Implémentation de Nexus L2 EVPN sur MPLS de routage de segment

Contenu

Introduction

Ce document décrit comment déployer/configurer l'EVPN de couche 2 sur MPLS de routage de segment sur les commutateurs de la gamme Cisco Nexus 9000.

Conditions préalables

Conditions requises

Nécessaire pour avoir des connaissances sur BGP, OSPF, MPLS, LDP, RSVP, EVPN, routage de segment (SR)

Components Used

Commutateur Cisco Nexus 93360YC-FX2 exécuté avec 9.3.(3)

Commutateur Cisco Nexus 93240YC-FX2 exécuté avec 9.3.(3)

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Fond

Définissez VPN de couche 2, VPLS/L2-EVPN est un service VPN de couche 2 multipoint à multipoint qui connecte plusieurs filiales d'un client, dans une architecture logique commutée unique sur un réseau IP/MPLS.

EVPN-MPLS SR de couche 2 :

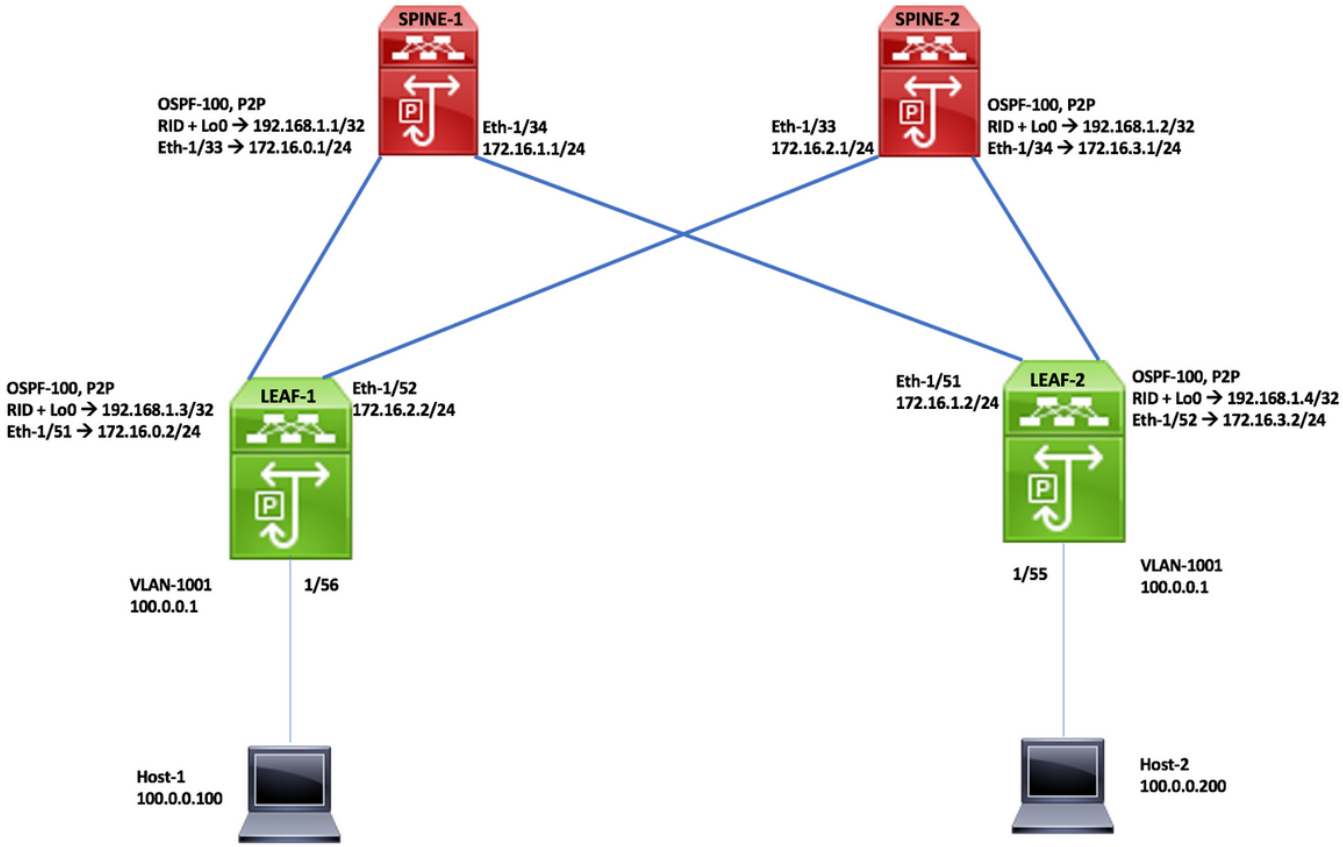
- EVPN (RFC 7432) est une solution BGP MPLS qui a été utilisée pour les services Ethernet de nouvelle génération dans un réseau de data center virtualisé
- EVPN utilise plusieurs éléments de base tels que les technologies RD, RT et VRF des technologies MPLS existantes
- EVPN fonctionne en contraste avec le VPLS existant en activant l'apprentissage MAC basé sur le plan de contrôle dans le coeur
- Dans EVPN, les PE participant aux instances EVPN apprennent les routes MAC du client dans le plan de contrôle à l'aide du protocole MP-BGP
- L'apprentissage MAC du plan de contrôle fournit un certain nombre d'avantages qui permettent à EVPN de combler les lacunes du VPLS, notamment la prise en charge du multihébergement avec équilibrage de charge par flux
- SR L2 EVPN est une nouvelle fonctionnalité disponible dans NXOS 9.3(1) et prise en charge sur la plate-forme Nexus 9300 FX2

Limitations pour L2 EVPN sur SR MPLS :

- L’inondation EVPN de la couche de routage de segment 2 est basée sur le mécanisme de réplication d’entrée
- Il utilise une route EVPN de type 3 pour le trafic BUM
- Le coeur MPLS ne prend pas en charge la multidiffusion
- La suppression ARP n'est pas prise en charge
- La vérification de cohérence sur VPC n'est pas prise en charge
- Les mêmes EVI de couche 2 et EVI de couche 3 ne peuvent pas être configurés ensemble

Configuration

Diagramme du réseau



Étapes de configuration de haut niveau :

- Fonctions d'installation
- Configurer L'Adresse Ip -Underlay
- Configurer IGP -OSPF
- Configurer MP-BGP
- Configuration de la superposition VLAN et EVPN
- Configuration de l'hôte final pour la couche 2

SPINE -1 Configuration

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

```
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
```

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

```
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
192.168.1.2/32index 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 192.168.1.2/32route-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

```
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
```

OSPF Configuration

```
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
```

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

  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
```

Vérification

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

Route Distinguisher: 192.168.1.4:37864
* i[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
*>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
*>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, I-injecte
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
*>l[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
*>l[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
*>l[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)
*>i[2]:[0]:[0]:[48]:[00ee.ab39.fafd]:[0]:[0.0.0.0]/216
                    192.168.1.4               100      32768 i
*>l[2]:[0]:[0]:[48]:[00ee.ab39.fb4b]:[0]:[0.0.0.0]/216
                    192.168.1.3               100          0 i
*>i[2]:[0]:[0]:[48]:[00ee.ab39.fafd]:[32]:[100.0.0.100]/248
                    192.168.1.4               100      32768 i
*>l[2]:[0]:[0]:[48]:[00ee.ab39.fb4b]:[32]:[100.0.0.200]/272
                    192.168.1.3               100          0 i
*>l[3]:[0]:[32]:[192.168.1.3]/88
                    192.168.1.3               100          0 i
*>i[3]:[0]:[32]:[192.168.1.4]/88
                    192.168.1.4               100      32768 i
```

Références

[Segment Routing on Cisco Nexus 9500, 9300, 9200, 3200 et 3100 Platform Switches (Livre blanc)]

[Configuration de l'EVPN de couche 2 sur le routage de segment MPLS]