Cisco SD-WAN組播部署中的自動RP故障排除

目錄

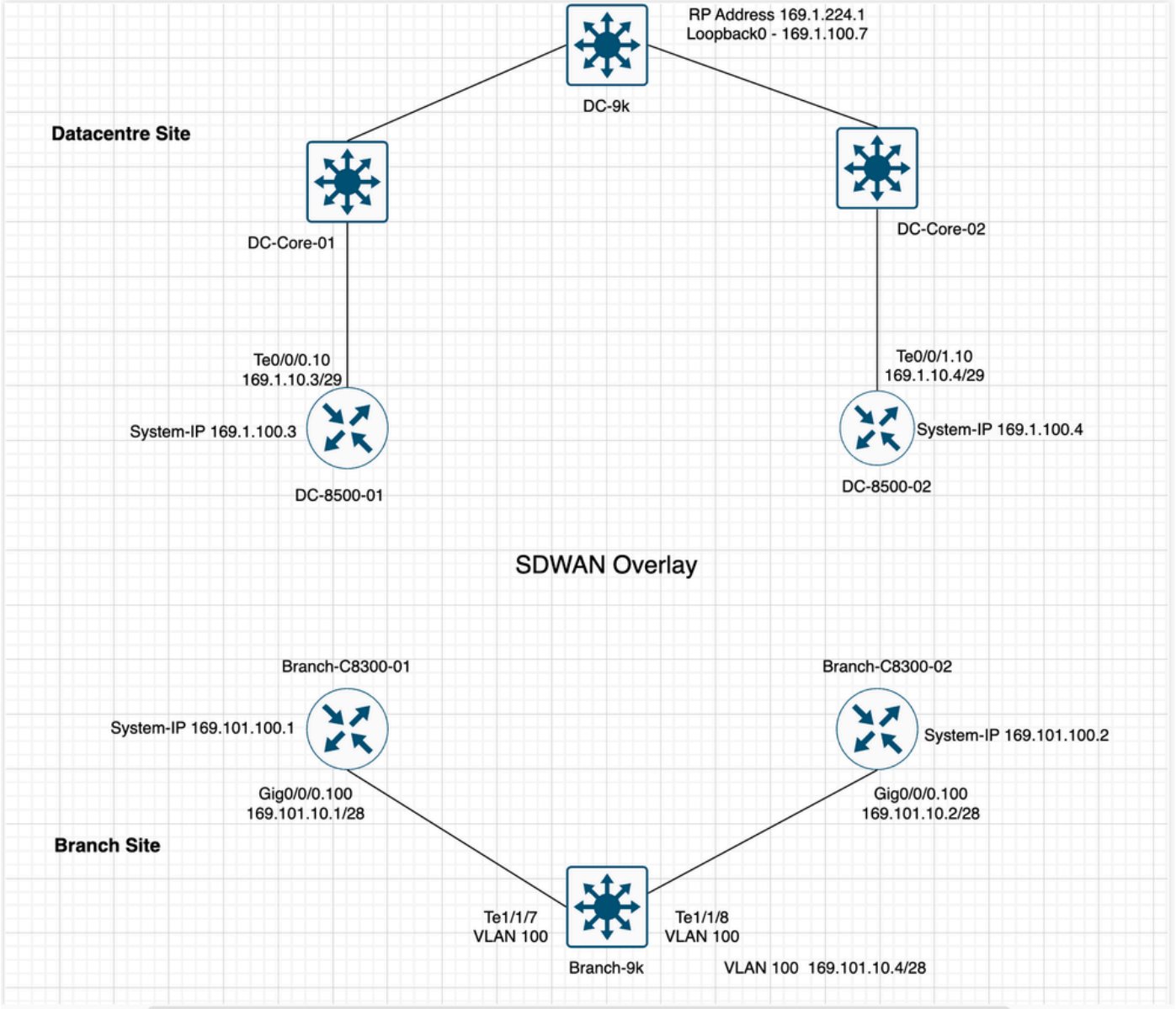
簡介

本文說明為什麼輔助分支路由器無法學習自動RP（集結點）對映，並提供解決此問題的步驟。

背景資訊

在SD-WAN分支站點的雙邊界路由器設定中，主SD-WAN路由器可以學習自動RP對映消息，而輔助SD-WAN路由器不學習自動RP對映消息。如果被選為協定無關組播(PIM)斷言轉發器的SD-WAN路由器沒有學習自動RP對映，則分支中的下游交換機也不會收到這些對映。

拓撲圖表



1. 在此拓撲中，在分支站點SD-WAN路由器Branch-C8300-01和Branch-C8300-02與服務VRF/VPN 10上的交換機Branch-9k具有開放最短路徑優先(OSPF)鄰居關係。分支路由器Branch-C8300-01是主路由器，OSPF開銷為10，而在輔助路由器Branch-C8300-02上，OSPF開銷為15。
2. 資料中心站點的DC-9k交換機是RP。以下是該交換器上的組態：

```
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組播部署的注意事項

- 您只能在資料中心站點裝置上配置組播集點和複製器節點。無法在分支站點裝置上配置Replicator。
- 對映代理和候選RP可以部署在資料中心LAN端。
- Cisco自動RP不能與PIM BSR共存。必須使用僅支援模式禁用Cisco自動RP模式。
- 如果同一站點中有兩個Cisco IOS XE Catalyst SD-WAN裝置，則每個Cisco IOS XE Catalyst SD-WAN裝置都需要配置為流量流動的複製器。
- 環回介面是可用於配置RP候選介面的眾多介面型別之一。

意見

- 追蹤多點傳播流時，您必須從接收端（最後一個躍點路由器）開始，然後移動到來源端（第一個躍點路由器）。 這裡的Branch-9k是最後一跳路由器(LHR)。
- 在分支端選中時，交換機未接收AutoRP對映。

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

Branch-9k#
```

交換機上的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#
```

- 在分支路由器上檢查組播轉發資訊庫(MFIB)時，發現分支路由器01上的RP介面被修剪。AutoRP使用組224.0.1.40通告RP資訊。分支路由器01的show ip pim mfib輸出中沒有為RP介面設定F標誌。分支路由器02上設定了F標誌。

<#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#
```

正在設定的F標誌表示路由器Branch-C8300-02是AutoRP和多播流量的指定轉發器。當PIM鄰居位於同一個廣播域中時，會選擇PIM斷言轉發器/指定轉發器。具有最高IP地址的路由器被選為PIM斷言轉發器/指定轉發器。(Active Directory(AD)和度量相同。) 在此案例中，Branch路由器2的IP地址高於Branch路由器1:

```
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
```

- 已注意到Branch路由器01正在接收AutoRP消息，但Branch路由器02沒有接收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#
```

- 由於Branch路由器01不是Assert winner，因此S，G被修剪，因此無法將AutoRP對映轉發到

下游交換機，而在Branch路由器02上，即使它是Designted Forwarder，它也沒有獲知AutoRP對映消息，並且它無法將AutoRP轉發到下游交換機。現在，問題在於為什麼Branch路由器02未獲知自動RP消息。

- 分支路由器從DC邊界路由器獲知AutoRP對映。DC SD-WAN路由器充當複製器和對映代理。對映代理決定給定組播組的候選RP。

- 在DC SD-WAN路由器上，檢查了MFIB，發現為S、G條目設定了轉發標誌：

<#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是虛擬隧道介面，如點對多點(P2MP)隧道，即一個端點到多個遠端端點。Lspvif0隧道用於SD-WAN組播。Lspvif0是指示資料包通過SD-WAN重疊傳輸的虛擬隧道。

```
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
```

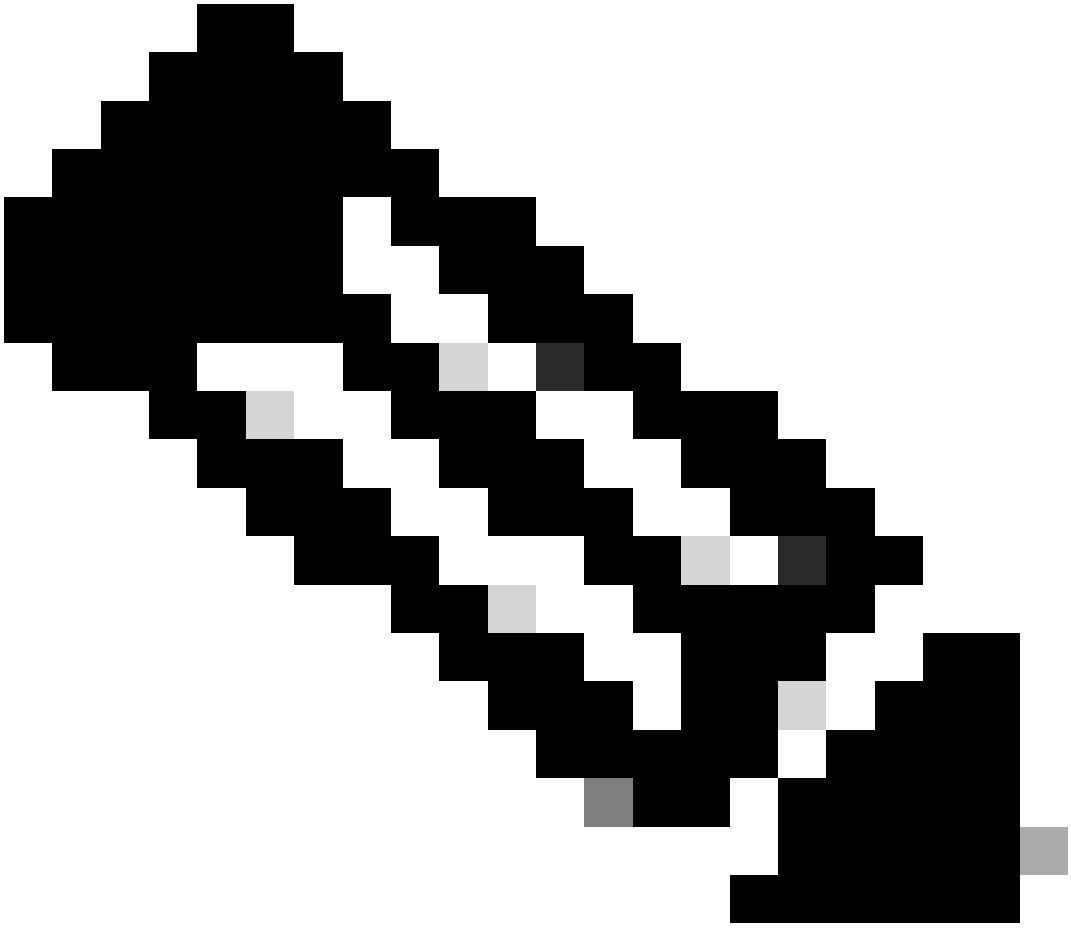
```
     3 packets input, 210 bytes, 0 no buffer
     Received 0 broadcasts (3 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     1628856 packets output, 71967520 bytes, 0 underruns
     Output 0 broadcasts (1289488 IP multicasts)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

MFIB輸出中的LSM/1表示連線到Lspvif0隧道的複製清單。

根據Cisco SD-WAN組播的設計，DC路由器通過重疊管理協定(OMP)學習啟用了PIM的分支路由器，這些分支路由器的系統IP將新增到複製清單中。

```
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
```



附註：來自DC路由器的AutoRP資料包將通過SD-WAN BFD隧道（資料平面）傳送到Branch路由器。 DC路由器將將AutoRP資料包封裝到IPsec隧道並將其轉發到Branch路由器。

- 當您看到DC路由器的MFIB中設定的轉發標誌時，它表示複製清單是為分支路由器的system-ips構建的，並將根據複製清單轉發組播流量。在複製清單中，您可以看到兩台分支路由器的條目。以下是複製清單的指令輸出：

```
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
```

- 複製清單中出現system-ips後，檢查是否對給定分支路由器建立了間接運行雲環境(OCE)鏈/轉發鏈。正如您在下一個輸出中所看到的，間接OCE僅可用於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
```

間接OCE鏈是在DC路由器從各自的分支路由器獲知單播路由時構建的內部轉發鏈。這與SD-WAN組播的設計相同，在該設計中，組播將利用單播路由轉發組播RP資訊。

DC路由器沒有將AutoRP對映轉發到分支路由器02的原因在於，間接OCE只為分支路由器01構建，而不是為分支路由器02構建。僅當建立到相應分支路由器的內部轉發鏈時，DC路由器才會將AutoRP對映轉發到該分支路由器。

- 由於DC路由器從分支路由器02獲知的路由資訊庫(RIB)中沒有單播路由，因此不會將轉發鏈構建到分支路由器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路由輸出所示，從Branch路由器02獲知的路由沒有安裝到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#
```

從輔助路由器獲知的路由未安裝到RIB的原因是，從輔助路由器獲知的路由的OSPF開銷高於主路由器：

<#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路由分發到分支路由器上的OMP。以下是來自輔助分支路由器的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
```

可能的變通辦法

1. 您可以在branch路由器02上配置環回介面，並通過OMP向DC路由器通告字首。

```
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
```

分支路由器02上的OMP配置用於通告連線的路由：

<#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
  !
```

!

現在您會看到在分支路由器02上學習的AutoRP對映：

```
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#
```

同樣，您也可在分支機構交換機上看到AutoRP對映：

```
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 (?)
```

當您檢查DC路由器上的間接OCE/轉發鏈輸出時，它包含主分支路由器和輔助分支路由器的system-ip條目：

<#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
```

現在您會看到DC路由器RIB也安裝了從分支路由器02獲知的字首。

<#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. 在連線到LAN交換機的分支機構路由器介面上，在主分支機構路由器上配置比輔助路由器更高的IP地址。通過此主分支路由器將成為「指定轉發器」，這樣，當主分支路由器獲知AutoRP資訊時，它將能夠將AutoRP資訊轉發到交換機。

結論

當通過Cisco SD-WAN實施組播時，您必須確保所有遠端路由器（包括主路由器和輔助路由器）都通過OMP向更靠近RP的SD-WAN路由器通告單播字首。SD-WAN組播利用單播路由建立轉發鏈，這是傳輸組播控制平面資訊所必需的。

關於此翻譯

思科已使用電腦和人工技術翻譯本文件，讓全世界的使用者能夠以自己的語言理解支援內容。請注意，即使是最佳機器翻譯，也不如專業譯者翻譯的內容準確。Cisco Systems, Inc. 對這些翻譯的準確度概不負責，並建議一律查看原始英文文件（提供連結）。