

# 實施ACI傳輸路由(Multipod)

## 目錄

---

[簡介](#)

[必要條件](#)

[需求](#)

[採用元件](#)

[背景資訊](#)

[設定](#)

[網路圖表](#)

[組態](#)

[相關資訊](#)

---

## 簡介

本檔案介紹如何在以應用程式為中心的基礎架構(ACI)多容器環境中設定傳輸路由。

## 必要條件

### 需求

思科建議您瞭解以下主題：

1. ACI多腳架
2. L3Out
3. 合約
4. 路由協定

### 採用元件

本文中的資訊係根據以下軟體和硬體版本：

1. 2台N5K-C5548UP交換機，均在NXOS版本7.3(8)上（用作外部路由器）
2. 1個N9K-C9332PQ枝葉交換機和1個N9K-C93108TC-EX枝葉交換機，均位於ACI 14.2(7f)版上
3. 2台N9K-C9336PQ主幹交換機，均位於ACI 14.2(7f)版上
4. 1台N9K-C9232C交換機（用作IPN裝置）在NXOS版本10.3(3)上

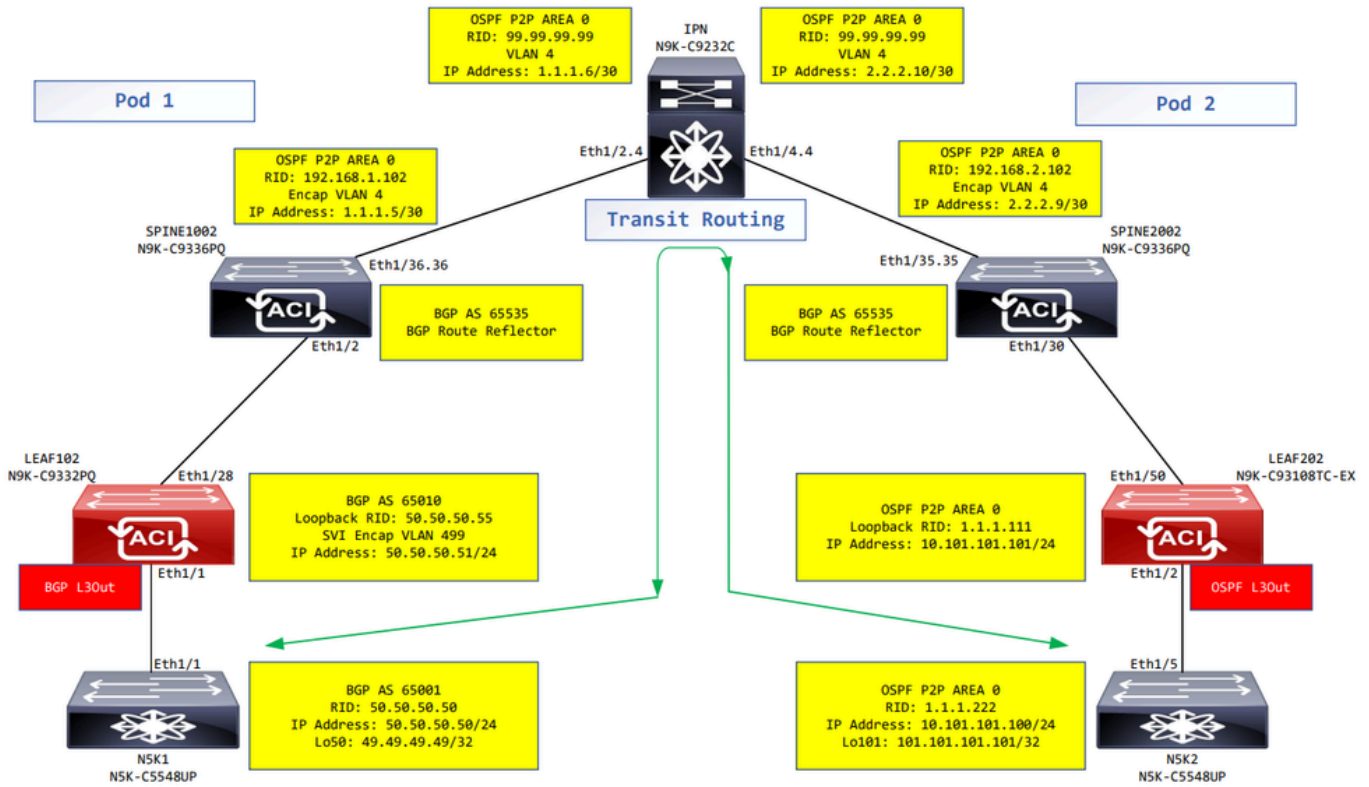
本文中的資訊是根據特定實驗室環境內的上述裝置所建立。文中使用到的所有裝置皆從已清除（預設）的組態來啟動。如果您的網路運作中，請確保您瞭解任何指令可能造成的影響。

## 背景資訊

在傳輸路由中，思科ACI交換矩陣將從一個第3層輸出(L3Out)連線獲知的路由通告到另一個L3Out連線。外部第3層域與邊界枝葉交換機上的交換矩陣對等。交換矩陣是對等體之間的傳輸多協定邊界網關協定(MP-BGP)域。

## 設定

### 網路圖表



網路圖表

## 組態

邏輯節點配置檔案用於標識連線到外部網路的枝葉交換機，並且可以向其部署路由協定或靜態路由。要在L3Out中檢視邏輯節點配置檔案，請導航到 Tenant > Networking > L3Outs > L3Out > Logical Node Profiles > Logical Node Profile 如下圖所示。

Logical Node Profile - MR-BGP\_nodeProfile

Policy | Faults | History

Properties

Name: MR-BGP\_nodeProfile  
Description: optional  
Alias:   
Target DSCP: Unspecified

Nodes:

Node ID	Router ID	Loopback Address
topology/pod-1/node-102	50.50.50.55	50.50.50.55

BGP Peer Connectivity:

Peer IP Address	Peer Controls	Interface
50.50.50.24		Pod-1/Node-102/eth1/1

LEAF102的邏輯節點配置檔案

Logical Node Profile - MR-OSPF\_nodeProfile

Policy | Faults | History

Properties

Name: MR-OSPF\_nodeProfile  
Description: optional  
Alias:   
Target DSCP: Unspecified

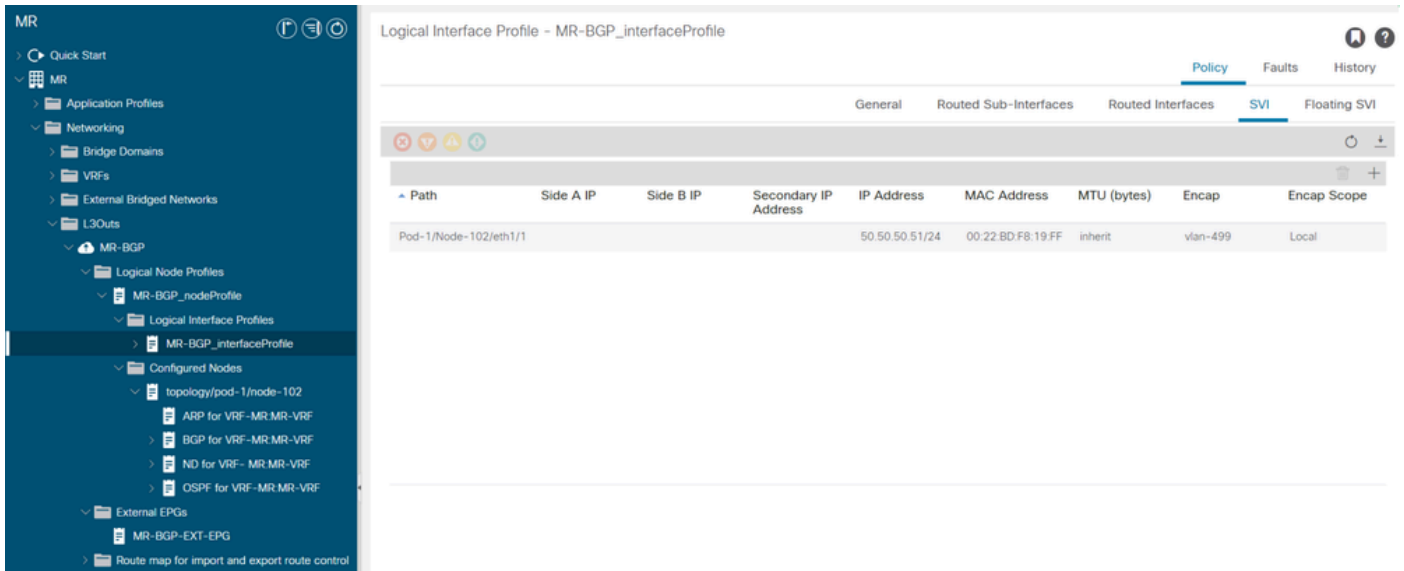
Nodes:

Node ID	Router ID	Loopback Address
topology/pod-2/node-202	1.1.1.111	1.1.1.111

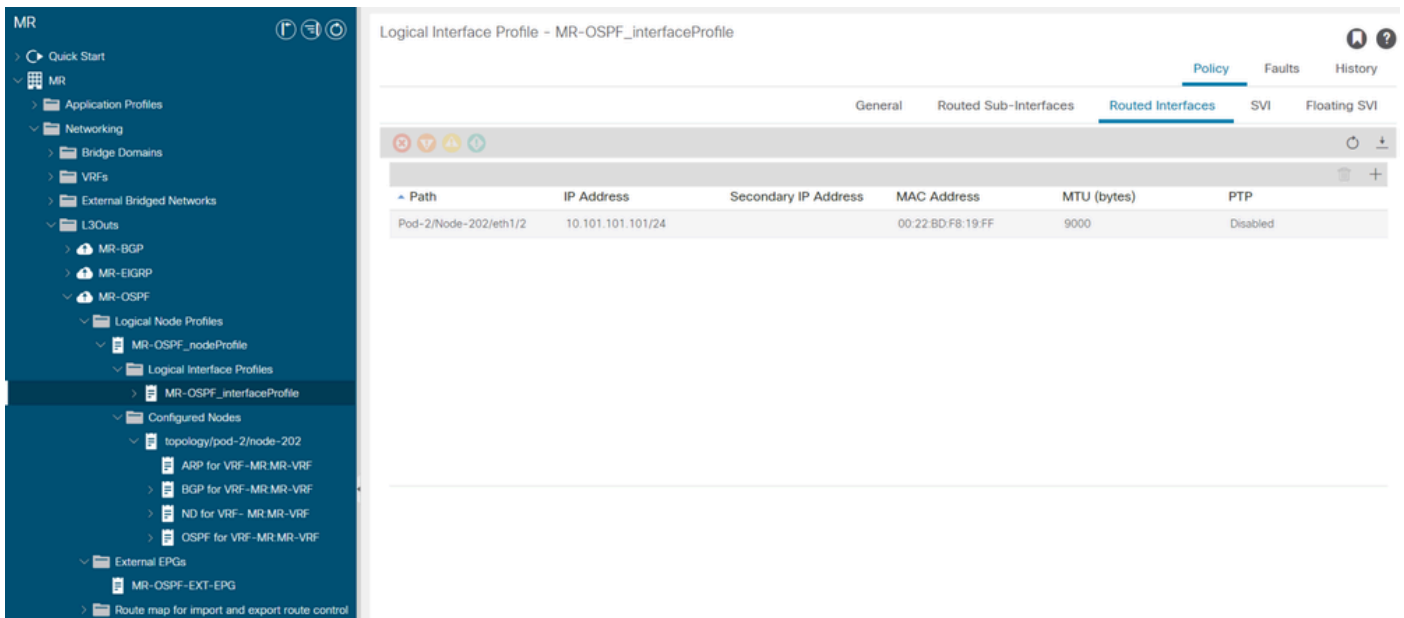
Create BGP Protocol Profile:

LEAF202的邏輯節點配置檔案

邏輯介面配置檔案用於標識連線到外部裝置的L3Out介面。您會看到為虛擬路由和轉送(VRF)定義的幾個功能元素：地址解析協定(ARP)、邊界網關協定(BGP)、鄰居發現和開放最短路徑優先(OSPF)，這是兩個配置檔案的結果。要在L3Out中檢視邏輯介面配置檔案，請導航到 Tenant > Networking > L3Outs > L3Out > Logical Node Profiles > Logical Node Profile > Logical Interface Profiles > Logical Interface Profile。在這些示例中，在邏輯介面配置檔案中配置了SVI。



LEAF102, eth1/1的邏輯介面配置檔案



LEAF202, eth1/2的邏輯介面配置檔案

外部EPG例項配置檔案 ( 外部EPG、L3Out EPG ) 表示具有相同安全行為的外部子網組。其他子網還可以與其他範圍關聯，這些範圍定義了該子網的路由行為。要在L3Out中檢視外部EPG，請導航到 Tenant > Networking > L3Outs > L3Out > External EPGs > External EPG 如下圖所示。

**External EPG Instance Profile - MR-BGP-EXT-EPG**

Policy | Operational | Stats | Health | Faults | History

General | Contracts | Inherited Contracts

Properties

Name: MR-BGP-EXT-EPG  
 Alias:   
 Tags:  (enter tags separated by comma)  
 Global Alias:   
 Description: optional

pcTag: 49159  
 Contract Exception Tag:   
 Configured VRF Name: MR-VRF  
 Resolved VRF: uni/tn-MR/ctx-MR-VRF  
 QoS Class: Unspecified  
 Target DSCP: Unspecified

Configuration Status: applied  
 Configuration Issues:

Preferred Group Member:  Exclude  Include

Subnets:

IP Address	Scope	Name	Aggregate	Route Control Profile	Route Summarization Policy
49.49.49.49/32					External Subnets for th...

MR-BGP L3Out的外部EPG例項配置檔案

**External EPG Instance Profile - MR-OSPF-EXT-EPG**

Policy | Operational | Stats | Health | Faults | History

General | Contracts | Inherited Contracts

Properties

Name: MR-OSPF-EXT-EPG  
 Alias:   
 Tags:  (enter tags separated by comma)  
 Global Alias:   
 Description: optional

pcTag: 49156  
 Contract Exception Tag:   
 Configured VRF Name: MR-VRF  
 Resolved VRF: uni/tn-MR/ctx-MR-VRF  
 QoS Class: Unspecified  
 Target DSCP: Unspecified

Configuration Status: applied  
 Configuration Issues:

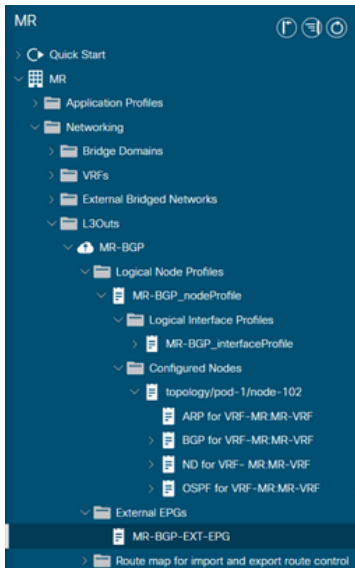
Preferred Group Member:  Exclude  Include

Subnets:

IP Address	Scope	Name	Aggregate	Route Control Profile	Route Summarization Policy
101.101.101.101/32					External Subnets for th...

MR-OSPF L3Out的外部EPG例項配置檔案

在這些示例中， MR-PERMIT-ICMP合約在外部EPG中同時作為提供合約和消費合約應用。



External EPG Instance Profile - MR-BGP-EXT-EPG

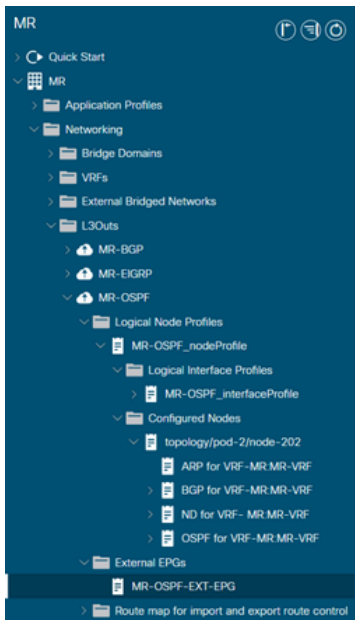
Policy | Operational | Stats | Health | Faults | History

General | **Contracts** | Inherited Contracts

Healthy

Name	Tenant	Tenant Alias	Contract Type	Provided / Consumed	QoS Class	State	Label	Subject Label
<b>Contract Type: Contract</b>								
MR-PERMIT-ICMP	MR		Contract	Provided	Unspecified	formed		
MR-PERMIT-ICMP	MR		Contract	Consumed	Unspecified	formed		

MR-PERMIT-ICMP合約適用於MR-BGP-EXT-EPG



External EPG Instance Profile - MR-OSPF-EXT-EPG

Policy | Operational | Stats | Health | Faults | History

General | **Contracts** | Inherited Contracts

Healthy

Name	Tenant	Tenant Alias	Contract Type	Provided / Consumed	QoS Class	State	Label	Subject Label
<b>Contract Type: Contract</b>								
MR-PERMIT-ICMP	MR		Contract	Provided	Unspecified	formed		
MR-PERMIT-ICMP	MR		Contract	Consumed	Unspecified	formed		

MR-PERMIT-ICMP合約適用於MR-OSPF-EXT-EPG

於 LEAF102,BGP與鄰居建立 50.50.50.50 正在接收外部網路 49.49.49/32.

LEAF102上的BGP對等項

```
LEAF102# show ip bgp summary vrf MR:MR-VRF
BGP summary information for VRF MR:MR-VRF, address family IPv4 Unicast
BGP router identifier 50.50.50.55, local AS number 65535
BGP table version is 37, IPv4 Unicast config peers 4, capable peers 2
14 network entries and 16 paths using 1952 bytes of memory
BGP attribute entries [12/1776], BGP AS path entries [0/0]
BGP community entries [0/0], BGP clusterlist entries [5/28]

Neighbor      V    AS MsgRcvd MsgSent  TblVer  InQ  OutQ  Up/Down  State/PfxRcd
50.50.50.50   4 65001   1691   1700     37    0    0    1d04h 1
```

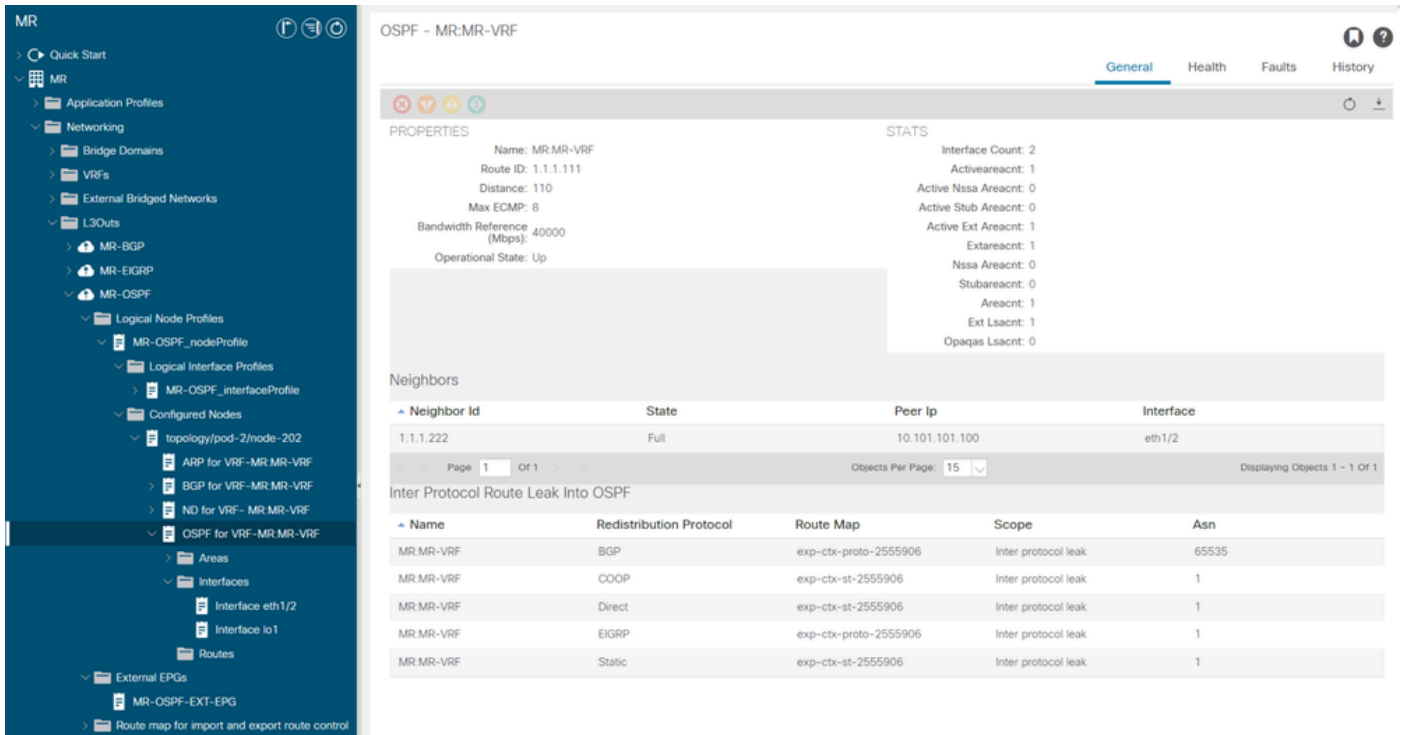
LEAF102上VRF MR:MR-VRF的BGP摘要

```
LEAF102# show ip route bgp vrf MR:MR-VRF
IP Route Table for VRF "MR:MR-VRF"
'*' denotes best ucast next-hop
***' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]
'%<string>' in via output denotes VRF <string>

49.49.49.49/32, ubest/mbest: 1/0
 *via 50.50.50.50%MR:MR-VRF, [20/0], 1d04h, bgp-65535, external, tag 65010
```

LEAF102上VRF MR:MR-VRF的BGP路由

於 LEAF202,OSPF與鄰居建立 1.1.1.222 正在接收外部網路 101.101.101.101/32.



LEAF202上的OSPF鄰居條目

```
LEAF202# show ip ospf neighbors vrf MR:MR-VRF
OSPF Process ID default VRF MR:MR-VRF
Total number of neighbors: 1
Neighbor ID      Pri State           Up Time   Address          Interface
1.1.1.222        1 FULL/ -          2d04h    10.101.101.100  Eth1/2
```

LEAF202上VRF MR:MR-VRF的OSPF鄰居

```
LEAF202# show ip route ospf vrf MR:MR-VRF
IP Route Table for VRF "MR:MR-VRF"
'*' denotes best ucast next-hop
 '**' denotes best mcast next-hop
 '[x/y]' denotes [preference/metric]
 '%<string>' in via output denotes VRF <string>

101.101.101.101/32, ubest/mbest: 1/0
 *via 10.101.101.100, eth1/2, [110/41], 1d00h, ospf-default, intra
```

LEAF202上VRF MR:MR-VRF的OSPF路由

兩者 LEAF102 和 LEAF202中，VRF的MP-BGP表顯示外部BGP網路， 49.49.49.49/32，但它顯示為外部的 LEAF102 和內部 LEAF202.OSPF外部網路、 101.101.101.101/32也出現在兩台枝葉交換機的BGP表中；開啟 LEAF202 它顯示為redistributed from OSPF and on LEAF102 它顯示為內部。

```
LEAF102# show bgp vpnv4 unicast vrf MR:MR-VRF
BGP routing table information for VRF overlay-1, address family VPNv4 Unicast
BGP table version is 119, local router ID is 10.0.232.68
Status: s-suppressed, x-deleted, S-stale, d-dampened, h-history, *-valid, >-best
Path type: i-internal, e-external, c-confed, l-local, a-aggregate, r-redist, I-injected
Origin codes: i - IGP, e - EGP, ? - incomplete, | - multipath, & - backup

Network          Next Hop          Metric   LocPrf   Weight Path
Route Distinguisher: 102:2555906 (VRF MR:MR-VRF)
*>e49.49.49.49/32  50.50.50.50      0        0 65010 65001 i
*>i101.101.101.101/32 20.0.248.0      41       100    0 ?
```

適用於LEAF102上的VRF MR:MR-VRF的MP-BGP表



```

LEAF202# show bgp vpnv4 unicast vrf MR:MR-VRF
BGP routing table information for VRF overlay-1, address family VPNv4 Unicast
BGP table version is 95, local router ID is 20.0.248.0
Status: s-suppressed, x-deleted, S-stale, d-dampened, h-history, *-valid, >-best
Path type: i-internal, e-external, c-confed, l-local, a-aggregate, r-redist, I-injected
Origin codes: i - IGP, e - EGP, ? - incomplete, | - multipath, & - backup

   Network          Next Hop          Metric      LocPrf      Weight Path
Route Distinguisher: 202:2555906 (VRF MR:MR-VRF)
*>i49.49.49.49/32    10.0.232.68      100         100         0 65010 65001 i
*>r101.101.101.101/32 0.0.0.0          41          100         32768 ?

```

適用於LEAF202上VRF MR:MR-VRF的MP-BGP表

BGP IPv4表包含等效資訊。

```

LEAF102# show bgp ipv4 unicast vrf MR:MR-VRF
BGP routing table information for VRF MR:MR-VRF, address family IPv4 Unicast
BGP table version is 37, local router ID is 50.50.50.55
Status: s-suppressed, x-deleted, S-stale, d-dampened, h-history, *-valid, >-best
Path type: i-internal, e-external, c-confed, l-local, a-aggregate, r-redist, I-injected
Origin codes: i - IGP, e - EGP, ? - incomplete, | - multipath, & - backup

   Network          Next Hop          Metric      LocPrf      Weight Path
*>e49.49.49.49/32    50.50.50.50      0           100         65010 65001 i
*>i101.101.101.101/32 20.0.248.0       41          100         0 ?

```

適用於LEAF102上VRF MR:MR-VRF的BGP IPv4表

```

LEAF202# show bgp ipv4 unicast vrf MR:MR-VRF
BGP routing table information for VRF MR:MR-VRF, address family IPv4 Unicast
BGP table version is 31, local router ID is 1.1.1.111
Status: s-suppressed, x-deleted, S-stale, d-dampened, h-history, *-valid, >-best
Path type: i-internal, e-external, c-confed, l-local, a-aggregate, r-redist, I-injected
Origin codes: i - IGP, e - EGP, ? - incomplete, | - multipath, & - backup

   Network          Next Hop          Metric      LocPrf      Weight Path
*>i49.49.49.49/32    10.0.232.68      100         100         0 65010 65001 i
*>r101.101.101.101/32 0.0.0.0          41          100         32768 ?

```

適用於LEAF202上VRF MR:MR-VRF的BGP IPv4表

但是，OSPF外部網路、 101.101.101.101/32不在的路由表中 N5K1.

```

N5K1# show ip route vrf MR-BGP
IP Route Table for VRF "MR-BGP"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]
'%<string>' in via output denotes VRF <string>

49.49.49.49/32, ubest/mbest: 2/0, attached
  *via 49.49.49.49, Lo50, [0/0], 1d07h, local
  *via 49.49.49.49, Lo50, [0/0], 1d07h, direct
50.50.50.0/24, ubest/mbest: 1/0, attached
  *via 50.50.50.50, Vlan499, [0/0], 1d07h, direct
50.50.50.50/32, ubest/mbest: 1/0, attached
  *via 50.50.50.50, Vlan499, [0/0], 1d07h, local

```

用於N5K1上的VRF MR-BGP的RIB

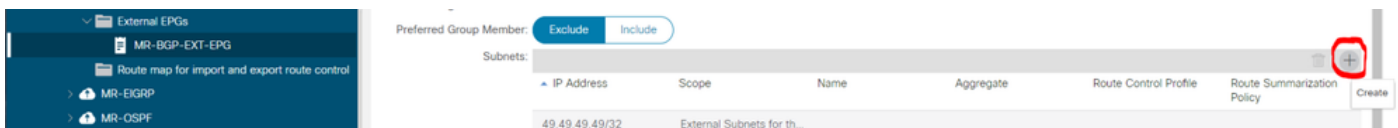
同樣，BGP外部網路， 49.49.49.49/32，不在 N5K2 肋骨。

```
N5K2# show ip route vrf MR-OSPF
IP Route Table for VRF "MR-OSPF"
'*' denotes best ucast next-hop
 '**' denotes best mcast next-hop
 '[x/y]' denotes [preference/metric]
 '%<string>' in via output denotes VRF <string>

1.1.1.111/32, ubest/mbest: 1/0
  *via 10.101.101.101, Eth1/5, [110/41], 2d05h, ospf-1, intra
10.101.101.0/24, ubest/mbest: 1/0, attached
  *via 10.101.101.100, Eth1/5, [0/0], 6d22h, direct
10.101.101.100/32, ubest/mbest: 1/0, attached
  *via 10.101.101.100, Eth1/5, [0/0], 6d22h, local
101.101.101.101/32, ubest/mbest: 2/0, attached
  *via 101.101.101.101, Lo101, [0/0], 2d04h, local
  *via 101.101.101.101, Lo101, [0/0], 2d04h, direct
```

用於N5K2上的VRF MR-OSPF的RIB

在BGP L3Out中，導航至 External EPGs > External EPG > Subnets 並選擇 + 圖示。輸入從OSPF L3Out接收的外部子網的IP地址。 101.101.101.101/32. 選擇 Export Route Control Subnet 在 Route Control 分割槽並清除 External Subnets for the External EPG 分類。按一下 Submit.其 Export Route Control Subnet 選項允許將網路匯出 (通告) 到外部對等體。



建立新子網

Create Subnet

IP Address: 101.101.101.101/32  
address/mask

Name:

Route Control:

Export Route Control Subnet  
 Import Route Control Subnet  
 Shared Route Control Subnet

Aggregate

Aggregate Export  
 Aggregate Import  
 Aggregate Shared Routes

Route Summarization Policy

BGP Route Summarization Policy: select an option

Route Control Profile:

Name	Direction
------	-----------

Route control is used for filtering external routes advertised out of the fabric, allowed into the fabric, or leaked to other VRFs within the fabric.

External EPG classification:

External Subnets for External EPG  
 Shared Security Import Subnet

External EPG classification is used to identify the external networks associated with this external EPG for policy enforcement (Contracts).

Cancel Submit

為新子網配置正確的選項

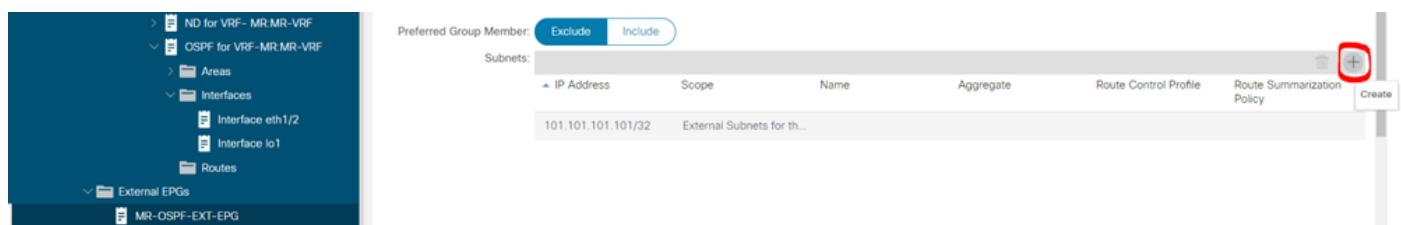
於 N5K1, OSPF外部網路, 101.101.101.101/32, 現在通過BGP接收。

```
N5K1# show ip route vrf MR-BGP
IP Route Table for VRF "MR-BGP"
'*' denotes best ucast next-hop
 '**' denotes best mcast next-hop
 '[x/y]' denotes [preference/metric]
 '%<string>' in via output denotes VRF <string>

49.49.49.32, ubest/mbest: 2/0, attached
  *via 49.49.49.49, Lo50, [0/0], 1d08h, local
  *via 49.49.49.49, Lo50, [0/0], 1d08h, direct
50.50.50.0/24, ubest/mbest: 1/0, attached
  *via 50.50.50.50, Vlan499, [0/0], 1d08h, direct
50.50.50.50/32, ubest/mbest: 1/0, attached
  *via 50.50.50.50, Vlan499, [0/0], 1d08h, local
101.101.101.101/32, ubest/mbest: 1/0
  *via 50.50.50.51, [20/0], 00:00:03, bgp-65001, external, tag 65010,
```

用於N5K1上的VRF MR-BGP的RIB

在OSPF L3Out中, 導航至 External EPGs > External EPG > Subnets 並選擇 + 圖示。輸入從BGP L3Out接收的外部子網的IP地址。 49.49.49.49/32. 選擇 Export Route Control Subnet 在 Route Control 剖分並清除 External Subnets for the External EPG 分類。按一下 Submit.



建立新子網

## Create Subnet



IP Address:   
address/mask

Name:

### Route Control:

- Export Route Control Subnet
- Import Route Control Subnet
- Shared Route Control Subnet

### Aggregate

- Aggregate Export
- Aggregate Import
- Aggregate Shared Routes

### Route Summarization Policy

### Route Control Profile:

Name	Direction
------	-----------

Route control is used for filtering external routes advertised out of the fabric, allowed into the fabric, or leaked to other VRFs within the fabric.

### External EPG classification:

- External Subnets for External EPG
- Shared Security Import Subnet

External EPG classification is used to identify the external networks associated with this external EPG for policy enforcement (Contracts).

Cancel

Submit

為新子網配置正確的選項

現在開始 N5K2,BGP外部網路 , 49.49.49.49/32通過OSPF接收。

```
N5K2# show ip route vrf MR-OSPF
IP Route Table for VRF "MR-OSPF"
'*' denotes best ucast next-hop
 '**' denotes best mcast next-hop
 '[x/y]' denotes [preference/metric]
 '%<string>' in via output denotes VRF <string>

1.1.1.111/32, ubest/mbest: 1/0
  *via 10.101.101.101, Eth1/5, [110/41], 2d05h, ospf-1, intra
10.101.101.0/24, ubest/mbest: 1/0, attached
  *via 10.101.101.100, Eth1/5, [0/0], 6d22h, direct
10.101.101.100/32, ubest/mbest: 1/0, attached
  *via 10.101.101.100, Eth1/5, [0/0], 6d22h, local
49.49.49.49/32, ubest/mbest: 1/0
  *via 10.101.101.101, Eth1/5, [110/1], 00:01:59, ospf-1, type-2, tag 4294967295,
101.101.101.101/32, ubest/mbest: 2/0, attached
  *via 101.101.101.101, Lo101, [0/0], 2d05h, local
  *via 101.101.101.101, Lo101, [0/0], 2d05h, direct
```

用於N5K2上的VRF MR-OSPF的RIB

Ping可在兩個網路之間運作，因為 MR-PERMIT-ICMP 之前應用於兩個外部EPG的合約。

```
N5K1# ping 101.101.101.101 vrf MR-BGP source 49.49.49.49
PING 101.101.101.101 (101.101.101.101) from 49.49.49.49: 56 data bytes
64 bytes from 101.101.101.101: icmp_seq=0 ttl=252 time=3.059 ms
64 bytes from 101.101.101.101: icmp_seq=1 ttl=252 time=2.963 ms
64 bytes from 101.101.101.101: icmp_seq=2 ttl=252 time=7.928 ms
64 bytes from 101.101.101.101: icmp_seq=3 ttl=252 time=2.954 ms
64 bytes from 101.101.101.101: icmp_seq=4 ttl=252 time=2.982 ms

--- 101.101.101.101 ping statistics ---
5 packets transmitted, 5 packets received, 0.00% packet loss
round-trip min/avg/max = 2.954/3.977/7.928 ms
```

N5K1上的通訊驗證

```
N5K2# ping 49.49.49.49 vrf MR-OSPF source 101.101.101.101
PING 49.49.49.49 (49.49.49.49) from 101.101.101.101: 56 data bytes
64 bytes from 49.49.49.49: icmp_seq=0 ttl=252 time=3.107 ms
64 bytes from 49.49.49.49: icmp_seq=1 ttl=252 time=2.99 ms
64 bytes from 49.49.49.49: icmp_seq=2 ttl=252 time=2.98 ms
64 bytes from 49.49.49.49: icmp_seq=3 ttl=252 time=2.986 ms
64 bytes from 49.49.49.49: icmp_seq=4 ttl=252 time=2.99 ms

--- 49.49.49.49 ping statistics ---
5 packets transmitted, 5 packets received, 0.00% packet loss
round-trip min/avg/max = 2.98/3.01/3.107 ms
```

N5K2通訊驗證

## 相關資訊

- [思科APIC第3層網路配置指南6.0\(x\)版](#)
- [思科以應用程式為中心的基礎架構基礎知識版本4.2\(x\)](#)
- [思科APIC第3層網路配置指南3.x版及更低版本](#)
- [思科技術支援與下載](#)

## 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）。