

通過分段路由MPLS實施Nexus L2 EVPN

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簡介

本檔案介紹如何在Cisco Nexus 9000系列交換器上透過區段路由MPLS部署/設定第2層EVPN。

必要條件

需求

需要具備有關BGP、OSPF、MPLS、LDP、RSVP、EVPN、分段路由(SR)的知識

採用元件

運行9.93360.(3)的Cisco Nexus交換機1000YC-FX2

運行9.93240.(3)的Cisco Nexus交換機1000YC-FX2

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

背景

定義第2層VPN，VPLS/L2-EVPN是一種多點到多點第2層VPN服務，它通過IP/MPLS網路在單個邏輯交換架構中連線客戶的多個分支。

第2層EVPN-MPLS SR:

- EVPN(RFC 7432)是基於BGP MPLS的解決方案，已用於虛擬化資料中心網路中的下一代乙太網服務
- EVPN使用來自現有MPLS技術的「RD」、「RT」和「VRF」等構建塊
- EVPN通過在核心啟用基於控制平面的MAC學習來運行與現有VPLS相反的操作
- 在EVPN中，參與EVPN例項的PE使用MP-BGP協定在控制平面中學習客戶MAC路由

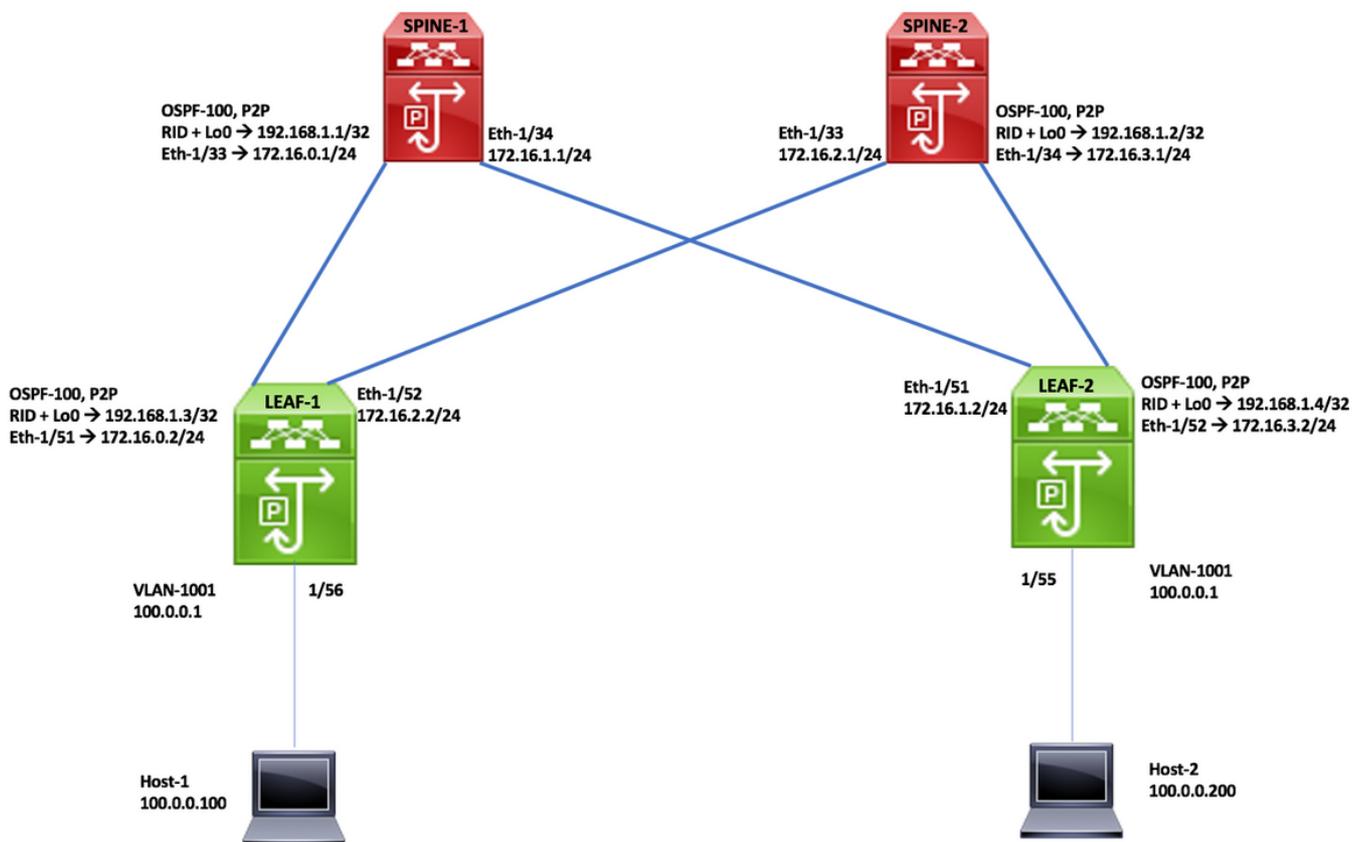
- 控制平面MAC學習提供了許多優點，允許EVPN解決VPLS的缺點，包括支援多宿主和每流負載平衡
- SR L2 EVPN是NXOS 9.3(1)中提供的新功能，在Nexus 9300 FX2系列平台上受支援

使用SR MPLS的第2層EVPN限制：

- 分段路由第2層EVPN泛洪基於入口複製機制
- 它使用EVPN型別3路由來處理BUM流量
- MPLS核心不支援組播
- 不支援ARP抑制
- 不支援對VPC進行一致性檢查
- 不能同時配置相同的L2 EVI和L3 EVI

設定

網路圖表



高級配置步驟：

- 安裝功能
- 配置Ip地址 — Underlay
- 配置IGP -OSPF
- 設定MP-BGP
- 配置VLAN和EVPN重疊
- 為第2層配置終端主機

SPINE -1 Configuration

Enabling Features, Label-Range, Route-map, Label-Index	OSPF Configuration	BGP/EVPN Configuration
install feature-set mpls feature-set mpls feature ospf feature bgp feature mpls segment-routing feature mpls evpn feature interface-vlan feature mpls oam mpls label range 5000 450000 segment-routing mpls global-block 16000 25000 connected-prefix-sid-map address-family ipv4 192.168.1.1/32 index 211 route-map label-index-spine1 permit 10 set label-index 211	interface Ethernet1/33 ip address 172.16.0.1/24 ip ospf network point-to-point ip router ospf 100 area 0.0.0.0 mpls ip forwarding no shutdown interface Ethernet1/34 ip address 172.16.1.1/24 ip ospf network point-to-point ip router ospf 100 area 0.0.0.0 mpls ip forwarding no shutdown interface loopback0 ip address 192.168.1.1/32 ip router ospf 100 area 0.0.0.0 router ospf 100 segment-routing mpls router-id 192.168.1.1	router bgp 65001 router-id 192.168.1.1 address-family ipv4 unicast network 192.168.1.1/32 route-map label-index-spine1 allocate-label all address-family ipv4 labeled-unicast address-family l2vpn evpn template peer EVPN remote-as 65001 update-source loopback0 address-family l2vpn evpn send-community extended route-reflector-client encapsulation mpls template peer Labeled-unicast remote-as 65001 address-family ipv4 labeled-unicast send-community extended route-reflector-client next-hop-self soft-reconfiguration inbound always neighbor 172.16.0.2 inherit peer Labeled-unicast neighbor 172.16.1.2 inherit peer Labeled-unicast neighbor 192.168.1.3 inherit peer EVPN neighbor 192.168.1.4 inherit peer EVPN

SPINE -2 Configuration

Enabling Features, Label-Range, Route-map, Label-Index	OSPF Configuration	BGP/EVPN Configuration
install feature-set mpls feature-set mpls feature ospf feature bgp feature mpls segment-routing feature mpls evpn feature interface-vlan feature mpls oam mpls label range 5000 450000 segment-routing mpls global-block 16000 25000 connected-prefix-sid-map address-family ipv4 192.168.1.2/32 index 221 route-map label-index-spine2 permit 10 set label-index 221	interface Ethernet1/33 ip address 172.16.2.1/24 ip ospf network point-to-point ip router ospf 100 area 0.0.0.0 mpls ip forwarding no shutdown interface Ethernet1/34 ip address 172.16.3.1/24 ip ospf network point-to-point ip router ospf 100 area 0.0.0.0 mpls ip forwarding no shutdown interface loopback0 ip address 192.168.1.2/32 ip router ospf 100 area 0.0.0.0 router ospf 100 segment-routing mpls router-id 192.168.1.2	router bgp 65001 router-id 192.168.1.2 address-family ipv4 unicast network 192.168.1.2/32 route-map label-index-spine2 allocate-label all address-family ipv4 labeled-unicast address-family l2vpn evpn template peer EVPN remote-as 65001 update-source loopback0 address-family l2vpn evpn send-community extended route-reflector-client encapsulation mpls template peer Labeled-unicast remote-as 65001 address-family ipv4 labeled-unicast send-community extended route-reflector-client next-hop-self soft-reconfiguration inbound always neighbor 172.16.2.2 inherit peer Labeled-unicast neighbor 172.16.3.2 inherit peer Labeled-unicast neighbor 192.168.1.3 inherit peer EVPN neighbor 192.168.1.4 inherit peer EVPN

Leaf-1 Configuration

Enabling Features, Label-Range, Route-map, Label-Index	OSPF Configuration	BGP/EVPN Configuration
install feature-set mpls nv overlay evpn feature ospf feature bgp feature mpls segment-routing feature mpls evpn feature interface-vlan feature mpls oam feature nv overlay fabric forwarding anycast-gateway-mac 0000.0000.1111 mpls label range 5000 450000 vlan 1,1001 segment-routing mpls global-block 16000 25000 connected-prefix-sid-map address-family ipv4 192.168.1.3/32 index 311 vlan 1001 evi auto route-map label-index-leaf-1 permit 10 set label-index 311 vrf context Tenant-A evi 30001 interface Vlan1001 no shutdown vrf member Tenant-A ip address 100.0.0.1/24 fabric forwarding mode anycast-gateway	interface Ethernet1/51 ip address 172.16.0.2/24 ip ospf network point-to-point ip router ospf 100 area 0.0.0.0 mpls ip forwarding no shutdown interface Ethernet1/52 ip address 172.16.2.2/24 ip ospf network point-to-point ip router ospf 100 area 0.0.0.0 mpls ip forwarding no shutdown interface Ethernet1/56 switchport switchport mode trunk switchport trunk allowed vlan 1001 no shutdown interface loopback0 ip address 192.168.1.3/32 ip router ospf 100 area 0.0.0.0 router ospf 100 segment-routing mpls router-id 192.168.1.3	router bgp 65001 router-id 192.168.1.3 address-family ipv4 unicast network 192.168.1.3/32 route-map label-index-leaf-1 allocate-label all address-family ipv4 labeled-unicast address-family l2vpn evpn template peer EVPN remote-as 65001 update-source loopback0 address-family l2vpn evpn send-community extended encapsulation mpls template peer Labeled-unicast remote-as 65001 address-family ipv4 labeled-unicast send-community extended soft-reconfiguration inbound always neighbor 172.16.0.1 inherit peer Labeled-unicast neighbor 172.16.2.1 inherit peer Labeled-unicast neighbor 192.168.1.1 inherit peer EVPN neighbor 192.168.1.2 inherit peer EVPN vrf Tenant-A evpn encapsulation mpls source-interface loopback0

Leaf-2 Configuration

Enabling Features, Label-Range, Route-map, Label-Index	OSPF Configuration	BGP/EVPN Configuration
install feature-set mpls nv overlay evpn feature ospf feature bgp feature mpls segment-routing feature mpls evpn feature interface-vlan feature mpls oam feature nv overlay fabric forwarding anycast-gateway-mac 0000.0000.1111 mpls label range 5000 450000 vlan 1,1001 segment-routing mpls global-block 16000 25000 connected-prefix-sid-map address-family ipv4 192.168.1.4/32 index 321 vlan 1001 evi auto route-map label-index-Leaf2 permit 10 set label-index 321 vrf context Tenant-A evi 30001 interface Vlan1001 no shutdown vrf member Tenant-A ip address 100.0.0.1/24 fabric forwarding mode anycast-gateway	interface Ethernet1/51 ip address 172.16.1.2/24 ip ospf network point-to-point ip router ospf 100 area 0.0.0.0 mpls ip forwarding no shutdown interface Ethernet1/52 ip address 172.16.3.2/24 ip ospf network point-to-point ip router ospf 100 area 0.0.0.0 mpls ip forwarding no shutdown interface Ethernet1/55 switchport switchport mode trunk switchport trunk allowed vlan 1001 no shutdown interface loopback0 ip address 192.168.1.4/32 ip router ospf 100 area 0.0.0.0 router ospf 100 segment-routing mpls router-id 192.168.1.4	router bgp 65001 router-id 192.168.1.4 address-family ipv4 unicast network 192.168.1.4/32 route-map label-index-Leaf2 allocate-label all address-family ipv4 labeled-unicast address-family l2vpn evpn template peer EVPN remote-as 65001 update-source loopback0 address-family l2vpn evpn send-community extended encapsulation mpls template peer Labeled-unicast remote-as 65001 address-family ipv4 labeled-unicast send-community extended soft-reconfiguration inbound always neighbor 172.16.1.1 inherit peer Labeled-unicast neighbor 172.16.3.1 inherit peer Labeled-unicast neighbor 192.168.1.1 inherit peer EVPN neighbor 192.168.1.2 inherit peer EVPN vrf Tenant-A evpn encapsulation mpls source-interface loopback0

Host1# show ip int brief

```
IP Interface Status for VRF "default"(1)
Interface IP Address Interface Status
Vlan1001 100.0.0.200 protocol-up/link-up/admin-up
```

Mhost1# ping 100.0.0.100

```
PING 100.0.0.100 (100.0.0.100): 56 data bytes
64 bytes from 100.0.0.100: icmp_seq=0 ttl=253 time=0.84 ms
64 bytes from 100.0.0.100: icmp_seq=1 ttl=253 time=0.45 ms
64 bytes from 100.0.0.100: icmp_seq=2 ttl=253 time=0.443 ms
64 bytes from 100.0.0.100: icmp_seq=3 ttl=253 time=0.438 ms
64 bytes from 100.0.0.100: icmp_seq=4 ttl=253 time=0.431 ms
```

--- 100.0.0.100 ping statistics ---

```
5 packets transmitted, 5 packets received, 0.00% packet loss
round-trip min/avg/max = 0.431/0.52/0.84 ms
```

Host2# show ip int brief

```
IP Interface Status for VRF "default"(1)
Interface IP Address Interface Status
Vlan1001 100.0.0.100 protocol-up/link-up/admin-up
```

Mhost2# ping 100.0.0.200

```
PING 100.0.0.200 (100.0.0.200): 56 data bytes
64 bytes from 100.0.0.200: icmp_seq=0 ttl=253 time=0.854 ms
64 bytes from 100.0.0.200: icmp_seq=1 ttl=253 time=0.46 ms
64 bytes from 100.0.0.200: icmp_seq=2 ttl=253 time=0.451 ms
64 bytes from 100.0.0.200: icmp_seq=3 ttl=253 time=0.427 ms
64 bytes from 100.0.0.200: icmp_seq=4 ttl=253 time=0.418 ms
```

--- 100.0.0.200 ping statistics ---

```
5 packets transmitted, 5 packets received, 0.00% packet loss
round-trip min/avg/max = 0.418/0.522/0.854 ms
```

Mhost2#

Leaf1# show bgp l2vpn evpn

BGP routing table information for VRF default, address family L2VPN EVPN

BGP table version is 57, Local Router ID is 192.168.1.3

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, l-injected

Origin codes: i - IGP, e - EGP, ? - incomplete, | - multipath, & - backup, 2 - best2

Network	Next Hop	Metric	LocPrf	Weight	Path
Route Distinguisher: 192.168.1.3:37864 (L2VNI 1001)					
*>[2]:[0]:[0]:[48]:[00ee.ab39.fafd]:[0]:[0.0.0.0]/216	192.168.1.4	100	0	i	
*>[2]:[0]:[0]:[48]:[00ee.ab39.fb4b]:[0]:[0.0.0.0]/216	192.168.1.3	100	32768	i	
*>[2]:[0]:[0]:[48]:[00ee.ab39.fafd]:[32]:[100.0.0.100]/248					
192.168.1.4	100	0	i		
*>[2]:[0]:[0]:[48]:[00ee.ab39.fb4b]:[32]:[100.0.0.200]/272					
192.168.1.3	100	32768	i		
*>[3]:[0]:[32]:[192.168.1.3]/88	192.168.1.3	100	32768	i	
*>[3]:[0]:[32]:[192.168.1.4]/88	192.168.1.4	100	0	i	

Route Distinguisher: 192.168.1.4:37864

```
* [2]:[0]:[0]:[48]:[00ee.ab39.fafd]:[0]:[0.0.0.0]/216
192.168.1.4 100 0 i
*i 192.168.1.4 100 0 i
*>[2]:[0]:[0]:[48]:[00ee.ab39.fafd]:[32]:[100.0.0.100]/248
192.168.1.4 100 0 i
*i 192.168.1.4 100 0 i
*>[3]:[0]:[32]:[192.168.1.4]/88
192.168.1.4 100 0 i
*i 192.168.1.4 100 0 i
```

Leaf2# show bgp l2vpn evpn

BGP routing table information for VRF default, address family L2VPN EVPN

BGP table version is 40, Local Router ID is 192.168.1.4

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, l-injected

Origin codes: i - IGP, e - EGP, ? - incomplete, | - multipath, & - backup, 2 - best2

Network	Next Hop	Metric	LocPrf	Weight	Path
Route Distinguisher: 192.168.1.3:37864					
*>[2]:[0]:[0]:[48]:[00ee.ab39.fb4b]:[0]:[0.0.0.0]/216	192.168.1.3	100	0	i	
*i 192.168.1.3	100	0	i		
*>[2]:[0]:[0]:[48]:[00ee.ab39.fb4b]:[32]:[100.0.0.200]/272	192.168.1.3	100	0	i	
*i 192.168.1.3	100	0	i		
*>[3]:[0]:[32]:[192.168.1.3]/88	192.168.1.3	100	0	i	
*i 192.168.1.3	100	0	i		
Route Distinguisher: 192.168.1.4:37864 (L2VNI 1001)					
*>[2]:[0]:[0]:[48]:[00ee.ab39.fafd]:[0]:[0.0.0.0]/216	192.168.1.4	100	32768	i	
*>[2]:[0]:[0]:[48]:[00ee.ab39.fb4b]:[0]:[0.0.0.0]/216	192.168.1.3	100	0	i	
*>[2]:[0]:[0]:[48]:[00ee.ab39.fafd]:[32]:[100.0.0.100]/248					
192.168.1.4	100	32768	i		
*>[2]:[0]:[0]:[48]:[00ee.ab39.fb4b]:[32]:[100.0.0.200]/272					
192.168.1.3	100	0	i		
*>[3]:[0]:[32]:[192.168.1.3]/88	192.168.1.3	100	0	i	
*>[3]:[0]:[32]:[192.168.1.4]/88	192.168.1.4	100	32768	i	

參考資料

[Cisco Nexus 9500、9300、9200、3200和3100平台交換機上的分段路由白皮書](#)

[在分段路由MPLS上配置第2層EVPN](#)