# Bereitstellung von Layer-3-EVPN über Segment Routing MPLS [OSPF/iBGP] in Nexus 9300

## Inhalt



## Einführung

Dieses Dokument beschreibt die Bereitstellung/Konfiguration von Layer-3-EVPN über Segment Routing MPLS auf Nexus 9300-Produkten.

## Voraussetzungen

### Anforderungen

Cisco empfiehlt, über Kenntnisse in folgenden Bereichen zu verfügen:

- Border Gateway Protocol (BGP)
- L3VPN
- EVPN
- Segmentweiterleitung

### Verwendete Komponenten

Die Informationen in diesem Dokument basieren auf den folgenden Software- und Hardwareversionen:

- SPINE-Hardware - 93360YC-FX2 mit 9.3.(3)
- LEAF-Hardware - 93240YC-FX2 mit 9.3.(3)
- CLIENT - 93216TC-FX2

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.

# Hintergrundinformationen

## MPLS-L3VPN-Zusammenfassung

Ein VPN ist:

- Ein IP-basiertes Netzwerk, das private Netzwerkdienste über eine öffentliche Infrastruktur bereitstellt.
- Eine Gruppe von Websites, die privat über das Internet oder andere öffentliche oder private Netzwerke miteinander kommunizieren dürfen.

Herkömmliche VPNs werden durch die Konfiguration eines vollständigen Netzes von Tunneln oder permanenten virtuellen Schaltungen (PVCs) für alle Standorte in einem VPN erstellt. Dieser VPN-Typ lässt sich nicht einfach verwalten oder erweitern, da beim Hinzufügen eines neuen Standorts jedes Edge-Gerät im VPN geändert werden muss.

MPLS-basierte VPNs werden in Layer 3 erstellt und basieren auf dem Peer-Modell. Das Peer-Modell ermöglicht es dem Service Provider und dem Kunden, Layer-3-Routing-Informationen auszutauschen. Der Leistungserbringer leitet die Daten ohne Beteiligung des Kunden zwischen den Kundenstandorten weiter.

MPLS-VPNs lassen sich einfacher verwalten und erweitern als herkömmliche VPNs. Wenn einem MPLS-VPN ein neuer Standort hinzugefügt wird, muss nur der Edge-Router des Service Providers, der Services für den Kundenstandort bereitstellt, aktualisiert werden.

Dies sind die Komponenten des MPLS-VPN:

- Provider (P)-Router - Router im Core des Anbieternetzwerks. PE-Router führen MPLS-Switching aus und hängen keine VPN-Labels an geroutete Pakete an. VPN-Labels werden verwendet, um Datenpakete an das richtige private Netzwerk oder den richtigen Edge-Router zu leiten.

- PE-Router - Router, der das VPN-Label an eingehende Pakete anhängt, basierend auf der Schnittstelle oder Subschnittstelle, auf der sie empfangen werden, und außerdem die MPLS-Core-Labels anhängt. Ein PE-Router wird direkt an einen CE-Router angeschlossen.

- Customer (C) Router - Router im Internet Service Provider (ISP) oder Enterprise Network.

- Customer Edge (CE)-Router - Edge-Router im Netzwerk des ISP, der mit dem PE-Router im Netzwerk verbunden ist. Ein CE-Router muss über eine Schnittstelle mit einem PE-Router verfügen.

## Übersicht über EVPN mit L3VPN (MPLS SR)

In Rechenzentrums-Bereitstellungen wurde VXLAN EVPN (oder) MPLS EVPN für die Vorteile wie

EVPN-Kontrollebenenlernen, Multi-Tenant-Funktion, nahtlose Mobilität, Redundanz und einfachere POD-Erweiterungen verwendet. Ebenso ist der CORE entweder ein LDP-basiertes MPLS-L3VPN-Netzwerk (Label Distribution Protocol) oder eine Umstellung vom herkömmlichen MPLS-L3VPN-LDP-basierten Underlay auf eine anspruchsvollere Lösung wie Segment Routing (SR).

Segmentrouting wird für folgende Vorteile eingesetzt:

- Einheitliche Kontrollebenen für IGP und MPLS
- Vereinfachte Traffic Engineering-Methoden
- Einfachere Konfiguration
- SDN-Einführung

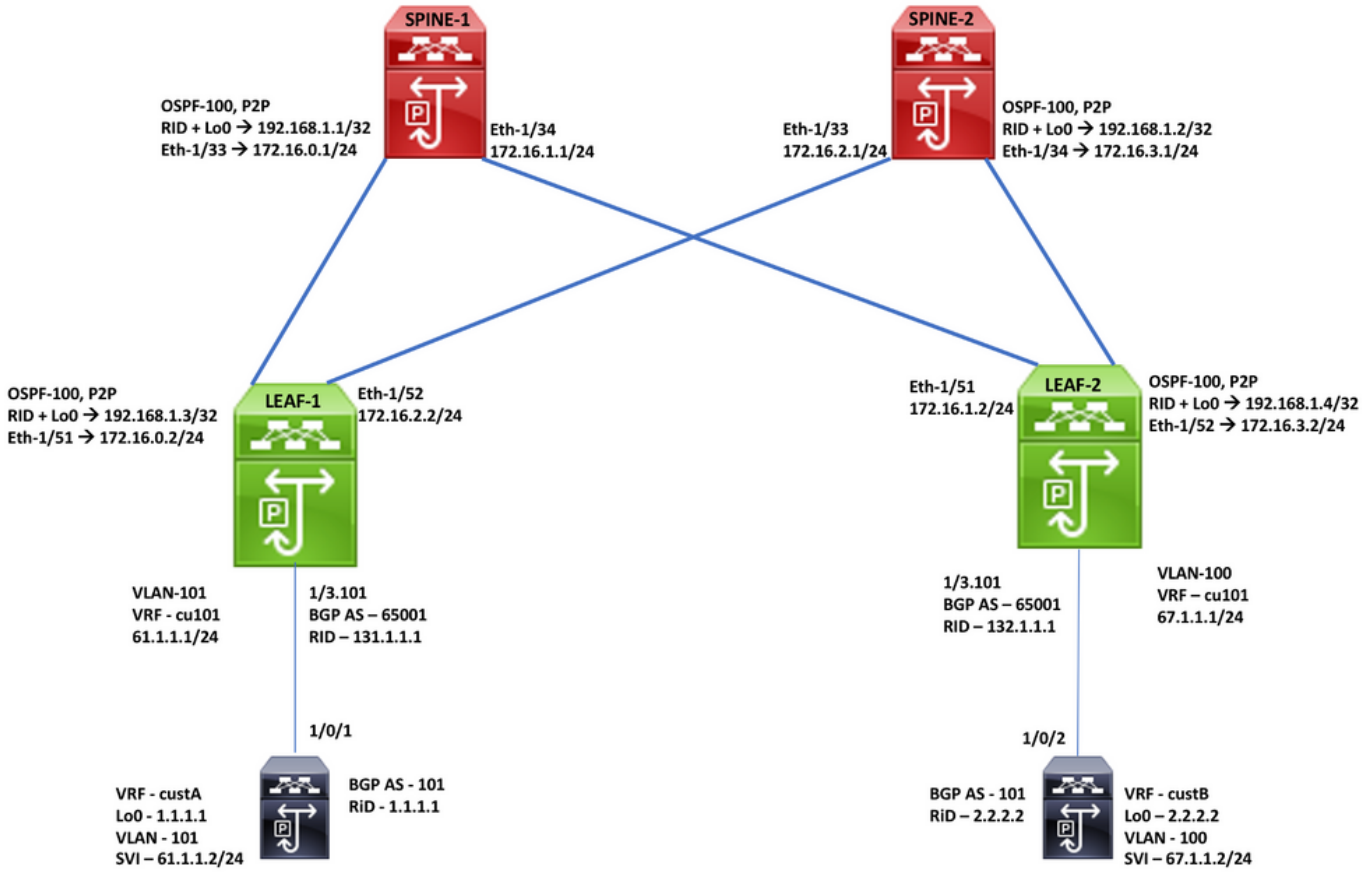
EVPN (RFC 7432) ist eine MPLS-basierte BGP-Lösung, die für Ethernet-Services der nächsten Generation in einem virtualisierten Rechenzentrumsnetzwerk verwendet wurde. Dabei werden verschiedene Bausteine wie RD, RT und VRF aus vorhandenen MPLS-Technologien verwendet.

L3 EVPN over SR, das mit der Version NXOS 7.0(3)I6(1) eingeführt wurde, verwendet die EVPN-Route Typ 5 mit MPLS-Kapselung. Sie bietet Multi-Tenant-Funktionen, Skalierbarkeit und hohe Leistung für erweiterte Rechenzentrumsservices.

> **Hinweis**: Im Rechenzentrum kann die Datenebene VXLAN oder MPLS sein.

| Herkömmliches MPLS-L3-VPN | MPLS-L3-VPN über SR |
|---|---|
| Hauptbausteine: RD, RT und VRF | Hauptbausteine: RD, RT und VRF |
| Underlay-Layer für Transport: IGP, LDP und RSVP-TE | Underlay-Layer für Transport: IGP/BGP-LU und SR-TE |
| Overlay-Layer für Service: VPNv4 und VPNv6 | Overlay-Layer für Service: EVPN |

# Topologie




# Konfiguration

## Allgemeine Konfiguration

1. Installationsfunktionen
2. Konfigurieren der IP-Adresse - Underlay
3. Konfigurieren von IGP - OSPF
4. Konfigurieren von MP-BGP
5. VLAN- und EVPN-Overlay konfigurieren
6. Konfigurieren des e-BGP zwischen Hosts und LEAFs

## SPINE-1 Configuration

**Enabling Features, Label-Range, Route-map, Label-Index**

```
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
```

**OSPF Configuration**

```
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
```

**BGP/EVPN Configuration**

```
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**

```
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
```

**OSPF Configuration**

```
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
```

**BGP/EVPN Configuration**

```
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

```
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
    192.168.1.3/32 index 311

route-map label-index-leaf-1 permit 10
 set label-index 311


vrf context cu101
 rd auto
 address-family ipv4 unicast
  route-target import 1:101
  route-target import 1:101 evpn
  route-target export 1:101
  route-target export 1:101 evpn
```

### OSPF Configuration

```
interface Ethernet1/3.101
 encapsulation dot1q 101
 vrf member cu101
 ip address 61.1.1.1/24
 no shutdown

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 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
```

### BGP/EVPN Configuration

```
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
 template peer cu1
  address-family ipv4 unicast
   as-override
   send-community
   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 cu101
  router-id 131.1.1.1
  address-family ipv4 unicast
   advertise l2vpn evpn
  neighbor 61.1.1.2
   inherit peer cu1
   remote-as 101
```

**LEAF-2 Configuration**

**Enabling Features, Label-Range, Route-map, Label-Index**

```
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
    192.168.1.4/32 index 321

route-map label-index-Leaf2 permit 10
 set label-index 321


vrf context cu101
 rd auto
 address-family ipv4 unicast
  route-target import 1:101
  route-target import 1:101 evpn
  route-target export 1:101
  route-target export 1:101 evpn
```

**OSPF Configuration**

```
interface Ethernet1/3.101
 encapsulation dot1q 100
 vrf member cu101
 ip address 67.1.1.1/24
 no shutdown

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 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
 template peer cu1
  address-family ipv4 unicast
   as-override
   send-community
   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 cu101
  router-id 132.1.1.1
  address-family ipv4 unicast
   advertise l2vpn evpn
  neighbor 67.1.1.2
   inherit peer cu1
   remote-as 101
```

**End-Host Configuration**

**VRF, Loopback Configuration**

```
vrf definition custA
 rd 101:1
 !
 address-family ipv4
 exit-address-family
!
vrf definition custB
 rd 101:2
 !
 address-family ipv4
 exit-address-family

interface Loopback0
 vrf forwarding custA
 ip address 1.1.1.1 255.255.255.255
!
interface Loopback1
 vrf forwarding custB
 ip address 2.2.2.2 255.255.255.255
```

**Interface, SVI Configuration**

```
interface GigabitEthernet1/0/1
 switchport trunk allowed vlan 101
 switchport trunk encapsulation dot1q
 switchport mode trunk
 !
interface GigabitEthernet1/0/2
 switchport trunk allowed vlan 100
 switchport trunk encapsulation dot1q
 switchport mode trunk


interface Vlan100
 vrf forwarding custB
 ip address 67.1.1.2 255.255.255.0
 !
interface Vlan101
 vrf forwarding custA
 ip address 61.1.1.2 255.255.255.0
 !
```

**BGP Configuration**

```
router bgp 101
 bgp log-neighbor-changes
 no bgp default ipv4-unicast
 !
 address-family ipv4 vrf custA
  bgp router-id 1.1.1.1
  network 1.1.1.1 mask 255.255.255.255
  redistribute connected
  neighbor 61.1.1.1 remote-as 65001
  neighbor 61.1.1.1 activate
  neighbor 61.1.1.1 send-community
  neighbor 61.1.1.1 soft-reconfiguration inbound
 exit-address-family
 !
 address-family ipv4 vrf custB
  bgp router-id 2.2.2.2
  network 2.2.2.2 mask 255.255.255.255
  redistribute connected
  neighbor 67.0.0.1 soft-reconfiguration inbound
  neighbor 67.1.1.1 remote-as 65001
  neighbor 67.1.1.1 activate
  neighbor 67.1.1.1 send-community
  neighbor 67.1.1.1 soft-reconfiguration inbound
 exit-address-family
```

# Überprüfen

## Leaf 1 Captures : Control Plane and MPLS Data Plane:

```
Leaf1(config)# show ip bgp 1.1.1.1 vrf cu101
BGP routing table information for VRF cu101, address family IPv4 Unicast
BGP routing table entry for 1.1.1.1/32, version 6
Paths: (2 available, best #1)
Flags: (0x880c001a) (high32 0x000020) on xmit-list, is in urib, is best urib route, is in HW, exported, has label
  vpn: version 3, (0x00000000100002) on xmit-list
  local label: 492288

  Advertised path-id 1, VPN AF advertised path-id 1
  Path type: external, path is valid, is best path, no labeled nexthop, in rib
  AS-Path: 101 , path sourced external to AS
    61.1.1.2 (metric 0) from 61.1.1.2 (1.1.1.1)
      Origin IGP, MED 0, localpref 100, weight 0
      Extcommunity: RT:1:101

  Path type: external, path is valid, received only, no labeled nexthop
  AS-Path: 101 , path sourced external to AS
    61.1.1.2 (metric 0) from 61.1.1.2 (1.1.1.1)
      Origin IGP, MED 0, localpref 100, weight 0

  VRF advertise information:
  Path-id 1 not advertised to any peer

  VPN AF advertise information:
  Path-id 1 not advertised to any peer
```

```
Leaf1(config)# show bgp l2vpn evpn 1.1.1.1
BGP routing table information for VRF default, address family L2VPN EVPN
Route Distinguisher: 192.168.1.3:3
BGP routing table entry for [5]:[0]:[0]:[32]:[1.1.1.1]/224, version 6
Paths: (1 available, best #1)
Flags: (0x000002) (high32 00000000) on xmit-list, is not in l2rib/evpn, has label
  local label: 492288

  Advertised path-id 1
  Path type: local, path is valid, is best path, no labeled nexthop
  Gateway IP: 0.0.0.0
  AS-Path: 101 , path sourced external to AS
    0.0.0.0 (metric 0) from 0.0.0.0 (192.168.1.3)
      Origin IGP, MED 0, localpref 100, weight 0
      Received label 0
      Extcommunity: RT:1:101

  Path-id 1 advertised to peers:
    192.168.1.1        192.168.1.2
```

```
Leaf1(config)# show bgp ipv4  labeled-unicast 192.168.1.3
BGP routing table information for VRF default, address family IPv4 Label Unicast
BGP routing table entry for 192.168.1.3/32, version 8
Paths: (1 available, best #1)
Flags: (0x20c0002) (high32 00000000) on xmit-list, is not in urib, has label
  label af: version 11, (0x00000000100002) on xmit-list
  local label: 3

  Advertised path-id 1, Label AF advertised path-id 1
  Path type: local, path is valid, is best path, no labeled nexthop
  AS-Path: NONE, path locally originated
    0.0.0.0 (metric 0) from 0.0.0.0 (192.168.1.3)
      Origin IGP, MED not set, localpref 100, weight 32768
      Prefix-SID Attribute: Length: 10
        Label Index TLV: Length 7, Flags 0x0 Label Index 311

  Path-id 1 not advertised to any peer

  Label AF advertisement
  Path-id 1 advertised to peers:
    172.16.0.1         172.16.2.1
```

```
Leaf1(config)# show forwarding mpls 192.168.1.4/32

slot  1
=======

--------+-----------+-------------------+----------------+-------------+-------
Local   |Prefix     |FEC                |Next-Hop        |Interface    |Out
Label   |Table Id   |(Prefix/Tunnel id) |                |             |Label
--------+-----------+-------------------+----------------+-------------+-------
16321   |0x1        |192.168.1.4/32     |172.16.0.1      |Eth1/51      |16321    SWAP
    "   |0x1        |192.168.1.4/32     |172.16.2.1      |Eth1/52      |16321    SWAP
```

## Leaf 2 Captures : Control Plane and MPLS Data Plane:

```
Leaf2# show forwarding 1.1.1.1/32 vrf cu101

slot  1
=======


IPv4 routes for table cu101/base

------------------+-------------------------------------------+-----------------+----------------+-----------------
Prefix            | Next-hop                                  | Interface       | Labels         | Partial Install
------------------+-------------------------------------------+-----------------+----------------+-----------------
*1.1.1.1/32       172.16.1.1                                  Ethernet1/51      PUSH 16311 492288
                  172.16.3.1                                  Ethernet1/52      PUSH 16311 492288
Leaf2#
Leaf2#
```

```
Leaf2# show forwarding mpls 192.168.1.3/32

slot  1
=======

--------+-----------+-------------------+----------------+-------------+-------
Local   |Prefix     |FEC                |Next-Hop        |Interface    |Out
Label   |Table Id   |(Prefix/Tunnel id) |                |             |Label
--------+-----------+-------------------+----------------+-------------+-------
16311   |0x1        |192.168.1.3/32     |172.16.1.1      |Eth1/51      |16311    SWAP
    "   |0x1        |192.168.1.3/32     |172.16.3.1      |Eth1/52      |16311    SWAP
```

```
Leaf2# show forwarding 172.16.1.1/24

slot  1
=======


IPv4 routes for table default/base

------------------+-------------------------------------------+-----------------+----------------+-----------------
Prefix            | Next-hop                                  | Interface       | Labels         | Partial Install
------------------+-------------------------------------------+-----------------+----------------+-----------------
172.16.1.0/24     Attached                                    Ethernet1/51
Leaf2#
Leaf2#
```

```
Leaf2# show forwarding 192.168.1.3/32

slot  1
=======


IPv4 routes for table default/base

------------------+-------------------------------------------+-----------------+----------------+-----------------
Prefix            | Next-hop                                  | Interface       | Labels         | Partial Install
------------------+-------------------------------------------+-----------------+----------------+-----------------
192.168.1.3/32    172.16.1.1                                  Ethernet1/51      PUSH 16311
                  172.16.3.1                                  Ethernet1/52      PUSH 16311
```

## Spine 1 Captures

```
spine1# show bgp ipv4 labeled-unicast 1.1.1.1
spine1# show bgp l2vpn evpn 1.1.1.1
BGP routing table information for VRF default, address family L2VPN EVPN
Route Distinguisher: 192.168.1.3:3
BGP routing table entry for [5]:[0]:[0]:[32]:[1.1.1.1]/224, version 5
Paths: (1 available, best #1)
Flags: (0x000002) (high32 00000000) on xmit-list, is not in l2rib/evpn, is not in HW

  Advertised path-id 1
  Path type: internal, path is valid, is best path
  Gateway IP: 0.0.0.0
  AS-Path: 101 , path sourced external to AS
    192.168.1.3 (metric 0) from 192.168.1.3 (192.168.1.3)
      Origin IGP, MED 0, localpref 100, weight 0
      Received label 492288
      Extcommunity: RT:1:101

  Path-id 1 advertised to peers:
    192.168.1.4
```

```
spine1# show bgp ipv4 labeled-unicast 192.168.1.3
BGP routing table information for VRF default, address family IPv4 Label Unicast
BGP routing table entry for 192.168.1.3/32, version 5
Paths: (1 available, best #1)
Flags: (0x820c0012) (high32 00000000) on xmit-list, is in urib, is backup urib route, is in HW, has label
  label af: version 7, (0x00000000100002) on xmit-list
  local label: 16311

  Advertised path-id 1, Label AF advertised path-id 1
  Path type: internal, path is valid, received and used, is best path, no labeled nexthop, in rib
  AS-Path: NONE, path sourced internal to AS
    172.16.0.2 (metric 0) from 172.16.0.2 (192.168.1.3)
      Origin IGP, MED not set, localpref 100, weight 0
      Received label 3
      Prefix-SID Attribute: Length: 10
        Label Index TLV: Length 7, Flags 0x0 Label Index 311

  Path-id 1 not advertised to any peer

  Label AF advertisement
  Path-id 1 advertised to peers:
    172.16.1.2
```

```
spine1# show forwarding mpls 192.168.1.4/32

slot  1
=======

--------+-----------+-------------------+----------------+-------------+------
Local   |Prefix     |FEC                |Next-Hop        |Interface    |Out
Label   |Table Id   |(Prefix/Tunnel id) |                |             |Label
--------+-----------+-------------------+----------------+-------------+------
16321   |0x1        |192.168.1.4/32     |172.16.1.2      |Eth1/34      |0       SWAP
```

**End-Host Captures**

```
endhost#show ip int brief
Interface              IP-Address      OK? Method Status                Protocol
Vlan1                  unassigned      YES NVRAM  up                    up
Vlan100                67.1.1.2        YES manual up                    up
Vlan101                61.1.1.2        YES manual up                    up

Loopback0              1.1.1.1         YES manual up                    up
Loopback1              2.2.2.2         YES manual up                    up
```

```
endhost#ping vrf custB 1.1.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/7/17 ms
```

```
endhost#ping vrf custA 2.2.2.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2.2.2.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/8/17 ms
```

```
endhost#traceroute vrf custB 1.1.1.1
Type escape sequence to abort.
Tracing the route to 1.1.1.1
VRF info: (vrf in name/id, vrf out name/id)
  1 67.1.1.1 0 msec 8 msec 0 msec
  2 172.16.3.1 0 msec 0 msec 0 msec
  3 172.16.0.2 0 msec
    172.16.2.2 0 msec
    172.16.0.2 8 msec
  4 61.1.1.2 0 msec *  0 msec
```

```
endhost#traceroute vrf custA 2.2.2.2
Type escape sequence to abort.
Tracing the route to 2.2.2.2
VRF info: (vrf in name/id, vrf out name/id)
  1 61.1.1.1 0 msec 17 msec 0 msec
  2 172.16.2.1 17 msec
    172.16.0.1 0 msec
    172.16.2.1 9 msec
  3 172.16.3.2 0 msec
    172.16.1.2 0 msec
    172.16.3.2 17 msec
  4 67.1.1.2 8 msec *  0 msec
endhost#
```

# Zugehörige Informationen

- Multiprotocol BGP MPLS VPN
- Segment Routing auf Cisco Nexus 9500-, 9300-, 9200-, 3200- und 3100-Plattform-Switches (Whitepaper)
- Konfigurieren von Layer-3-EVPN und Layer-3-VPN über Segment-Routing-MPLS