HSRP感知PIM故障排除

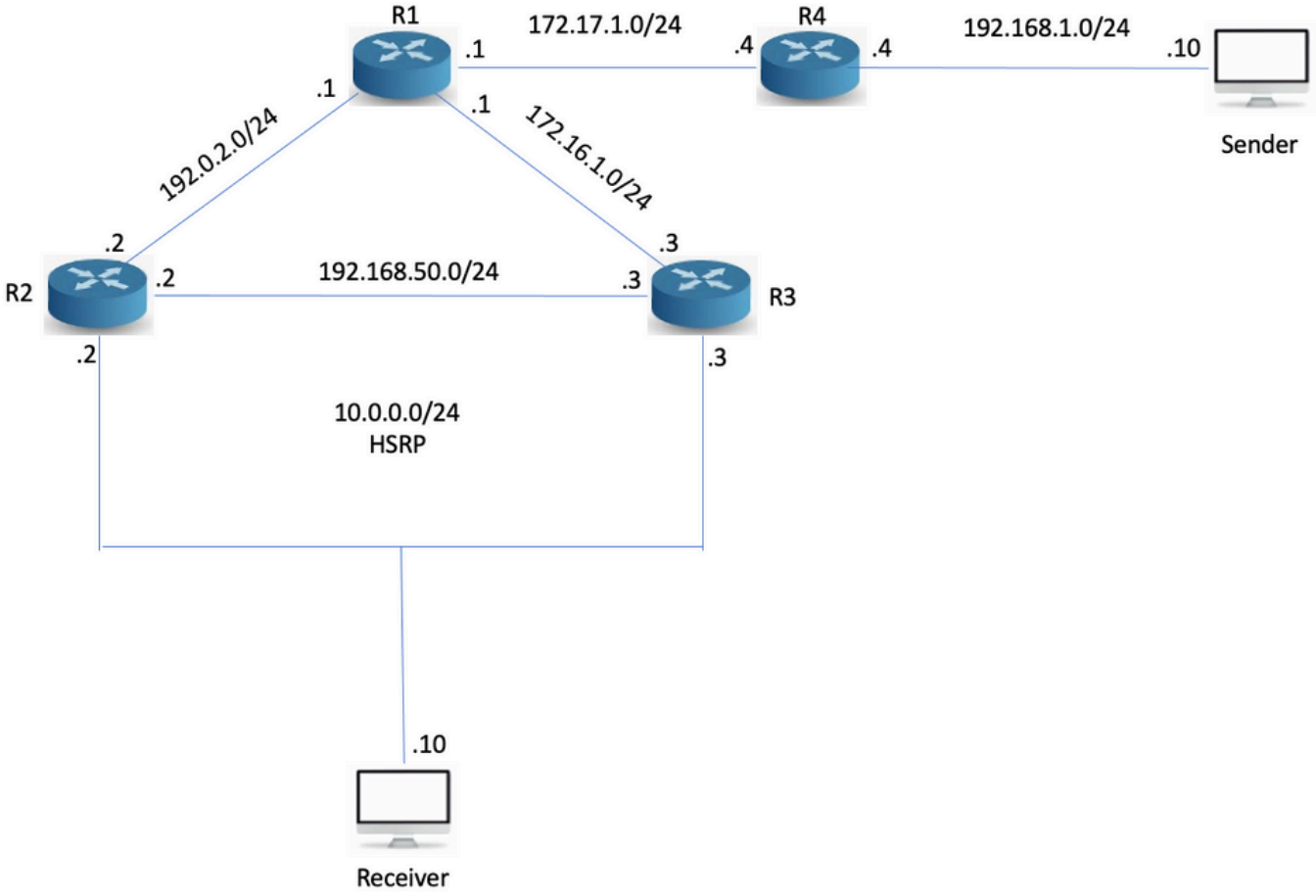
目錄

簡介

本檔案介紹如何對熱待命路由器通訊協定(HSRP)感知通訊協定無關多點傳送(PIM)功能及其可使用的情況進行疑難排解。

說明

在需要冗餘的環境中，HSRP會正常運行。HSRP是一個經過驗證的協定，它確實有效，但是當有需要組播的客戶端時，您如何處理？當活動路由器(AR)關閉時，什麼會觸發組播收斂？在這種情況下，使用拓撲1:



拓撲1

此處需要注意的一點是，R3是PIM指定路由器(DR)，即使R2是HSRP AR也是如此。網路已設定為開放最短路徑優先(OSPF),PIM和R1是具有10.1.1.1 IP地址的交匯點(RP)。R2和R3都接收網際網路組管理協定(IGMP)報告，但只有R3傳送PIM加入，因為它是PIM DR。R3向RP構建「*,G」：

```
R3#sh ip mroute 239.0.0.1 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, N - Received BGP Shared-Tree Prune, n -
BGP C-Mroute suppressed, Q - Received BGP S-A Route, q - Sent BGP S-A Route, V - RD & Vector, v
- Vector, p - PIM Joins on route Outgoing interface flags: H - Hardware switched, A - Assert
winner, p - PIM Join Timers: Uptime/Expires Interface state: Interface, Next-Hop or VCD,
State/Mode (*, 239.0.0.1), 02:54:15/00:02:20, RP 10.1.1.1, flags: SJC Incoming interface:
Ethernet0/0, RPF nbr 172.16.1.1 Outgoing interface list: Ethernet0/2, Forward/Sparse,
00:25:59/00:02:20
```

然後，從組播源ping 239.0.0.1以構建S，G:

```
Sender#ping 239.0.0.1 re 3 Type escape sequence to abort. Sending 3, 100-byte ICMP Echos to
239.0.0.1, timeout is 2 seconds: Reply to request 0 from 10.0.0.10, 35 ms Reply to request 1
from 10.0.0.10, 1 ms Reply to request 2 from 10.0.0.10, 2 ms
```

S、G已經構建：

```
R3#sh ip mroute 239.0.0.1 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, N - Received BGP Shared-Tree Prune, n -
BGP C-Mroute suppressed, Q - Received BGP S-A Route, q - Sent BGP S-A Route, V - RD & Vector, v
- Vector, p - PIM Joins on route Outgoing interface flags: H - Hardware switched, A - Assert
winner, p - PIM Join Timers: Uptime/Expires Interface state: Interface, Next-Hop or VCD,
State/Mode (*, 239.0.0.1), 02:57:14/stopped, RP 10.1.1.1, flags: SJC Incoming interface:
Ethernet0/0, RPF nbr 172.16.1.1 Outgoing interface list: Ethernet0/2, Forward/Sparse,
00:28:58/00:02:50 (192.168.1.10, 239.0.0.1), 00:02:03/00:00:56, flags: JT Incoming interface:
Ethernet0/0, RPF nbr 172.16.1.1 Outgoing interface list: Ethernet0/2, Forward/Sparse,
00:02:03/00:02:50
```

單播和組播拓撲當前不一致。這可能很重要，也可能不重要。當R3發生故障時會發生什麼情況？

```
R3(config)#int e0/2 R3(config-if)#sh R3(config-if)#
```

在R2上的PIM檢測到R3已丟失並接管DR角色之前，不會收到對ping的回覆。使用預設計時器時，這需要60-90秒。

```
Sender#ping 239.0.0.1 re 100 ti 1 Type escape sequence to abort. Sending 100, 100-byte ICMP
Echos to 239.0.0.1, timeout is 1 seconds: Reply to request 0 from 10.0.0.10, 18 ms Reply to
request 1 from 10.0.0.10, 2
ms............................................................... ....... Reply to request
77 from 10.0.0.10, 10 ms Reply to request 78 from 10.0.0.10, 1 ms Reply to request 79 from
10.0.0.10, 1 ms Reply to request 80 from 10.0.0.10, 1 ms
```

您可以提高R2上的DR優先順序，使其成為DR。

```
R2(config-if)#ip pim dr-priority 50 *May 30 12:42:45.900: %PIM-5-DRCHG: DR change from neighbor
10.0.0.3 to 10.0.0.2 on interface Ethernet0/2
```

HSRP感知PIM是使HSRP AR成為PIM DR的一項功能。它也會從虛擬IP傳送PIM訊息，這在具有通往虛擬IP(VIP)的靜態路由的路由器的情況下非常有用。 思科是這樣描述此功能的：

HSRP感知PIM允許通過HSRP AR轉發組播流量，允許PIM利用HSRP冗餘，避免潛在的重複流量，並啟用故障切換，這取決於裝置中的HSRP狀態。PIM-DR與HSRP AR在同一網關上運行，並維護mroute狀態。

在拓撲1中，HSRP面向客戶端運行，因此，即使此功能聽起來非常適合，它也不能幫助組播收斂。在R2上配置此功能：

```
R2(config-if)#ip pim redundancy HSRP1 hsrp dr-priority 100 R2(config-if)# *May 30 12:48:20.024: %PIM-5-DRCHG: DR change from neighbor 10.0.0.3 to 10.0.0.2 on interface Ethernet0/2
```

R2現在是PIM DR，而R3現在在介面E0/2上看到兩個PIM鄰居：

```
R3#sh ip pim nei e0/2 PIM Neighbor Table Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority, P - Proxy Capable, S - State Refresh Capable, G - GenID Capable Neighbor Interface Uptime/Expires Ver DR Address Prio/Mode 10.0.0.1 Ethernet0/2 00:00:51/00:01:23 v2 0 / S P G 10.0.0.2 Ethernet0/2 00:07:24/00:01:23 v2 100/ DR S P G
```

現在R2具有S、G，您可以看到它是斷言獲勝者，因為R3以前是LAN網段的組播轉發者。

```
R2#sh ip mroute 239.0.0.1 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, N - Received BGP Shared-Tree Prune, n - BGP C-Mroute suppressed, Q - Received BGP S-A Route, q - Sent BGP S-A Route, V - RD & Vector, v - Vector, p - PIM Joins on route Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join Timers: Uptime/Expires Interface state: Interface, Next-Hop or VCD, State/Mode (*, 239.0.0.1), 00:20:31/stopped, RP 10.1.1.1, flags: SJC Incoming interface: Ethernet0/0, RPF nbr 192.0.2.1 Outgoing interface list: Ethernet0/2, Forward/Sparse, 00:16:21/00:02:35 (192.168.1.10, 239.0.0.1), 00:00:19/00:02:40, flags: JT Incoming interface: Ethernet0/0, RPF nbr 192.0.2.1 Outgoing interface list: Ethernet0/2, Forward/Sparse, 00:00:19/00:02:40, A
```

當R2的LAN介面關閉時，會發生什麼情況？R3能否成為DR?它融合的速度能有多快？

```
R2(config)#int e0/2 R2(config-if)#sh
```

HSRP在R3上變為活動狀態，但PIM DR角色不會收斂，直到PIM查詢間隔已過期(3x hello)。

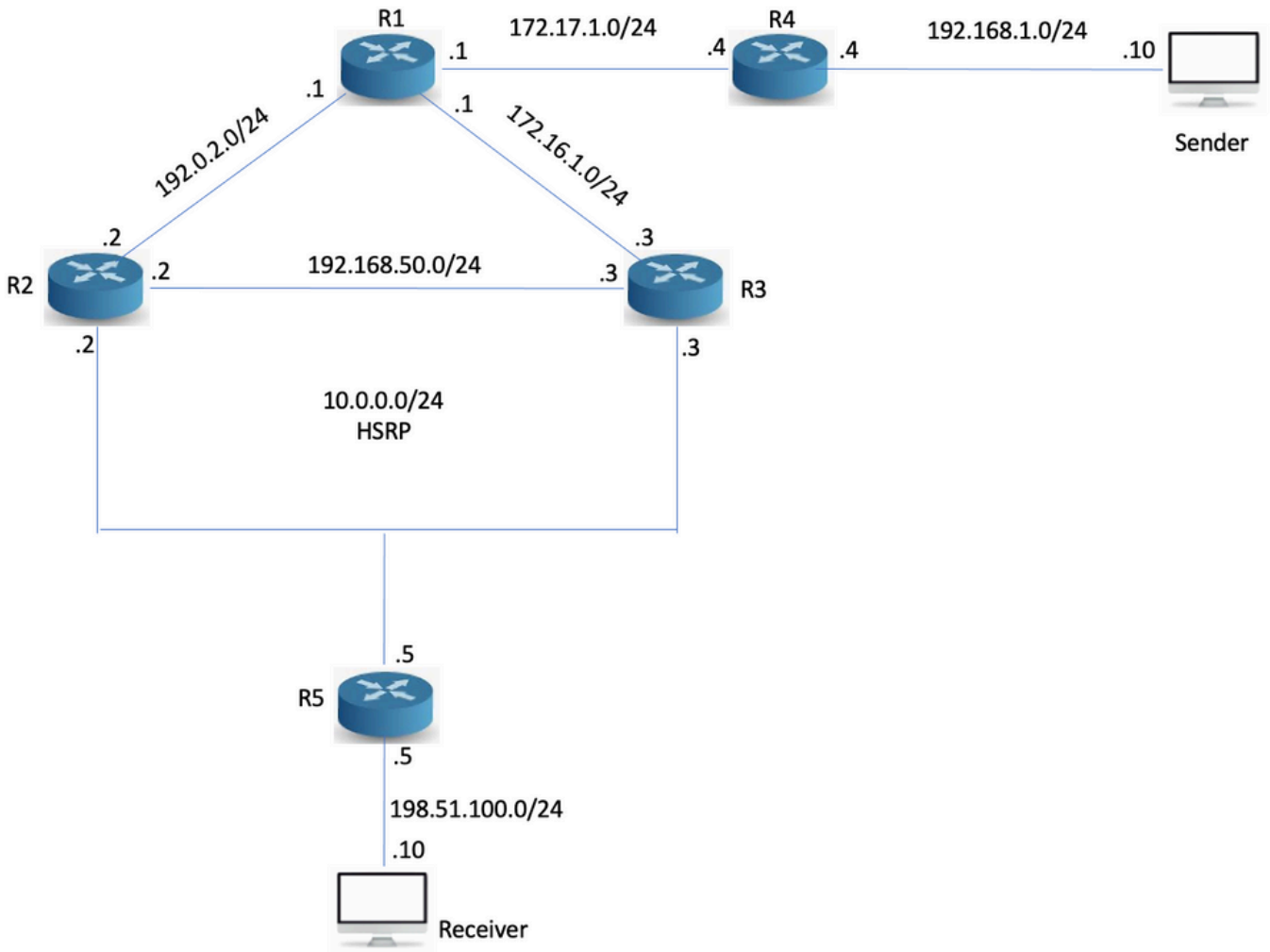
```
*May 30 12:51:44.204: HSRP: Et0/2 Grp 1 Redundancy "hsrp-Et0/2-1" state Standby -> Active R3#sh ip pim nei e0/2 PIM Neighbor Table Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority, P - Proxy Capable, S - State Refresh Capable, G - GenID Capable Neighbor Interface Uptime/Expires Ver DR Address Prio/Mode 10.0.0.1 Ethernet0/2 00:04:05/00:00:36 v2 0 / S P G 10.0.0.2 Ethernet0/2 00:10:39/00:00:36 v2 100/ DR S P G R3# *May 30 12:53:02.013: %PIM-5-NBRCHG: neighbor 10.0.0.2 DOWN on interface Ethernet0/2 DR *May 30 12:53:02.013: %PIM-5-DRCHG: DR change from neighbor 10.0.0.2 to 10.0.0.3 on interface Ethernet0/2 *May 30 12:53:02.013: %PIM-5-NBRCHG: neighbor 10.0.0.1 DOWN on interface Ethernet0/2 non DR
```

發生PIM收斂時，會丟失大量資料包：

```
Sender#ping 239.0.0.1 re 100 time 1 Type escape sequence to abort. Sending 100, 100-byte ICMP Echos to 239.0.0.1, timeout is 1 seconds: Reply to request 0 from 10.0.0.10, 5 ms Reply to request 0 from 10.0.0.10, 14
```

```
ms..... Reply to request 68 from 10.0.0.10, 10 ms Reply to request 69 from 10.0.0.10, 2 ms Reply to request 70 from 10.0.0.10, 1 ms
```

HSRP知道PIM在這方面並沒有真正起作用。改為使用拓撲2時，將非常有用：



拓撲2

路由器R5已新增，而接收器位於R5後面。R5不與R2和R3一起運行路由，只與RP和組播源上的靜態路由點一起運行：

```
R5(config)#ip route 10.1.1.1 255.255.255.255 10.0.0.1 R5(config)#ip route 192.168.1.0 255.255.255.0 10.0.0.1
```

如果沒有HSRP感知PIM，反向路徑轉發(RPF)檢查將失敗，因為PIM對等實體具有實體地址，但R5在網段上看到三個鄰居，其中一個是VIP:

```
R5#sh ip pim nei PIM Neighbor Table Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority, P - Proxy Capable, S - State Refresh Capable, G - GenID Capable Neighbor Interface Uptime/Expires Ver DR Address Prio/Mode 10.0.0.2 Ethernet0/0 00:03:00/00:01:41 v2 100/ DR S P G 10.0.0.1 Ethernet0/0 00:03:00/00:01:41 v2 0 / S P G 10.0.0.3 Ethernet0/0 00:03:00/00:01:41 v2 1 / S P G
```

R2是在正常情況下轉發組播的路由器，因為它是通過活動路由器的HSRP狀態的PIM DR:

```
R2#sh ip mroute 239.0.0.1 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, N - Received BGP Shared-Tree Prune, n -
BGP C-Mroute suppressed, Q - Received BGP S-A Route, q - Sent BGP S-A Route, V - RD & Vector, v
- Vector, p - PIM Joins on route Outgoing interface flags: H - Hardware switched, A - Assert
winner, p - PIM Join Timers: Uptime/Expires Interface state: Interface, Next-Hop or VCD,
State/Mode (*, 239.0.0.1), 00:02:12/00:02:39, RP 10.1.1.1, flags: S Incoming interface:
Ethernet0/0, RPF nbr 192.0.2.1 Outgoing interface list: Ethernet0/2, Forward/Sparse,
00:02:12/00:02:39
```

嘗試從來源執行ping:

```
Sender#ping 239.0.0.1 re 3 Type escape sequence to abort. Sending 3, 100-byte ICMP Echos to
239.0.0.1, timeout is 2 seconds: Reply to request 0 from 198.51.100.10, 1 ms Reply to request 1
from 198.51.100.10, 2 ms Reply to request 2 from 198.51.100.10, 2 ms
```

Ping工作正常，R2的S、G:

```
R2#sh ip mroute 239.0.0.1 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, N - Received BGP Shared-Tree Prune, n -
BGP C-Mroute suppressed, Q - Received BGP S-A Route, q - Sent BGP S-A Route, V - RD & Vector, v
- Vector, p - PIM Joins on route Outgoing interface flags: H - Hardware switched, A - Assert
winner, p - PIM Join Timers: Uptime/Expires Interface state: Interface, Next-Hop or VCD,
State/Mode (*, 239.0.0.1), 00:04:18/00:03:29, RP 10.1.1.1, flags: S Incoming interface:
Ethernet0/0, RPF nbr 192.0.2.1 Outgoing interface list: Ethernet0/2, Forward/Sparse,
00:04:18/00:03:29 (192.168.1.10, 239.0.0.1), 00:01:35/00:01:24, flags: T Incoming interface:
Ethernet0/0, RPF nbr 192.0.2.1 Outgoing interface list: Ethernet0/2, Forward/Sparse,
00:01:35/00:03:29
```

當R2出現故障時會發生什麼？

```
R2#conf t Enter configuration commands, one per line. End with CNTL/Z. R2(config)#int e0/2
R2(config-if)#sh R2(config-if)#

Sender#ping 239.0.0.1 re 200 ti 1 Type escape sequence to abort. Sending 200, 100-byte ICMP
Echos to 239.0.0.1, timeout is 1 seconds: Reply to request 0 from 198.51.100.10, 9 ms Reply to
request 1 from 198.51.100.10, 2 ms Reply to request 1 from 198.51.100.10, 11
ms.....................................................................
.....................................................................
.............................................................
```

ping超時，因為從R5進入PIM連線時，R3未意識到必須處理該連線。

```
*May 30 13:20:13.236: PIM(0): Received v2 Join/Prune on Ethernet0/2 from 10.0.0.5, not to us
*May 30 13:20:32.183: PIM(0): Generation ID changed from neighbor 10.0.0.2
```

事實證明，輔助路由器上也必須配置PIM冗餘命令，以便處理PIM與VIP的連線。

```
R3(config-if)#ip pim redundancy HSRP1 hsrp dr-priority 10
```

配置此連線後，將處理傳入的加入。R3觸發R5傳送新的聯接，因為PIM hello中的GenID設定為新值。

```
*May 30 13:59:19.333: PIM(0): Matched redundancy group VIP 10.0.0.1 on Ethernet0/2 Active,
```

```
processing the Join/Prune, to us *May 30 13:40:34.043: PIM(0): Generation ID changed from
neighbor 10.0.0.1
```

進行此配置後，PIM DR角色會以HSRP允許的最快速度收斂。此案例中使用的是雙向轉發檢測(BFD)。

結論

瞭解HSRP感知PIM的關鍵概念如下：

- 最初，AR上的PIM冗餘配置使其成為DR。
- 輔助路由器上也必須配置PIM冗餘，否則，它無法處理PIM與VIP的連線。
- 在PIM hello超時之前，PIM DR角色不會收斂。輔助路由器處理加入，因此組播會收斂。

要點

當您在HSRP LAN上擁有接收器時，此功能不起作用，因為在PIM鄰接關係到期之前，不會移動DR角色。

相關資訊

- https://www.cisco.com/en/US/docs/ios-xml/ios/ipmulti_pim/configuration/15-2s/imc_hsrp_aware.html#GUID-1294B212-466A-4D8D-AB20-D8DE0B3645CD
- 技術支援與文件 - Cisco Systems