使用週轉PE路由器的mVPN配置檔案遷移

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簡介

本檔案介紹使用迴轉路由器在Cisco IOS®-XR中從mVPN（多點傳送虛擬私人網路）設定檔0到基於mLDP的（多點標籤發佈通訊協定）設定檔的遷移策略。

網路正在運行mVPN配置檔案0，它是核心網路中具有PIM（協定無關組播）和重疊中具有PIM的配置檔案。網路將遷移到核心中使用mLDP的配置檔案。在此遷移至配置檔案6:使用mLDP並在PE（提供商邊緣）路由器上使用VRF（虛擬路由/轉發）的帶內信令。

遷移解決方案適用於SSM（源特定組播）和ASM（任何源組播）流量。

檢視影象1。

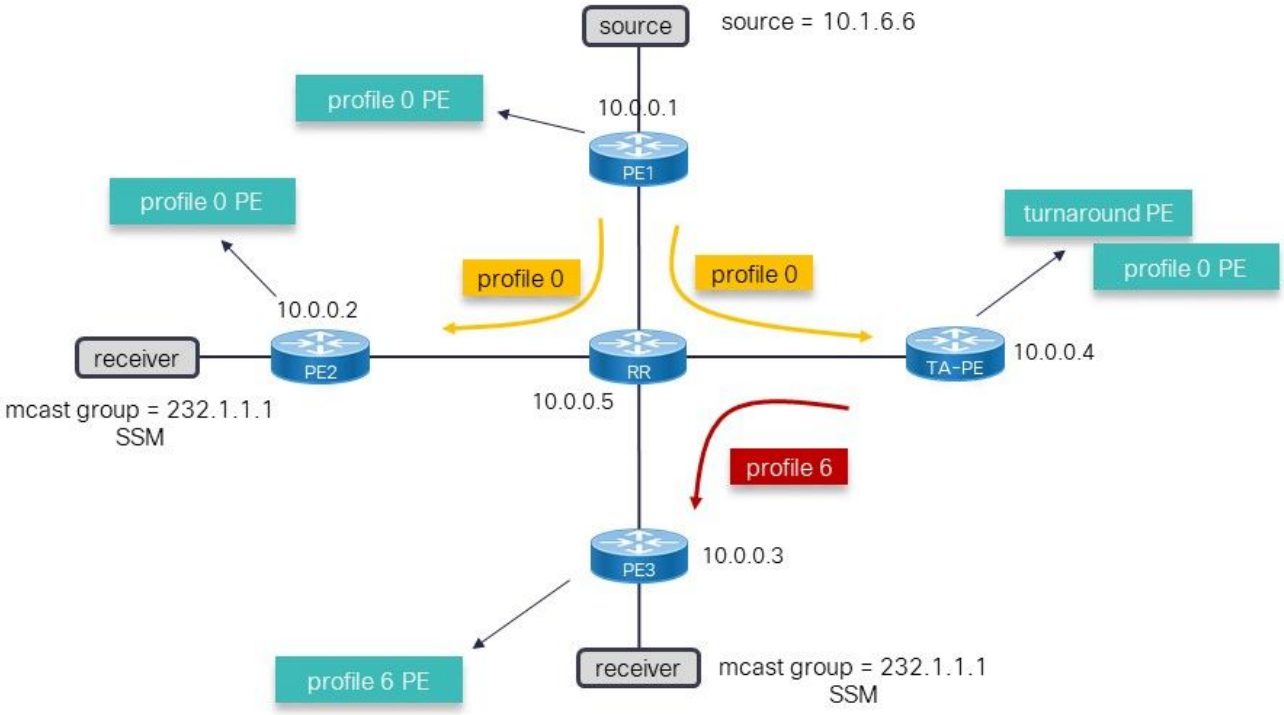

圖1

圖1顯示運行配置檔案0的網路。源位於PE1之後。遷移是針對配置檔案6，但問題是入口PE（提供商邊緣）路由器PE1是無法立即遷移至配置檔案6的舊式路由器。解決方案是：在PE1上繼續使用配置檔案0，並在網路中使用TurnAround(TA)PE路由器，負責將組播流量從配置檔案0切換至配置檔案6。使用轉換路由器的解決方案是臨時解決方案，直到源PE也可以遷移至配置檔案6。拓撲上的箭頭顯示了組播流量。

解決方案

該解決方案需要：

- 一種可運行配置檔案0和配置檔案6的週轉路由器。
- 必須在非傳統路由器上啟用SAFI（後續地址系列識別符號）2路由。這是此解決方案的關鍵。通向源(或ASM的RP(Rendez-Vous Point))的RPF（反向路徑轉發）需要指向TA PE路由器。為此，在週轉路由器的SAFI 2中的VRF中，必須有來源和RP（如果使用ASM）的靜態路由。這些靜態路由由SAFI 129（vpnv4多點傳送）中的BGP在TA PE路由器上通告。 靜態路由位於SAFI 2中，不會覆蓋SAFI 1中的路由（單播），也不會覆蓋TA PE路由器以及接收SAFI 129路由的PE路由器上的單播轉發決策。
- BGP中的SAFI 129用於設定檔6 PE和RR（路由反射器）路由器。BGP中的SAFI 2用於配置檔案6 PE路由器。此SAFI 2承載用於組播RPF的BGP中的組播路由，覆蓋未廣播路由。SAFI 2是VRF中的組播路由，SAFI 129路由是vpnv4的組播路由。

轉向PE路由器負責吸引配置檔案0中的組播流量，並將其傳送回配置檔案6的核心中。這使它成為轉向路由器。這種轉變不需要本地連線的接收器，但它可以有一個。

組態

RR的配置

```
router bgp 65001
 bgp router-id 10.0.0.5
 address-family ipv4 unicast
 !
 address-family vpnv4 unicast
 !
address-family ipv4 mdt   ## for profile 0
 !
 address-family ipv4 mvpn
 !
address-family vpnv4 multicast   ## SAFI 129
 !
 neighbor 10.0.0.1       ## profile 0 peer
 remote-as 65001
 update-source Loopback0
 address-family vpnv4 unicast
  route-reflector-client
 !
 address-family ipv4 mdt
  route-reflector-client
 !
 !
 neighbor 10.0.0.2    ## profile 0 peer
 remote-as 65001
 update-source Loopback0
 address-family vpnv4 unicast
  route-reflector-client
 !
 address-family ipv4 mdt
  route-reflector-client
 !
 !
 neighbor 10.0.0.3    ## TA peer
 remote-as 65001
 update-source Loopback0
 address-family vpnv4 unicast
  route-reflector-client
 !
 address-family ipv4 mvpn
  route-reflector-client
 !
 address-family vpnv4 multicast   ## SAFI 129
  route-reflector-client
 !
 !
 neighbor 10.0.0.4   ## profile 6 peer
 remote-as 65001
 update-source Loopback0
 address-family vpnv4 unicast
  route-reflector-client
 !
 address-family ipv4 mdt
  route-reflector-client
 !
 address-family ipv4 mvpn
  route-reflector-client
 !
 address-family vpnv4 multicast
  route-reflector-client
```

RR反映配置檔案0(AF ipv4 mdt)的路由。MDT代表組播分發樹。

RR需要SAFI 129。這是地址系列*vpnv4組播*。在RR和每個運行配置檔案6的路由器之間此AF的BGP會話都需要存在。

源PE的配置

附註：源PE配置必須新增到作為遷移一部分的任何其他配置檔案0 PE。

```
vrf one
 address-family ipv4 unicast
 import route-target
  65001:1
 !
 export route-target
  65001:1

router bgp 65001
 bgp router-id 10.0.0.1
 address-family vpnv4 unicast
 !
address-family ipv4 mdt
 !
 neighbor 10.0.0.5
 remote-as 65001
 update-source Loopback0
 address-family vpnv4 unicast
 !
 address-family ipv4 mdt
 !
 !
 vrf one
 rd 1:2
 address-family ipv4 unicast
  redistribute onnected

multicast-routing
 address-family ipv4
 interface Loopback0
  enable
 !
 interface GigabitEthernet0/0/0/0
  enable
 !
 !
 vrf one
 address-family ipv4
  interface GigabitEthernet0/0/0/1
   enable
  !
  mdt source Loopback0
  rate-per-route
  mdt default ipv4 232.1.1.1   ## profile 0 Default MDT
```

源PE路由器只有配置檔案0的配置。未配置SAFI 129或SAFI 2。沒有配置檔案6配置。

TA PE的配置

```
vrf one
 address-family ipv4 unicast
 import route-target
  65001:1
 !
 export route-target
  65001:1
 !
 !
address-family ipv4 multicast   ## SAFI 2
 import route-target
  65001:1
 !
 export route-target
  65001:1

router bgp 65001
 bgp router-id 10.0.0.4
 address-family ipv4 unicast
 !
address-family ipv4 multicast   ## this is needed to have the static route in SAFI 2
 !
 address-family vpnv4 unicast
 !
address-family ipv4 mdt   ## for profile 0
 !
 address-family ipv4 mvpn
 !
address-family vpnv4 multicast   ## SAFI 129
 !
 neighbor 10.0.0.5   ## RR peer
 remote-as 65001
 update-source Loopback0
 address-family vpnv4 unicast
 !
 address-family ipv4 mdt
 !
 address-family ipv4 mvpn
 !
 address-family vpnv4 multicast   ## SAFI 129
 !
 !
 vrf one
 rd 1:4
 address-family ipv4 unicast
  redistribute connected
  redistribute static
 !
 address-family ipv4 multicast   ## SAFI 2
  redistribute connected
  redistribute static   ## redistribute SAFI 2 static routes
 !
 !

router static
 vrf one
 address-family ipv4 multicast
   10.1.6.0/24 vrf default 10.0.0.1   ## SAFI 2 static route

route-policy rpf-PE-TA
 set core-tree pim-default
end-polic
```

```
multicast-routing
 address-family ipv4
 interface Loopback0
  enable
 !
 interface GigabitEthernet0/0/0/0
  enable
 !
 !
 vrf one
 address-family ipv4
  mdt source Loopback0
  rate-per-route
   mdt default ipv4 232.1.1.1    ## profile 0
   mdt mldp in-band-signaling ipv4    ## profile 6
 !
 !
!
router pim
 vrf one
 address-family ipv4
  rpf topology route-policy rpf-PE-TA
```

TA PE需要SAFI 129。這是指向RR的地址系列vpnv4組播。

VRF和BGP下需要SAFI 2。

需要在VRF中指向源（或ASM的RP）的靜態路由，指向輸入PE路由器。此靜態SAFI 2路由必須重新分發，作為BGP中的SAFI 129路由。此SAFI 129路由由BGP中的配置檔案6 PE路由作為SAFI 129路由接收，並作為SAFI 2路由安裝在VRF中。

需要配置檔案0和6配置。RPF topology命令針對配置檔案0進行配置，這是源（或RP）所在的位置。

> **附註**：週轉路由器需要在VRF中啟用組播路由的物理（子）介面（不是環回介面）。如果情況並非如此，則組播路由不會安裝線上卡中，而且組播流量也不會被轉回。

出口PE的配置

```
vrf one
 address-family ipv4 unicast
 import route-target
  65001:1
 export route-target
  65001:1
 !
 address-family ipv4 multicast   ## SAFI 2
 import route-target
  65001:1
 !
 export route-target
  65001:1

router bgp 65001
 bgp router-id 10.0.0.3
```

```
 address-family ipv4 unicast
 !
 address-family vpnv4 unicast
 !
 address-family ipv4 mvpn
 !
address-family vpnv4 multicast   ## SAFI 129
 !
 neighbor 10.0.0.5    ## RR peer
 remote-as 65001
 update-source Loopback0
 address-family vpnv4 unicast
 !
 address-family ipv4 mvpn
 !
 address-family vpnv4 multicast   ## SAFI 129
 !
 !
 vrf one
 rd 1:3
 address-family ipv4 unicast
  redistribute connected
 !
  address-family ipv4 multicast   ## SAFI 2
  redistribute connected
  redisribute static

route-policy in-band-mldp
 set core-tree mldp-inband   ## profile 6
end-polic

multicast-routing
 address-family ipv4
 interface Loopback0
  enable
 !
 !
 vrf one
 address-family ipv4
  interface GigabitEthernet0/0/0/1
   enable
  !
  mdt source Loopback0
  rate-per-route
  mdt mldp in-band-signaling ipv4   ## profile 6
 !
 !
!
router pim
 address-family ipv4
 interface Loopback0
  enable
 !
 !
 vrf one
 address-family ipv4
  rpf topology route-policy in-band-mldp   ## profile 6
```

輸出PE路由器具有配置檔案6的配置。除此之外：為了讓輸出PE路由器成功將源的TA PE路由器（或ASM的RP）RPF到TA PE路由器，它需要配置SAFI 2和SAFI 129。

驗證

配置檔案6 PE - PE3

```
RP/0/RP0/CPU0:PE3#show bgp vpnv4 multicast rd 1:3 10.1.6.0/24
BGP routing table entry for 10.1.6.0/24, Route Distinguisher: 1:3
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                136         136
Last Modified: Jul  7 12:02:27.278 for 00:49:22
Paths: (1 available, best #1)
 Not advertised to any peer
 Path #1: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.4 (metric 30) from 10.0.0.5 (10.0.0.4)
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
     Received Path ID 0, Local Path ID 1, version 136
     Extended community: RT:65001:1
     Originator: 10.0.0.4, Cluster list: 10.0.0.5
     Connector: type: 1, Value:1:4:10.0.0.4
     Source AFI: VPNv4 Multicast, Source VRF: default, Source Route Distinguisher: 1:4
```

下一跳是10.0.0.4，即TA PE路由器。

```
RP/0/RP0/CPU0:PE3#show route vrf one ipv4 multicast 10.1.6.0/24
Routing entry for 10.1.6.0/24
 Known via "bgp 65001", distance 200, metric 0, type internal
 Installed Jul  7 12:02:27.236 for 00:50:44
 Routing Descriptor Blocks
   10.0.0.4, from 10.0.0.5
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
 No advertising protos.
```

```
RP/0/RP0/CPU0:PE3#show pim vrf one rpf 10.1.6.6
Table: IPv4-Multicast-default
* 10.1.6.6/32 [200/0]
   via Imdtone with rpf neighbor 10.0.0.4
   Connector: 1:4:10.0.0.4, Nexthop: 10.0.0.4
```

RPF指向TA PE路由器。

```
RP/0/RP0/CPU0:PE3#show mrib vrf one route 232.1.1.1
IP Multicast Routing Information Base
Entry flags: L - Domain-Local Source, E - External Source to the Domain,
   C - Directly-Connected Check, S - Signal, IA - Inherit Accept,
   IF - Inherit From, D - Drop, ME - MDT Encap, EID - Encap ID,
   MD - MDT Decap, MT - MDT Threshold Crossed, MH - MDT interface handle
```

```
   CD - Conditional Decap, MPLS - MPLS Decap, EX - Extranet
   MoFE - MoFRR Enabled, MoFS - MoFRR State, MoFP - MoFRR Primary
   MoFB - MoFRR Backup, RPFID - RPF ID Set, X - VXLAN
Interface flags: F - Forward, A - Accept, IC - Internal Copy,
   NS - Negate Signal, DP - Don't Preserve, SP - Signal Present,
   II - Internal Interest, ID - Internal Disinterest, LI - Local Interest,
   LD - Local Disinterest, DI - Decapsulation Interface
   EI - Encapsulation Interface, MI - MDT Interface, LVIF - MPLS Encap,
   EX - Extranet, A2 - Secondary Accept, MT - MDT Threshold Crossed,
   MA - Data MDT Assigned, LMI - mLDP MDT Interface, TMI - P2MP-TE MDT Interface
   IRMI - IR MDT Interface, TRMI - TREE SID MDT Interface, MH - Multihome Interface
(10.1.6.6,232.1.1.1) RPF nbr: 10.0.0.4 Flags: RPF
 Up: 09:29:38
 Incoming Interface List
    Imdtone Flags: A LMI, Up: 00:47:04
 Outgoing Interface List
   GigabitEthernet0/0/0/1 Flags: F NS, Up: 09:29:38
```

輸入介面是設定檔6。

TA PE

```
RP/0/RP0/CPU0:TA-PE#show bgp vpnv4 multicast rd 1:4 10.1.6.0/24
BGP routing table entry for 10.1.6.0/24, Route Distinguisher: 1:4
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                80          80
Last Modified: Jul  7 12:02:27.317 for 01:04:42
Paths: (1 available, best #1)
 Advertised to peers (in unique update groups):
   10.0.0.5
 Path #1: Received by speaker 0
 Advertised to peers (in unique update groups):
    10.0.0.5
 Local
   10.0.0.1 (metric 30) from 0.0.0.0 (10.0.0.4)
     Origin incomplete, metric 0, localpref 100, weight 32768, valid, redistributed, best,
group-best, import-candidate
     Received Path ID 0, Local Path ID 1, version 80
     Extended community: RT:65001:1
```

此路由是本地路由，但下一跳是源PE(10.0.0.1)。 路由會通告給RR(10.0.0.5)。

```
RP/0/RP0/CPU0:TA-PE#show route vrf one ipv4 multicast 10.1.6.0/24
Routing entry for 10.1.6.0/24
 Known via "static", distance 1, metric 0
 Installed Jul  7 12:02:27.234 for 01:07:01
 Routing Descriptor Blocks
   10.0.0.1
     Nexthop in Vrf: "default", Table: "default", IPv4 Multicast, Table Id: 0xe0100000
     Route metric is 0, Wt is 1
 No advertising protos.

RP/0/RP0/CPU0:PE-TA#show pim vrf one rpf 10.1.6.6
Table: IPv4-Multicast-default
* 10.1.6.6/32 [1/0]
```

```
   via mdtone with rpf neighbor 10.0.0.1
```

RPF使用配置檔案0指向源路由器。

```
RP/0/RP0/CPU0:TA-PE#show mrib vrf one route 232.1.1.1
IP Multicast Routing Information Base
Entry flags: L - Domain-Local Source, E - External Source to the Domain,
   C - Directly-Connected Check, S - Signal, IA - Inherit Accept,
   IF - Inherit From, D - Drop, ME - MDT Encap, EID - Encap ID,
   MD - MDT Decap, MT - MDT Threshold Crossed, MH - MDT interface handle
   CD - Conditional Decap, MPLS - MPLS Decap, EX - Extranet
   MoFE - MoFRR Enabled, MoFS - MoFRR State, MoFP - MoFRR Primary
   MoFB - MoFRR Backup, RPFID - RPF ID Set, X - VXLAN
Interface flags: F - Forward, A - Accept, IC - Internal Copy,
   NS - Negate Signal, DP - Don't Preserve, SP - Signal Present,
   II - Internal Interest, ID - Internal Disinterest, LI - Local Interest,
   LD - Local Disinterest, DI - Decapsulation Interface
   EI - Encapsulation Interface, MI - MDT Interface, LVIF - MPLS Encap,
   EX - Extranet, A2 - Secondary Accept, MT - MDT Threshold Crossed,
   MA - Data MDT Assigned, LMI - mLDP MDT Interface, TMI - P2MP-TE MDT Interface
   IRMI - IR MDT Interface, TRMI - TREE SID MDT Interface, MH - Multihome Interface
(10.1.6.6,232.1.1.1) RPF nbr: 10.0.0.1 Flags: RPF
 Up: 01:13:28
 Incoming Interface List
    mdtone Flags: A MI, Up: 01:13:28
 Outgoing Interface List
    Imdtone Flags: F LMI, Up: 01:13:28
```

傳入介面是配置檔案0的MDT，傳出介面是配置檔案6的MDT。這是扭轉。

```
RP/0/RP0/CPU0:TA-PE#show mfib vrf one route 232.1.1.1 detail
IP Multicast Forwarding Information Base
Entry flags: C - Directly-Connected Check, S - Signal, D - Drop,
 IA - Inherit Accept, IF - Inherit From, EID - Encap ID,
 ME - MDT Encap, MD - MDT Decap, MT - MDT Threshold Crossed,
 MH - MDT interface handle, CD - Conditional Decap,
 DT - MDT Decap True, EX - Extranet, RPFID - RPF ID Set,
 MoFE - MoFRR Enabled, MoFS - MoFRR State, X - VXLAN
Interface flags: F - Forward, A - Accept, IC - Internal Copy,
 NS - Negate Signal, DP - Don't Preserve, SP - Signal Present,
 EG - Egress, EI - Encapsulation Interface, MI - MDT Interface,
 EX - Extranet, A2 - Secondary Accept
Forwarding/Replication Counts: Packets in/Packets out/Bytes out
Failure Counts: RPF / TTL / Empty Olist / Encap RL / Other
(10.1.6.6,232.1.1.1),  Flags:  EID RPFID
 Up: 01:15:01
 Last Used: never
 SW Forwarding Counts: 0/0/0
 SW Replication Counts: 0/0/0
 SW Failure Counts: 0/0/0/0/0
 Route ver: 0xd672
 MVPN Info :-
   Associated Table ID : 0xe0000000
   MDT Handle: 0x0, MDT Probe:N [N], Rate:Y, Acc:N
   MDT SW Ingress Encap V4/V6, Egress decap: 0 / 0, 0
   Encap ID: 262146, RPF ID: 3
```

```
   Local Receiver: False, Turnaround: True
 mdtone Flags:  A MI, Up:01:15:01
 Imdtone Flags:  F LMI, Up:01:15:01
```

傳入介面是配置檔案0的MDT，傳出介面是配置檔案6的MDT。這是扭轉。

配置檔案0 PE - PE2

```
RP/0/RP0/CPU0:PE2#show pim vrf one rpf 10.1.6.6
Table: IPv4-Unicast-default
* 10.1.6.6/32 [200/0]
   via mdtone with rpf neighbor 10.0.0.1
   Connector: 1:1:10.0.0.1, Nexthop: 10.0.0.1
```

RPF指向配置檔案0輸入PE路由器。

```
RP/0/RP0/CPU0:PE2#show mrib vrf one route 232.1.1.1
IP Multicast Routing Information Base
Entry flags: L - Domain-Local Source, E - External Source to the Domain,
   C - Directly-Connected Check, S - Signal, IA - Inherit Accept,
   IF - Inherit From, D - Drop, ME - MDT Encap, EID - Encap ID,
   MD - MDT Decap, MT - MDT Threshold Crossed, MH - MDT interface handle
   CD - Conditional Decap, MPLS - MPLS Decap, EX - Extranet
   MoFE - MoFRR Enabled, MoFS - MoFRR State, MoFP - MoFRR Primary
   MoFB - MoFRR Backup, RPFID - RPF ID Set, X - VXLAN
Interface flags: F - Forward, A - Accept, IC - Internal Copy,
   NS - Negate Signal, DP - Don't Preserve, SP - Signal Present,
   II - Internal Interest, ID - Internal Disinterest, LI - Local Interest,
   LD - Local Disinterest, DI - Decapsulation Interface
   EI - Encapsulation Interface, MI - MDT Interface, LVIF - MPLS Encap,
   EX - Extranet, A2 - Secondary Accept, MT - MDT Threshold Crossed,
   MA - Data MDT Assigned, LMI - mLDP MDT Interface, TMI - P2MP-TE MDT Interface
   IRMI - IR MDT Interface, TRMI - TREE SID MDT Interface, MH - Multihome Interface
(10.1.6.6,232.1.1.1) RPF nbr: 10.0.0.1 Flags: RPF
 Up: 1d22h
 Incoming Interface List
   mdtone Flags: A MI, Up: 02:49:35
 Outgoing Interface List
   GigabitEthernet0/0/0/1 Flags: F NS, Up: 1d22h
```

輸入介面是設定檔0。

RR

```
RP/0/RP0/CPU0:P#show bgp vpnv4 multicast rd 1:4 10.1.6.0/24
BGP routing table entry for 10.1.6.0/24, Route Distinguisher: 1:4
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                84          84
Last Modified: Jul  7 12:02:27.979 for 00:54:33
Paths: (1 available, best #1)
 Advertised to update-groups (with more than one peer):
```

```
   0.2
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
    0.2
 Local, (Received from a RR-client)
   10.0.0.4 (metric 20) from 10.0.0.4 (10.0.0.4)
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, not-in-vrf
     Received Path ID 0, Local Path ID 1, version 84
     Extended community: RT:65001:1
     Connector: type: 1, Value:1:4:10.0.0.4
```

通向源的路由會通告給配置檔案6 PE路由器，並從TA路由器(10.0.0.4)接收。

退出策略

使用週轉路由器的遷移解決方案是臨時解決方案。遷移應該通過將每個PE路由器遷移到配置檔案6來完成。可通過以下步驟完成：

- 新增新的源PE路由器
- 將PE路由器上的路由策略新增到RPF到傳統源PE路由器（配置檔案0）、TA PE路由器（配置檔案6）或新源PE路由器（配置檔案6） 在路由策略中指定源和/或組
- 將組播源移動到新的源PE路由器
- 將所有組播組遷移到新的源PE路由器後，刪除舊的源PE路由器

結論

使用用於mVPN的週轉路由器是一種簡便的方法，可以方便從配置檔案0遷移到新的mVPN配置檔案，作為臨時解決方案，同時等待能夠運行新mVPN配置檔案的更新源PE路由器。