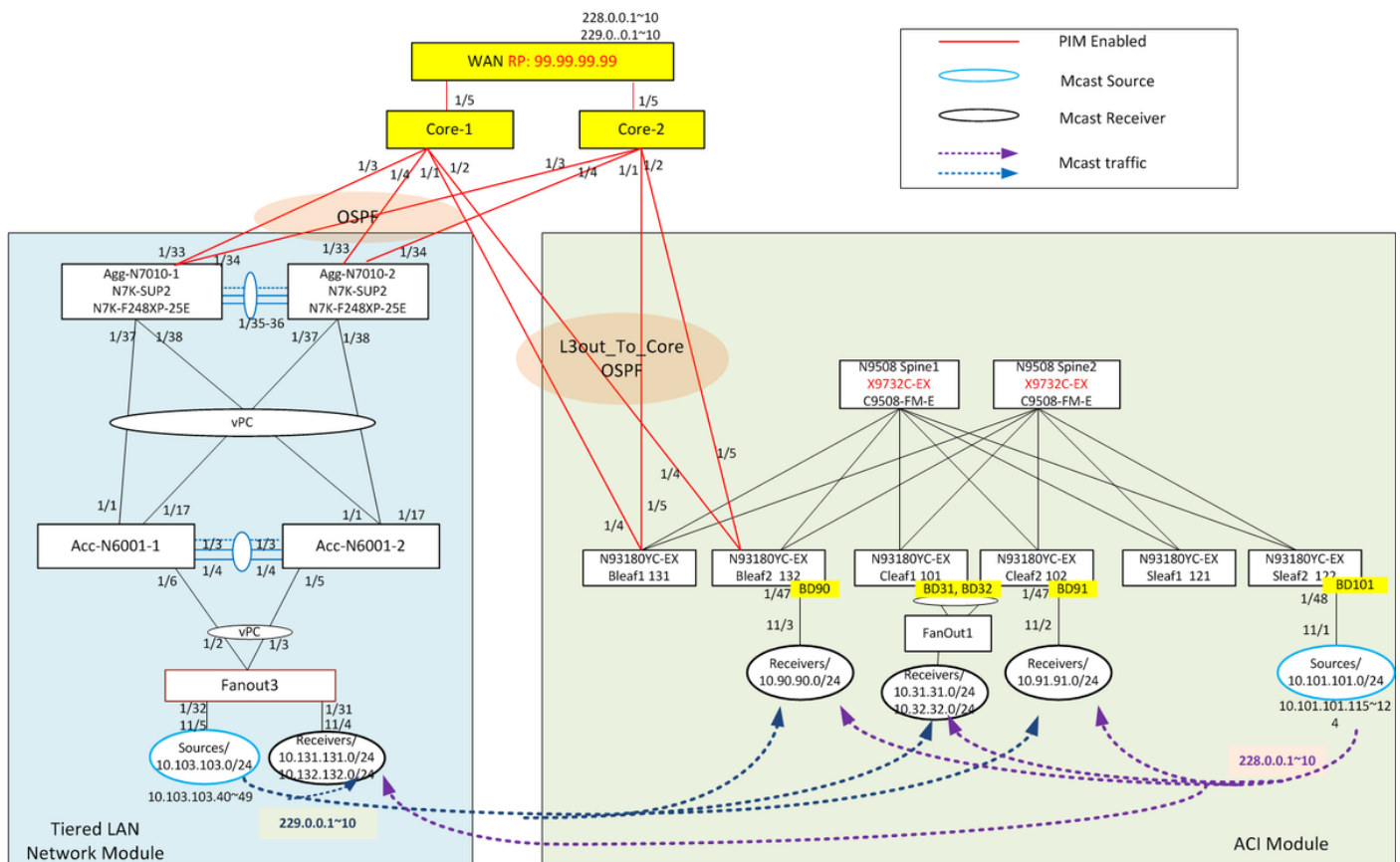
- Un VRF distribuito per tutti i tenant.

Nota: Il multicast richiede un'uscita L3 dedicata per ciascun VRF. Se nell'infrastruttura sono presenti più VRF, l'uscita L3 condivisa non è supportata per il routing multicast.

- Ricevitori in fabric con fonti esterne
- Fonti in fabric con ricevitori esterni
- Fonti e ricevitori nel fabric
- RP statica o Auto-RP

Soluzione

Revisione topologia



Nella topologia sono presenti due componenti principali: il modulo ACI e il modulo Tiered LAN Network. Entrambi i moduli sono collegati ai dispositivi principali tramite collegamenti L3 point-to-point con OSPF e PIM. Nel modulo ACI, la rete con routing esterno è chiamata L3out-to-Core associata al VRF common:default. Include i quattro collegamenti dalle due foglie di bordo ai dispositivi principali. Il modulo di rete LAN su più livelli, definito esterno al fabric, è costituito dal tradizionale layer di accesso e di aggregazione con vPC.

I flussi multicast L3 vengono eseguiti attraverso la struttura ACI e la rete LAN legacy attraverso il layer Core. Per lo scenario RP statico, RP viene distribuito sul dispositivo edge WAN.

Utilizziamo generatori di traffico a spirale (STC) per simulare le fonti e i ricevitori interni ed esterni. Le porte Spirent sono collegate a diverse posizioni nel modulo ACI e nel modulo di rete LAN su più livelli. I riceventi inviano messaggi di partecipazione a IGMP v2.

Origini interne collegate a Sleaf2: gli IP di origine sono 10.101.101.115~124, inviando a indirizzi di gruppo: 228.0.0.1~10

Ricevitori interni collegati a Bleaf1, Cleaf1 e Cleaf2: I BD con supporto multicast sono BD90, BD91, BD31, BD32 e gruppi interessati: 228.0.0.1~10 e 229.0.0.1~10.

Origini esterne collegate al livello di accesso nella rete LAN: gli IP di origine sono 10.103.103.40~49, inviando a indirizzi di gruppo: 229.0.0.1~10.

Ricevitori esterni collegati al livello di accesso nella rete LAN: vlan131, vlan132, gruppi interessati: 228.0.0.1~10.

Configurazione

Passaggio 0: Impostare RP sul dispositivo WAN simulato collegato al core, abilitare la modalità

sparse PIM sui dispositivi di rete LAN a livelli.

```
!!!!!! RP configuration

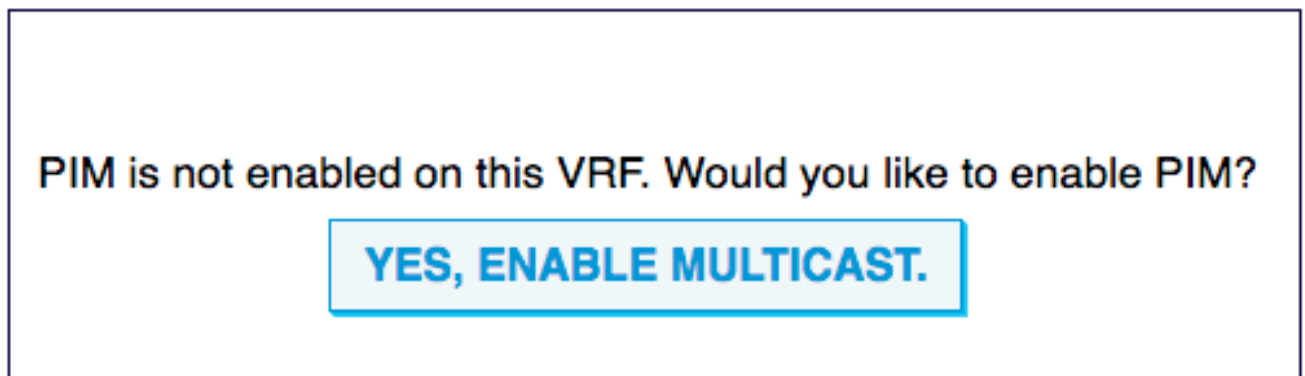
ip pim rp-address 99.99.99.99 group-list 224.0.0.0/4
ip pim ssm range 232.0.0.0/8

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
```

Passaggio 1: Abilitare il multicast sul VRF. In Spazio tenant, selezionare Rete > VRF > Multicast, nel pannello di lavoro, fare clic sul burro per abilitare il multicast.



Passaggio 2: abilitare il multicast ai livelli di uscita BD e L3e abilitare IGMP per i BD ricevitori. Selezionare Rete > VRF > Nome VRF > Multicast, nel pannello di lavoro selezionare Configurazione > scheda Interfaccia, fare clic su "+" per aggiungere i domini bridge in cui è previsto il traffico multicast. Abilitare i criteri IMGP per BD con supporto multicast.

Quindi fare clic su "+" per aggiungere L3out per questo VRF. Quando il multicast è abilitato per un L3out, il PIM verrà abilitato su tutte le interfacce sotto l3out e tutti i bordi lasciati per tale L3out verranno abilitati con il routing multicast. Selezionare il criterio PIM per i gruppi di interfacce L3out.

Si supponga che i BD e l3out siano già dotati di provisioning.

Multicast

Configuration | Stats | Faults | History

Interfaces | Rendezvous Points | Pattern Policy | PIM Setting | IGMP Setting

Enable

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

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

L'associazione dei criteri IGMP ai BD lo rende anch'esso un query IGMP. I criteri IGMP sono configurati in Tenant > Reti > Criteri protocollo > Interfaccia IGMP. Il criterio IGMP predefinito prevede i parametri seguenti, in cui è possibile definire gli intervalli di query. Se non viene specificato alcun criterio, l'interfaccia utilizzerà il criterio predefinito.

IGMP Interface Policy - default

Poliv | Faults | History

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

La policy PIM è configurata anche in Tenant > Reti > Protocol Policies > PIM.

Il criterio PIM predefinito prevede i parametri seguenti, in cui è possibile definire gli intervalli di saluto.

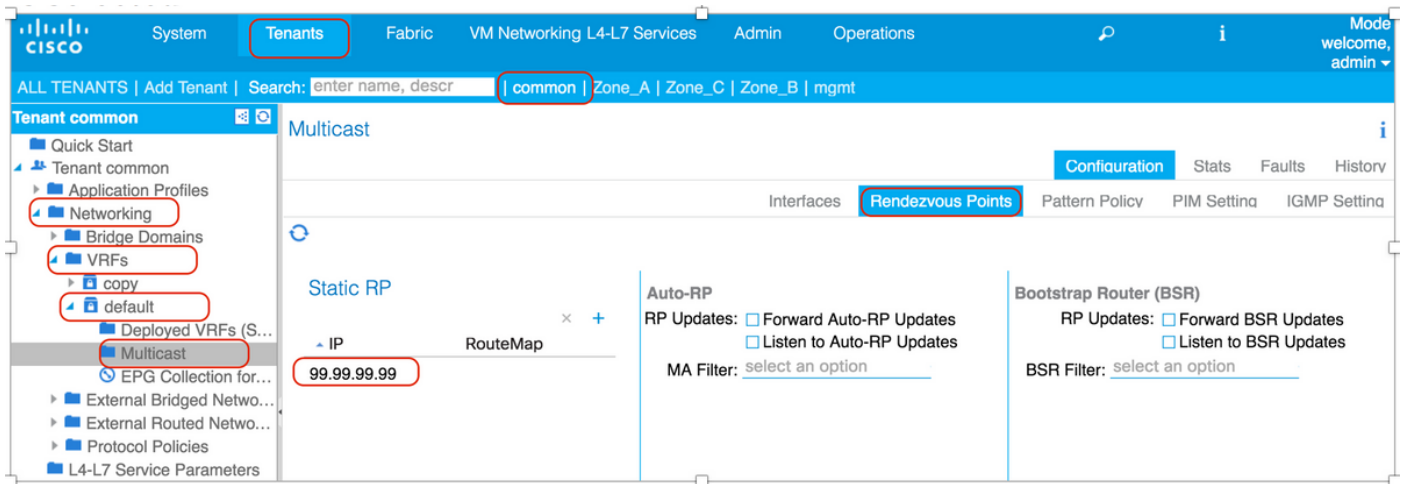
The screenshot shows the Cisco SD-WAN GUI interface. The left sidebar displays a tree view of configuration options under 'Tenant common' > 'Networking' > 'PIM Policies'. The main panel is titled 'Edit Interface Policy' and shows the configuration for a policy named 'default'. The 'Auth Type' is set to 'MD5 HMAC authentication'. The 'Hello Interval (milliseconds)' is set to 30000. Other settings include 'Designated Router Delay (seconds): 3', 'Designated Router Priority: 1', and 'Join-Prune Interval Policy (seconds): 60'.

È necessario configurare L3Outs su foglia bordo con indirizzi di loopback abilitati nel profilo del nodo.

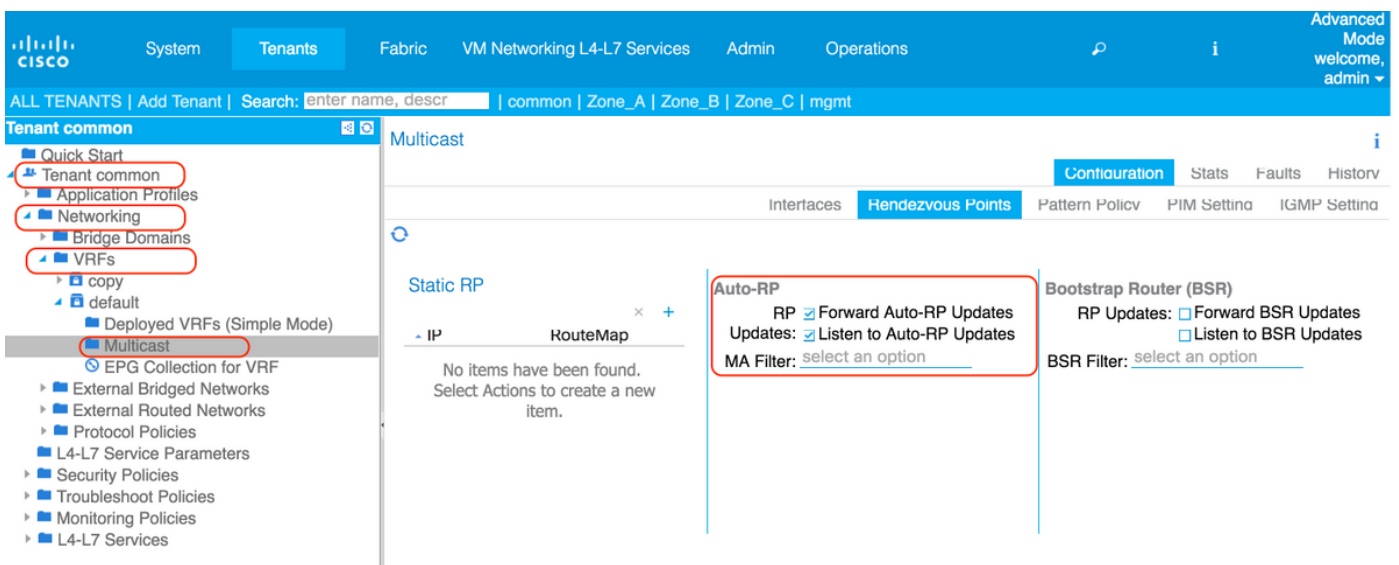
The screenshot shows the Cisco SD-WAN GUI interface for a 'Logical Node Profile - L3Out_To_Core_NP'. The left sidebar shows the configuration path: 'Tenant common' > 'Networking' > 'External Routed Networks' > 'L3Out_To_Core' > 'Logical Node Profiles' > 'L3Out_To_Core_NP'. The main panel displays the profile configuration, including a table of nodes with their Router IDs and Loopback Addresses.

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

Passaggio 3: Configurare RP per PIM ASM. Passare a Tenant > VRF > Multicast, nel pannello di lavoro selezionare Configurazione > Punti di rendering. Nell'esempio, è selezionato RP statico. Fare clic su "+" per aggiungere l'RP.



Per la configurazione Auto-RP, selezionare le caselle "Inoltra aggiornamenti Auto-RP" e "Ascolta aggiornamenti Auto-RP" nella pagina "Rendezvous Points".



Al di fuori della struttura ACI, le configurazioni AUTO-RP sulle piattaforme NX-OS rimangono le stesse.

!!! 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
```

Passaggio 4: configurare le impostazioni PIM necessarie. Passare a Tenant >VRF -> Multicast, nel pannello di lavoro, selezionare Configuration > PIM settings (Configurazione > Impostazioni PIM), notare l'indirizzo VRF GIPo 225.1.192.0/32 assegnato da APIC dal pool di indirizzi del gruppo multicast. Il GIPo VRF verrà utilizzato come indirizzo IP del gruppo esterno per il traffico multicast per i BD abilitati con PIM.

Quando la modalità **Fast Convergence** è abilitata (l'impostazione predefinita è disabilitata), tutte le foglie dei bordi abilitate con PIM invieranno join alla rete esterna, ma solo una foglia dei bordi inoltrerà il traffico sulla struttura per evitare duplicati. La foglia di bordo che inoltra il traffico per il gruppo è il **mittente designato** per il gruppo. L'abilitazione della funzionalità Fast Convergence

consente di ridurre la durata di rilascio dei pacchetti per i flussi multicast con origini esterne e ricevitori interni, in caso sia presente una modifica del vincitore dello stripe dovuta al fatto che il bordo foglia è inattivo. Non si verifica alcuna latenza quando si unisce l'albero PIM del nuovo vincitore dello stripe. Questo avviene al costo dell'uso aggiuntivo della larghezza di banda sui collegamenti esterni dei vincitori non-stripe, dal momento che tutte le foglie di confine estraggono il traffico dalla fonte esterna.

Informazioni sui vincitori di striping - Attualmente ACI utilizza un hash BSR (Bootstrap Router) per calcolare il vincitore di striping BL. L'hash viene calcolato utilizzando l'indirizzo IP di loopback S,G e Leaf. A partire da ACI 3.0(1) non c'è modo di influenzare la scelta del vincitore della striscia per l'utente.

The screenshot displays the Cisco ACI configuration interface for Multicast. The left-hand navigation pane shows the hierarchy: Tenant common > Networking > VRFs > default > Multicast. The main configuration area is titled 'Multicast' and includes tabs for 'Configuration', 'Stats', 'Faults', and 'History'. Under the 'PIM Setting' section, the following parameters are visible: VRF GIPo address is set to 225.1.192.0/32; Control State has 'Fast Convergence' checked and 'Strict RFC Compliant' unchecked; MTU port is set to 1500; Resource Policy includes a 'RouteMap' dropdown set to 'select an option', and fields for 'Maximum Limit', 'Reserved', and 'Multicast Entries'.

Passaggio 5: Creare il contratto necessario per consentire il traffico multicast:

- Origine e ricevitore all'interno del fabric (contratto non necessario)
- Ricevitore all'interno del fabric, fonte esterna (contratto non necessario)
- Origine all'interno del fabric, ricevitore esterno (contratto obbligatorio)*

*Il contratto non è richiesto se il BD è installato sulla foglia del bordo

Nel nostro caso, abbiamo ricevitori al di fuori del fabric, applicare il contratto tra L3out_to_Core e mcast source in EPG101.

The screenshot shows the Cisco SD-WAN GUI. 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'.

Verifica

Verifica PIM

Quando il VRF è abilitato per il routing multicast, viene creata un'interfaccia di infrastruttura (tunnel) per il routing multicast all'interno dell'infrastruttura. I pacchetti del control plane PIM vengono inviati tramite le interfacce di infrastruttura all'interno dell'infrastruttura. La destinazione del tunnel sarà l'indirizzo multicast GiPo VRF. Sugli switch border leaf, l'origine del tunnel sarà l'interfaccia di loopback sul border leaf. Sugli switch foglia non frontaliere l'origine del tunnel sarà un indirizzo di loopback (127.0.0.100).

Il bordo lascia inviare hello PIM sull'interfaccia del fabric. Le interfacce L3Out eseguono PIM in modalità normale, tra cui l'invio e la ricezione di hello, la selezione di DR, ecc. Le foglie non-border funzionano in modalità passiva sull'interfaccia del fabric; ascoltano i pim hellos dalle foglie di confine ma non li inviano. Le foglie esterne non verranno visualizzate nell'output per "show ip pim neighbors".

!!!!!! **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	tunnell6	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
```

```
Tunnell6 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  tunnell16         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

```
Tunnell16 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- Priority	BFD 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- Priority	BFD 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#

```

Verifica attiva foglia bordo

Se con routing multicast sono abilitate più foglie di bordo, APIC sceglie un vincitore di striping per ogni indirizzo di gruppo su tutte le foglie di bordo attive. La foglia di confine vincitrice dello stripe per un gruppo è responsabile dell'invio di join PIM per conto del fabric e dell'inoltro del traffico multicast nel fabric.

Il vincitore della striscia per il gruppo decide sul mittente designato. Se il vincitore della striscia è raggiungibile dalla radice, il vincitore della striscia è anche il DF. Se il vincitore dello stripe non dispone di connettività esterna alla radice, BL sceglie un DF inviando un join PIM sull'interfaccia fabric.

```

!!!! 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#

```

Verifica rapida della convergenza

```

!!! 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#

```

Verifica 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#
```

Verifica MRIB

Il nodo foglia sleaf2, ovvero FHR, ha origini multicast collegate direttamente. Il router adiacente RPF è la versione 10.0.176.64 sul dorso1. L'interfaccia in ingresso è l'interfaccia fabric (tunnel16) su cui è in corso il peer con la foglia del bordo tramite PIM.

Per semplicità, l'output mostrato si riferisce a un indirizzo IP multicast di ciascun intervallo di gruppi: 228.0.0.1 per le sorgenti interne e 229.0.0.1 per le sorgenti esterne.

```
!!!! 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: Tunnell16, 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: Tunnell16, 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: Tunnell16, 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  tunnell16          04:01:06              00:01:23              1
no          n/a
132.132.132.1/32  tunnell16          04:01:06              00:01:32              1
no          n/a
sleaf2#

sleaf2# show interface tunnel 16
Tunnell16 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#
```

I ricevitori per 228.0.0.1 sono collegati a bleaf2 (nodo 132), cleaf1 (nodo 101) e cleaf2 (nodo 102).

Bleaf2 inoltra il mcast al gruppo 228.0.0.1 ai ricevitori interni tramite il tunnel 16 e ai ricevitori esterni tramite l3out ai dispositivi core.

!!!!!! 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#

Bleaf1 inoltra il gruppo di 228.0.0.1 all'esterno tramite l'interfaccia L3out, ma non inoltra sul fabric tramite le interfacce fabric poiché non è il vincitore dello stripe per 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, mrrib ip pim
  Incoming interface: Tunnell14, 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, mrrib ip pim
  Incoming interface: Tunnell14, 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 mrrib ip
  Incoming interface: Tunnell14, 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 mrrib ip
  Incoming interface: Tunnell14, 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 mrrib pim
  Incoming interface: Tunnell14, 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 mrrib ip
  Incoming interface: Tunnell14, RPF nbr: 10.0.176.64 (pervasive)
  Outgoing interface list: (count: 1)
    Ethernet1/4, uptime: 1d01h, pim

```

bleaf1#

Bleaf1 è il segnaposto foglia/stripe attivo del bordo per il gruppo 229.0.0.1. bleaf1 riceve il multicast per il gruppo 229.0.0.1 tramite il dispositivo core esterno, e lo inoltra ai ricevitori interni in BD90, BD91, BD31, BD32. (notare che l'ID vlan è solo interno al nodo foglia come 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) Tunnell14, uptime: 3w5d,
ngmvpn (10.103.103.40/32, 229.0.0.1/32), uptime: 1d01h, ip mrrib pim Incoming interface:
Ethernet1/5, RPF nbr: 10.1.20.25 Outgoing interface list: (count: 1) Tunnell14, uptime: 1d01h,
mrrib (10.103.103.41/32, 229.0.0.1/32), uptime: 1d01h, ip mrrib pim Incoming interface:
Ethernet1/4, RPF nbr: 10.1.20.1 Outgoing interface list: (count: 1) Tunnell14, uptime: 1d01h,
mrrib (10.103.103.42/32, 229.0.0.1/32), uptime: 1d01h, ip mrrib pim Incoming interface:
Ethernet1/5, RPF nbr: 10.1.20.25 Outgoing interface list: (count: 1) Tunnell14, uptime: 1d01h,
mrrib (10.103.103.43/32, 229.0.0.1/32), uptime: 1d01h, ip mrrib pim Incoming interface:
Ethernet1/5, RPF nbr: 10.1.20.25 Outgoing interface list: (count: 1) Tunnell14, uptime: 1d01h,
mrrib (10.103.103.44/32, 229.0.0.1/32), uptime: 1d01h, ip mrrib pim Incoming interface:
Ethernet1/5, RPF nbr: 10.1.20.25 Outgoing interface list: (count: 1) Tunnell14, uptime: 1d01h,
mrrib (10.103.103.45/32, 229.0.0.1/32), uptime: 1d01h, ip mrrib pim Incoming interface:
Ethernet1/5, RPF nbr: 10.1.20.25 Outgoing interface list: (count: 1) Tunnell14, uptime: 1d01h,
mrrib (10.103.103.46/32, 229.0.0.1/32), uptime: 1d01h, ip mrrib pim Incoming interface:
Ethernet1/5, RPF nbr: 10.1.20.25 Outgoing interface list: (count: 1) Tunnell14, uptime: 1d01h,
mrrib (10.103.103.47/32, 229.0.0.1/32), uptime: 1d01h, ip mrrib pim Incoming interface:
Ethernet1/4, RPF nbr: 10.1.20.1 Outgoing interface list: (count: 1) Tunnell14, 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) Tunnell4, 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) Tunnell4, 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#
```

Foglia esterna Cleaf1 e Cleaf2 sono dotati di ricevitori collegati in BD31, BD32, BD91.
L'installazione del nodo foglia esterno (*, G) non è supportata.

```
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: Tunnell4, 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: Tunnell4, 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: Tunnell6, 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: Tunnell6, 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#
```

Sui router principali, N7K-core-1 e N7K-core-2 condividono il carico per i flussi multicast provenienti dalla rete LAN. Se la convergenza veloce non è abilitata, solo una foglia di bordo (bleaf1) sta inviando il join verso l'origine.

```
!!!! 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 mrrib 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 mrrib 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 mrrib 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 mrrib 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 mrrib 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 mrrib 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 mrrib 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 mrrib 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#

Riferimenti

[ACI 2.0 Multicast Routing](#)