

# Overzicht van Any-Source Multicast (ASM) in SDA Campus Fabric-omgeving

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## Inleiding

Dit document beschrijft Overzicht van Any-Source Multicast (ASM) met Single Rendezvous Point (*RP*) in Softwaregedefinieerde Access-omgeving.

## Voorwaarden

### Vereisten

Het wordt aanbevolen dat u kennis hebt van Locator ID Separation Protocol (*LISP*) en multicast.

### Gebruikte componenten

Dit document is niet beperkt tot specifieke software- en hardware-versies.

De informatie in dit document is gemaakt van apparatuur in een specifieke labomgeving. Als uw netwerk live is, zorg er dan voor dat u de mogelijke impact van een opdracht.GUI begrijpt

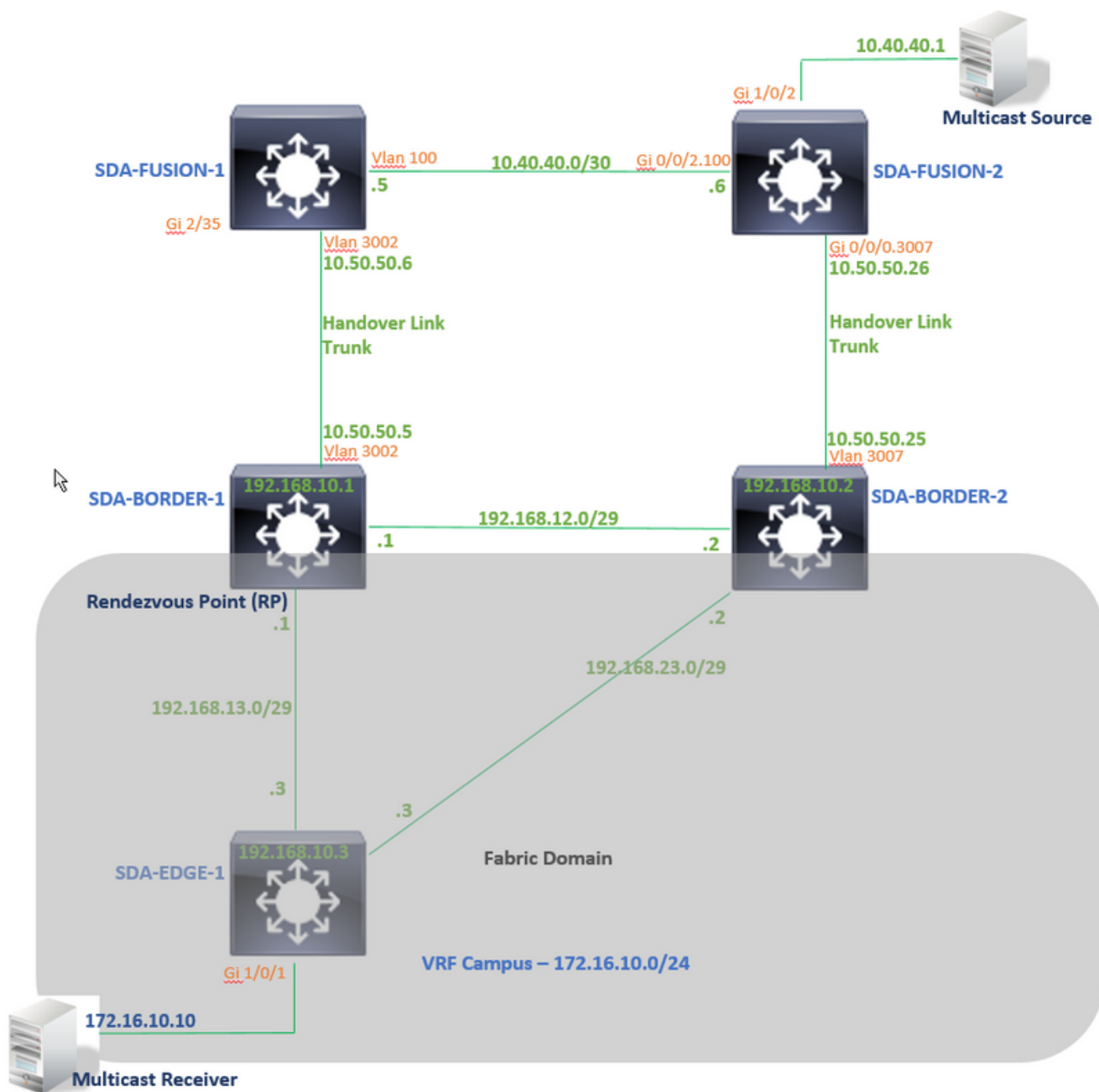
Voor dit artikel gebruikte hulpmiddelen

Fusie - Cisco-router met ondersteuning voor lekkage van Inter-VRF (Virtual Route Forwarding)

## Configureren

### Netwerkdigram

De topologie die voor dit artikel wordt gebruikt bestaat uit twee grensrouters die zowel als buitengrenzen worden bestempeld, en twee Fusie routers met een verbinding naar elke respectievelijke Grensrouter. Border-1 wordt ingesteld als RP, Multicast Source is aangesloten op Fusion-2 en Multicast ontvanger wordt aangesloten op Edge-1.



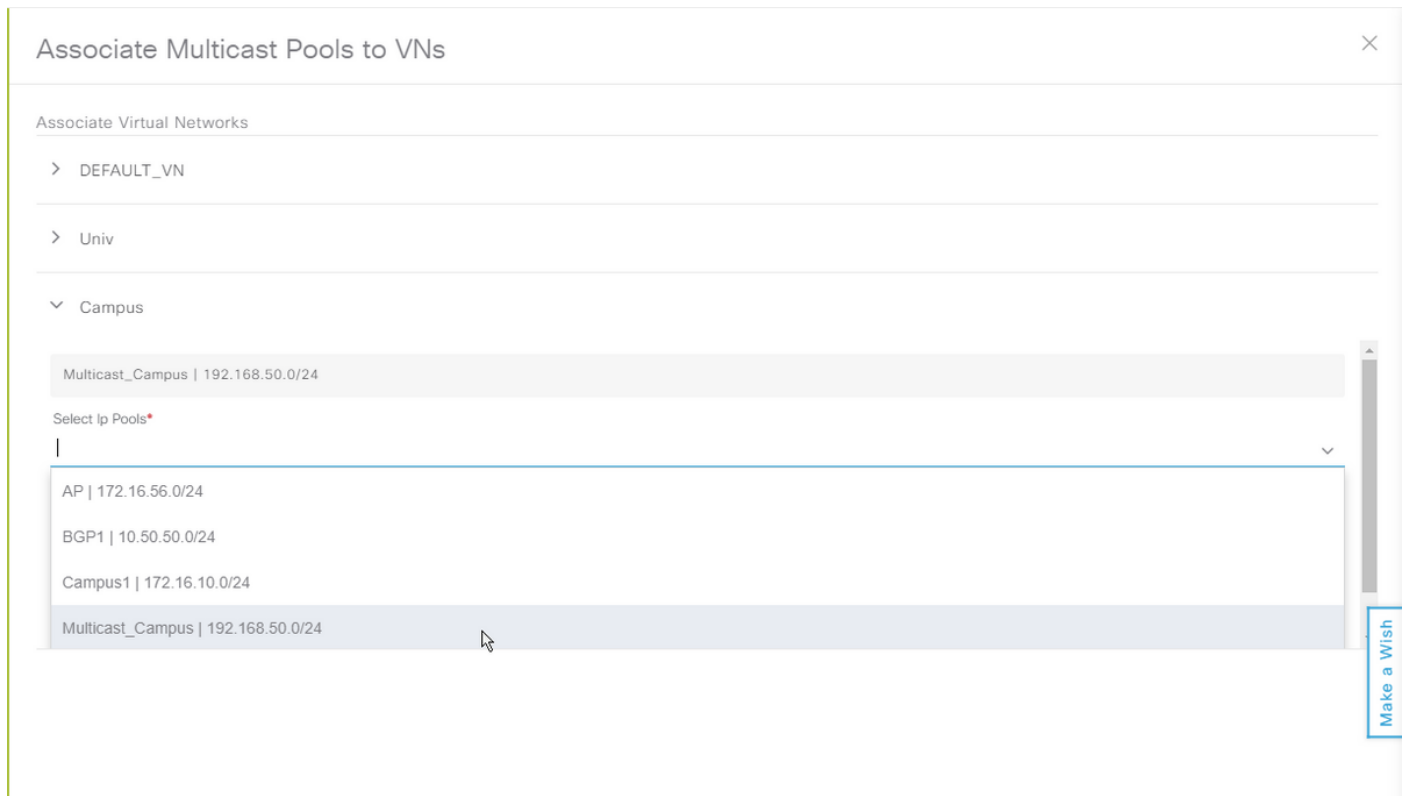
### Configuraties

Dit artikel bestrijkt geen stappen om Fabric te configureren in een softwaregedefinieerde toegangsomgeving (SDA) en begint met een verklaring van stappen om multicast te configureren in een fabric-domein voor een specifiek VPN.

## Stap 1: Multicast voor fabricapparaten configureren via DNA

In DNA Graphical User Interface (GUI), under provision -> Fabric ZE. Multicast wordt ingesteld door optie "Rendezvous Point inschakelen" op SDA-BORDER-1 apparaat.

Kies vervolgens een IP-pool (*Internet Protocol*) die voor multicast Configuration moet worden gebruikt onder specifiek VN. "Campus" in dit voorbeeld.



## Stap 2: Controleer of de configuratie is ingeschakeld op apparaten

Deze paragraaf heeft betrekking op de verificatie van de multicast-configuratie op Fabric-apparaten.

### SDA-BORDER-1

```
interface Loopback4099 <<<<<<<<<<< Loopback Interface is created and assigned an IP from Pool
selected
vrf forwarding Campus
ip address 192.168.50.1 255.255.255.255
ip pim sparse-mode <<<<<<<<<<< PIM is enabled on Interface
end
```

```
interface LISP0.4099 <<<<<<<<<<< PIM is enabled on LISP interface
ip pim sparse-mode
end
```

```
SDA-Border1#sh run | in pim|multicast ip multicast-routing <<<<<<<<<< Multicast Routing is
enabled for Global ip multicast-routing vrf Campus <<<<<<<<<< Multicast Routing is enabled for
Campus VN ip pim ssm default <<<<<<<<<< PIM SSM mode is enabled for Global for default address
range ip pim vrf Campus rp-address 192.168.50.1 <<<<<<<<<< BORDER-1 Loopback4099 is configued as
RP
ip pim vrf Campus register-source Loopback4099
ip pim vrf Campus ssm default <<<<<<<<<< PIM SSM mode is enabled for vrf Campus for default
address range
```

```
SDA-Border1#sh run | s address-family ipv4 vrf Campus
address-family ipv4 vrf Campus
.....
network 192.168.50.1 mask 255.255.255.255 <<<<<<<<<< RP Address is injected into BGP Table
aggregate-address 192.168.50.0 255.255.255.0 summary-only <<<<<<<<<< Aggregate for Multicast
Pool is advertised
.....
```

## SDA-BORDER-2

```
interface Loopback4099
 vrf forwarding Campus
 ip address 192.168.50.3 255.255.255.255
 ip pim sparse-mode
end
```

```
interface LISP0.4099
 ip pim sparse-mode
end
```

```
SDA-Border2#sh run | in pim|multicast
```

```
ip multicast-routing
ip multicast-routing vrf Campus
```

```
ip pim ssm default
ip pim vrf Campus rp-address 192.168.50.1 <<<<<<<<<< BORDER-1 Loopback4099 is configued as
RP
ip pim vrf Campus register-source Loopback4099
ip pim vrf Campus ssm default
```

```
SDA-Border2#sh run | s address-family ipv4 vrf Campus
address-family ipv4 vrf Campus
.....
network 192.168.50.1 mask 255.255.255.255
aggregate-address 192.168.50.0 255.255.255.0 summary-only
.....
```

## SDA-EDGE-1

```
interface Vlan1021
description Configured from apic-em
mac-address 0000.0c9f.f45c
vrf forwarding Campus
ip address 172.16.10.1 255.255.255.0
ip helper-address 10.10.10.100
no ip redirects
```

```
ip local-proxy-arp
ip pim sparse-mode <<<<<<<<<< PIM is enabled on all SVI-s under Campus VN
ip route-cache same-interface
ip igmp version 3
no lisp mobility liveness test
lisp mobility 172_16_10_0-Campus
end
```

```
interface Loopback4099 vrf forwarding Campus ip address 192.168.50.2 255.255.255.255 ip pim
sparse-mode end interface LISP0.4099 ip pim sparse-mode end SDA-Edge1#sh run | in pim|multicast
ip multicast-routing ip multicast-routing vrf Campus ip pim ssm default ip pim vrf Campus rp-
address 192.168.50.1 <<<<<<<<<< BORDER-1 Loopback4099 is configued as RP ip pim vrf Campus
register-source Loopback4099 ip pim vrf Campus ssm default
```

### Stap 3: PIM handmatig instellen via link naar ontvanger

Multicast-bron wordt in dit voorbeeld buiten het Fabric aangesloten op Fusion-2. Zorg ervoor dat er voor de multicast stream-flow een PIM-pad is van RP naar Bron en ontvanger naar Bron (paden kunnen anders zijn!).

### PIM-eren tussen SDA-BORDER-1 en SDA-FUSION-1

#### SDA-BORDER-1

```
-----
interface Vlan3002                                     <<<<<<<<< Enable PIM on Handover link in Campus VN
description vrf interface to External router
vrf forwarding Campus
ip address 10.50.50.5 255.255.255.252
no ip redirects
ip pim sparse-mode
ip route-cache same-interface
end
```

#### SDA-FUSION-1

```
-----
ip multicast-routing
ip multicast-routing vrf Campus                       <<<<<<<<< Enable Multicast Routing in vrf Campus
ip pim vrf Campus rp-address 192.168.50.1            <<<<<<<<< Configure BORDER-1 Loopback4099 as RP
interface Vlan3002 <<<<<<<<< Enable PIM on Fusion Interface towards Border vrf forwarding Campus
ip address 10.50.50.6 255.255.255.252 ip pim sparse-mode
end
```

### PIM-eren tussen SDA-BORDER-2 en SDA-FUSION-2

#### SDA-BORDER-2

```
-----
interface Vlan3007
description vrf interface to External router
vrf forwarding Campus
ip address 10.50.50.25 255.255.255.252
no ip redirects
ip pim sparse-mode
ip route-cache same-interface
end
```

## SDA-FUSION-2

```
-----  
ip multicast-routing distributed  
ip multicast-routing vrf Campus distributed  
  
ip pim vrf Campus rp-address 192.168.50.1  
  
interface GigabitEthernet0/0/0.3007  
  encapsulation dot1Q 3007  
  vrf forwarding Campus  
  ip address 10.50.50.26 255.255.255.252  
  ip pim sparse-mode  
  no cdp enable  
end
```

## PIM-onderhandeling tussen SDA-FUSION-1 en SDA-FUSION-2

### SDA-FUSION-1

```
-----  
interface Vlan100  
  description Muticast_Campus  
  vrf forwarding Campus  
  ip address 10.40.40.5 255.255.255.252  
  ip pim sparse-mode  
end
```

### SDA-FUSION-2

```
-----  
interface GigabitEthernet0/0/2.100  
  encapsulation dot1Q 100  
  vrf forwarding Campus  
  ip address 10.40.40.6 255.255.255.252  
  ip pim sparse-mode  
end
```

## PIM op de interface inschakelen voor de bron

### SDA-FUSION-2

```
-----  
interface GigabitEthernet1/0/2  
  vrf forwarding Campus  
  ip address 10.40.40.2 255.255.255.252  
  ip pim sparse-mode  
  load-interval 30  
  negotiation auto  
end
```

## proces van het besturingsplane

Op enig punt stuurt Multicast Ontv een Protocol van het Beheer van de Internet Group (IGMP) toe te voegen aan Laatste Router (LHR) om de Stream voor een specifieke groep te ontvangen, en de Multicast Bron (Server) begint de Multicaststream naar First Hop Router (FHR) te verzenden. In ons geval is FHR SDA-FUSION-2 en LHR is SDA-EDGE-1 en het proces van het besturingsplane wordt uitgelegd in het scenario waarin de ontvanger eerst om een stroom vraagt, en Bron begint



```
SDA-Edge1#show ip cef vrf Campus 192.168.50.1/32
192.168.50.1/32
  nexthop 192.168.10.1 LISP0.4099 <<<<<<<<<< RP is reachable
via LISP interface
```

```
SDA-Edge1#show ip mroute vrf Campus 239.1.1.1
IP Multicast Routing Table

(*, 239.1.1.1), 00:50:06/00:02:57, RP 192.168.50.1, flags: SJC <<<<<<<<<< (*,G) entry is
created
  Incoming interface: LISP0.4099, RPF nbr 192.168.10.1 <<<<<<<<<< Incoming
interface is set as LISP interface
  Outgoing interface list:
    Vlan1021, Forward/Sparse, 00:50:06/00:02:57 <<<<<<<<<< Outgoing
Interface is set towards Receiver
```

Daarna stuurt de LHR een PIM (\*,G) naar de RP (met tussenpozen van één minuut) - indien LHR voor dat segment DR is.

```
SDA-Edge1#debug ip pim vrf Campus 239.1.1.1
PIM debugging is on

*Aug 15 00:03:44.592: PIM(4): Building Periodic (*,G) Join / (S,G,RP-bit) Prune message for
239.1.1.1
*Aug 15 00:03:44.593: PIM(4): Insert (*,239.1.1.1) join in nbr 192.168.10.1's queue
*Aug 15 00:03:44.593: PIM(4): Building Join/Prune packet for nbr 192.168.10.1
*Aug 15 00:03:44.594: PIM(4): Adding v2 (192.168.50.1/32, 239.1.1.1), WC-bit, RPT-bit, S-bit
Join
*Aug 15 00:03:44.594: PIM(4): Adding LISP Unicast transport attribute in join/prune to
192.168.10.1 (LISP0.4099)
*Aug 15 00:03:44.594: PIM(4): Send v2 join/prune to 192.168.10.1 (LISP0.4099) <<<<<<<
PIM (*,G) Join is sent towards the RP

*Aug 15 00:04:42.892: PIM(4): Building Periodic (*,G) Join / (S,G,RP-bit) Prune message for
239.1.1.1 *Aug 15 00:04:42.892: PIM(4): Insert (*,239.1.1.1) join in nbr 192.168.10.1's queue
*Aug 15 00:04:42.892: PIM(4): Building Join/Prune packet for nbr 192.168.10.1 *Aug 15
00:04:42.892: PIM(4): Adding v2 (192.168.50.1/32, 239.1.1.1), WC-bit, RPT-bit, S-bit Join *Aug
15 00:04:42.892: PIM(4): Adding LISP Unicast transport attribute in join/prune to 192.168.10.1
(LISP0.4099) *Aug 15 00:04:42.892: PIM(4): Send v2 join/prune to 192.168.10.1 (LISP0.4099)
SDA-Edge1#
```

### Buurvorming

Zodra de RPF-informatie verkregen is die naar de LISP-interface wijst, moet PIM expliciet een buurstructuur voor de corresponderende RLOC creëren. Dit is nodig omdat de upstream Tunnel router (xTR) geen hallo-berichten stuurt. Het nieuwe buurblok verstrijkt wanneer geen verbinding/duin berichten naar de buur zijn verstuurd na 2 keer de standaardintervaltijd tussen hoeven zich aan te sluiten/prikken.

In ons geval creëert de SDA-EDGE-1 een PIM buurman die het upstream/RPF RLOC adres gebruikt.

```
SDA-Edge1#show ip pim vrf Campus neighbor
PIM Neighbor Table
```



```
Neighbor           Interface                    Uptime/Expires  Ver  DR
Address            192.168.10.1     LISP0.4099      1w5d/00:01:27  v2   0 /
address used for the neighbor                <<<<<<<<<< RLOC
```

```
SDA-Edge1#debug ip pim vrf Campus timers <- chatty!
PIM-TIMERS debugging is on
```

```
*Aug 15 00:08:37.992: PIM(4): Building Periodic (*,G) Join / (S,G,RP-bit) Prune message for
239.1.1.1 *Aug 15 00:08:37.993: PIM(4) Twheel Start: Neighbor Timer for Mbr: 192.168.10.1. idb
LISP0.4099. delay: 120000 ms. jitter 0.
```

...

## PIM-toetreding ontvangen op RP

PIM-lidmaatschap wordt ontvangen op RP (SDA-BORDER-1) van LHR (SDA-EDGE-1) via de LISP-interface

```
SDA-Border1#debug ip pim vrf Campus 239.1.1.1
PIM debugging is on
```

```
*Aug 18 01:47:14.812: PIM(4): J/P Transport Attribute, Transport Type: Unicast
*Aug 18 01:47:14.813: PIM(4): Join-list: (*, 239.1.1.1), RPT-bit set, WC-bit set, S-bit set
*Aug 18 01:47:14.813: PIM(4): Check RP 192.168.50.1 into the (*, 239.1.1.1) entry
*Aug 18 01:47:14.813: PIM(4): Adding register decap tunnel (Tunnel1) as accepting interface of
(*, 239.1.1.1).
*Aug 18 01:47:14.813: PIM(4): Add LISP0.4099/192.168.10.3 to (*, 239.1.1.1), Forward state, by
PIM *G Join <<<<<<<<<< (*,G) join received from RLOC of LHR over LISP Interface
```

```
*Aug 18 01:48:14.267: PIM(4): J/P Transport Attribute, Transport Type: Unicast
*Aug 18 01:48:14.267: PIM(4): Join-list: (*, 239.1.1.1), RPT-bit set, WC-bit set, S-bit set
*Aug 18 01:48:14.267: PIM(4): Update LISP0.4099/192.168.10.3 to (*, 239.1.1.1), Forward state,
by PIM *G Join
```

```
SDA-Border1#show ip mroute vrf Campus 239.1.1.1
IP Multicast Routing Table
```

```
(*, 239.1.1.1), 00:01:38/00:02:51, RP 192.168.50.1, flags: S
  Incoming interface: Null, RPF nbr 0.0.0.0 <<<<<<<<<<<<<<<<<<<<<< RP is
  myself hence RPF Neighbor is Null
  Outgoing interface list:
    LISP0.4099, 192.168.10.3, Forward/Sparse, 00:01:38/00:02:51 <<<<<<<<<<<<<<<<<<<<<< Outgoing
  Interface is set towards LHR RLOC
```

RP (Border1) stuurt geen verbindingen via de LISP-interface, zodat er geen PIM buurman wordt gecreëerd op de RP via de LISP-interface.

In ons geval is de enige buurman PIM richting Fusion-1 via een niet-LISP interface en gevormd door de periodieke pakketten die PIM Hallo worden ontvangen.

```
SDA-Border1#debug ip pim vrf Campus hello
```

```
PIM-HELLO debugging is on
SDA-Border1#
*Aug 24 00:02:19.944: PIM(4): Received v2 hello on Vlan3002 from 10.50.50.6
*Aug 24 00:02:19.944: PIM(4): Neighbor (10.50.50.6) Hello GENID = 1315387214
SDA-Border1#
*Aug 24 00:02:49.396: PIM(4): Received v2 hello on Vlan3002 from 10.50.50.6
*Aug 24 00:02:49.397: PIM(4): Neighbor (10.50.50.6) Hello GENID = 1315387214
```

```
SDA-Border1#show ip pim vrf Campus neigh
PIM Neighbor Table
```

Neighbor Address	Interface	Uptime/Expires	Ver	DR Prio/Mode
10.50.50.6	Vlan3002	2w0d/00:01:31	v2	1 / DR S P G

## PIM-buurman bij Fusion routers

PIM-buren op Fusion Routers zijn te groot voor niet-LISP interfaces en worden dus ook aangemaakt op basis van de periodieke PIM Hallo's ontvangen.

### SDA-FUSION-1

```
SDA-Fusion1#show ip pim vrf Campus neighbor
PIM Neighbor Table
```

Neighbor Address	Interface	Uptime/Expires	Ver	DR Prio/Mode
10.40.40.6	Vlan100	5d00h/00:01:41	v2	1 / S P G
10.50.50.5	Vlan3002	2w4d/00:01:44	v2	1 / S P G

### SDA-FUSION-2

```
SDA-Fusion2#show ip pim vrf Campus neighbor
PIM Neighbor Table
```

Neighbor Address	Interface	Uptime/Expires	Ver	DR Prio/Mode
10.50.50.25	Gi0/0/0.3007	2w5d/00:01:36	v2	1 / S P G
10.40.40.5	GigabitEthernet0/0/2.100	5d00h/00:01:23	v2	100/ DR S P G

## PIM-register op RP van FHR

Wanneer de Bron verkeer voor de groep begint te verzenden, registreert de FHR (SDA-FUSION-2) de (S,G) bij de RP wanneer zij het eerste multicast pakket van de Bron ontvangt - en als FHR de DR op dat segment is.

```
SDA-Fusion2#show ip pim vrf Campus rp mapping 239.1.1.1
PIM Group-to-RP Mappings
```

```
Group(s): 224.0.0.0/4, Static
```

```
RP: 192.168.50.1 (?)
```

```
<<<<<<<< RP for the Group
```

```
SDA-Fusion2#show ip cef vrf Campus 192.168.50.1
```

```
192.168.50.1/32
```

```
nexthop 10.40.40.5 GigabitEthernet0/0/2.100
```

```
<<<<<<<< Next-hop Interface towards RP
```

SDA-Fusion2#**debug ip mrouting vrf Campus**

IP multicast routing debugging is on

SDA-Fusion2#**debug ip pim vrf Campus**

PIM debugging is on

```
*Aug 22 21:59:42.601: PIM(2): Check RP 192.168.50.1 into the (*, 239.1.1.1) entry
*Aug 22 21:59:42.601: MRT(2): (*,239.1.1.1), RPF change from /0.0.0.0 to
GigabitEthernet0/0/2.100/10.40.40.5 <<<<<<<< RPF Interface is determined
*Aug 22 21:59:42.601: PIM(2): Building Triggered (*,G) Join / (S,G,RP-bit) Prune message for
239.1.1.1
*Aug 22 21:59:42.601: MRT(2): Create (*,239.1.1.1), RPF (GigabitEthernet0/0/2.100, 10.40.40.5,
1/0)
*Aug 22 21:59:42.602: MRT(2): (10.40.40.1,239.1.1.1), RPF install from /0.0.0.0 to
GigabitEthernet1/0/2/0.0.0.0
*Aug 22 21:59:42.602: PIM(2): Adding register encap tunnel (Tunnel0) as forwarding interface of
(10.40.40.1, 239.1.1.1). <<<<<< Register Tunnel is created
*Aug 22 21:59:42.602: MRT(2): Set the F-flag for (*, 239.1.1.1)
*Aug 22 21:59:42.602: MRT(2): Set the F-flag for (10.40.40.1, 239.1.1.1)
<<<<<<<< Register(F) flag is set
*Aug 22 21:59:42.602: MRT(2): Create (10.40.40.1,239.1.1.1), RPF (GigabitEthernet1/0/2, 0.0.0.0,
0/0) <<<<<<<< (S,G) is created
*Aug 22 21:59:42.602: MRT(2): Set the T-flag for (10.40.40.1, 239.1.1.1)
<<<<<<<< SPT (T) flag is set
*Aug 22 21:59:42.629: PIM(2): Received v2 Join/Prune on GigabitEthernet0/0/2.100 from
10.40.40.5, to us
*Aug 22 21:59:42.629: PIM(2): Join-list: (10.40.40.1/32, 239.1.1.1), S-bit set
<<<<<<<< (S,G) join is received
*Aug 22 21:59:42.629: MRT(2): WAVL Insert interface: GigabitEthernet0/0/2.100 in
(10.40.40.1,239.1.1.1) Successful

*Aug 22 21:59:42.630: MRT(2): set min mtu for (10.40.40.1, 239.1.1.1) 18010->1500
*Aug 22 21:59:42.630: MRT(2): Add GigabitEthernet0/0/2.100/239.1.1.1 to the olist of
(10.40.40.1, 239.1.1.1), Forward state - MAC built
*Aug 22 21:59:42.630: PIM(2): Add GigabitEthernet0/0/2.100/10.40.40.5 to (10.40.40.1,
239.1.1.1), Forward state, by PIM SG Join
*Aug 22 21:59:42.630: MRT(2): Add GigabitEthernet0/0/2.100/239.1.1.1 to the olist of
(10.40.40.1, 239.1.1.1), Forward state - MAC built
*Aug 22 21:59:42.630: MRT(2): Set the PIM interest flag for (10.40.40.1, 239.1.1.1)
```

SDA-Fusion2#**show ip mroute vrf Campus 239.1.1.1**

IP Multicast Routing Table

```
(*, 239.1.1.1), 00:01:17/stopped, RP 192.168.50.1, flags: SPF
Incoming interface: GigabitEthernet0/0/2.100, RPF nbr 10.40.40.5
Outgoing interface list: Null

(10.40.40.1, 239.1.1.1), 00:01:17/00:02:14, flags: FT
Incoming interface: GigabitEthernet1/0/2, RPF nbr 0.0.0.0 <<<<<<<< RPF neighbor is
0.0.0.0 as the Source is directly connected
Outgoing interface list:
Gi0/0/0.3007, Forward/Sparse, 00:01:17/00:03:10
```

SDA-Fusion2# SDA-Fusion2#**show interface tunnel 0** <<<<<<<< Register Tunnel is created

between FHR and RP

Tunnel0 is up, line protocol is up

Hardware is Tunnel

Description: **Pim Register Tunnel (Encap) for RP 192.168.50.1 on VRF Campus**

Interface is unnumbered. Using address of GigabitEthernet0/0/2.100 (10.40.40.6)

MTU 9972 bytes, BW 100 Kbit/sec, DLY 50000 usec,

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

Encapsulation TUNNEL, loopback not set

Keepalive not set

Tunnel linestate evaluation up

Tunnel source 10.40.40.6 (GigabitEthernet0/0/2.100), destination 192.168.50.1

RP (BORDER-1) ontvangt het register van de FHR, waardoor een (S,G)-toetreding naar de FHR wordt gestuurd, en ook een "Register-Stop" naar de FHR - zodra de stroom op de RP wordt ontvangen.

SDA-Border1#**debug ip mrouting vrf Campus 239.1.1.1**

IP multicast routing debugging is on

```
*Aug 18 02:29:05.186: PIM(4): Received v2 Register on Vlan3002 from 10.40.40.6
<<<<<< PIM Register is received from FHR
*Aug 18 02:29:05.186:      for 10.40.40.1, group 239.1.1.1
*Aug 18 02:29:05.187: PIM(4): Adding register decap tunnel (Tunnel1) as accepting interface of
(10.40.40.1, 239.1.1.1). <<<<<< Register tunnel is created
*Aug 18 02:29:05.187: MRT(4): (10.40.40.1,239.1.1.1), RPF install from /0.0.0.0 to
Vlan3002/10.50.50.6
*Aug 18 02:29:05.188: MRT(4): Create (10.40.40.1,239.1.1.1), RPF (Vlan3002, 10.50.50.6, 20/0)
<<<<<< (S,G) is created and RPF is resolved
*Aug 18 02:29:05.188: MRT(4): WAVL Insert LISP interface: LISP0.4099 in (10.40.40.1,239.1.1.1)
Next-hop: 192.168.10.3 Outer-source: 0.0.0.0 Successful
*Aug 18 02:29:05.188: MRT(4): set min mtu for (10.40.40.1, 239.1.1.1) 18010->17892
*Aug 18 02:29:05.189: MRT(4): Add LISP0.4099/192.168.10.3 to the olist of (10.40.40.1,
239.1.1.1), Forward state - MAC not built <<<<<< LISP OIF is inherited from (*,G)
*Aug 18 02:29:05.189: PIM(4): Insert (10.40.40.1,239.1.1.1) join in nbr 10.50.50.6's queue
*Aug 18 02:29:05.189: PIM(4): Building Join/Prune packet for nbr 10.50.50.6
*Aug 18 02:29:05.189: PIM(4): Adding v2 (10.40.40.1/32, 239.1.1.1), S-bit Join
*Aug 18 02:29:05.189: PIM(4): Send v2 join/prune to 10.50.50.6 (Vlan3002)
<<<<<< (S,G) join is sent towards the Source
*Aug 18 02:29:05.272: PIM(4): J/P Transport Attribute, Transport Type: Unicast
*Aug 18 02:29:05.272: PIM(4): Join-list: (*, 239.1.1.1), RPT-bit set, WC-bit set, S-bit set
*Aug 18 02:29:05.272: PIM(4): Update LISP0.4099/192.168.10.3 to (*, 239.1.1.1), Forward state,
by PIM *G Join
*Aug 18 02:29:05.272: MRT(4): Update LISP0.4099/192.168.10.3 in the olist of (*, 239.1.1.1),
Forward state - MAC not built
*Aug 18 02:29:05.272: PIM(4): Prune-list: (10.40.40.1/32, 239.1.1.1) RPT-bit set
*Aug 18 02:29:05.273: PIM(4): Prune LISP0.4099/192.168.10.3 from (10.40.40.1/32, 239.1.1.1)
<<<<<< (S,G) Prune is received from Edgel
*Aug 18 02:29:05.273: MRT(4): Delete LISP0.4099/192.168.10.3 from the olist of (10.40.40.1,
239.1.1.1)
*Aug 18 02:29:05.273: PIM(4): Insert (10.40.40.1,239.1.1.1) prune in nbr 10.50.50.6's queue -
deleted

*Aug 18 02:29:05.273: PIM(4): Building Join/Prune packet for nbr 10.50.50.6
*Aug 18 02:29:05.273: PIM(4): Adding v2 (10.40.40.1/32, 239.1.1.1), S-bit Prune
*Aug 18 02:29:05.273: PIM(4): Send v2 join/prune to 10.50.50.6 (Vlan3002)
*Aug 18 02:29:05.439: PIM(4): J/P Transport Attribute, Transport Type: Unicast

*Aug 18 02:29:07.193: PIM(4): Received v2 Register on Vlan3002 from 10.40.40.6
*Aug 18 02:29:07.193:      for 10.40.40.1, group 239.1.1.1
*Aug 18 02:29:07.194: PIM(4): Send v2 Register-Stop to 10.40.40.6 for 10.40.40.1, group
239.1.1.1
<<<<<< Register-Stop is sent towards FHR
```

SDA-Border1#**show ip mroute vrf Campus 239.1.1.1**

IP Multicast Routing Table

```
(*, 239.1.1.1), 00:51:28/00:02:44, RP 192.168.50.1, flags: S
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
```





```
balancing towards 2 Proxy ETR-s
  nexthop 192.168.10.2 LISP0.4099
  2 IPL sources [no flags]
  nexthop 192.168.10.1 LISP0.4099
  nexthop 192.168.10.2 LISP0.4099
```

```
SDA-Edge1#show ip cef vrf Campus exact-route 192.168.50.2 10.40.40.1      <<<<<<<<<< CEF
hashing points towards Border-2
192.168.50.2 -> 10.40.40.1 =>IP adj out of GigabitEthernet1/0/11, addr 192.168.23.2
```

```
SDA-Edge1#show ip rpf vrf Campus 10.40.40.1
RPF information for ? (10.40.40.1)
  RPF interface: LISP0.4099
  RPF neighbor: ? (192.168.10.2)      <<<<<<<<<< Hence
SPT Join is sent towards Border-2
RPF route/mask: 0.0.0.0/1
RPF type: unicast ()
Doing distance-preferred lookups across tables
RPF topology: ipv4 multicast base
SDA-Edge1#
```

Aangezien de (S,G)-aansluiting via de LISP-interface naar Border-2 wordt verzonden, wordt een nieuwe PIM-buurman aangemaakt op Edge-1

```
SDA-Edge1#show ip pim vrf Campus neighbor
PIM Neighbor Table
```

Neighbor Address	Interface	Uptime/Expires	Ver	DR Prio/Mode	
192.168.10.2	LISP0.4099	00:07:32/00:01:22	v2	0 /	<<<<<<<< Neighbor
towards Border-2	is created				
192.168.10.1	LISP0.4099	2w1d/00:01:58	v2	0 /	

Aangezien border-2 in het Data Path voor de multicast-stroom is, moet het expliciete RLOC-tracering uitvoeren om de RLOC van Downstream XTR-s te volgen voor Unicast-replicatie van de pakketten.

```
SDA-Border2#show ip mroute vrf Campus 239.1.1.1
IP Multicast Routing Table
```

```
(*, 239.1.1.1), 00:23:00/stopped, RP 192.168.50.1, flags: SP
  Incoming interface: LISP0.4099, RPF nbr 192.168.10.1
  Outgoing interface list: Null

(10.40.40.1, 239.1.1.1), 00:12:35/00:02:52, flags: T      <<<<<<< SPT flag is set
  Incoming interface: Vlan3007, RPF nbr 10.50.50.26      <<<<<<< RPF neighbor is
based on RPF towards the Source - must be a PIM neighbor
  Outgoing interface list:
    LISP0.4099, 192.168.10.3, Forward/Sparse, 00:12:35/00:02:45      <<<<<<< OIL created from
(S,G) join received from LHR and containing LHR's RLOC info which has to be tracked
```

```
SDA-Border2#show ip mfib vrf Campus 239.1.1.1 10.40.40.1
Entry Flags:      C - Directly Connected, S - Signal, IA - Inherit A flag,
                  ET - Data Rate Exceeds Threshold, K - Keepalive
                  DDE - Data Driven Event, HW - Hardware Installed
                  ME - MoFRR ECMP entry, MNE - MoFRR Non-ECMP entry, MP - MFIB
                  MoFRR Primary, RP - MRIB MoFRR Primary, P - MoFRR Primary
                  MS - MoFRR Entry in Sync, MC - MoFRR entry in MoFRR Client.
```

I/O Item Flags: IC - Internal Copy, NP - Not platform switched,  
NS - Negate Signalling, SP - Signal Present,  
A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB Forward,  
MA - MFIB Accept, A2 - Accept backup,  
RA2 - MRIB Accept backup, MA2 - MFIB Accept backup

**Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second**

Other counts: Total/RPF failed/Other drops

I/O Item Counts: FS Pkt Count/PS Pkt Count

VRF Campus

(10.40.40.1,239.1.1.1) Flags: HW

SW Forwarding: 0/0/0/0, Other: 0/0/0

**HW Forwarding: 176/0/122/0**, Other: 0/0/0

<<<<<<< Multicast stream is

forwarded in h/w

Vlan3007 Flags: A

LISP0.4099, 192.168.10.3 Flags: F NS

Pkts: 0/0

**SDA-Border2#sh ip mfib vrf Campus 239.1.1.1 10.40.40.1 count**

Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second

Other counts: Total/RPF failed/Other drops(OIF-null, rate-limit etc)

VRF Campus

6 routes, 2 (\*,G)s, 3 (\*,G/m)s

Group: 239.1.1.1

Source: 10.40.40.1,

SW Forwarding: 0/0/0/0, Other: 0/0/0

**HW Forwarding: 182/0/122/0**, Other: 0/0/0

<<<<<<< Counter is

incrementing

Totals - Source count: 1, Packet count: 182

Groups: 1, 1.00 average sources per group

SDA-Border2#