

# 实施ACI传输路由(Multipod)

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## 简介

本文档介绍如何在以应用为中心的基础设施(ACI)多Pod环境中配置传输路由。

## 先决条件

### 要求

Cisco 建议您了解以下主题：

1. ACI多面板
2. L3Out
3. 合同
4. 路由协议

### 使用的组件

本文档中的信息基于以下软件和硬件版本：

1. 2台N5K-C5548UP交换机，均在NXOS版本7.3(8)上（用作外部路由器）
2. 1台N9K-C9332PQ枝叶交换机和1台N9K-C93108TC-EX枝叶交换机，均位于ACI版本14.2(7f)上
3. 2台N9K-C9336PQ主干交换机，均位于ACI版本14.2(7f)上
4. 1台N9K-C9232C交换机（用作IPN设备），位于NXOS版本10.3(3)上

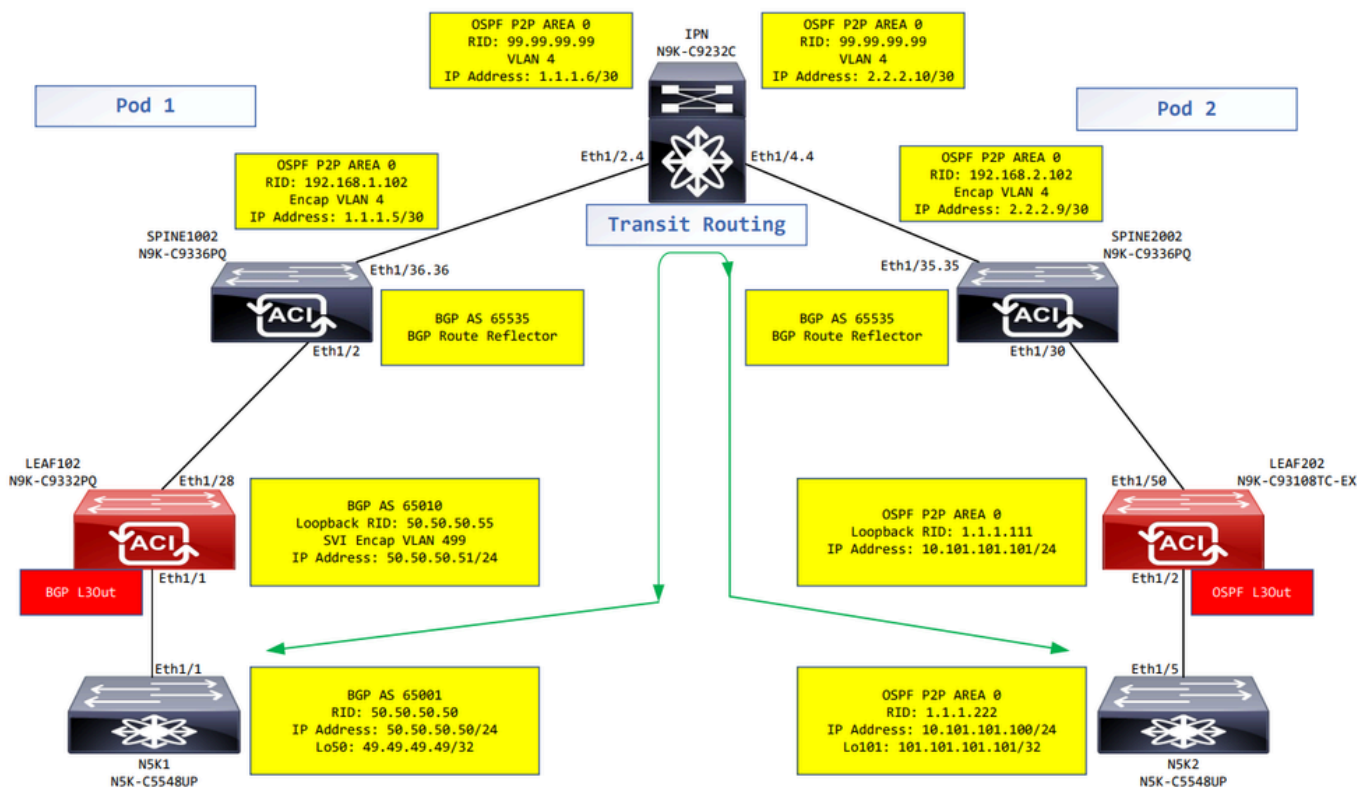
本文档中的信息是在特定实验环境中使用上述设备创建的。本文档中使用的所有设备最初均采用原始（默认）配置。如果您的网络处于活动状态，请确保您了解所有命令的潜在影响。

## 背景信息

在传输路由中，思科ACI交换矩阵将从一个第3层输出(L3Out)连接获知的路由通告到另一个L3Out连接。外部第3层域与边界枝叶交换机上的交换矩阵对等。交换矩阵是对等体之间的中转多协议边界网关协议(MP-BGP)域。

## 配置

### 网络图



网络图

## 配置

逻辑节点配置文件用于标识连接到外部网络的枝叶交换机，并且可以向其部署路由协议或静态路由。要查看L3Out中的逻辑节点配置文件，请导航到 [Tenant > Networking > L3Outs > L3Out > Logical Node Profiles > Logical Node Profile](#) 如图所示。

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的逻辑节点配置文件

Logical Node Profile - MR-OSPF\_nodeProfile

Policy Faults History

Properties

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

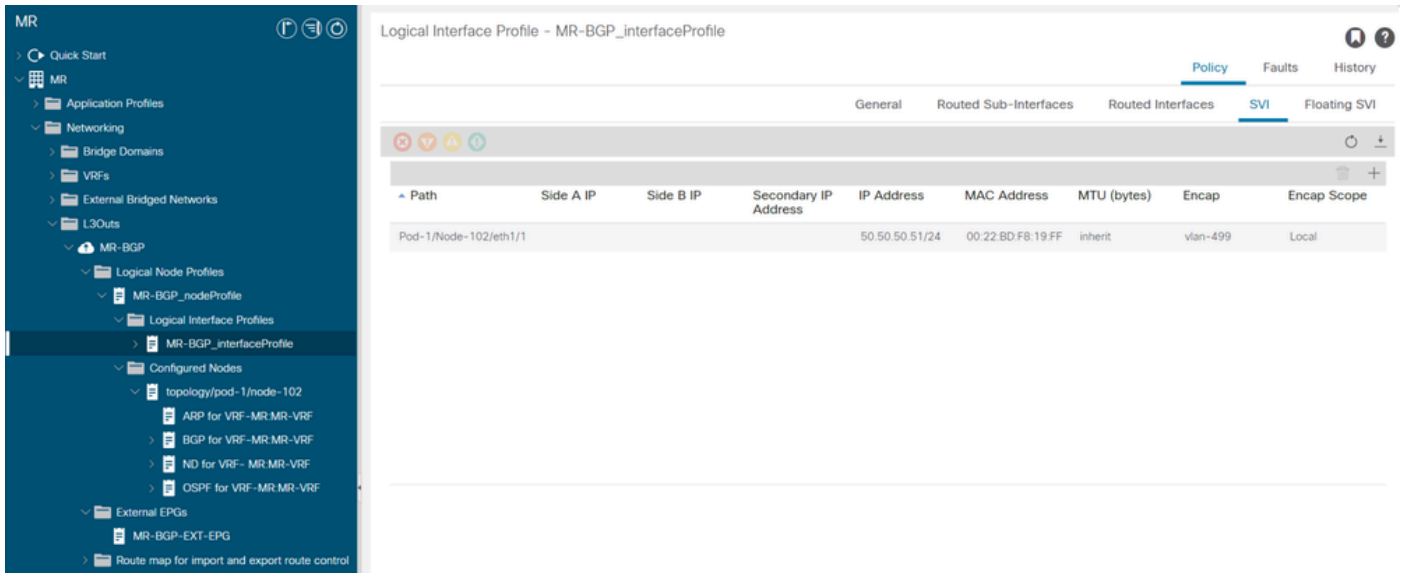
Nodes:

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

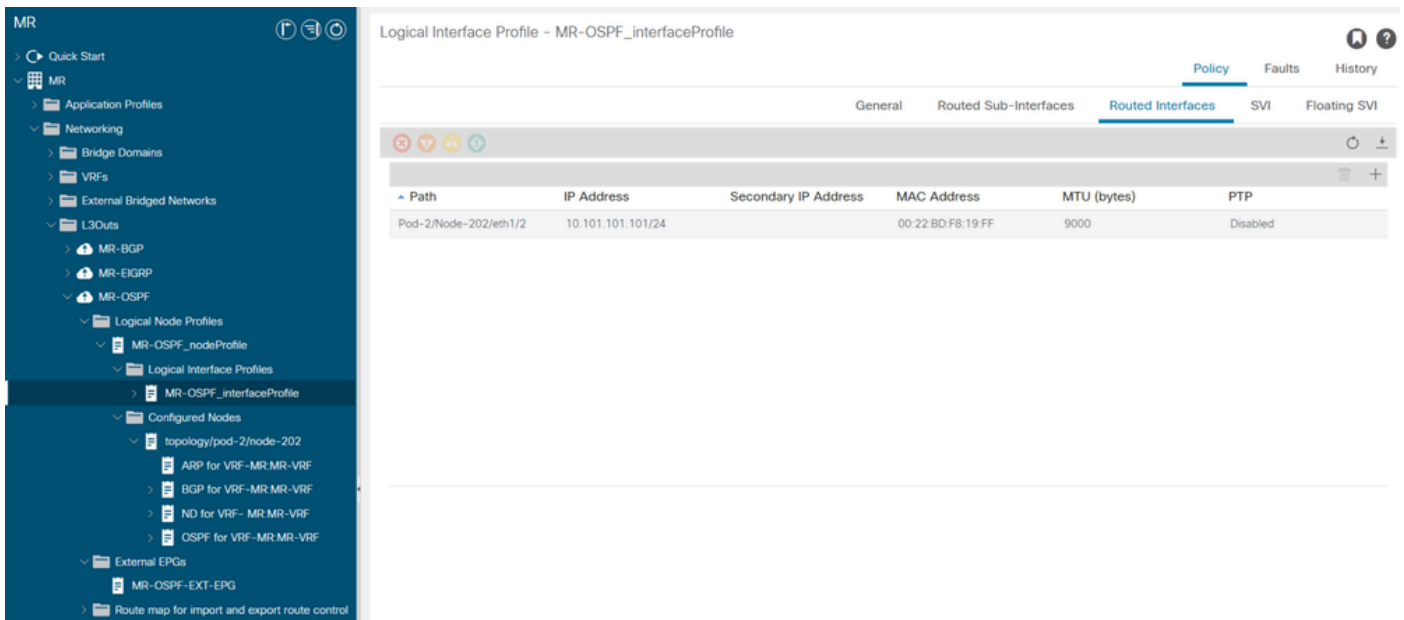
Create BGP Protocol Profile:

LEAF202的逻辑节点配置文件

逻辑接口配置文件用于标识连接到外部设备的L3Out接口。您会看到为虚拟路由和转发(VRF)定义的几个功能元素：地址解析协议(ARP)、边界网关协议(BGP)、邻居发现和开放最短路径优先(OSPF)，这是两个配置文件的结果。要查看L3Out中的逻辑接口配置文件，请导航到 Tenant > Networking > L3Outs > L3Out > Logical Node Profiles > Logical Node Profile > Logical Interface Profiles > Logical Interface Profile. 在这些示例中，在逻辑接口配置文件中配置了SVI。

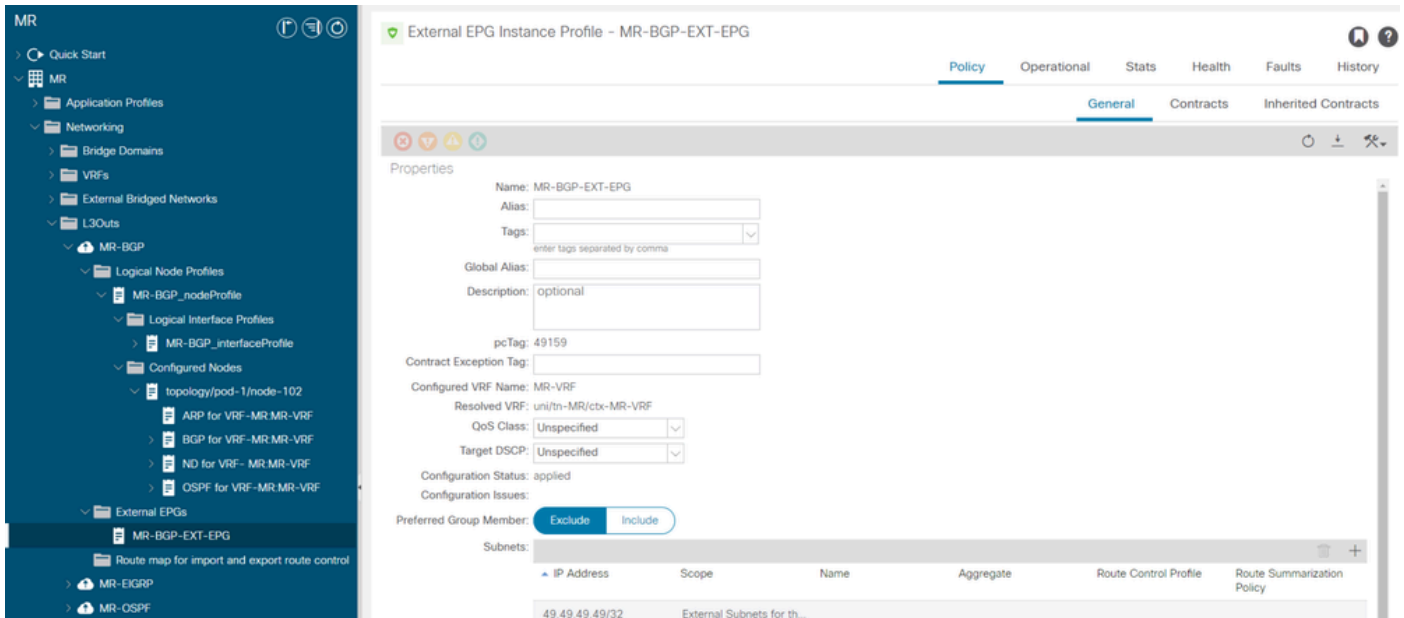


LEAF102、eth1/1的逻辑接口配置文件

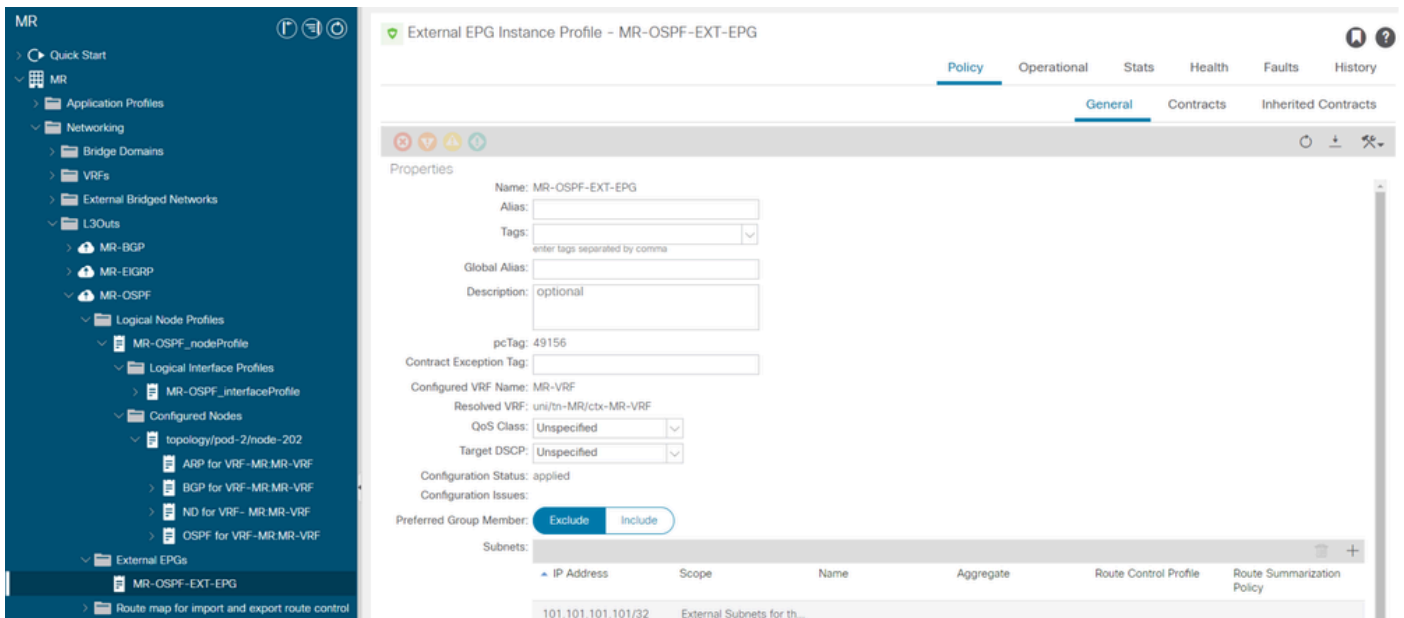


LEAF202的逻辑接口配置文件，eth1/2

外部EPG实例配置文件（外部EPG、L3Out EPG）表示具有相同安全行为的一组外部子网。其他子网也可以与其他作用域关联，这些作用域定义该子网的路由行为。要查看L3Out中的外部EPG，请导航至 **Tenant > Networking > L3Outs > L3Out > External EPGs > External EPG** 如图所示。

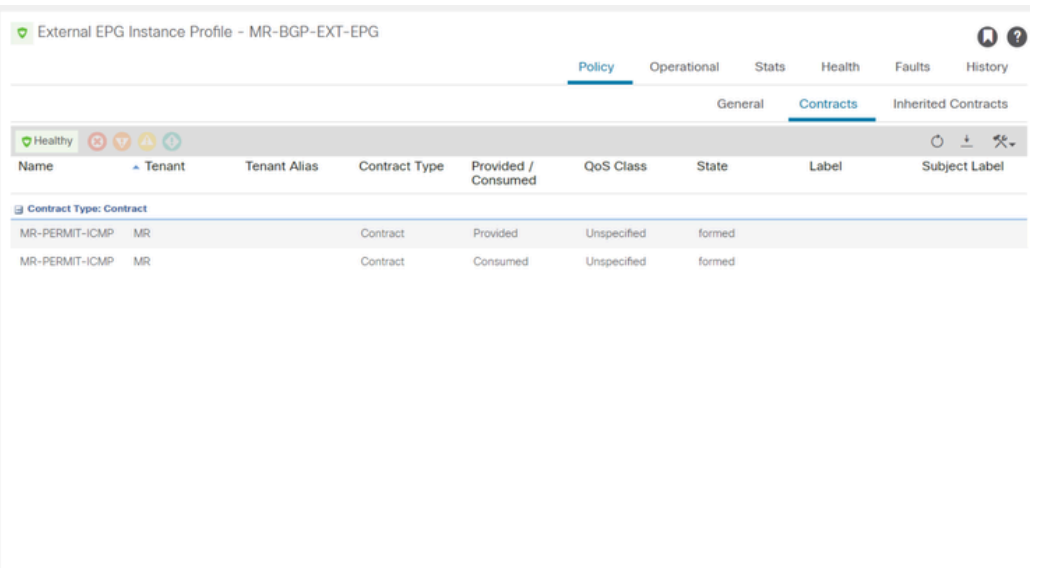
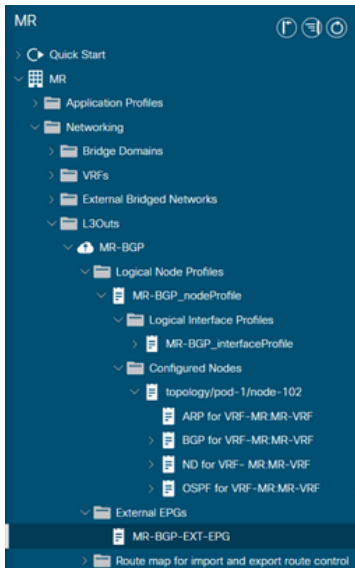


MR-BGP L3Out的外部EPG实例配置文件

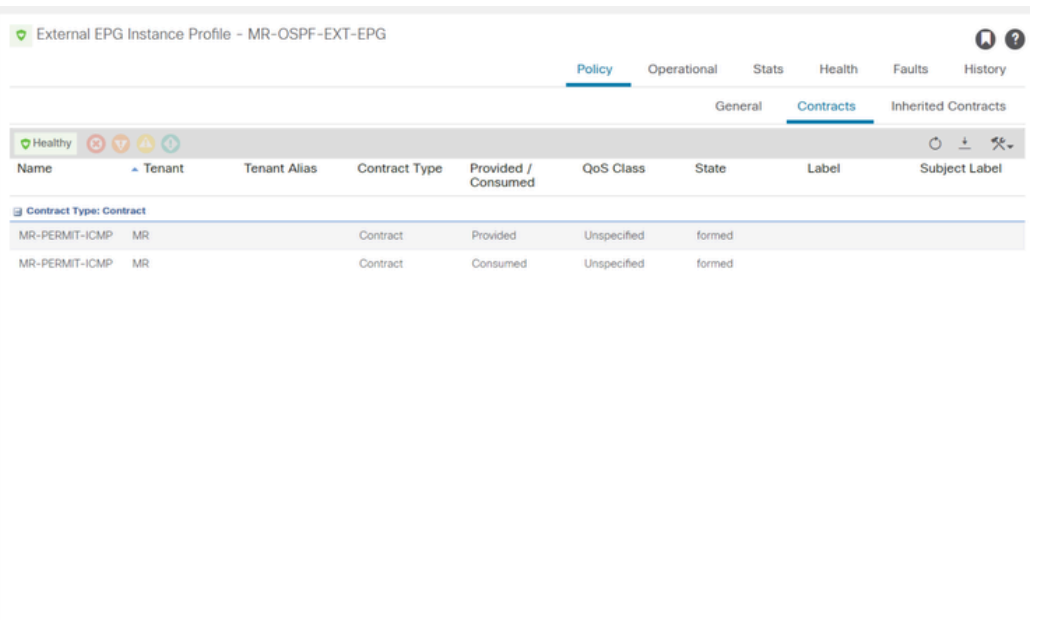
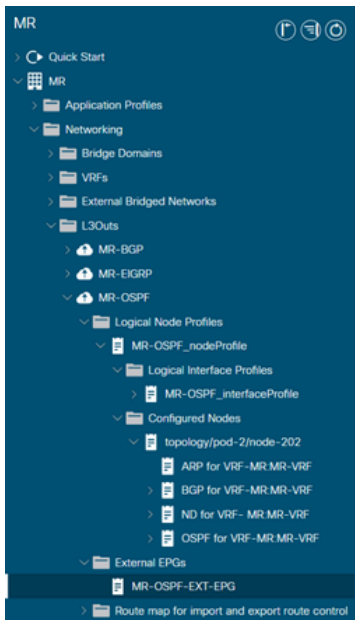


MR-OSPF L3Out的外部EPG实例配置文件

在这些示例中， MR-PERMIT-ICMP合同同时用作外部EPG中提供的和使用的合同。



MR-PERMIT-ICMP合同适用于MR-BGP-EXT-EPG



MR-PERMIT-ICMP合同适用于MR-OSPF-EXT-EPG

开启 LEAF102,BGP与邻居建立 50.50.50.50 接收外部网络 49.49.49/32.

**BGP Peer Entry - 50.50.50.50**

**Properties**

- Vrf Name: MR-MR-VRF
- BGP Version: BGP Version 4
- Remote Router Id: 50.50.50.50
- BGP State: Established
- Up For: 2022-07-27T17:22:493+00:00
- Remote As: 65001
- Update Source: vlan14
- Restart Time Advertised By Peer: Default
- Hold Time: 180
- Keepalive Interval: 60
- Neighbor: 50.50.50.50
- Link: eBGP
- Peer Index: 1
- Shutdown Reason: Unspecified
- State Reason: none
- Directly Attached Interface: vlan14
- Tcp Md5 Authentication: disabled
- Connection Established: 1
- Connection Dropped: 0
- Connection Attempts: na

**Message Statistics**

	Sent	Rcvd
Opens	1	1
Notifications	0	0
Updates	8	2
Keepalives	1692	1689
Route Refresh	0	0
Capability	1	1
Total	1702	1693
Total bytes	32485	32186
Bytes in queue	0	0

**Next Hop**

Address:	Resolved Using:
Refcount	

LEAF102上的BGP对等条目

```
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
```

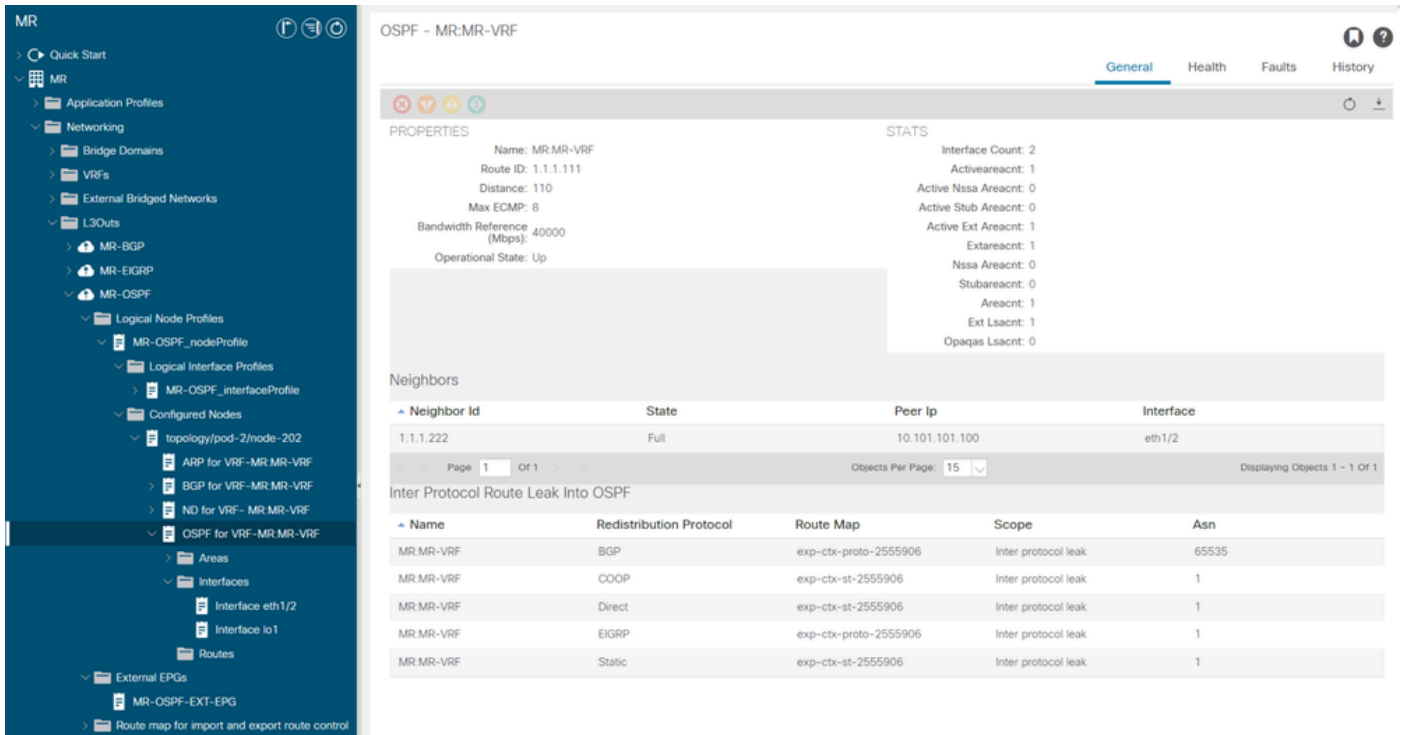
LEAF102上VRF MR:MR-VRF的BGP摘要

```
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

开启 LEAF202,OSPF与邻居建立 1.1.1.222 接收外部网络 101.101.101.101/32.



LEAF202上的OSPF邻居条目

```
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邻居

```
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

两者 LEAF102 和 LEAF202,VRF的MP-BGP表显示外部BGP网络， 49.49.49.49/32，但它显示为外部的 LEAF102 和内部 LEAF202.OSPF外部网络， 101.101.101.101/32也出现在两个枝叶交换机上的BGP表中；打开 LEAF202 它显示为从OSPF和on LEAF102 显示为internal。

```
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 ?
```

LEAF102上VRF MR:MR-VRF的MP-BGP表



```

LEAF202# show bgp vpv4 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 ?

```

LEAF202上VRF MR:MR-VRF的MP-BGP表

BGP IPv4表包含等效信息。

```

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 ?

```

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 ?

```

LEAF202上VRF MR:MR-VRF的BGP IPv4表

但是，OSPF外部网络、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

```

RIB，用于N5K1上的VRF MR-BGP

同样，BGP外部网络、49.49.49.49/32，不在 N5K2 的肋骨。

```

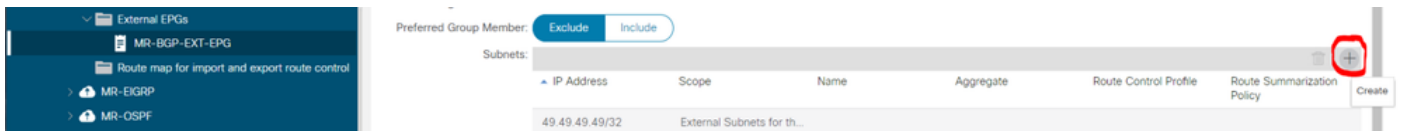
N5K2# show ip route vrf MR-OSPF
IP Route Table for VRF "MR-OSPF"
'*' denotes best ucast next-hop
 '**' denotes best mcast next-hop
 '[x/y]' denotes [preference/metric]
 '%<string>' in via output denotes VRF <string>

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

```

RIB, 用于N5K2上的VRF MR-OSPF

在BGP L3Out中, 导航至 External EPGs > External EPG > Subnets 并选择 + 图标的右上角。输入从OSPF L3Out接收的外部子网的IP地址。 101.101.101.101/32. 选择 Export Route Control Subnet 如果 Route Control 并清除 External Subnets for the External EPG 分类。点击 Submit.此 Export Route Control Subnet 选项允许将网络导出 (通告) 到外部对等体。



创建新子网

### 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

BGP 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).

为新子网配置正确的选项

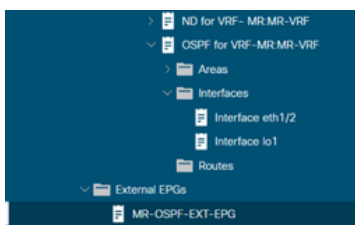
开启 N5K1,OSPF外部网络， 101.101.101.101/32现在通过BGP接收。

```
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,
```

RIB，用于N5K1上的VRF MR-BGP

在OSPF L3Out中，导航至 External EPGs > External EPG > Subnets 并选择 + 图标 的右上角。输入从BGP L3Out接收的外部子网的IP地址。 49.49.49.32. 选择 Export Route Control Subnet 如果 Route Control 部分并清除 External Subnets for the External EPG 分类。点击 Submit.



创建新子网

## 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

为新子网配置正确的选项

现在开始 N5K2,BGP外部网络 , 49.49.49.49/32通过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
```

RIB , 用于N5K2上的VRF MR-OSPF

Ping在两个网络之间运行 , 因为 MR-PERMIT-ICMP 之前应用于两个外部EPG的合同。

```
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上的通信验证

```
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上的通信验证

## 相关信息

- [思科APIC第3层网络配置指南，版本6.0\(x\)](#)
- [思科以应用为中心的基础设施基础知识，版本4.2\(x\)](#)
- [思科APIC第3层网络配置指南，版本3.x及更低版本](#)
- [思科技术支持和下载](#)

## 关于此翻译

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