Implémenter VxLAN/EVPN au transfert MPLS/SR dans Nexus 9000

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Introduction

Ce document décrit comment configurer l'EVPN VxLAN sur le transfert MPLS de routage de segment sur les commutateurs de la gamme Cisco Nexus 9000.

Conditions préalables

Conditions requises

Cisco vous recommande de prendre connaissance des rubriques suivantes :

- VPN de couche 3 MPLS
- MP-BGP
- Routage de segment

Components Used

Les informations contenues dans ce document sont basées sur les versions de matériel et de logiciel suivantes :

- BL // N9K-C93240YC-FX2 // 9.3(3)
- ASR1K // 16.12.02
- Spine-1 // N9K-C92160YC-X // 9.2(3)
- PE // N9K-C93240YC-FX2 // 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. Si votre réseau est en ligne, assurez-vous de bien comprendre l'incidence possible des commandes.

Informations générales

Les déploiements de data center (DC) ont adopté l'EVPN VXLAN pour ses avantages tels que l'apprentissage du plan de contrôle EVPN, la mutualisation, la mobilité transparente, la redondance et des ajouts de POD plus faciles. De même, le CORE est soit un réseau MPLS L3VPN basé sur le protocole LDP (Label Distribution Protocol), soit une transition de la sous-couche LDP traditionnelle MPLS L3VPN vers une solution plus sophistiquée comme le routage de segment (SR).

Le routage de segment est une méthode de transmission des paquets sur le réseau basée sur le paradigme de routage source. La source choisit un chemin et l'encode dans l'en-tête du paquet en tant que liste ordonnée de segments. Les segments sont un identificateur pour tout type d'instruction.

Avantages de la SR

Le routage de segment est adopté pour les avantages suivants :

- Plans de contrôle MPLS IGP unifiés.
- Prêt pour le SDN : Le routage de segment a été conçu pour SDN et constitue la base du routage AER (Application Engineered Routing). SR prépare les réseaux aux modèles commerciaux, où les applications peuvent orienter le comportement du réseau. SR offre le bon équilibre entre intelligence distribuée et optimisation et programmation centralisées.
- Configuration minimale : Le routage de segment pour TE nécessite une configuration minimale sur le routeur source.
- Équilibrage de charge : Contrairement à RSVP-TE, l'équilibrage de charge pour le routage de segment peut avoir lieu en présence d'ECMP (Equal Cost Multiple Paths).
- Prise en charge de la réacheminement rapide (FRR) : Le réacheminement rapide permet l'activation d'un chemin de sauvegarde préconfiguré dans les 50 millisecondes d'une défaillance de chemin.
- Déploiement Plug-and-Play : Les stratégies de routage de segment sont interopérables avec les plans de contrôle et de données MPLS existants et peuvent être implémentées dans un déploiement existant.

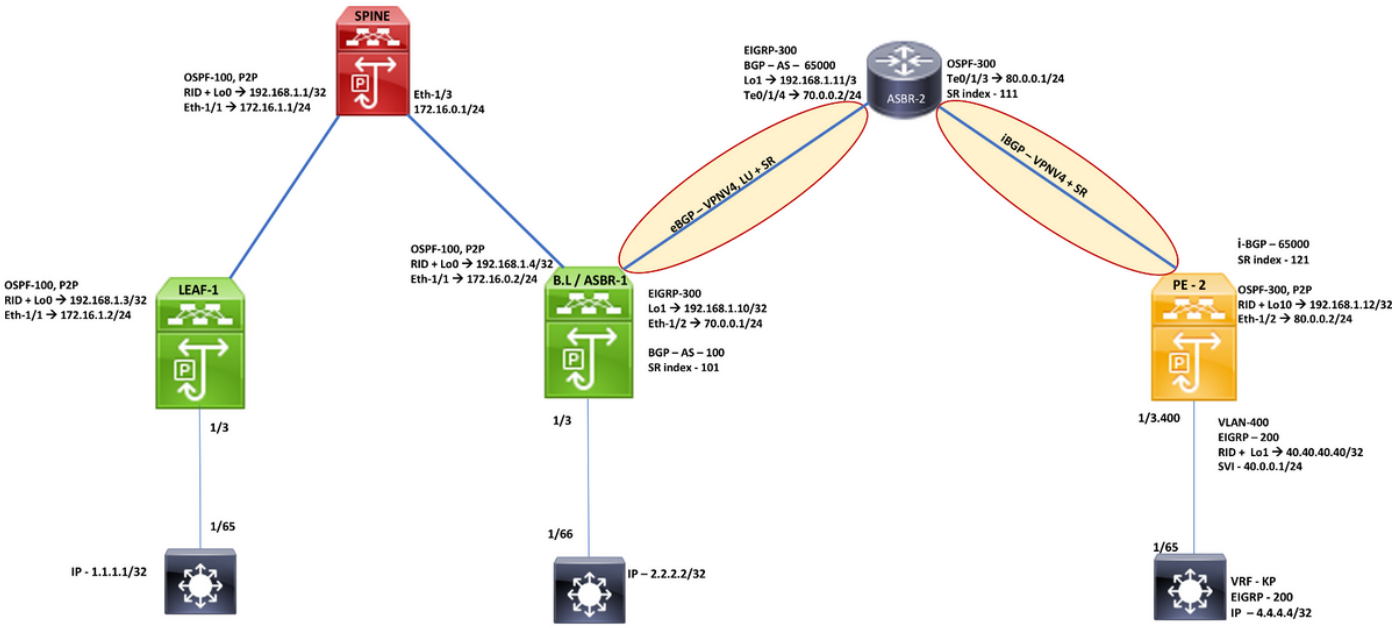
Directives et limites pour configurer une intégration transparente d'EVPN avec L3VPN (MPLS SR)

Fonctionnalité	Commutateurs Cisco Nexus 9300-FX2	Commutateurs Cisco Nexus 9504 et 9508 avec cartes de ligne -R	Commentaires
VXLAN EVPN à	Oui	Oui	Étendez la connectivité de couche 3 entre

SR-L3VPN			différents modules CC IGP/BGP sous-jace avec des extensions SR.
VXLAN EVPN à SR-L3VPN	Oui	Oui	Étendre la connectivité de couche 3 entre POD CC qui exécute VXLAN et tout doma (DC ou CORE) qui exécute SR.
VPN EVPN VXLAN vers VPN L3VPN MPLS (LDP)	Non	Oui	La sous-couche est LDP.

Configuration

Diagramme du réseau



Configuration

Border Leaf - ASBR1 Configuration

```
hostname BL
install feature-set mpls
  allow feature-set mpls
feature-set mpls
nv overlay evpn
feature ospf
feature bgp
feature pim
feature eigrp
feature mpls l3vpn
feature mpls segment-routing
feature interface-vlan
feature vn-segment-vlan-based
feature lldp
feature mpls oam
feature nv overlay

ip pim rp-address 192.168.1.1 group-list 224.0.0.0/4
ip pim ssm range 232.0.0.0/8
mpls label range 5000 450000

segment-routing
  mpls
    global-block 16000 25000
    connected-prefix-sid-map
      address-family ipv4
        192.168.1.10/32 index 100

ip prefix-list adveig seq 5 permit 2.2.2.2/32
ip prefix-list localsub seq 5 permit 30.0.0.0/24
ip prefix-list localsub seq 10 permit 30.30.30.30/32
ip prefix-list localsub seq 15 permit 192.168.1.10/32
ip prefix-list localsub seq 20 permit 70.0.0.0/24

route-map direct permit 10
  match ip address prefix-list localsub
route-map eig permit 10
  match ip address prefix-list adveig
route-map ibgpout permit 10
  match route-type external internal
route-map label-index-Leaf2 permit 10
  set label-index 101

vlan 1,200,300
vlan 200
  vn-segment 201
vlan 300
  vn-segment 5000

interface Vlan200
  no shutdown
  vrf member KP
  ip address 30.0.0.1/24
  ip router eigrp 200

interface Vlan201

interface Vlan300
  no shutdown
  vrf member KP
  ip forward


vrf context KP
  vni 5000
  ip pim rp-address 192.168.1.1 group-list 224.0.0.0/4
  rd auto
  address-family ipv4 unicast
    route-target import 65000:1
    route-target export 65000:1
    route-target both auto
    route-target both auto evpn


interface nve1
  no shutdown
  host-reachability protocol bgp
  suppress mac-route
  source-interface loopback0
  member vni 201
    mcast-group 239.0.0.1
  member vni 5000 associate-vrf

interface loopback0
  ip address 192.168.1.4/32
  ip router ospf 100 area 0.0.0.0
  ip pim sparse-mode

interface loopback1
  ip address 192.168.1.10/32
  ip router eigrp 300

interface loopback10
  vrf member KP
  ip address 30.30.30.30/32
  ip router eigrp 200

interface Ethernet1/1
  ip address 172.16.0.2/24
  ip ospf network point-to-point
  ip router ospf 100 area 0.0.0.0
  ip pim sparse-mode
  no shutdown

interface Ethernet1/2
  mtu 9216
  ip address 70.0.0.1/24
  ip router eigrp 300
  mpls ip forwarding
  no shutdown

interface Ethernet1/3
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 200-201,300
  no shutdown

router eigrp 200
  router-id 30.30.30.30
  vrf KP
    address-family ipv4 unicast
      redistribute bgp 100 route-map ibgpout
router eigrp 300
  router-id 192.168.1.10
router ospf 100
  router-id 192.168.1.4

router bgp 100
  router-id 192.168.1.4
  address-family ipv4 unicast
    network 192.168.1.10/32 route-map label-index-Leaf2
    redistribute direct route-map direct
    allocate-label all
  address-family ipv6 unicast
  address-family vpnv4 unicast
  address-family ipv4 labeled-unicast
  address-family l2vpn evpn
  neighbor 70.0.0.2
    remote-as 65000
    ebgp-multihop 10
    address-family ipv4 labeled-unicast
      send-community
      send-community extended
  neighbor 192.168.1.1
    remote-as 100
    update-source loopback0
    address-family ipv4 unicast
      send-community extended
    address-family l2vpn evpn
      send-community extended
      import vpn unicast reoriginate


  neighbor 192.168.1.11
    remote-as 65000
    update-source loopback1
    disable-connected-check
    ebgp-multihop 10
    address-family vpnv4 unicast
      send-community extended
      import l2vpn evpn reoriginate
    address-family l2vpn evpn
      send-community extended
      rewrite-evpn-rt-asn
  vrf KP
    address-family ipv4 unicast
      redistribute direct route-map direct
      redistribute eigrp 200 route-map eig
```

ASR1K - ASBR2 Configuration

```
hostname P-Router
interface Loopback0
 ip address 192.168.1.11 255.255.255.255
!

!
segment-routing mpls
 global-block 16000 25000
 !
 connected-prefix-sid-map
  address-family ipv4
   192.168.1.11/32 index 111 range 1
  exit-address-family
 !
!
interface TenGigabitEthernet0/1/3
 ip address 80.0.0.1 255.255.255.0
 ip ospf network point-to-point
 cdp enable
 mpls ip
!
router ospf 300
 router-id 192.168.1.11
 segment-routing area 0 mpls
 segment-routing mpls
 segment-routing prefix-sid-map advertise-local
 redistribute connected
 redistribute static
 redistribute bgp 65000
 network 80.0.0.0 0.0.0.255 area 0
 network 192.168.1.11 0.0.0.0 area 0
!
!
router eigrp 300
 network 70.0.0.0 0.0.0.255
 network 192.168.1.11 0.0.0.0
 eigrp router-id 192.168.1.11
!
!
interface TenGigabitEthernet0/1/4
 mtu 9216
 ip address 70.0.0.2 255.255.255.0
 ip ospf network point-to-point
 cdp enable
 mpls ip
 mpls bgp forwarding
!
!
router bgp 65000
 bgp router-id 192.168.1.11
 no bgp transport path-mtu-discovery
 bgp log-neighbor-changes
 no bgp default route-target filter
 neighbor 70.0.0.1 remote-as 100
 neighbor 70.0.0.1 ebgp-multihop 10
 neighbor 192.168.1.10 remote-as 100
 neighbor 192.168.1.10 ebgp-multihop 10
 neighbor 192.168.1.10 disable-connected-check
 neighbor 192.168.1.10 update-source Loopback0
 neighbor 192.168.1.12 remote-as 65000
 neighbor 192.168.1.12 update-source Loopback0
 !
 address-family ipv4
  redistribute connected
  redistribute ospf 300
  segment-routing mpls
  neighbor 70.0.0.1 activate
  neighbor 70.0.0.1 send-community both
  neighbor 70.0.0.1 send-label
  neighbor 192.168.1.10 activate
  neighbor 192.168.1.10 send-community both
  neighbor 192.168.1.10 soft-reconfiguration inbound
  neighbor 192.168.1.10 send-label
  no neighbor 192.168.1.12 activate
 exit-address-family
 !
 address-family vpnv4
  neighbor 192.168.1.10 activate
  neighbor 192.168.1.10 send-community both
  neighbor 192.168.1.12 activate
  neighbor 192.168.1.12 send-community both
  neighbor 192.168.1.12 next-hop-self
 exit-address-family
 !
 address-family l2vpn evpn
 exit-address-family
!
```

Far-End PE2 Configuration

```
hostname PE2
install feature-set mpls
  allow feature-set mpls
feature-set mpls
feature ospf
feature bgp
feature eigrp
feature mpls l3vpn
feature mpls segment-routing
feature interface-vlan
feature lldp
feature mpls oam

vlan 1,400
segment-routing
  mpls
    global-block 16000 25000
    connected-prefix-sid-map
      address-family ipv4
        192.168.1.12/32 index 121

ip prefix-list adveig seq 5 permit 4.4.4.4/32
ip prefix-list localsub seq 5 permit 40.0.0.0/24
ip prefix-list localsub seq 10 permit 40.40.40.40/32
route-map direct permit 10
  match ip address prefix-list localsub
route-map eig permit 10
  match ip address prefix-list adveig
route-map ibgpout permit 10
  match tag 100
  match route-type internal

route-map label-index-Leaf2 permit 10
  set label-index 121

vrf context KP
  rd auto
  address-family ipv4 unicast
    route-target import 100:5000
    route-target import 65000:1
    route-target export 100:5000
    route-target export 65000:1

interface Ethernet1/2
  ip address 80.0.0.2/24
  ip ospf network point-to-point
  ip router ospf 300 area 0.0.0.0
  mpls ip forwarding
  no shutdown

interface loopback10
  ip address 192.168.1.12/32
  ip router ospf 300 area 0.0.0.0

router ospf 300
  segment-routing mpls
  router-id 192.168.1.12
  distance 115

interface Ethernet1/3
  switchport
  switchport mode trunk
  switchport trunk allowed vlan 400
  no shutdown

interface Vlan400
  no shutdown
  vrf member KP
  ip address 40.0.0.1/24
  ip router eigrp 200

interface loopback1
  vrf member KP
  ip address 40.40.40.40/32
  ip router eigrp 200


router eigrp 200
  router-id 40.40.40.40
  address-family ipv4 unicast
  vrf KP
    address-family ipv4 unicast
      redistribute bgp 65000 route-map ibgpout

router bgp 65000
  router-id 192.168.1.12
  address-family ipv4 unicast
    network 192.168.1.12/32 route-map label-index-Leaf2
    redistribute direct route-map direct
    redistribute eigrp 200 route-map eig
    allocate-label all
  address-family vpnv4 unicast
  address-family ipv4 labeled-unicast
  neighbor 192.168.1.11
    remote-as 65000
    update-source loopback10
    address-family vpnv4 unicast
      send-community extended
  vrf KP
    address-family ipv4 unicast
      redistribute direct route-map direct
      redistribute eigrp 200 route-map eig
```

Vérification

Host-1 & Leaf-1 Verification

```
host1# sh ip int  br | ex down

IP Interface Status for VRF "default"(1)
Interface         IP Address      Interface Status
Vlan201           20.0.0.2        protocol-up/link-up/admin-up
Lo0               1.1.1.1         protocol-up/link-up/admin-up
```

```
host1# traceroute 4.4.4.4 source 1.1.1.1
traceroute to 4.4.4.4 (4.4.4.4) from 1.1.1.1 (1.1.1.1), 30 hops max, 40 byte packets
 1  20.0.0.1 (20.0.0.1)  0.92 ms  0.531 ms  0.513 ms
 2  30.0.0.1 (30.0.0.1)  1.043 ms  0.819 ms  0.733 ms
 3  40.0.0.1 (40.0.0.1)  0.912 ms  0.673 ms  0.624 ms
     [Label=492287 E=0 TTL=253 S=1]
 4  4.4.4.4 (4.4.4.4)  0.882 ms  0.825 ms  0.561 ms
host1#
```

```
Leaf1_N3k# show bgp l2vpn evpn
BGP routing table information for VRF default, address family L2VPN EVPN
BGP table version is 42, 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: 192.168.1.4:3
*>i[5]:[0]:[0]:[24]:[30.0.0.0]/224
                    192.168.1.4               0        100          0 ?
*>i[5]:[0]:[0]:[24]:[40.0.0.0]/224
                    192.168.1.4                        100          0 65000 ?
*>i[5]:[0]:[0]:[32]:[2.2.2.2]/224
                    192.168.1.4          130816        100          0 ?
*>i[5]:[0]:[0]:[32]:[4.4.4.4]/224
                    192.168.1.4                        100          0 65000 ?
*>i[5]:[0]:[0]:[32]:[30.30.30.30]/224
                    192.168.1.4               0        100          0 ?
*>i[5]:[0]:[0]:[32]:[40.40.40.40]/224
                    192.168.1.4                        100          0 65000 ?

Route Distinguisher: 192.168.1.3:3    (L3VNI 5000)
*>i[5]:[0]:[0]:[24]:[20.0.0.0]/224
                    192.168.1.3               0        100      32768 ?
*>i[5]:[0]:[0]:[24]:[30.0.0.0]/224
                    192.168.1.4               0        100          0 ?
*>i[5]:[0]:[0]:[24]:[40.0.0.0]/224
                    192.168.1.4                        100          0 65000 ?
*>i[5]:[0]:[0]:[32]:[1.1.1.1]/224
                    192.168.1.3          130816        100      32768 ?
*>i[5]:[0]:[0]:[32]:[2.2.2.2]/224
                    192.168.1.4          130816        100          0 ?
*>i[5]:[0]:[0]:[32]:[4.4.4.4]/224
                    192.168.1.4                        100          0 65000 ?
*>i[5]:[0]:[0]:[32]:[20.20.20.20]/224
                    192.168.1.3               0        100      32768 ?
*>i[5]:[0]:[0]:[32]:[30.30.30.30]/224
                    192.168.1.4               0        100          0 ?
*>i[5]:[0]:[0]:[32]:[40.40.40.40]/224
                    192.168.1.4                        100          0 65000 ?

Leaf1_N3k#
```

Border Leaf Verification

BL# sh bgp l2vpn evpn

```
BGP routing table information for VRF default, address family L2VPN EVPN
BGP table version is 30, 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
Route Distinguisher: 192.168.1.3:3
*>i[5]:[0]:[0]:[24]:[20.0.0.0]/224
                    192.168.1.3              0     100      0 ?
*>i[5]:[0]:[0]:[32]:[1.1.1.1]/224
                    192.168.1.3         130816     100      0 ?
*>i[5]:[0]:[0]:[32]:[20.20.20.20]/224
                    192.168.1.3              0     100      0 ?

Route Distinguisher: 192.168.1.4:3    (L3VNI 5000)
*>i[5]:[0]:[0]:[24]:[20.0.0.0]/224
                    192.168.1.3              0     100      0 ?
*>i[5]:[0]:[0]:[24]:[30.0.0.0]/224
                    192.168.1.4              0     100  32768 ?
*>i[5]:[0]:[0]:[24]:[40.0.0.0]/224
                    192.168.1.4                          0 65000 ?
*>i[5]:[0]:[0]:[32]:[1.1.1.1]/224
                    192.168.1.3         130816     100      0 ?
*>i[5]:[0]:[0]:[32]:[2.2.2.2]/224
                    192.168.1.4         130816     100  32768 ?
*>i[5]:[0]:[0]:[32]:[4.4.4.4]/224
                    192.168.1.4                          0 65000 ?
*>i[5]:[0]:[0]:[32]:[20.20.20.20]/224
                    192.168.1.3              0     100      0 ?
*>i[5]:[0]:[0]:[32]:[30.30.30.30]/224
                    192.168.1.4              0     100  32768 ?
*>i[5]:[0]:[0]:[32]:[40.40.40.40]/224
                    192.168.1.4                          0 65000 ?

BL#
```

BL# show bgp vpnv4 unicast

```
BGP routing table information for VRF default, address family VPNv4 Unicast
BGP table version is 81, 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
Route Distinguisher: 192.168.1.4:3    (VRF KP)
*>i1.1.1.1/32       192.168.1.3         130816     100      0 ?
*>r2.2.2.2/32       0.0.0.0             130816     100  32768 ?
*>e4.4.4.4/32       192.168.1.11                         0 65000 ?
*>i20.0.0.0/24      192.168.1.3              0     100      0 ?
*>i20.20.20.20/32   192.168.1.3              0     100      0 ?
*>r30.0.0.0/24      0.0.0.0                  0     100  32768 ?
*>r30.30.30.30/32   0.0.0.0                  0     100  32768 ?
*>e40.0.0.0/24      192.168.1.11                         0 65000 ?
*>e40.40.40.40/32   192.168.1.11                         0 65000 ?

Route Distinguisher: 192.168.1.12:3
*>e4.4.4.4/32       192.168.1.11                         0 65000 ?
*>e40.0.0.0/24      192.168.1.11                         0 65000 ?
*>e40.40.40.40/32   192.168.1.11                         0 65000 ?

BL#
```

BL# show segment-routing mpls clients

```
      Segment-Routing Mpls Client Info

Client: bgp-100
  PIB index: 1   UUID: 0x11b   PID: 4611   MTS SAP: 7255
  TIBs registered:
    VRF: default Table: base

Total Clients: 1
BL#

BL# show segment-routing mpls ipv4 connected-prefix-sid-map
      Segment-Routing Mpls Prefix-SID Mappings
Prefix-SID mappings for VRF default Table base

Prefix          SID  Type Range SRGB
192.168.1.10/32   100  Indx 1   Y

*SRGB - Indicates whether Prefix-Sid is within configured SRGB
BL#

BL# show segment-routing mpls detail
      Segment-Routing Mpls Global info
Service Name: segment-routing
State: Enabled
Process Id: 2605
Configured SRGB: 16000 - 25000
SRGB Allocation status: Alloc-Successful
Current SRGB: 16000 - 25000
Cleanup Interval: 60
Retry Interval: 180
SRGB ULIB handle: 4096002
Ulib RegStatus: Done
ULIB PIB handle: 0x2
BL#
```

BL# show mpls switching

```
Legend:
(P)=Protected, (F)=FRR active, (*)=more labels in stack.

IPV4:
In-Label  Out-Label  FEC name          Out-Interface     Next-Hop
VRF default
5000      Pop Label  80.0.0.0/24       Eth1/2            70.0.0.2
16111     Pop Label  192.168.1.11/32   Eth1/2            70.0.0.2
16121     16121      192.168.1.12/32   Eth1/2            70.0.0.2

In-Label  VRF
492288    default
492287    KP

Local     Out-Label  Out-Interface     Next-Hop
FEC: 4.4.4.4/32, 192.168.1.12:3
5001      22                           192.168.1.11

FEC: 40.0.0.0/24, 192.168.1.12:3
5002      23                           192.168.1.11

FEC: 40.40.40.40/32, 192.168.1.12:3
5003      24                           192.168.1.11


Block     Label-Range
1         16000 - 25000
BL#
```

P-Router Verification

P-Router#sh ip inter bri | ex down

```
Interface              IP-Address      OK? Method Status                Protocol
Te0/1/2                unassigned      YES NVRAM  up                    up
Te0/1/3                80.0.0.1        YES NVRAM  up                    up
Te0/1/4                70.0.0.2        YES NVRAM  up                    up
GigabitEthernet0       10.82.139.101   YES manual up                    up
Loopback0              192.168.1.11    YES NVRAM  up                    up
```

P-Router#show ip ospf neighbor

```
Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.1.12      0   FULL/  -        00:00:35    80.0.0.2        TenGigabitEthernet0/1/3
P-Router#
```

P-Router#show bgp vpnv4 unicast all

```
BGP table version is 28, local router ID is 192.168.1.11
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
              t secondary path, L long-lived-stale,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

     Network          Next Hop            Metric LocPrf Weight Path
Route Distinguisher: 192.168.1.4:3
 *>   1.1.1.1/32       192.168.1.10                           0 100 ?
 *>   2.2.2.2/32       192.168.1.10           130816          0 100 ?
 *>   20.0.0.0/24      192.168.1.10                           0 100 ?
 *>   20.20.20.20/32   192.168.1.10                           0 100 ?
 *>   30.0.0.0/24      192.168.1.10                0          0 100 ?
 *>   30.30.30.30/32   192.168.1.10                0          0 100 ?
Route Distinguisher: 192.168.1.12:3
 *>i  4.4.4.4/32       192.168.1.12           130816    100      0 ?
 *>i  40.0.0.0/24      192.168.1.12                0    100      0 ?
 *>i  40.40.40.40/32   192.168.1.12                0    100      0 ?
P-Router#
```

P-Router#show segment-routing mpls state

```
 Segment Routing MPLS State : ENABLED

P-Router#
```

P-Router#show mpls forwarding-table

```
Local      Outgoing    Prefix          Bytes Label   Outgoing    Next Hop
Label      Label       or Tunnel Id    Switched      interface
16         Pop Label   80.0.0.2-A      0             Te0/1/3     80.0.0.2
17         [M]  Pop Label  192.168.1.12/32  0        Te0/1/3     80.0.0.2
18         Pop Label   192.168.1.10/32  0            Te0/1/4     70.0.0.1
19         492287      192.168.1.4:3:2.2.2.2/32  \
                                       0             Te0/1/4     70.0.0.1
20         492287      192.168.1.4:3:30.0.0.0/24  \
                                       510           Te0/1/4     70.0.0.1
21         492287      192.168.1.4:3:30.30.30.30/32  \
                                       0             Te0/1/4     70.0.0.1
22         492287      192.168.1.12:3:4.4.4.4/32  \
                                       2828          Te0/1/3     80.0.0.2
23         492287      192.168.1.12:3:40.0.0.0/24  \
                                       9774          Te0/1/3     80.0.0.2
24         492287      192.168.1.12:3:40.40.40.40/32  \
                                       1848          Te0/1/3     80.0.0.2
25         492287      192.168.1.4:3:1.1.1.1/32  \
                                       5082          Te0/1/4     70.0.0.1
26         492287      192.168.1.4:3:20.0.0.0/24  \
                                       780           Te0/1/4     70.0.0.1
27         492287      192.168.1.4:3:20.20.20.20/32  \

P-Router#
```

P-Router#show segment-routing client all

```
SRHandle: 1 ClientType: SR INTERNAL ClientHandle: 0

SRHandle: 2 ClientType: OSPF ClientHandle: 7FB45A5B94C8
Registered Notifications:
 Handle: 0x0 topoid(0) sidmap_bitmask(1) algo(0)
 Handle: 0x1 topoid(0) sidmap_bitmask(1) algo(1)
 Handle: 0x2 topoid(0) sidmap_bitmask(2) algo(0)
 Handle: 0x3 topoid(0) sidmap_bitmask(2) algo(1)
 Handle: 0x4 topoid(0) sidmap_bitmask(E) algo(0) Expanded
 Handle: 0x5 topoid(0) sidmap_bitmask(E) algo(1) Expanded

SRHandle: 3 ClientType: BGP ClientHandle: 7FB45A5DF9A8
Registered Notifications:
 Handle: 0x6 topoid(0) sidmap_bitmask(8) algo(0)
 Handle: 0x7 topoid(0) sidmap_bitmask(1) algo(0)
P-Router#
```

P-Router#show segment-routing mpls connected-prefix-sid-map protocol ipv4

```
        PREFIX_SID_PROTOCOL_ADV_MAP ALGO_0

  Prefix/masklen  SID Type Range Flags SRGB Source
  192.168.1.10/32  100 Indx  1     Y  BGP 192.168.1.4
  192.168.1.11/32  111 Indx  1     Y  OSPF Area 0 192.168.1.11
  192.168.1.12/32  121 Indx  1     Y  OSPF Area 0 192.168.1.12

        PREFIX_SID_PROTOCOL_ADV_MAP ALGO_1

  Prefix/masklen  SID Type Range Flags SRGB Source
```

P-Router#sh mpls forwarding-table 192.168.1.12 32

```
Local      Outgoing    Prefix          Bytes Label   Outgoing    Next Hop
Label      Label       or Tunnel Id    Switched      interface
17         [M]  Pop Label  192.168.1.12/32  0        Te0/1/3     80.0.0.2
16121 [M]  Pop Label  192.168.1.12/32  0            Te0/1/3     80.0.0.2

[M] - Merged
```

P-Router#sh mpls forwarding-table 192.168.1.10 32

```
Local      Outgoing    Prefix          Bytes Label   Outgoing    Next Hop
Label      Label       or Tunnel Id    Switched      interface
18         Pop Label   192.168.1.10/32  0            Te0/1/4     70.0.0.1
16100      Pop Label   192.168.1.10/32  0            Te0/1/4     70.0.0.1
```

P-Router#show mpls forwarding-table labels 16

```
Local      Outgoing    Prefix          Bytes Label   Outgoing    Next Hop
Label      Label       or Tunnel Id    Switched      interface
16         Pop Label   80.0.0.2-A      0             Te0/1/3     80.0.0.2

A - Adjacency SID
```

P-Router#show mpls forwarding-table labels 17

```
Local      Outgoing    Prefix          Bytes Label   Outgoing    Next Hop
Label      Label       or Tunnel Id    Switched      interface
17         [M]  Pop Label  192.168.1.12/32  0        Te0/1/3     80.0.0.2

[M] - Merged
```

P-Router#show mpls forwarding-table labels 18

```
Local      Outgoing    Prefix          Bytes Label   Outgoing    Next Hop
Label      Label       or Tunnel Id    Switched      interface
18         Pop Label   192.168.1.10/32  0            Te0/1/4     70.0.0.1
```

P-Router#show mpls forwarding-table labels 22

```
Local      Outgoing    Prefix          Bytes Label   Outgoing    Next Hop
Label      Label       or Tunnel Id    Switched      interface
22         492287      192.168.1.12:3:4.4.4.4/32  \
                                       2828          Te0/1/3     80.0.0.2
P-Router#
```

Far-End PE Verification

```
PE2# show bgp vpnv4 unicast
BGP routing table information for VRF default, address family VPNv4 Unicast
BGP table version is 79, Local Router ID is 192.168.1.12
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: 192.168.1.4:3
*>i1.1.1.1/32       192.168.1.11             0        100          0 100 ?
*>i2.2.2.2/32       192.168.1.11        130816        100          0 100 ?
*>i20.0.0.0/24      192.168.1.11             0        100          0 100 ?
*>i20.20.20.20/32   192.168.1.11             0        100          0 100 ?
*>i30.0.0.0/24      192.168.1.11             0        100          0 100 ?
*>i30.30.30.30/32   192.168.1.11             0        100          0 100 ?

Route Distinguisher: 192.168.1.12:3   (VRF KP)
*>i1.1.1.1/32       192.168.1.11             0        100          0 100 ?
*>i2.2.2.2/32       192.168.1.11        130816        100          0 100 ?
*>r4.4.4.4/32       0.0.0.0             130816        100      32768 ?
*>i20.0.0.0/24      192.168.1.11             0        100          0 100 ?
*>i20.20.20.20/32   192.168.1.11             0        100          0 100 ?
*>i30.0.0.0/24      192.168.1.11             0        100          0 100 ?
*>i30.30.30.30/32   192.168.1.11             0        100          0 100 ?
*>r40.0.0.0/24      0.0.0.0                  0        100      32768 ?
*>r40.40.40.40/32   0.0.0.0                  0        100      32768 ?

PE2# show ip interface brief | ex down
IP Interface Status for VRF "default"(1)
Interface            IP Address      Interface Status
Lo10                 192.168.1.12    protocol-up/link-up/admin-up
Eth1/2               80.0.0.2        protocol-up/link-up/admin-up
PE2#
PE2# sh ip interface brief  vrf KP | ex down
IP Interface Status for VRF "KP"(3)
Interface            IP Address      Interface Status
Vlan400              40.0.0.1        protocol-up/link-up/admin-up
Lo1                  40.40.40.40     protocol-up/link-up/admin-up
PE2#
PE2# show ip ospf neighbors
 OSPF Process ID 300 VRF default
 Total number of neighbors: 1
 Neighbor ID     Pri State            Up Time  Address         Interface
 192.168.1.11      1 FULL/ -          06:48:03 80.0.0.1        Eth1/2
PE2#
```

```
PE2# show segment-routing mpls detail
        Segment-Routing Mpls Global info
Service Name: segment-routing
State: Enabled
Process Id: 2257
Configured SRGB: 16000 - 25000
SRGB Allocation status: Alloc-Successful
Current SRGB: 16000 - 25000
Cleanup Interval: 60
Retry Interval: 180
SRGB ULIB handle: 4096002
Ulib RegStatus: Done
ULIB PIB handle: 0x2
PE2#
PE2# show segment-routing mpls clients
        Segment-Routing Mpls Client Info
Client: ospf-300
   PIB index: 1    UUID: 0x41000119   PID: 4281    MTS SAP: 320
   TIBs registered:
      VRF: default Table: base
Client: bgp-65000
   PIB index: 2    UUID: 0x11b    PID: 4302    MTS SAP: 6825
   TIBs registered:
      VRF: default Table: base
Total Clients: 2

PE2# show segment-routing mpls ipv4 connected-prefix-sid-map
        Segment-Routing Mpls Prefix-SID Mappings
Prefix-SID mappings for VRF default Table base

Prefix          SID   Type Range SRGB
192.168.1.12/32  121  Indx 1     Y

*SRGB - Indicates whether Prefix-Sid is within configured SRGB
PE2# sho forwarding mpls
slot  1
=======
--------+------------+------------------+---------------+-------------+-------
Local   |Prefix      |FEC               |Next-Hop       |Interface    |Out
Label   |Table Id    |(Prefix/Tunnel Id) |               |             |Label
--------+------------+------------------+---------------+-------------+-------
16      |N/A         |N/A               |80.0.0.1       |Eth1/2       |Pop Label
16111   |0x1         |192.168.1.11/32   |80.0.0.1       |Eth1/2       |0      SWAP
492288  |            |                  |               |             |Pop Label
PE2#
```

```
PE2# show mpls switching
Legend:
(P)=Protected, (F)=FRR active, (*)=more labels in stack.

IPV4:
In-Label  Out-Label  FEC name         Out-Interface     Next-Hop
VRF default
16111     Pop Label  192.168.1.11/32  Eth1/2            80.0.0.1

In-Label  VRF
492288    default
492287    KP

ADJ_SID:
In-Label  Out-Label  FEC name         Out-Interface     Next-Hop
16        3          80.0.0.1         Eth1/2            80.0.0.1

Block     Label-Range
1         16000 - 25000
PE2#
```

```
PE2# show mpls switching detail

VRF default
IPv4 FEC
In-Label              : 16111
Out-Label stack       : Pop Label
FEC                   : 192.168.1.11/32
Out interface         : Eth1/2
Next hop              : 80.0.0.1
Input traffic statistics     : 0 packets, 0 bytes
Output statistics per label  : label Pop Label, 0 packets, 0 bytes

Deaggregation FEC type
In-Label              : 492288
VRF                   : default
Address-Family        : IPv4
Flags                 : RFC3107
Input traffic statistics     : 0 packets 0 bytes

Deaggregation FEC type
In-Label              : 492287
VRF                   : KP
Address-Family        : IPv4
Input traffic statistics     : 132 packets 15540 bytes

ADJ SID
In-Label              : 16
Out-Label stack       : 3
FEC                   : 80.0.0.1
Out interface         : Eth1/2
Next hop              : 80.0.0.1
Input traffic statistics     : 0 packets, 0 bytes
Output statistics per label  : label 3, 0 packets, 0 bytes

*Label statistics accurate as of 117 seconds ago
Block     Label-Range
1         16000 - 25000
PE2#
```

Informations connexes

- Informations sur la configuration de l'intégration transparente d'EVPN avec L3VPN (MPLS SR)
- Support et documentation techniques - Cisco Systems