

Routage multidiffusion - Passage en revue des protocoles MSDP et PIM

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Introduction

Ce document décrit le fonctionnement des protocoles PIM (Protocol Independent Multicast) et MSDP (Multicast Source Discovery Protocol) avec l'utilisation d'une topologie de multidiffusion simple. Ceci est utile afin de comprendre le fonctionnement du plan de contrôle et la séquence d'événements à partir du moment où une source est enregistrée jusqu'au moment où le récepteur commence à recevoir des paquets de multidiffusion.

Note: Les périphériques utilisés dans ce document exécutent Cisco IOS® version 15.3M dans un environnement de travaux pratiques.

Topologie

Le système autonome AS65000 de gauche contient la source de multidiffusion. R1 agit en tant que routeur de premier saut (FHR) et enregistre la source (10.1.1.1) avec le point de rendez-vous PIM (PIM RP) R3. R7 et R3 sont des voisins iBGP et R3-R4 et R7-R6 sont des voisins eBGP. R7 et R6 sont configurés pour être le chemin préféré entre les deux systèmes autonomes. Dans AS64999, R5 a un récepteur connecté localement. R5 est configuré pour utiliser R4 comme RP PIM.

Plan de contrôle

La vidéo présente les messages envoyés et le moment où ils sont envoyés. Regardez cette vidéo et la lecture pour obtenir des descriptions détaillées à chaque étape.

Enregistrement de la source (étapes 1 à 3)

La source commence à envoyer des données de multidiffusion à 239.1.1.1. À la réception de ces données, R1 (qui est le routeur désigné (DR) PIM pour le segment) prend le paquet de multidiffusion et génère un message de registre PIM.

Le message d'enregistrement est un paquet PIM de monodiffusion envoyé de R1 à R3 afin d'informer le RP PIM de la source.

```
R1#
*May 21 14:54:08.461: PIM(0): Check RP 10.10.10.10 into the (*, 239.1.1.1) entry
*May 21 14:54:08.461: PIM(0): Building Triggered (*,G) Join / (S,G,RP-bit) Prune message
for 239.1.1.1
*May 21 14:54:08.461: PIM(0): Adding register encaps tunnel (Tunnel0) as forwarding
interface of (10.1.1.1, 239.1.1.1).
```

Maintenant, le RP PIM, R3 reçoit le message d'enregistrement et répond avec register-stop. R3 envoie également un message SA MSDP à R4 via MSDP. L'indicateur A sur le mroute signifie qu'il est candidat à l'annonce MSDP. L'indicateur « P » indique qu'il a été élagué parce que vous n'avez pas de récepteur ou d'interface sortante pour le groupe.

```
R3#
*May 21 14:54:08.459: PIM(0): Received v2 Register on Ethernet1/0 from 10.0.12.1
*May 21 14:54:08.459:           for 10.1.1.1, group 239.1.1.1
*May 21 14:54:08.459: PIM(0): Check RP 10.10.10.10 into the (*, 239.1.1.1) entry
*May 21 14:54:08.459: PIM(0): Adding register decap tunnel (Tunnel1) as accepting
interface of (*, 239.1.1.1).
*May 21 14:54:08.459: PIM(0): Adding register decap tunnel (Tunnel1) as accepting
interface of (10.1.1.1, 239.1.1.1).
*May 21 14:54:08.459: PIM(0): Send v2 Register-Stop to 10.0.12.1 for 10.1.1.1,
group 239.1.1.1
```

```
R3#show ip mroute 239.1.1.1
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       G - Received BGP C-Mroute, g - Sent BGP C-Mroute,
       Q - Received BGP S-A Route, q - Sent BGP S-A Route,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 239.1.1.1), 00:00:33/stopped, RP 10.10.10.10, flags: SP
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list: Null
```

```
(10.1.1.1, 239.1.1.1), 00:00:33/00:02:26, flags: PA
Incoming interface: Ethernet1/0, RPF nbr 10.0.37.7
Outgoing interface list: Null
```

```
R3#show ip msdp sa-cache
MSDP Source-Active Cache - 0 entries
R3#
*May 21 14:54:58.511: MSDP(0): (10.1.1.1/32, 239.1.1.1)
```

Ici, R1 reçoit l'arrêt de registre de R3.

```
*May 21 14:54:08.461: PIM(0): Received v2 Register-Stop on Ethernet0/0 from 10.10.10.10
*May 21 14:54:08.461: PIM(0):   for source 10.1.1.1, group 239.1.1.1
*May 21 14:54:08.461: PIM(0): Removing register encaps tunnel (Tunnel0) as forwarding
interface of (10.1.1.1, 239.1.1.1).
*May 21 14:54:08.461: PIM(0): Clear Registering flag to 10.10.10.10 for
(10.1.1.1/32, 239.1.1.1)
```

Sur R4, vous pouvez voir qu'il n'y a pas d'état mroute, mais vous avez une SA MSDP.

```
R4#show ip mroute
```

```
*May 21 14:54:58.591: MSDP(0): (10.1.1.1/32, 239.1.1.1), accepted
```

```
R4#show ip mroute
```

```
IP Multicast Routing Table
```

```
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       G - Received BGP C-Mroute, g - Sent BGP C-Mroute,
       Q - Received BGP S-A Route, q - Sent BGP S-A Route,
       V - RD & Vector, v - Vector
```

```
Outgoing interface flags: H - Hardware switched, A - Assert winner
```

```
Timers: Uptime/Expires
```

```
Interface state: Interface, Next-Hop or VCD, State/Mode
```

```
(* , 224.0.1.40), 00:35:32/00:02:31, RP 10.20.20.20, flags: SJCL
```

```
Incoming interface: Null, RPF nbr 0.0.0.0
```

```
Outgoing interface list:
```

```
Ethernet1/0, Forward/Sparse, 00:23:16/00:02:36
```

```
Loopback0, Forward/Sparse, 00:35:31/00:02:31
```

```
R4#show ip msdp sa-cache
```

```
MSDP Source-Active Cache - 1 entries
```

```
(10.1.1.1, 239.1.1.1), RP 10.10.10.10, BGP/AS 65000, 00:01:00/00:05:49, Peer 10.33.33.33
```

Groupe Reçus (étapes 4 à 11)

R5 reçoit une jointure IGMP sur son interface et crée un paquet de jointure PIM (*, G join). La jointure est envoyée à R6.

```
R5#conf t
```

```
Enter configuration commands, one per line. End with CNTL/Z.
```

```
R5(config)#int e0/1
```

```
R5(config-if)#ip igmp join-group 239.1.1.1
```

```
R5(config-if)#
```

```
*May 21 14:56:43.234: PIM(0): Check RP 10.20.20.20 into the (*, 239.1.1.1) entry
```

```
*May 21 14:56:43.234: PIM(0): Building Triggered (*,G) Join / (S,G,RP-bit) Prune message
for 239.1.1.1
```

```
*May 21 14:56:43.234: PIM(0): Building Triggered (*,G) Join / (S,G,RP-bit) Prune message
for 239.1.1.1
```

```
*May 21 14:56:43.234: PIM(0): Insert (*,239.1.1.1) join in nbr 10.0.56.6's queue
```

```
*May 21 14:56:43.246: PIM(0): Building Join/Prune packet for nbr 10.0.56.6
```

```
*May 21 14:56:43.246: PIM(0): Adding v2 (10.20.20.20/32, 239.1.1.1), WC-bit, RPT-bit,
S-bit Join
```

```
*May 21 14:56:43.246: PIM(0): Send v2 join/prune to 10.0.56.6 (Ethernet0/0)
```

R6 reçoit la jointure (*, G) PIM de R5 et envoie la jointure (*, G) au RP PIM R4.

```
R6#
*May 21 14:56:43.248: PIM(0): Received v2 Join/Prune on Ethernet2/0 from 10.0.56.5,
to us
*May 21 14:56:43.248: PIM(0): Join-list: (*, 239.1.1.1), RPT-bit set, WC-bit set,
S-bit set
*May 21 14:56:43.248: PIM(0): Check RP 10.20.20.20 into the (*, 239.1.1.1) entry
*May 21 14:56:43.248: PIM(0): Building Triggered (*,G) Join / (S,G,RP-bit) Prune
message for 239.1.1.1
*May 21 14:56:43.248: PIM(0): Add Ethernet2/0/10.0.56.5 to (*, 239.1.1.1), Forward
state, by PIM *G Join
*May 21 14:56:43.248: PIM(0): Building Triggered (*,G) Join / (S,G,RP-bit) Prune
message for 239.1.1.1
*May 21 14:56:43.248: PIM(0): Insert (*,239.1.1.1) join in nbr 10.0.46.4's queue
*May 21 14:56:43.248: PIM(0): Building Join/Prune packet for nbr 10.0.46.4
*May 21 14:56:43.248: PIM(0): Adding v2 (10.20.20.20/32, 239.1.1.1), WC-bit,
RPT-bit, S-bit Join
*May 21 14:56:43.248: PIM(0): Send v2 join/prune to 10.0.46.4 (Ethernet1/0)
```

R4 PIM RP reçoit la jointure (*, G) de R6. Il envoie ensuite une jointure (S, G) vers la source 10.1.1.1, qui retourne à R6.

```
R4#
*May 21 14:56:43.331: PIM(0): Received v2 Join/Prune on Ethernet1/0 from 10.0.46.6,
to us
*May 21 14:56:43.331: PIM(0): Join-list: (*, 239.1.1.1), RPT-bit set, WC-bit set,
S-bit set
*May 21 14:56:43.331: PIM(0): Check RP 10.20.20.20 into the (*, 239.1.1.1) entry
*May 21 14:56:43.331: PIM(0): Adding register decap tunnel (Tunnell) as accepting
interface of (*, 239.1.1.1).
*May 21 14:56:43.331: PIM(0): Add Ethernet1/0/10.0.46.6 to (*, 239.1.1.1), Forward
state, by PIM *G Join
*May 21 14:56:43.331: PIM(0): Adding register decap tunnel (Tunnell) as accepting
interface of (10.1.1.1, 239.1.1.1).
*May 21 14:56:43.331: PIM(0): Insert (10.1.1.1,239.1.1.1) join in nbr 10.0.46.6's queue
R4#
*May 21 14:56:43.331: PIM(0): Building Join/Prune packet for nbr 10.0.46.6
*May 21 14:56:43.331: PIM(0): Adding v2 (10.1.1.1/32, 239.1.1.1), S-bit Join
*May 21 14:56:43.331: PIM(0): Send v2 join/prune to 10.0.46.6 (Ethernet1/0)
```

R6 reçoit la jointure (S, G) de R4, puis envoie une jointure (S, G) vers R7 dans AS65000. Lorsque la jointure (S, G) est reçue de R4, R6 envoie une élingue (SGR) à R4 (ÉTAPE 9). Ceci est fait pour éviter les paquets en double sur R4.

```
*May 21 14:56:43.248: PIM(0): Received v2 Join/Prune on Ethernet1/0 from 10.0.46.4,
to us
*May 21 14:56:43.248: PIM(0): Join-list: (10.1.1.1/32, 239.1.1.1), S-bit set
*May 21 14:56:43.248: PIM(0): Add Ethernet1/0/10.0.46.4 to (10.1.1.1, 239.1.1.1),
Forward state, by PIM SG Join
*May 21 14:56:43.248: PIM(0): Insert (10.1.1.1,239.1.1.1) join in nbr 10.0.67.7's queue
R6#
*May 21 14:56:43.248: PIM(0): Building Join/Prune packet for nbr 10.0.67.7
*May 21 14:56:43.248: PIM(0): Adding v2 (10.1.1.1/32, 239.1.1.1), S-bit Join
*May 21 14:56:43.248: PIM(0): Send v2 join/prune to 10.0.67.7 (Ethernet0/0)
R6#
*May 21 14:56:44.476: PIM(0): Insert (10.1.1.1,239.1.1.1) sgr prune in nbr 10.0.46.4's
queue
*May 21 14:56:44.476: PIM(0): Building Join/Prune packet for nbr 10.0.46.4
*May 21 14:56:44.476: PIM(0): Adding v2 (10.1.1.1/32, 239.1.1.1), RPT-bit, S-bit Prune
```

*May 21 14:56:44.476: PIM(0): Send v2 join/prune to 10.0.46.4 (Ethernet1/0)

R7 reçoit la jointure (S, G) de R6, puis envoie la jointure (S, G) à R2 en suivant la route vers la source.

R7#

*May 21 14:56:43.241: PIM(0): Received v2 Join/Prune on Ethernet0/0 from 10.0.67.6, to us

*May 21 14:56:43.241: PIM(0): Join-list: (10.1.1.1/32, 239.1.1.1), S-bit set

May 21 14:56:43.241: PIM(0): Check RP 10.10.10.10 into the (, 239.1.1.1) entry

May 21 14:56:43.241: PIM(0): Building Triggered (,G) Join / (S,G,RP-bit) Prune message for 239.1.1.1

*May 21 14:56:43.241: PIM(0): Add Ethernet0/0/10.0.67.6 to (10.1.1.1, 239.1.1.1), Forward state, by PIM SG Join

*May 21 14:56:43.241: PIM(0): Insert (10.1.1.1,239.1.1.1) join in nbr 10.0.27.2's queue

*May 21 14:56:43.241: PIM(0): Building Join/Prune packet for nbr 10.0.27.2

R7#

*May 21 14:56:43.241: PIM(0): Adding v2 (10.1.1.1/32, 239.1.1.1), S-bit Join

*May 21 14:56:43.241: PIM(0): Send v2 join/prune to 10.0.27.2 (Ethernet2/0)

R7#show ip mroute

IP Multicast Routing Table

Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,

L - Local, P - Pruned, R - RP-bit set, F - Register flag,

T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,

X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,

U - URD, I - Received Source Specific Host Report,

Z - Multicast Tunnel, z - MDT-data group sender,

Y - Joined MDT-data group, y - Sending to MDT-data group,

G - Received BGP C-Mroute, g - Sent BGP C-Mroute,

Q - Received BGP S-A Route, q - Sent BGP S-A Route,

V - RD & Vector, v - Vector

Outgoing interface flags: H - Hardware switched, A - Assert winner

Timers: Uptime/Expires

Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 239.1.1.1), 00:03:33/stopped, RP 10.10.10.10, flags: SP

Incoming interface: Ethernet1/0, RPF nbr 10.0.37.3

Outgoing interface list: Null

(10.1.1.1, 239.1.1.1), 00:03:33/00:02:56, flags: T

Incoming interface: Ethernet2/0, RPF nbr 10.0.27.2

Outgoing interface list:

Ethernet0/0, Forward/Sparse, 00:03:33/00:02:53

R2 reçoit la jointure (S, G) de R7, puis envoie la jointure (S, G) à R1 en suivant la route vers la source

R2#

*May 21 14:56:43.253: PIM(0): Received v2 Join/Prune on Ethernet1/0 from 10.0.27.7, to us

*May 21 14:56:43.253: PIM(0): Join-list: (10.1.1.1/32, 239.1.1.1), S-bit set

May 21 14:56:43.253: PIM(0): Check RP 10.10.10.10 into the (, 239.1.1.1) entry

May 21 14:56:43.253: PIM(0): Building Triggered (,G) Join / (S,G,RP-bit) Prune message for 239.1.1.1

*May 21 14:56:43.253: PIM(0): Add Ethernet1/0/10.0.27.7 to (10.1.1.1, 239.1.1.1), Forward state, by PIM SG Join

*May 21 14:56:43.253: PIM(0): Insert (10.1.1.1,239.1.1.1) join in nbr 10.0.12.1's queue

*May 21 14:56:43.253: PIM(0): Building Join/Prune packet for nbr 10.0.12.1

R2#

*May 21 14:56:43.253: PIM(0): Adding v2 (10.1.1.1/32, 239.1.1.1), S-bit Join

*May 21 14:56:43.253: PIM(0): Send v2 join/prune to 10.0.12.1 (Ethernet0/0)

```

R2#show ip mroute
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
      L - Local, P - Pruned, R - RP-bit set, F - Register flag,
      T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
      X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
      U - URD, I - Received Source Specific Host Report,
      Z - Multicast Tunnel, z - MDT-data group sender,
      Y - Joined MDT-data group, y - Sending to MDT-data group,
      G - Received BGP C-Mroute, g - Sent BGP C-Mroute,
      Q - Received BGP S-A Route, q - Sent BGP S-A Route,
      V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode

```

```

(*, 239.1.1.1), 00:01:27/stopped, RP 10.10.10.10, flags: SP
Incoming interface: Ethernet1/0, RPF nbr 10.0.27.7
Outgoing interface list: Null

```

```

(10.1.1.1, 239.1.1.1), 00:01:27/00:01:32, flags: T
Incoming interface: Ethernet0/0, RPF nbr 10.0.12.1
Outgoing interface list:
  Ethernet1/0, Forward/Sparse, 00:01:27/00:03:01

```

R1 reçoit la jointure (S, G) de R2 et ajoute l'interface à la liste des interfaces sortantes

```

*May 21 14:56:43.261: PIM(0): Received v2 Join/Prune on Ethernet0/0 from 10.0.12.2,
to us
*May 21 14:56:43.261: PIM(0): Join-list: (10.1.1.1/32, 239.1.1.1), S-bit set
*May 21 14:56:43.261: PIM(0): Add Ethernet0/0/10.0.12.2 to (10.1.1.1, 239.1.1.1),
Forward state, by PIM SG Join

```

```

R1#show ip mroute
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
      L - Local, P - Pruned, R - RP-bit set, F - Register flag,
      T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
      X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
      U - URD, I - Received Source Specific Host Report,
      Z - Multicast Tunnel, z - MDT-data group sender,
      Y - Joined MDT-data group, y - Sending to MDT-data group,
      G - Received BGP C-Mroute, g - Sent BGP C-Mroute,
      Q - Received BGP S-A Route, q - Sent BGP S-A Route,
      V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode

```

```

(*, 239.1.1.1), 00:03:25/stopped, RP 10.10.10.10, flags: SPF
Incoming interface: Ethernet0/0, RPF nbr 10.0.12.2
Outgoing interface list: Null

```

```

(10.1.1.1, 239.1.1.1), 00:03:25/00:03:24, flags: FT
Incoming interface: Ethernet0/1, RPF nbr 0.0.0.0
Outgoing interface list:
  Ethernet0/0, Forward/Sparse, 00:00:50/00:02:39

```

À ce stade, les données circulent de la source jusqu'au récepteur. À la réception d'un paquet de données, R5 passe de l'arborescence (*, G) à l'arborescence (S, G).

```
R5#
*May 21 14:56:44.494: PIM(0): Insert (10.1.1.1,239.1.1.1) join in nbr 10.0.56.6's queue
*May 21 14:56:44.498: PIM(0): Building Join/Prune packet for nbr 10.0.56.6
*May 21 14:56:44.498: PIM(0): Adding v2 (10.1.1.1/32, 239.1.1.1), S-bit Join
*May 21 14:56:44.498: PIM(0): Send v2 join/prune to 10.0.56.6 (Ethernet0/0)
```

```
R5#show ip mroute
```

```
IP Multicast Routing Table
```

```
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
      L - Local, P - Pruned, R - RP-bit set, F - Register flag,
      T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
      X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
      U - URD, I - Received Source Specific Host Report,
      Z - Multicast Tunnel, z - MDT-data group sender,
      Y - Joined MDT-data group, y - Sending to MDT-data group,
      G - Received BGP C-Mroute, g - Sent BGP C-Mroute,
      Q - Received BGP S-A Route, q - Sent BGP S-A Route,
      V - RD & Vector, v - Vector
```

```
Outgoing interface flags: H - Hardware switched, A - Assert winner
```

```
Timers: Uptime/Expires
```

```
Interface state: Interface, Next-Hop or VCD, State/Mode
```

```
(* , 239.1.1.1), 00:02:47/stopped, RP 10.20.20.20, flags: SJCL
```

```
Incoming interface: Ethernet0/0, RPF nbr 10.0.56.6
```

```
Outgoing interface list:
```

```
Ethernet0/1, Forward/Sparse, 00:02:47/00:02:14
```

```
(10.1.1.1, 239.1.1.1), 00:02:45/00:00:14, flags: LJT
```

```
Incoming interface: Ethernet0/0, RPF nbr 10.0.56.6
```

```
Outgoing interface list:
```

```
Ethernet0/1, Forward/Sparse, 00:02:45/00:02:14
```

R6 reçoit le (S, G) Join de R5 et transmet les paquets de données de E2/0 à R5.

```
R6#
```

```
*May 21 14:56:44.496: PIM(0): Received v2 Join/Prune on Ethernet2/0 from 10.0.56.5,
to us
```

```
*May 21 14:56:44.496: PIM(0): Join-list: (10.1.1.1/32, 239.1.1.1), S-bit set
```

```
*May 21 14:56:44.496: PIM(0): Update Ethernet2/0/10.0.56.5 to (10.1.1.1, 239.1.1.1),
Forward state, by PIM SG Join
```

```
*May 21 14:56:49.056: PIM(0): Received v2 Join/Prune on Ethernet1/0 from 10.0.46.4,
to us
```

```
*May 21 14:56:49.056: PIM(0): Prune-list: (10.1.1.1/32, 239.1.1.1)
```

```
*May 21 14:56:49.056: PIM(0): Prune Ethernet1/0/239.1.1.1 from (10.1.1.1/32, 239.1.1.1)
- deleted
```

```
R6#show ip mroute
```

```
IP Multicast Routing Table
```

```
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
      L - Local, P - Pruned, R - RP-bit set, F - Register flag,
      T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
      X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
      U - URD, I - Received Source Specific Host Report,
      Z - Multicast Tunnel, z - MDT-data group sender,
      Y - Joined MDT-data group, y - Sending to MDT-data group,
      G - Received BGP C-Mroute, g - Sent BGP C-Mroute,
      Q - Received BGP S-A Route, q - Sent BGP S-A Route,
      V - RD & Vector, v - Vector
```

```
Outgoing interface flags: H - Hardware switched, A - Assert winner
```

```
Timers: Uptime/Expires
```

```
Interface state: Interface, Next-Hop or VCD, State/Mode
```

```
(* , 239.1.1.1), 00:03:43/00:02:42, RP 10.20.20.20, flags: S
Incoming interface: Ethernet1/0, RPF nbr 10.0.46.4
Outgoing interface list:
  Ethernet2/0, Forward/Sparse, 00:03:43/00:02:42
```

```
(10.1.1.1, 239.1.1.1), 00:03:43/00:02:46, flags: T
Incoming interface: Ethernet0/0, RPF nbr 10.0.67.7
Outgoing interface list:
  Ethernet2/0, Forward/Sparse, 00:03:43/00:02:44
```

Étape 12 du RP PIM R4 Prunes off (S, G)

Enfin, R4 PIM RP envoie une élingue (S, G) à R6. Notez que l'indicateur « M » est présent sur le mroute (entrée créée par MSDP).

```
R4#
*May 21 14:56:44.559: PIM(0): Received v2 Join/Prune on Ethernet1/0 from 10.0.46.6,
to us
*May 21 14:56:44.559: PIM(0): Prune-list: (10.1.1.1/32, 239.1.1.1) RPT-bit set
*May 21 14:56:44.579: PIM(0): Removing register decap tunnel (Tunnel1) as accepting
interface of (10.1.1.1, 239.1.1.1).
*May 21 14:56:44.579: PIM(0): Installing Ethernet1/0 as accepting interface for
(10.1.1.1, 239.1.1.1).

*May 21 14:56:46.107: MSDP(0): (10.1.1.1/32, 239.1.1.1), accepted

*May 21 14:56:49.139: PIM(0): Insert (10.1.1.1,239.1.1.1) prune in nbr 10.0.46.6's queue
*May 21 14:56:49.139: PIM(0): Building Join/Prune packet for nbr 10.0.46.6
*May 21 14:56:49.139: PIM(0): Adding v2 (10.1.1.1/32, 239.1.1.1), S-bit Prune
*May 21 14:56:49.139: PIM(0): Send v2 join/prune to 10.0.46.6 (Ethernet1/0)
```

```
R4#show ip mroute
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
  L - Local, P - Pruned, R - RP-bit set, F - Register flag,
  T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
  X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
  U - URD, I - Received Source Specific Host Report,
  Z - Multicast Tunnel, z - MDT-data group sender,
  Y - Joined MDT-data group, y - Sending to MDT-data group,
  G - Received BGP C-Mroute, g - Sent BGP C-Mroute,
  Q - Received BGP S-A Route, q - Sent BGP S-A Route,
  V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode
```

```
(* , 239.1.1.1), 00:02:15/00:03:12, RP 10.20.20.20, flags: S
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
  Ethernet1/0, Forward/Sparse, 00:02:15/00:03:12
```

```
(10.1.1.1, 239.1.1.1), 00:02:15/00:02:46, flags: PMT
Incoming interface: Ethernet1/0, RPF nbr 10.0.46.6
Outgoing interface list: Null
```

Ici, l'interface sortante (OIF) E1/0 vers R4 est supprimée de R6.

```
R6#
*May 21 14:56:49.056: PIM(0): Received v2 Join/Prune on Ethernet1/0 from 10.0.46.4, to us
*May 21 14:56:49.056: PIM(0): Prune-list: (10.1.1.1/32, 239.1.1.1)
```


*May 21 14:56:49.056: PIM(0): Prune Ethernet1/0/239.1.1.1 from (10.1.1.1/32, 239.1.1.1)
- deleted
R6#

Résumé

MSDP fournit une méthode pour interconnecter différents domaines PIM qui utilisent chacun leur propre RP. Il est également couramment utilisé pour mettre en oeuvre « Anycast RP » qui n'a pas été traité dans ce document. MSDP et PIM fonctionnent ensemble pour permettre à un récepteur d'un domaine de recevoir le trafic d'une source d'un autre domaine. Les messages SA MSDP permettent aux autres RP d'apprendre des sources dans un autre domaine PIM, tandis que PIM est utilisé pour construire l'arborescence de multidiffusion.

Pour plus de détails sur les opérations de protocole, reportez-vous aux RFC mentionnées dans les informations associées.

Informations connexes

- RFC PIM

<https://tools.ietf.org/html/rfc4601>

- RFC MSDP

<https://tools.ietf.org/html/rfc3618>