

# Multicast-Routing - MSDP und PIM durchlaufen

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## Einführung

Dieses Dokument beschreibt den Betrieb von Protocol Independent Multicast (PIM) und Multicast Source Discovery Protocol (MSDP) unter Verwendung einer einfachen Multicast-Topologie. Dies ist hilfreich, um den Betrieb der Kontrollebene und die Abfolge von Ereignissen zu verstehen, von denen eine Quelle registriert wird, bis der Empfänger beginnt, Multicast-Pakete zu empfangen.

**Hinweis:** Auf den in diesem Dokument verwendeten Geräten wird Cisco IOS® Version 15.3M in einer Laborumgebung ausgeführt.

## Topologie

Das autonome System AS65000 links enthält die Multicast-Quelle. R1 fungiert als First Hop Router (FHR) und registriert die Quelle (10.1.1.1) beim PIM Rendezvous Point (PIM RP) R3. R7 und R3 sind iBGP-Nachbarn, R3-R4 und R7-R6 sind eBGP-Nachbarn. R7 und R6 sind als bevorzugter Pfad zwischen den beiden autonomen Systemen konfiguriert. Im AS6499 verfügt R5 über einen lokal angeschlossenen Receiver. R5 ist so konfiguriert, dass R4 als PIM RP verwendet wird.

## Kontrollebene

Das Video zeigt, welche Nachrichten wann gesendet werden. Sehen Sie sich dieses Video und das Lesen auf an, um ausführliche Beschreibungen in jedem Schritt zu erhalten.

## Quellregistrierung (Schritte 1-3)

Die Quelle sendet Multicast-Daten an 239.1.1.1. Nach Erhalt dieser Daten nimmt R1 (der PIM Designated Router (DR) für das Segment) das Multicast-Paket und erstellt eine PIM-Registernachricht.

Die Registernachricht ist ein Unicast-PIM-Paket, das von R1 an R3 gesendet wird, um den PIM-RP über die Quelle zu informieren.

```
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 encap tunnel (Tunnel0) as forwarding
interface of (10.1.1.1, 239.1.1.1).
```

Jetzt erhält der PIM RP, R3 die Registernachricht und antwortet mit Registerstopp. R3 sendet außerdem über MSDP eine MSDP-SA-Nachricht an R4. Das A-Flag auf der Route bedeutet, dass es für MSDP-Werbung geeignet ist. Das "P"-Flag gibt an, dass das Flag abgeschnitten ist, weil Sie für die Gruppe keine Empfänger- oder Ausgangsschnittstelle haben.

```
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)
```

Hier erhält R1 den Registerstopp von 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 encap 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)
```

**Auf R4 ist kein mroute-Zustand zu sehen, aber es gibt eine MSDP-SA.**

```
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
```

## Empfänger-Joins-Gruppe (Schritte 4 bis 11)

R5 empfängt eine IGMP-Verbindung an seiner Schnittstelle und erstellt ein PIM-Join-Paket (\*,G-Join). Das Join wird an R6 gesendet.

```
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 empfängt das (\*,G) PIM-Join von R5 und sendet (\*,G) Join an R4 PIM RP.

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 empfängt das (\*,G) Join von R6. Anschließend sendet er eine (S,G)-Join-Nachricht an  
die Quelle 10.1.1.1, die zurück zu R6 geht.**

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 empfängt die (S,G)-Join-Nachricht von R4 und sendet dann eine (S,G)-Join-Nachricht an R7 in  
AS65000. Wenn die (S,G)-Join von R4 empfangen wird, sendet R6 einen (SGR)-Prune an R4  
(SCHRITT 9). Auf diese Weise werden doppelte Pakete bei R4 vermieden.**

\*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 empfängt die (S,G)-Join-Verbindung von R6 und sendet dann (S,G)-Join an R2, nachdem die**

## Route zur Quelle verläuft.

```
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 empfängt die (S,G)-Join-Nachricht von R7 und sendet dann (S,G) Join-Nachricht an R1, nachdem die Route zur Quelle verläuft**

```
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 empfängt die (S,G)-Join von R2 und fügt die Schnittstelle der ausgehenden Schnittstellenliste hinzu

\*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

An diesem Punkt fließen Daten von der Quelle bis zum Empfänger. Beim Empfang eines Datenpakets wechselt R5 vom (\*,G)-Tree zum (S,G)-Tree.

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 empfängt die (S,G) Join-Nachricht von R5 und leitet die Datenpakete aus E2/0 an R5 weiter.**

```
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

## R4 PIM RP abgeschnitten (S,G) Schritt 12

Schließlich sendet R4 PIM RP einen (S,G) Prune an R6. Beachten Sie, dass das "M"-Flag auf der mroute vorhanden ist (MSDP-erstellter Eintrag).

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 (Tunnell) 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

Hier wird die Ausgangsschnittstelle (OIF) E1/0 bis R4 aus R6 entfernt.

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)



## Zusammenfassung

MSDP bietet eine Methode zum Verbinden verschiedener PIM-Domänen, die jeweils einen eigenen RP verwenden. Es wird auch häufig verwendet, um "Anycast RP" zu implementieren, was in diesem Dokument nicht behandelt wurde. MSDP und PIM arbeiten zusammen, um einem Empfänger in einer Domäne zu ermöglichen, Datenverkehr von einer Quelle in einer anderen Domäne zu empfangen. Mithilfe von MSDP-SA-Nachrichten können die anderen RPs Informationen über Quellen in einer anderen PIM-Domäne erhalten, während PIM zum Erstellen der Multicast-Struktur verwendet wird.

Weitere Informationen zu den Protokollvorgängen finden Sie in den in den zugehörigen Informationen erwähnten RFCs.

## Zugehörige Informationen

- PIM RFC

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

- MSDP RFC

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