

# Implementieren von Nexus L2 EVPN über Segment Routing MPLS

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## Einführung

Dieses Dokument beschreibt die Bereitstellung/Konfiguration von Layer-2-EVPN über Segment Routing MPLS auf Cisco Nexus Switches der Serie 9000.

## Voraussetzungen

### Anforderungen

Kenntnisse über BGP, OSPF, MPLS, LDP, RSVP, EVPN, Segment Routing (SR) erforderlich

### Verwendete Komponenten

Cisco Nexus Switch 9360YC-FX2 mit 9.3.(3)

Cisco Nexus Switch 93240YC-FX2 mit 9.3.(3)

Die Informationen in diesem Dokument wurden von den Geräten in einer bestimmten Laborumgebung erstellt. Alle in diesem Dokument verwendeten Geräte haben mit einer leeren (Standard-)Konfiguration begonnen. Wenn Ihr Netzwerk in Betrieb ist, stellen Sie sicher, dass Sie die potenziellen Auswirkungen eines Befehls verstehen.

## Hintergrund

Definieren Sie Layer-2-VPN, VPLS/L2-EVPN ist ein Multipoint-to-Multipoint-Layer-2-VPN-Service, der mehrere Zweigstellen eines Kunden in einer einzigen logischen Switch-Architektur über ein IP/MPLS-Netzwerk verbindet.

Layer-2-EVPN-MPLS-SR:

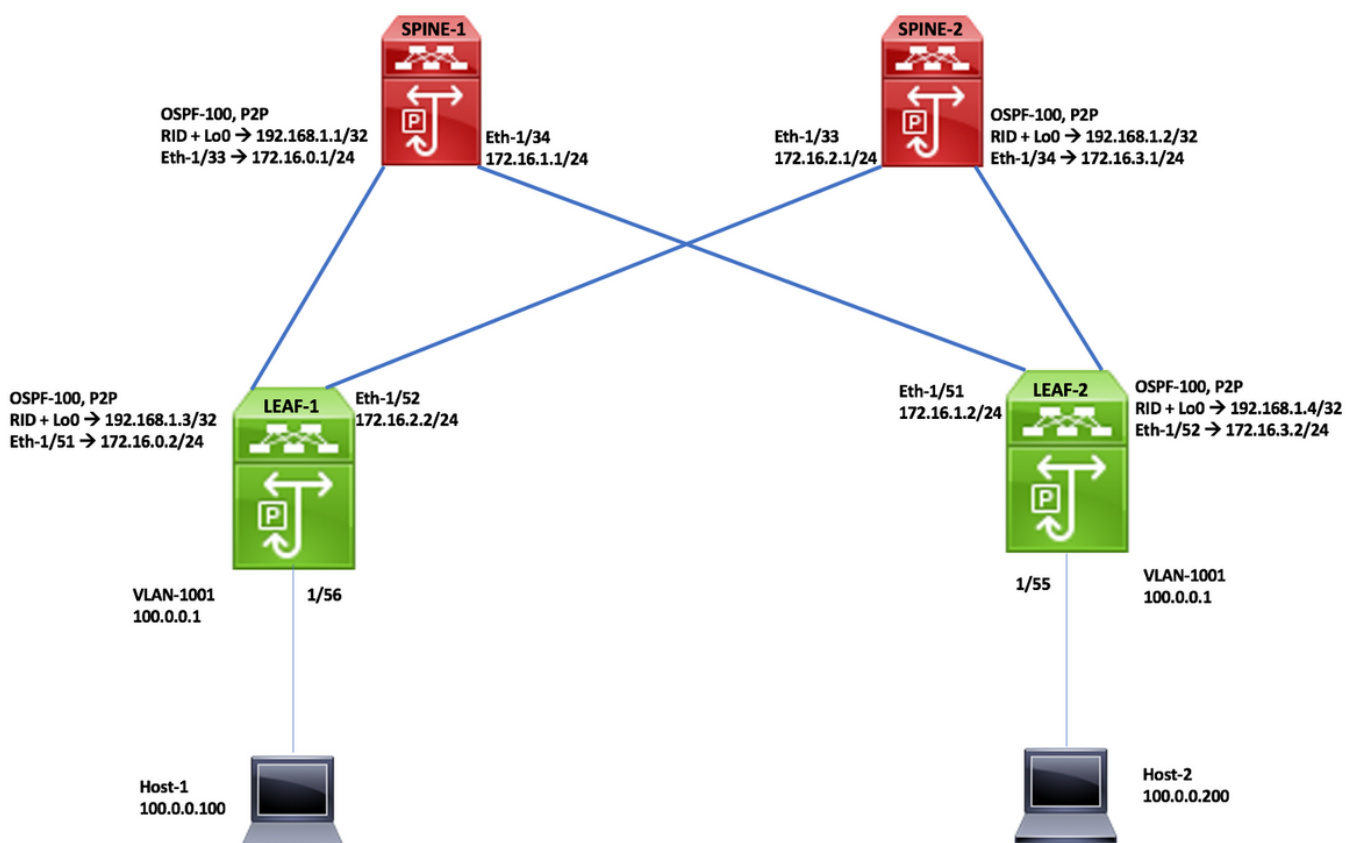
- EVPN (RFC 7432) ist eine MPLS-basierte BGP-Lösung, die für Ethernet-Services der nächsten Generation im virtualisierten Rechenzentrumsnetzwerk verwendet wird.
- EVPN verwendet verschiedene Bausteine wie RD, RT und VRF aus vorhandenen MPLS-Technologien.
- EVPN arbeitet im Gegensatz zu dem vorhandenen VPLS, indem es im Kern ein Kontrollebenen-basiertes MAC-Learning ermöglicht.
- In EVPN erfassen PEs, die an den EVPN-Instanzen teilnehmen, MAC-Routen der Kunden auf Kontrollebene mithilfe des MP-BGP-Protokolls.
- Das MAC-Learning auf Kontrollebene bietet eine Reihe von Vorteilen, die es EVPN ermöglichen, die VPLS-Mängel zu beheben, einschließlich Unterstützung für Multihoming mit Lastenausgleich pro Datenstrom
- SR L2 EVPN ist eine neue Funktion, die in NXOS 9.3(1) verfügbar ist und auf der Plattform der Nexus Serie 9300 FX2 unterstützt wird.

### Einschränkungen für L2 EVPN über SR MPLS:

- EVPN-Flooding für Layer-2-Segmentrouting basiert auf dem Eingangs-Replikationsmechanismus.
- Es verwendet die EVPN-Route des Typs 3 für den BUM-Datenverkehr.
- Multicast wird nicht vom MPLS-Core unterstützt.
- ARP-Unterdrückung wird nicht unterstützt
- Konsistenzprüfung auf VPC wird nicht unterstützt
- Dasselbe L2 EVI und L3 EVI können nicht zusammen konfiguriert werden.

## Konfigurieren

### Netzwerkdiagramm



## Allgemeine Konfigurationsschritte:

- Installationsfunktionen
- Konfigurieren der IP-Adresse - Underlay
- Konfigurieren von IGP - OSPF
- Konfigurieren von MP-BGP
- VLAN- und EVPN-Overlay konfigurieren
- Konfigurieren des Endhosts für Layer 2

SPINE -1 Configuration		
Enabling Features, Label-Range, Route-map, Label-Index	OSPF Configuration	BGP/EVPN Configuration
install feature-set mpls	interface Ethernet1/33	router bgp 65001
feature-set mpls	ip address 172.16.0.1/24	router-id 192.168.1.1
feature ospf	ip ospf network point-to-point	address-family ipv4 unicast
feature bgp	ip router ospf 100 area 0.0.0.0	network 192.168.1.1/32 route-map label-index-spine1
feature mpls segment-routing	mpls ip forwarding	allocate-label all
feature mpls evpn	no shutdown	address-family ipv4 labeled-unicast
feature interface-vlan	interface Ethernet1/34	address-family I2vpn evpn
feature mpls oam	ip address 172.16.1.1/24	template peer EVPN
mpls label range 5000 450000	ip ospf network point-to-point	remote-as 65001
segment-routing	ip router ospf 100 area 0.0.0.0	update-source loopback0
mpls	mpls ip forwarding	address-family I2vpn evpn
global-block 16000 25000	no shutdown	send-community extended
connected-prefix-sid-map	interface loopback0	route-reflector-client
address-family ipv4	ip address 192.168.1.1/32	encapsulation mpls
192.168.1.1/32 index 211	ip router ospf 100 area 0.0.0.0	template peer Labeled-unicast
route-map label-index-spine1 permit 10	router ospf 100	remote-as 65001
set label-index 211	segment-routing mpls	address-family ipv4 labeled-unicast
	router-id 192.168.1.1	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

```
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
```

### OSPF Configuration

```
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
```

### BGP/EVPN Configuration

```
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
```

# Überprüfung

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

Network	Next Hop	Metric	LocPrf	Weight	Path
<b>Route Distinguisher: 192.168.1.3:37864 (L2VNI 1001)</b>					
*>[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	
<b>*&gt;[2]:[0]:[0]:[48]:[00ee.ab39.fafd]:[32]:[100.0.0.100]/248</b>					
*>[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	
*>[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.fafd]:[32]:[100.0.0.100]/248	192.168.1.4	100	0	i	
*>[3]:[0]:[32]:[192.168.1.4]/88	192.168.1.4	100	0	i	
*>[3]:[0]:[32]:[192.168.1.4]/88	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, I-injected
Origin codes: i - IGP, e - EGP, ? - incomplete, | - multipath, & - backup, 2 - best2
```

Network	Next Hop	Metric	LocPrf	Weight	Path
<b>Route Distinguisher: 192.168.1.3:37864</b>					
*>[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.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	192.168.1.3	100	0	i	
<b>Route Distinguisher: 192.168.1.4:37864 (L2VNI 1001)</b>					
*>[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	
<b>*&gt;[2]:[0]:[0]:[48]:[00ee.ab39.fafd]:[32]:[100.0.0.100]/248</b>					
*>[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	

# Referenzen

[Segment Routing auf Cisco Nexus 9500-, 9300-, 9200-, 3200- und 3100-Plattform-Switches \(Whitepaper\)](#)

## [Konfigurieren von Layer-2-EVPN über Segment-Routing-MPLS](#)