使用Rudan PE路由器的mVPN配置文件迁移

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简介

本文档介绍使用周转路由器从mVPN（组播虚拟专用网络）配置文件0迁移到Cisco IOS®-XR中基于mLDP的(多点标签分发协议)配置文件的迁移策略。

网络运行mVPN配置文件0，该配置文件在核心网络中使用PIM（协议独立组播），在重叠中使用PIM。网络将使用核心中的mLDP迁移到配置文件。在此，迁移是到配置文件6:在PE（提供商边缘）路由器上使用mLDP和带内信令和VRF（虚拟路由/转发）。

迁移解决方案适用于SSM（源特定组播）和ASM（任何源组播）流量。

看图1。

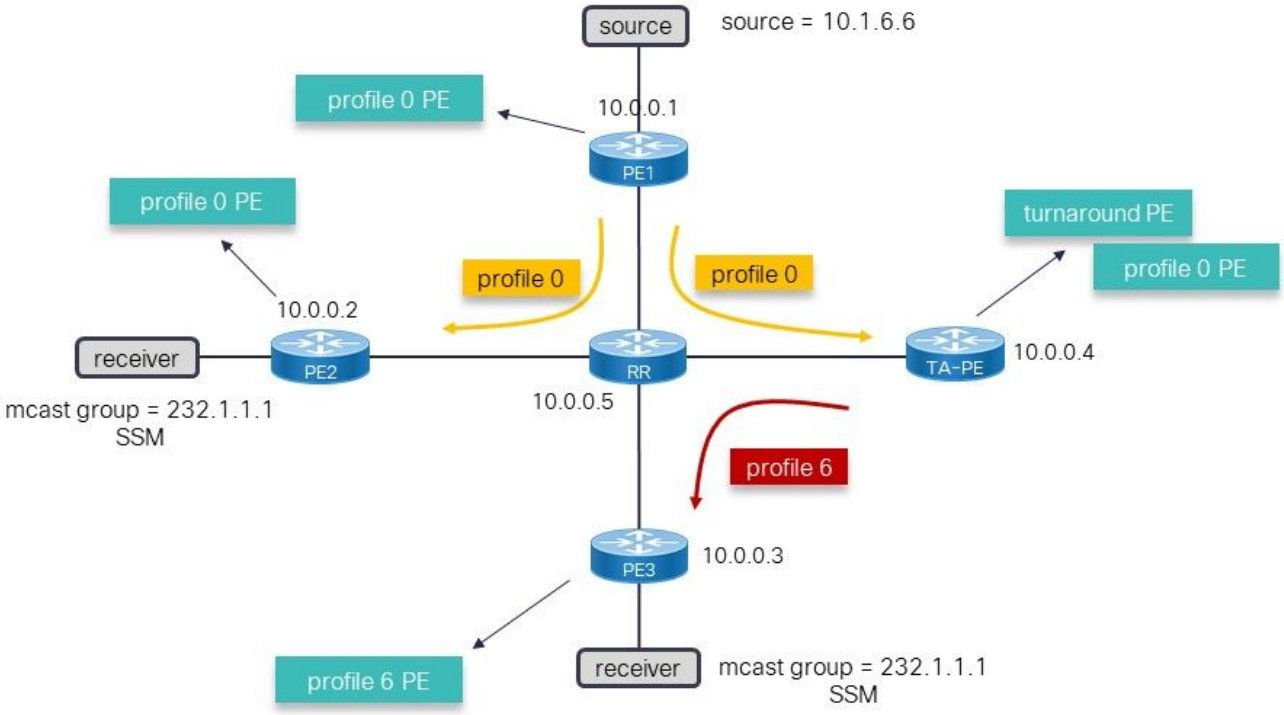

图1

图1显示网络运行配置文件0。源位于PE1后面。迁移向配置文件6，但问题是，入口PE（提供商边缘）路由器PE1是无法立即迁移至配置文件6的传统路由器。解决方案是继续使用PE1上的配置文件0并在网络中使用TurnAurd(TA)PE路由器，将组播流量从配置文件0切换到6。使用周转路由器的解决方案是临时解决方案，直到源PE也可以迁移到配置文件6。拓扑图上的箭头显示组播流量。

解决方案

该解决方案需要：

- 能够运行配置文件0和配置文件6的周转路由器。
- 必须在非传统路由器上启用SAFI（后续地址系列标识符）2路由。这是此解决方案的关键。指向源(或ASM的RP（Rendez-Vous点）)的RPF（反向路径转发）需要指向TA PE路由器。为此，在SAFI 2中的VRF中，在周转路由器上，源和RP（如果使用ASM）必须有静态路由。这些静态路由在SAFI 129（vpnv4组播）中由BGP在TA PE路由器上通告。 静态路由在SAFI 2中，因为不覆盖SAFI 1（单播）中的路由，也不覆盖TA PE路由器和接收SAFI 129路由的PE路由器上的单播转发决策。
- BGP中的SAFI 129用于配置文件6 PE和RR（路由反射器）路由器。BGP中的SAFI 2用于配置文件6 PE路由器。此SAFI 2在用于组播RPF的BGP中传送组播路由，覆盖未播路由。SAFI 2是VRF中的组播路由，而SAFI 129路由是vpnv4的组播路由。

周转PE路由器负责在配置文件0中吸引组播流量并将其发回到配置文件6的核心。这使它成为周转路由器。转换过程不需要本地连接的接收器，但可以有一个。

配置

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反映配置文件0(AF ipv4 mdt)的路由。MDT代表组播分布树。

RR需要SAFI 129。这是地址系列*vpnv4组播*。RR和运行配置文件6的每台路由器之间的此AF的BGP会话需要存在。

源PE的配置

注意：源PE配置必须添加到迁移过程中的任何其他配置文件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路由器仅配置了配置文件0。未配置SAFI 129或SAFI 2。没有配置文件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。这是指向RR的地址系列vpnv4组播。

VRF和BGP下需要SAFI 2。

VRF中指向源（或ASM的RP）的静态路由需要指向入口PE路由器。此静态SAFI 2路由必须重分发为BGP中的SAFI 129路由。此SAFI 129路由由BGP中的配置文件6 PE路由作为SAFI 129路由接收，并作为SAFI 2路由安装在VRF中。

需要配置文件0和6。RPF拓扑命令为配置文件0配置，因为此处存在源（或RP）。

> **注意：**周转路由器需要在VRF中为组播路由启用物理（子）接口（而非环回接口）。如果不是，则组播路由不会安装在线卡中，并且组播流量不会转向。

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
```

出口PE路由器具有配置文件6的配置。除此之外：为了使出口PE路由器成功向源TA PE路由器（或ASM的RP）RPF，它需要配置SAFI 2和SAFI 129。

确认

配置文件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
```

入口接口为配置文件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)。 路由通告给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使用配置文件0朝源路由器。

```
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
```

传入接口是配置文件0的MDT，传出接口是配置文件6的MDT。这是周转。

```
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
```

传入接口是配置文件0的MDT，传出接口是配置文件6的MDT。这是周转。

配置文件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指向配置文件0的入口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
```

入口接口为配置文件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
```

通向源的路由通告到配置文件6 PE路由器，并从TA路由器(10.0.0.4)接收。

退出策略

使用周转路由器的迁移解决方案是临时解决方案。迁移应通过将每台PE路由器迁移到配置文件6来结束。这可通过以下步骤完成：

- 添加新源PE路由器
- 在PE路由器上将路由策略添加到RPF到传统源PE路由器（配置文件0）、TA PE路由器（配置文件6）或新源PE路由器（配置文件6） 在路由策略中指定源和/或组
- 将组播源移动到新的源PE路由器
- 将所有组播组迁移到新源PE路由器后，删除旧源PE路由器

结论

为mVPN使用周转路由器是一种简单的方法，可以在等待能够运行新mVPN配置文件的较新源PE路由器时，将配置文件0迁移到新的mVPN配置文件作为临时解决方案。