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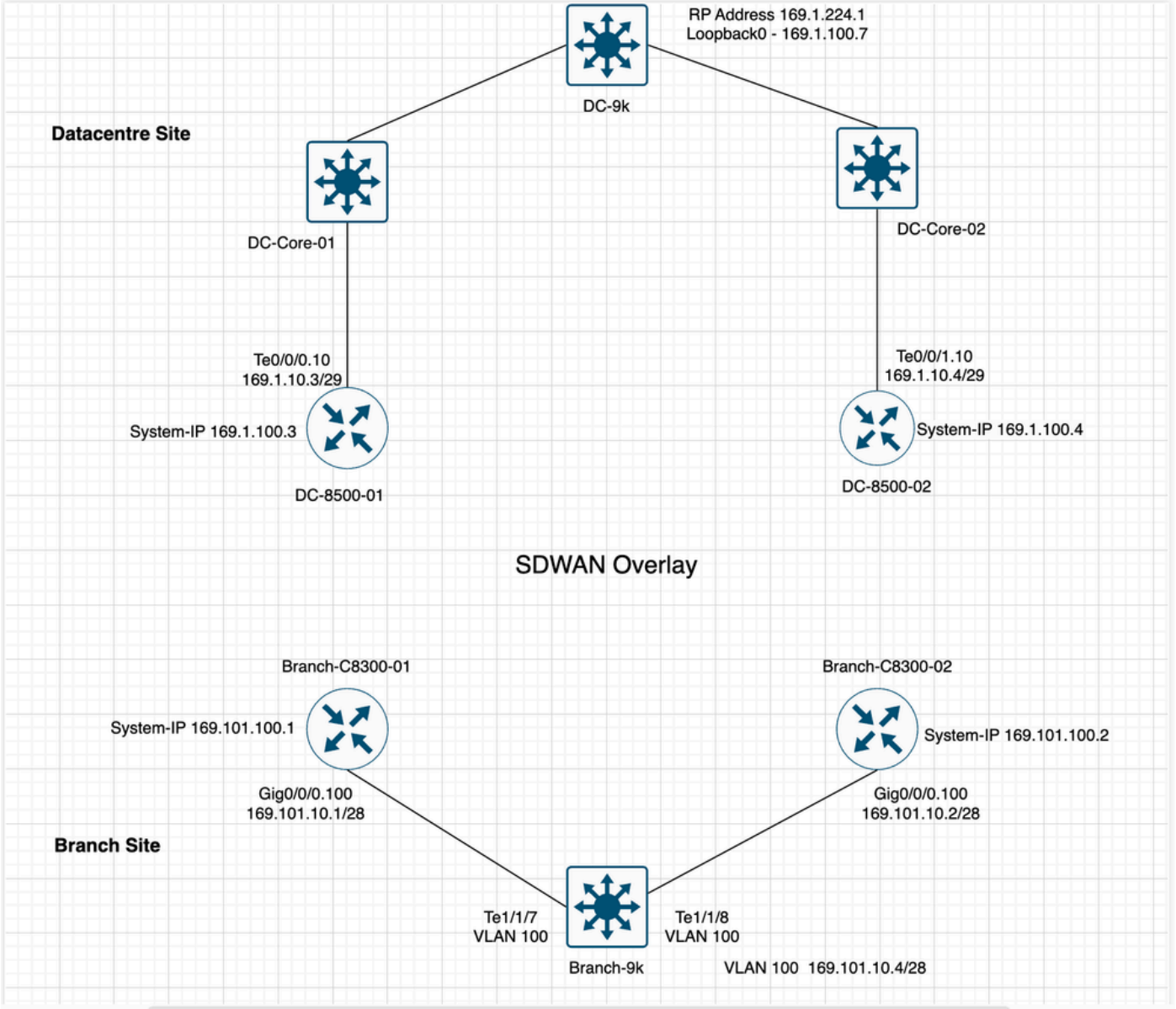
简介

本文档介绍辅助分支路由器无法学习自动RP（交汇点）映射的原因，并提供解决此问题的步骤。

背景信息

在SD-WAN分支站点的双边界路由器设置中，主SD-WAN路由器可以获取自动RP映射消息，而辅助SD-WAN路由器无法获取自动映射消息。如果被选为协议无关组播(PIM)断言转发器的SD-WAN路由器未获知自动RP映射，则分支处的下游交换机也不会收到这些映射。

拓扑图



1. 在此拓扑中，在分支站点SD-WAN路由器Branch-C8300-01和Branch-C8300-02与服务VRF/VPN 10上的交换机Branch-9k具有开放最短路径优先(OSPF)邻居关系。分支路由器Branch-C8300-01是主路由器，OSPF开销为10，而在辅助路由器Branch-C8300-02上，OSPF开销为15。
2. 数据中心站点的DC-9k交换机是RP。以下是此交换机上的配置：

```
ip pim rp-address 169.1.224.1 override
ip pim autorp listener
ip pim send-rp-announce Loopback1 scope 30 group-list RP-Groups
ip pim send-rp-discovery Loopback0 scope 30
ip pim ssm range PIM-SSM-Range

dc1-9k-01#sh ip access-lists RP-Groups
Standard IP access list RP-Groups
    30 permit 239.1.0.0, wildcard bits 0.0.255.255
```

Cisco SD-WAN组播部署的注意事项

- 您只能在数据中心站点设备上配置组播交汇点和复制器节点。无法在分支站点设备上配置复制器。
- 映射代理和候选RP可以部署在数据中心LAN端。
- 思科自动RP不能与PIM BSR共存。必须使用仅支持模式禁用思科自动RP模式。
- 如果同一站点中有两个Cisco IOS XE Catalyst SD-WAN设备，则每个Cisco IOS XE Catalyst SD-WAN设备都需要配置为流量传输的复制器。
- 环回接口是可用于配置RP候选接口的众多接口类型之一。

观察结果

- 当跟踪组播流时，必须从接收端（上一跳路由器）开始，然后移动到源端（第一跳路由器）。此处，Branch-9k是最后一跳路由器(LHR)。
- 在分支端选中时，交换机未收到AutoRP映射。

```
Branch-9k#sh ip pim rp mapping
PIM Group-to-RP Mappings

Branch-9k#
```

交换机上的PIM配置：

```
Branch-9k#sh run | in pim
 ip pim sparse-mode
 ip pim sparse-mode
 ip pim sparse-mode
ip pim autorp listener
ip pim ssm range PIM-SSM-Range
Branch-9k#
```

- 在分支路由器上检查组播转发信息库(MFIB)时，发现分支路由器01上修剪了RP接口。AutoRP使用组224.0.1.40通告RP信息。分支路由器01的show ip pim mfib输出中没有为RP接口设置F标志。分支路由器02上设置了F标志。

<#root>

```
Branch-C8300-01#sh ip mfib vrf 10 224.0.1.40
Entry Flags:    C - Directly Connected, S - Signal, IA - Inherit A flag,
```

```
                ET - Data Rate Exceeds Threshold, K - Keepalive
                DDE - Data Driven Event, HW - Hardware Installed
                ME - MoFRR ECMP entry, MNE - MoFRR Non-ECMP entry, MP - MFIB
                MoFRR Primary, RP - MRIB MoFRR Primary, P - MoFRR Primary
                MS  - MoFRR  Entry in Sync, MC - MoFRR entry in MoFRR Client,
                e   - Encap helper tunnel flag.
I/O Item Flags: IC - Internal Copy, NP - Not platform switched,
                NS - Negate Signalling, SP - Signal Present,
                A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB Forward,
                MA - MFIB Accept, A2 - Accept backup,
                RA2 - MRIB Accept backup, MA2 - MFIB Accept backup
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts:      Total/RPF failed/Other drops
I/O Item Counts:   HW Pkt Count/FS Pkt Count/PS Pkt Count   Egress Rate in pps
VRF 10
 (*,224.0.1.40) Flags: C HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 1741/1741/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: F NS
     Pkts: 0/0/0    Rate: 0 pps
   GigabitEthernet0/0/0.100 Flags: F IC NS
     Pkts: 0/0/0    Rate: 0 pps
 (169.1.10.3,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 29642/29642/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: A
   GigabitEthernet0/0/0.100 Flags: IC
 (169.1.10.4,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 29939/29939/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: A NS
   GigabitEthernet0/0/0.100 Flags: IC
 (169.1.20.2,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 47783/47783/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: A
   GigabitEthernet0/0/0.100 Flags: IC
 (169.1.20.6,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 47720/47720/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: A
   GigabitEthernet0/0/0.100 Flags: IC
 (169.1.20.10,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 47784/47784/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: A
   GigabitEthernet0/0/0.100 Flags: IC
 (169.1.20.14,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 47724/47724/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: A
   GigabitEthernet0/0/0.100 Flags: IC
 (169.1.100.7,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 60088/60088/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: A
   GigabitEthernet0/0/0.100 Flags: IC
 (169.2.20.2,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 47680/47680/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: A
   GigabitEthernet0/0/0.100 Flags: IC
```

```
 (169.2.20.6,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 47640/47640/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: A
   GigabitEthernet0/0/0.100 Flags: IC
Branch-C8300-01#

Branch-C8300-02#sh ip mfib vrf 10 224.0.1.40
Entry Flags:    C - Directly Connected, S - Signal, IA - Inherit A flag,
                ET - Data Rate Exceeds Threshold, K - Keepalive
                DDE - Data Driven Event, HW - Hardware Installed
                ME - MoFRR ECMP entry, MNE - MoFRR Non-ECMP entry, MP - MFIB
                MoFRR Primary, RP - MRIB MoFRR Primary, P - MoFRR Primary
                MS  - MoFRR  Entry in Sync, MC - MoFRR entry in MoFRR Client,
                e   - Encap helper tunnel flag.
I/O Item Flags: IC - Internal Copy, NP - Not platform switched,
                NS - Negate Signalling, SP - Signal Present,
                A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB Forward,
                MA - MFIB Accept, A2 - Accept backup,
                RA2 - MRIB Accept backup, MA2 - MFIB Accept backup
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts:      Total/RPF failed/Other drops
I/O Item Counts:   HW Pkt Count/FS Pkt Count/PS Pkt Count   Egress Rate in pps
VRF 10
 (*,224.0.1.40) Flags: C HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 10549/10549/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: F NS
     Pkts: 0/0/0    Rate: 0 pps
   GigabitEthernet0/0/0.100 Flags: F IC NS
     Pkts: 0/0/0    Rate: 0 pps
```

(169.1.10.3,224.0.1.40) Flags: HW

SW Forwarding: 0/0/0/0, Other: 0/0/0

HW Forwarding: 0/0/0/0, Other: 0/0/0

Lspvif0, LSM/0, RPF-ID: *, Flags: A NS

GigabitEthernet0/0/0.100 Flags: F IC NS   <==

Pkts: 0/0/0   Rate: 0 pps

(169.1.10.4,224.0.1.40) Flags: HW

SW Forwarding: 0/0/0/0, Other: 0/0/0

HW Forwarding: 0/0/0/0, Other: 0/0/0

```
   Lspvif0, LSM/0, RPF-ID: *, Flags: A NS


   GigabitEthernet0/0/0.100 Flags: F IC NS        <==


     Pkts: 0/0/0    Rate: 0 pps


 (169.1.20.2,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 0/0/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: A
   GigabitEthernet0/0/0.100 Flags: F IC NS
     Pkts: 0/0/0    Rate: 0 pps
 (169.1.20.6,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 0/0/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: A
   GigabitEthernet0/0/0.100 Flags: F IC NS
     Pkts: 0/0/0    Rate: 0 pps
 (169.1.20.10,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 0/0/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: A NS
   GigabitEthernet0/0/0.100 Flags: F IC NS
     Pkts: 0/0/0    Rate: 0 pps
 (169.1.20.14,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 0/0/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: A NS
   GigabitEthernet0/0/0.100 Flags: F IC NS
     Pkts: 0/0/0    Rate: 0 pps
 (169.2.20.2,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 0/0/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: A
   GigabitEthernet0/0/0.100 Flags: F IC NS
     Pkts: 0/0/0    Rate: 0 pps
 (169.2.20.6,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 0/0/0
   Lspvif0, LSM/0, RPF-ID: *, Flags: A
   GigabitEthernet0/0/0.100 Flags: F IC NS
     Pkts: 0/0/0    Rate: 0 pps
Branch-C8300-02#
```

设置的F标志表示路由器Branch-C8300-02是AutoRP和组播流量的指定转发器。当PIM邻居位于同一广播域中时，会选择PIM断言转发器/指定转发器。具有最高IP地址的路由器被选为PIM断言转发器/指定转发器。(Active Directory(AD)和度量相同。) 在此场景中，Branch路由器2的IP地址比Branch路由器1的IP地址高：

```
Branch-C8300-01#sh run interface Gi0/0/0.100
Building configuration...
Current configuration : 336 bytes
!
```

```
interface GigabitEthernet0/0/0.100
 description OSPF peering interface1
 encapsulation dot1Q 100
 vrf forwarding 10
 ip address 169.101.10.1 255.255.255.240
 no ip redirects
 ip pim sparse-mode
 ip nbar protocol-discovery
 ip ospf network broadcast
 ip ospf dead-interval 40
 ip ospf 10 area 0
 ip ospf cost 10
 arp timeout 1200
end
```

```
Branch-C8300-02#sh run interface Gi0/0/0.100
Building configuration...
Current configuration : 336 bytes
!
interface GigabitEthernet0/0/0.100
 description OSPF peering interface1
 encapsulation dot1Q 100
 vrf forwarding 10
 ip address 169.101.10.2 255.255.255.240
 no ip redirects
 ip pim sparse-mode
 ip nbar protocol-discovery
 ip ospf network broadcast
 ip ospf dead-interval 40
 ip ospf 10 area 0
 ip ospf cost 15
 arp timeout 1200
end
```

- 我们注意到，Branch路由器01正在接收AutoRP消息，但Branch路由器02没有接收AutoRP消息：

```
Branch-C8300-01#sh ip pim vrf 10 rp mapping
PIM Group-to-RP Mappings
Group(s) 239.195.0.0/16
  RP 10.125.125.1 (?), v2v1
    Info source: 169.254.100.9 (?), elected via Auto-RP
         Uptime: 1w0d, expires: 00:02:31
Branch-C8300-01#

Branch-C8300-02#sh ip pim vrf 10 rp mapping
PIM Group-to-RP Mappings


Branch-C8300-02#
```

- 由于Branch路由器01不是Assert winner，因此S，G被修剪，因此它不能将AutoRP映射转发到下游交换机，而在Branch路由器02上，即使它是Designated Forwarder，它也没有获知AutoRP映射消息，并且它不能将AutoRP转发到下游交换机。现在，问题在于Branch路由器02为什么未获知自动RP消息。
- 分支路由器从DC边界路由器学习自动RP映射。DC SD-WAN路由器充当复制器和映射代理。映射代理决定给定组播组的候选RP。

- 在DC SD-WAN路由器上，检查了MFIB，发现为S、G条目设置了转发标志：

<#root>

```
DC-8500-01#sh ip mfib vrf 10 224.0.1.40
Entry Flags:    C - Directly Connected, S - Signal, IA - Inherit A flag,
                ET - Data Rate Exceeds Threshold, K - Keepalive
                DDE - Data Driven Event, HW - Hardware Installed
                ME - MoFRR ECMP entry, MNE - MoFRR Non-ECMP entry, MP - MFIB
                MoFRR Primary, RP - MRIB MoFRR Primary, P - MoFRR Primary
                MS  - MoFRR  Entry in Sync, MC - MoFRR entry in MoFRR Client,
                e   - Encap helper tunnel flag.
I/O Item Flags: IC - Internal Copy, NP - Not platform switched,
                NS - Negate Signalling, SP - Signal Present,
                A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB Forward,
                MA - MFIB Accept, A2 - Accept backup,
                RA2 - MRIB Accept backup, MA2 - MFIB Accept backup
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts:      Total/RPF failed/Other drops
I/O Item Counts:   HW Pkt Count/FS Pkt Count/PS Pkt Count   Egress Rate in pps
VRF 10
 (*,224.0.1.40) Flags: C HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 294/294/0
   TenGigabitEthernet0/0/0.10 Flags: F IC NS
     Pkts: 0/0/0    Rate: 0 pps
   Lspvif0, LSM/1, RPF-ID: *, Flags: F NS
     Pkts: 0/0/0    Rate: 0 pps
 (169.1.10.4,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 0/0/0
   TenGigabitEthernet0/0/0.10 Flags: A IC
   Lspvif0, LSM/1, RPF-ID: *, Flags: F
     Pkts: 0/0/0    Rate: 0 pps
 (169.1.20.2,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 0/0/0
   TenGigabitEthernet0/0/0.10 Flags: A IC
   Lspvif0, LSM/1, RPF-ID: *, Flags: F
     Pkts: 0/0/0    Rate: 0 pps
 (169.1.20.6,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 0/0/0
   TenGigabitEthernet0/0/0.10 Flags: A IC
   Lspvif0, LSM/1, RPF-ID: *, Flags: F
     Pkts: 0/0/0    Rate: 0 pps
 (169.1.20.10,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 0/0/0
   TenGigabitEthernet0/0/0.10 Flags: A IC
   Lspvif0, LSM/1, RPF-ID: *, Flags: F
```

```
    Pkts: 0/0/0    Rate: 0 pps
 (169.1.20.14,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 0/0/0
   TenGigabitEthernet0/0/0.10 Flags: A IC
   Lspvif0, LSM/1, RPF-ID: *, Flags: F
     Pkts: 0/0/0    Rate: 0 pps
```

(169.1.100.7,224.0.1.40) Flags: HW

SW Forwarding: 0/0/0/0, Other: 0/0/0

HW Forwarding: 0/0/0/0, Other: 0/0/0

TenGigabitEthernet0/0/0.10 Flags: A IC

Lspvif0, LSM/1, RPF-ID: *, Flags: F   <==

Pkts: 0/0/0   Rate: 0 pps

```
 (169.2.20.2,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 0/0/0
   TenGigabitEthernet0/0/0.10 Flags: A IC
   Lspvif0, LSM/1, RPF-ID: *, Flags: F
     Pkts: 0/0/0    Rate: 0 pps
 (169.2.20.6,224.0.1.40) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   0/0/0/0, Other: 0/0/0
   TenGigabitEthernet0/0/0.10 Flags: A IC
   Lspvif0, LSM/1, RPF-ID: *, Flags: F
     Pkts: 0/0/0    Rate: 0 pps
```

Lspvif0是类似点对多点(P2MP)隧道的虚拟隧道接口，即一个终端到多个远程终端。Lspvif0隧道用于SD-WAN组播。Lspvif0是指示数据包通过SD-WAN重叠传输的虚拟隧道。

```
DC-8500-01#sh interfaces Lspvif0
Lspvif0 is up, line protocol is up
  Hardware is
  Interface is unnumbered. Using address of SD-WAN-system-intf (169.1.100.3)
  MTU 17892 bytes, BW 10000000 Kbit/sec, DLY 5000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation LOOPBACK, loopback not set
  Keepalive set (10 sec)
  Last input never, output 00:00:10, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/0 (size/max)
```

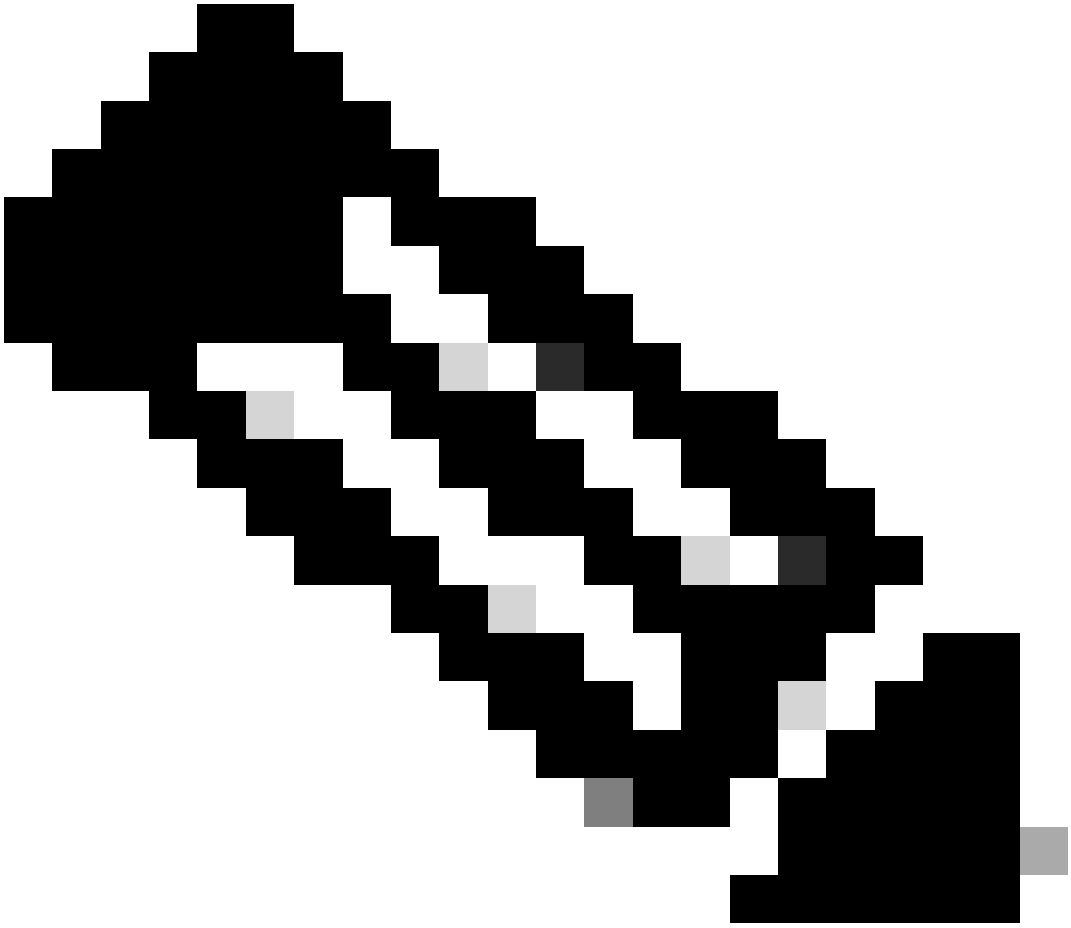
```
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     3 packets input, 210 bytes, 0 no buffer
     Received 0 broadcasts (3 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     1628856 packets output, 71967520 bytes, 0 underruns
     Output 0 broadcasts (1289488 IP multicasts)
     0 output errors, 0 collisions, 0 interface resets
     0 unknown protocol drops
     0 output buffer failures, 0 output buffers swapped out
```

MFIB输出中的LSM/1表示连接到Lspvif0隧道的复制列表。

根据Cisco SD-WAN组播的设计，DC路由器通过重叠管理协议(OMP)学习启用PIM的分支路由器，这些分支路由器的系统IP已添加到复制列表中。

```
DC-8500-01#sh SD-WAN omp multicast-auto-discover
Code:
C   -> chosen
I   -> installed
Red -> redistributed
Rej -> rejected
L   -> looped
R   -> resolved
S   -> stale
Ext -> extranet
Stg -> staged
IA  -> On-demand inactive
Inv -> invalid
BR-R -> border-router reoriginated
TGW-R -> transport-gateway reoriginated

ADDRESS                  SOURCE          FROM
FAMILY   TENANT    VPN   ORIGINATOR      PEER      STATUS
-----------------------------------------------------------
ipv4     0         10    169.1.100.3     0.0.0.0   C,Red,R
         0         10    169.1.100.4     2.2.2.1   Inv,U
                                         2.2.2.2   Inv,U
         0         10    169.101.100.1   2.2.2.1   C,R
                                         2.2.2.2   C,I,R
         0         10    169.101.100.2   2.2.2.1   C,R
                                         2.2.2.2   C,I,R
```



注意：来自DC路由器的AutoRP数据包将通过SD-WAN BFD隧道（数据平面）发送到分支路由器。 DC路由器会将AutoRP数据包封装到IPsec隧道并将其转发到分支路由器。

- 当您看到在DC路由器的MFIB中设置的转发标志时，它表示复制列表是为分支路由器的system-ips构建的，并将根据复制列表转发组播流量。在复制列表中，可以看到两台分支路由器的条目。以下是复制列表的命令输出：

```
DC-8500-01#sh mvpn replication lsm-id 1
Repl ID : 1FFFFF   LSM ID : 1   Uptime : 1w3d
  Path Set ID         : 25
  Replication branches: 2
   IR (169.101.100.1)
      Uptime         : 1w3d          Refcount  : 2
      Remote Label   : 1006
   IR (169.101.100.2)
      Uptime         : 1w3d          Refcount  : 2
      Remote Label   : 1004
```

- 复制列表中出现system-ips后，检查是否建立了到给定分支路由器的间接操作云环境(OCE)链/转发链。正如您在下一个输出中所见，间接OCE仅可用于Branch Router 01。

```
DC-8500-01#sh platform software SD-WAN f0 next-hop indirect all
Show SD-WAN next-hop oce all :

OCE ID: 0xf8000d9f, OCE Type: SD-WAN_NH_INDIRECT
Indirect: client_handle 0x5649f38aaa80, ppe addr 418b02c0
  nhobj_type: SD-WAN_NH_LOCAL_SLA_CLASS, nhobj_handle: 0xf80805cf
  label: 1006, dst_vpn: 10, nexthop sys_ip: 169.101.100.1, sla_class: 1
```

间接OCE链是在DC路由器从各自的分支路由器获取单播路由时构建的内部转发链。这与SD-WAN组播的设计一致，在该设计中，组播将利用单播路由来转发组播RP信息。

DC路由器不将AutoRP映射转发到分支路由器02的原因在于，间接OCE只为Branch Router 01而非Branch Router 02而构建。只有当内部转发链建立到相应分支路由器时，DC路由器才会将AutoRP映射转发到该分支路由器。

- 由于DC路由器在路由信息库(RIB)中没有从分支路由器02获知的任何单播路由，因此不会将转发链构建到分支路由器02。

```
DC-8500-01#sh ip route vrf 10 omp

Routing Table: 10
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, m - OMP
       n - NAT, Ni - NAT inside, No - NAT outside, Nd - NAT DIA
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       H - NHRP, G - NHRP registered, g - NHRP registration summary
       o - ODR, P - periodic downloaded static route, l - LISP
       a - application route
       + - replicated route, % - next hop override, p - overrides from PfR
       & - replicated local route overrides by connected

Gateway of last resort is 169.1.10.1 to network 0.0.0.0

m     169.101.0.0/16 [251/0] via 169.101.100.1, 2w0d, SD-WAN-system-intf
DC-8500-01#
```

- 如下面的OMP routes输出所示，从Branch Router 02获知的路由没有安装到DC路由器的VRF 10 RIB。

```
DC-8500-01#sh SD-WAN omp routes 169.101.0.0/16
Code:
```

```
C   -> chosen
I   -> installed
Red -> redistributed
Rej -> rejected
L   -> looped
R   -> resolved
S   -> stale
Ext -> extranet
Inv -> invalid
Stg -> staged
IA  -> On-demand inactive
U   -> TLOC unresolved
BR-R -> border-router reoriginated
TGW-R -> transport-gateway reoriginated

                                                    PATH                    ATTRIBUTE
TENANT    VPN     PREFIX              FROM PEER     ID     LABEL    STATUS   TYPE       TLOC IP
-------------------------------------------------------------------------------------------------
0         10      169.101.0.0/16      2.2.2.1       15     1004     R        installed  169.101.100.
                                      2.2.2.1       19     1006     C,I,R    installed  169.101.100.
                                      2.2.2.2       16     1004     R        installed  169.101.100.
                                      2.2.2.2       21     1006     C,R      installed  169.101.100.
DC-8500-01#
```

从辅助路由器获知的路由没有安装到RIB的原因是，从辅助路由器获知的路由与主路由器相比具有更高的OSPF开销：

<#root>

```
DC-8500-01#sh SD-WAN omp routes 169.101.0.0/16 detail
------------------------------------------------------------------------------
omp route entries for tenant-id 0 vpn 10 route 169.101.0.0/16
------------------------------------------------------------------------------
            RECEIVED FROM:
peer            2.2.2.1
path-id         15
label           1004
status          R
loss-reason     origin-metric

lost-to-peer    2.2.2.1
lost-to-path-id 19
    Attributes:
     originator       169.101.100.2
     type             installed
     tloc             169.101.100.2, public-internet, ipsec
     ultimate-tloc    not set
     domain-id        not set
     overlay-id        1
     site-id          10
     preference       not set
     affinity-group  None
     region-id        None
     region-path      not set
     route-reoriginator      not set
     tag              not set
     origin-proto     OSPF-external-1
```

```
     origin-metric    35


     as-path          not set
     community        not set
     unknown-attr-len not set
            RECEIVED FROM:
peer            2.2.2.1
path-id         19
label           1006
status          C,I,R
loss-reason     not set
lost-to-peer    not set
lost-to-path-id not set
    Attributes:
     originator       169.101.100.1
     type             installed
     tloc             169.101.100.1, biz-internet, ipsec
     ultimate-tloc    not set
     domain-id        not set
     overlay-id        1
     site-id          10
     preference       not set
     affinity-group  None
     region-id        None
     region-path      not set
     route-reoriginator      not set
     tag              not set
     origin-proto     OSPF-external-1

     origin-metric    30


     as-path          not set
     community        not set
     unknown-attr-len not set
            RECEIVED FROM:
peer            2.2.2.2
path-id         16
label           1004
status          R
loss-reason     origin-metric
lost-to-peer    2.2.2.2
lost-to-path-id 21
    Attributes:
     originator       169.101.100.2
     type             installed
     tloc             169.101.100.2, public-internet, ipsec
     ultimate-tloc    not set
     domain-id        not set
     overlay-id        1
     site-id          10
     preference       not set
     affinity-group  None
     region-id        None
     region-path      not set
     route-reoriginator      not set
     tag              not set
     origin-proto     OSPF-external-1

     origin-metric    35


     as-path          not set
```

```
     community        not set
     unknown-attr-len not set
            RECEIVED FROM:
peer            2.2.2.2
path-id         21
label           1006
status          C,R
loss-reason     not set
lost-to-peer    not set
lost-to-path-id not set
    Attributes:
     originator       169.101.100.1
     type             installed
     tloc             169.101.100.1, biz-internet, ipsec
     ultimate-tloc    not set
     domain-id        not set
     overlay-id        1
     site-id          10
     preference       not set
     affinity-group  None
     region-id        None
     region-path      not set
     route-reoriginator      not set
     tag              not set
     origin-proto     OSPF-external-1

     origin-metric    30


     as-path          not set
     community        not set
     unknown-attr-len not set
DC-8500-01#
```

- 此外，只有OSPF路由分发到分支路由器上的OMP。以下是来自辅助分支路由器的OMP配置：

<#root>

```
 omp
  no shutdown
  overlay-as       65376
  send-path-limit  16
  ecmp-limit       16
  graceful-restart
  no as-dot-notation
  timers
   holdtime               60
   advertisement-interval 1
   graceful-restart-timer 43200
   eor-timer              300
  exit
  address-family ipv4 vrf 10

advertise ospf external

<==
  !
  address-family ipv6
```

```
   advertise connected
   advertise static
```

可能的解决方法

1. 您可以在分支路由器02上配置环回接口，并通过OMP将前缀通告给DC路由器。

```
Branch-C8300-02#sh run interface Lo0
Building configuration...

Current configuration : 151 bytes
!
interface Loopback0
 description Management loopback
 vrf forwarding 10
 ip address 169.101.100.2 255.255.255.255
 no ip redirects
 ip mtu 1500
end
```

在分支路由器02上进行OMP配置，以通告连接的路由：

<#root>

```
 omp
  no shutdown
  overlay-as       65376
  send-path-limit  16
  ecmp-limit       16
  graceful-restart
  no as-dot-notation
  timers
   holdtime               60
   advertisement-interval 1
   graceful-restart-timer 43200
   eor-timer              300
  exit
  address-family ipv4 vrf 10
```

advertise ospf external

advertise connected

```
<==
  !
  address-family ipv6
   advertise connected
   advertise static
  !
 !
```

现在您会看到分支路由器02上学习的AutoRP映射：

```
Branch-C8300-02# sh ip pim vrf 10 rp mapping
PIM Group-to-RP Mappings

Group(s) 239.195.0.0/16
  RP 10.125.125.1 (?), v2v1
    Info source: 169.1.10.4 (terin.net.afrihost.co.za), elected via Auto-RP
         Uptime: 00:02:18, expires: 00:02:47
Branch-C8300-02#
```

同样，您还可以看到在分支机构交换机上学习的AutoRP映射：

```
Branch-9k#sh ip pim rp mapping
PIM Group-to-RP Mappings

Group(s) 239.195.0.0/16
  RP 10.125.125.1 (?), v2v1
    Info source: 169.254.100.9 (?), elected via Auto-RP
         Uptime: 00:03:36, expires: 00:02:46
Acl: RP-Region-Ent-Sites, Static-Override
    RP: 10.125.125.1 (?)
```

当您检查DC路由器上的Indirect OCE/Forwarding chain输出时，它包含主分支路由器和辅助分支路由器的system-ip条目：

<#root>

```
DC-8500-01#sh platform software SD-WAN f0 next-hop indirect all
Show SD-WAN next-hop oce all :

OCE ID: 0xf80009bf, OCE Type: SD-WAN_NH_INDIRECT
Indirect: client_handle 0x5649f389fbc0, ppe addr 418b05c0
  nhobj_type: SD-WAN_NH_LOCAL_SLA_CLASS, nhobj_handle: 0xf808044f
  label: 1006, dst_vpn: 10,

 nexthop sys_ip: 169.101.100.1

, sla_class: 1

OCE ID: 0xf80009df, OCE Type: SD-WAN_NH_INDIRECT
Indirect: client_handle 0x5649f38a11f0, ppe addr 418b06d0
  nhobj_type: SD-WAN_NH_LOCAL_SLA_CLASS, nhobj_handle: 0xf808045f
  label: 1004, dst_vpn: 10,

 nexthop sys_ip: 169.101.100.2

, sla_class: 1
```

现在您会看到DC路由器RIB还安装了从分支路由器02学习的前缀。

<#root>

```
DC-8500-01#sh ip route vrf 10 omp

Routing Table: 10
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, m - OMP
       n - NAT, Ni - NAT inside, No - NAT outside, Nd - NAT DIA
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       H - NHRP, G - NHRP registered, g - NHRP registration summary
       o - ODR, P - periodic downloaded static route, l - LISP
       a - application route
       + - replicated route, % - next hop override, p - overrides from PfR
       & - replicated local route overrides by connected

Gateway of last resort is 169.1.10.1 to network 0.0.0.0

      169.101.0.0/16 is variably subnetted, 3 subnets, 3 masks
m        169.101.0.0/16 [251/0] via 169.101.100.1, 13:59:47, SD-WAN-system-intf
m        169.101.10.0/28
           [251/0] via 169.101.100.2, 00:07:50,

SD-WAN-system-intf


m        169.101.100.2/32
           [251/0] via 169.101.100.2, 00:07:50,

 SD-WAN-system-intf
```

2. 在连接到LAN交换机的分支路由器接口上，配置主分支路由器的IP地址高于辅助路由器的IP地址。通过此主分支路由器将成为指定转发器，因此当主分支路由器获知自动RP信息时，它能够将AutoRP信息转发到交换机。

结论

在思科SD-WAN上实施组播时，您必须确保所有远程路由器（包括主路由器和辅助路由器）都通过OMP将单播前缀通告到靠近RP的SD-WAN路由器。SD-WAN组播利用单播路由建立转发链，这是传输组播控制平面信息所必需的。

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