Implemente VxLAN/EVPN a MPLS/SR Handoff en Nexus 9000

Contenido

Introducción

Este documento describe cómo configurar la transferencia MPLS de VxLAN EVPN over Segment Routing en switches Nexus de Cisco serie 9000.

Prerequisites

Requirements

Cisco recomienda que tenga conocimiento sobre estos temas:

- VPNs de Capa 3 MPLS
- MP-BGP
- Routing de segmentos

Componentes Utilizados

La información que contiene este documento se basa en las siguientes versiones de software y hardware.

- BL // N9K-C93240YC-FX2 // 9.3(3)
- ASR1K // 16.12.02
- Columna 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 tiene una red en vivo, asegúrese de entender el posible impacto de cualquier comando.

Antecedentes

Las implementaciones de Data Center (DC) han adoptado VXLAN EVPN por sus ventajas, como el aprendizaje del plano de control EVPN, la multiempresa, la movilidad fluida, la redundancia y las incorporaciones POD más sencillas. De forma similar, el CORE es una red MPLS L3VPN basada en el protocolo de distribución de etiquetas (LDP) o una transición de la capa subyacente tradicional basada en LDP de L3VPN MPLS a una solución más sofisticada como el routing de segmentos (SR).

El ruteo de segmentos es un método de reenvío de paquetes en la red basado en el paradigma de ruteo de origen. El origen elige una trayectoria y la codifica en el encabezado del paquete como una lista ordenada de segmentos. Los segmentos son un identificador para cualquier tipo de instrucción.

Ventajas de SR

El routing de segmentos se adopta por sus ventajas como:

- Planos de control MPLS de IGP unificado.

- Preparado para SDN: El routing de segmentos se creó para SDN y es la base para el routing diseñado por aplicaciones (AER). SR prepara redes para modelos empresariales, donde las aplicaciones pueden dirigir el comportamiento de la red. SR proporciona el equilibrio adecuado entre la inteligencia distribuida y la optimización y programación centralizadas.

- Configuración mínima: El ruteo de segmentos para TE requiere una configuración mínima en el router de origen.

- Equilibrio de carga: A diferencia de RSVP-TE, el equilibrio de carga para el routing de segmentos se puede realizar en presencia de ECMP (Equal Cost Multiple Paths).

- Admite Fast Reroute (FRR): El reroute rápido habilita la activación de una trayectoria de respaldo preconfigurada dentro de los 50 milisegundos de una falla de trayectoria.

- Implementación Plug-and-Play: Las políticas de ruteo de segmentos son interoperables con los planos de datos y control MPLS existentes y se pueden implementar en una implementación existente.

Pautas y limitaciones para configurar la integración perfecta de EVPN con L3VPN (MPLS SR)

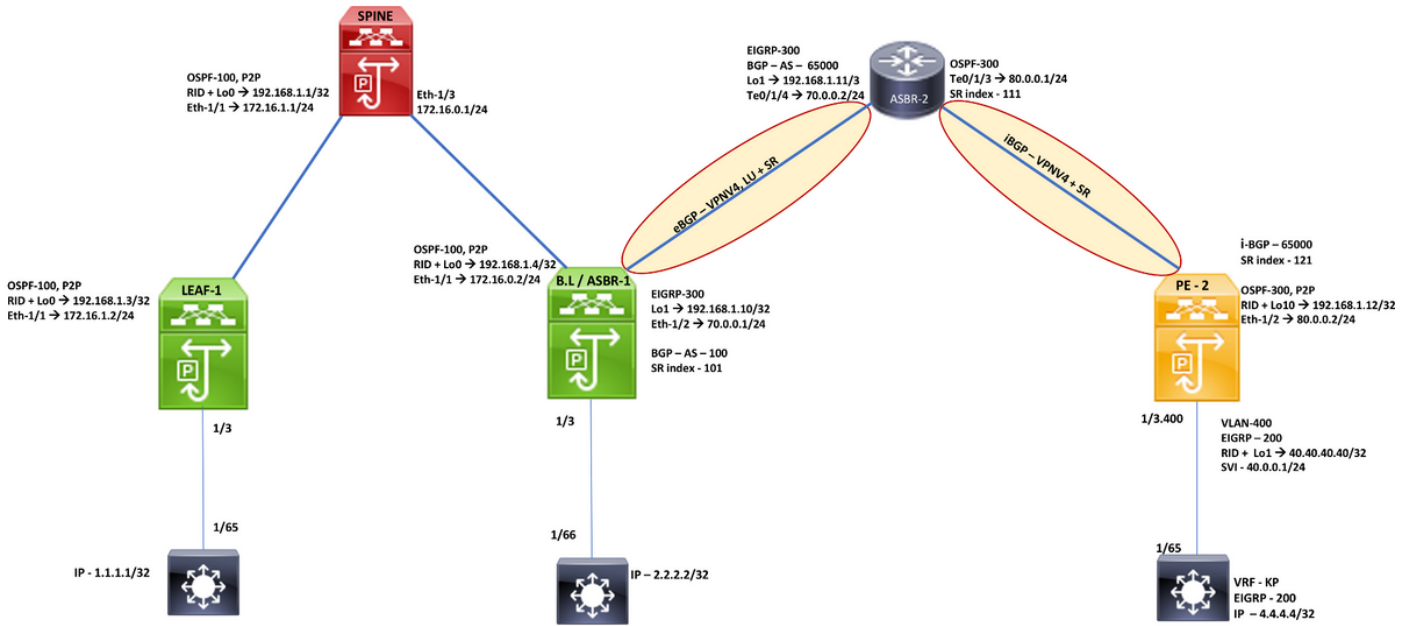| Función	Switches Cisco Nexus 9300-FX2	Switches Cisco Nexus 9504 y 9508 con tarjetas de línea -R	Comentarios
EVPN VXLAN a SR-L3VPN	Yes	Yes	Ampliación de la conectividad de Capa 3 e diferentes grupos de DC Inmersos en IGP

EVPN VXLAN a SR-L3VPN	Yes	Yes	con extensiones SR. Amplíe la conectividad de capa 3 entre DC y POD que ejecuta VXLAN y cualquier dominio (DC o CORE) que ejecute SR.
EVPN de VXLAN a MPLS L3VPN (LDP)	No	Yes	La base es LDP.

Configurar

Diagrama de la red

SPINE
OSPF-100, P2P
RID + Lo0 → 192.168.1.1/32
Eth-1/1 → 172.16.1.1/24
Eth-1/3
172.16.0.1/24

EIGRP-300
BGP – AS – 65000
Lo1 → 192.168.1.11/3
Te0/1/4 → 70.0.0.2/24
ASBR-2
OSPF-300
Te0/1/3 → 80.0.0.1/24
SR index - 111

eBGP – VPNV4, LU + SR

iBGP – VPNV4 + SR

LEAF-1
OSPF-100, P2P
RID + Lo0 → 192.168.1.3/32
Eth-1/1 → 172.16.1.2/24

OSPF-100, P2P
RID + Lo0 → 192.168.1.4/32
Eth-1/1 → 172.16.0.2/24
B.L / ASBR-1
EIGRP-300
Lo1 → 192.168.1.10/32
Eth-1/2 → 70.0.0.1/24
BGP – AS – 100
SR index - 101

PE - 2
i-BGP – 65000
SR index - 121
OSPF-300, P2P
RID + Lo10 → 192.168.1.12/32
Eth-1/2 → 80.0.0.2/24

1/3
1/3

1/3.400
VLAN-400
EIGRP – 200
RID + Lo1 → 40.40.40.40/32
SVI - 40.0.0.1/24

1/65
1/66
1/65

IP - 1.1.1.1/32
IP – 2.2.2.2/32
VRF - KP
EIGRP - 200
IP – 4.4.4.4/32

Configuración

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 4
    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
```

```
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
  !
```

```
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
```

Verificación

Host-1 & Leaf-1 Verification

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)
   *>l[5]:[0]:[0]:[24]:[20.0.0.0]/224
                    192.168.1.3      0         100      32768 ?
   *>l[5]:[0]:[0]:[24]:[30.0.0.0]/224
                    192.168.1.4      0         100      0 ?
   *>l[5]:[0]:[0]:[24]:[40.0.0.0]/224
                    192.168.1.4                100      0 65000 ?
   *>l[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 ?
   *>l[5]:[0]:[0]:[32]:[20.20.20.20]/224
                    192.168.1.3      0         100      32768 ?
   *>l[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#
```

```
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
```

```
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#
```

Border Leaf Verification

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)
   *>l[5]:[0]:[0]:[24]:[20.0.0.0]/224
              192.168.1.3     0      100      32768 ?
   *>l[5]:[0]:[0]:[24]:[30.0.0.0]/224
              192.168.1.4     0      100      0 ?
   *>l[5]:[0]:[0]:[24]:[40.0.0.0]/224
              192.168.1.4            0 65000 ?
   *>l[5]:[0]:[0]:[32]:[1.1.1.1]/224
              192.168.1.4   130816   100      0 ?
   *>l[5]:[0]:[0]:[32]:[2.2.2.2]/224
              192.168.1.4   130816   100      32768 ?
   *>l[5]:[0]:[0]:[32]:[4.4.4.4]/224
              192.168.1.4            0 65000 ?
   *>l[5]:[0]:[0]:[32]:[20.20.20.20]/224
              192.168.1.3     0      100      0 ?
   *>l[5]:[0]:[0]:[32]:[30.30.30.30]/224
              192.168.1.4     0      100      32768 ?
   *>l[5]:[0]:[0]:[32]:[40.40.40.40]/224
              192.168.1.4            0 65000 ?

BL#
```

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#
```

```
     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    Index 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#
```

```
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 Label	Outgoing Label or Tunnel Id	Prefix or Tunnel Id	Bytes Label Switched	Outgoing interface	Next Hop
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		80.0.0.2
23	492287	192.168.1.12:3:40.0.0.0/24 \			
			9774		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 Label	Outgoing Label or Tunnel Id	Prefix or Tunnel Id	Bytes Label Switched	Outgoing interface	Next Hop
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 Label	Outgoing Label or Tunnel Id	Prefix or Tunnel Id	Bytes Label Switched	Outgoing interface	Next Hop
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 Label	Outgoing Label or Tunnel Id	Prefix or Tunnel Id	Bytes Label Switched	Outgoing interface	Next Hop
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 Label	Outgoing Label or Tunnel Id	Prefix or Tunnel Id	Bytes Label Switched	Outgoing interface	Next Hop
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 Label	Outgoing Label or Tunnel Id	Prefix or Tunnel Id	Bytes Label Switched	Outgoing interface	Next Hop
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 Label	Outgoing Label or Tunnel Id	Prefix or Tunnel Id	Bytes Label Switched	Outgoing interface	Next Hop
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				
*>i	1.1.1.1/32	192.168.1.11	0	100	0 100 ?
*>i	2.2.2.2/32	192.168.1.11	130816	100	0 100 ?
*>i	20.0.0.0/24	192.168.1.11	0	100	0 100 ?
*>i	20.20.20.20/32	192.168.1.11	0	100	0 100 ?
*>i	30.0.0.0/24	192.168.1.11	0	100	0 100 ?
*>i	30.30.30.30/32	192.168.1.11	0	100	0 100 ?
	Route Distinguisher: 192.168.1.12:3 (VRF KP)				
*>i	1.1.1.1/32	192.168.1.11	0	100	0 100 ?
*>i	2.2.2.2/32	192.168.1.11	130816	100	0 100 ?
*>r	4.4.4.4/32	0.0.0.0	130816	100	32768 ?
*>i	20.0.0.0/24	192.168.1.11	0	100	0 100 ?
*>i	20.20.20.20/32	192.168.1.11	0	100	0 100 ?
*>i	30.0.0.0/24	192.168.1.11	0	100	0 100 ?
*>i	30.30.30.30/32	192.168.1.11	0	100	0 100 ?
*>r	40.0.0.0/24	0.0.0.0	0	100	32768 ?
*>r	40.40.40.40/32	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 Label	Prefix	FEC	Next-Hop	Interface	Out Label
	Table Id	(Prefix/Tunnel id)			
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#

Información Relacionada

- [Información sobre la Configuración de la Integración Perfecta de EVPN con L3VPN (MPLS SR)](#)
- [Soporte Técnico y Documentación - Cisco Systems](#)