

SR MPLS [OSPF / iBGP] ربع EVPN 3 ةقبطالارشن Nexus 9300 في [OSPF و PE-CE]

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ةمدقمل

عامسأ ليوحتل SR ربع 3 ةقبطالارنم EVPN نيوكتل/رشن ةيفيك دننتمسمل اذه حضوي راسم رصقأك PE-CE لوكوتورب عم Nexus 9300 تاجتنم لعل (MPLS) ةددعتمل تالوكوتوربال حوتفمل (OSPF) الوأ.

ةيساسال تابلطتم

تابلطتم

ةيلال عيضاوملاب ةفرعم كيديل نوكت نأب Cisco يصوت:

- (BGP) ةيدودحل ةباوبال لوكوتورب
- (OSPF) الوأ راسم رصقأ حتف لوكوتورب
- L3VPN
- EVPN
- (SR) ةحيرشلال هيحوت

ةمدختسم تانوكمل

ةيلال ةيدامل تانوكمل او حماربال تارادصلإ ل دننتمسمل اذه في ةدراوال تاملعمل دننتمس:

- 9.3.(3) عم لمعت 93360YC-FX2 - ةيساسال ةزهجال
- 9.3.(3) عم لمعت 93240YC-FX2 - ةيفرطال ةزهجال
- 93216TC-FX2 (Host-1)، Catalyst-3750 (Host-2) - ليمعل

ةصاخ ةيلمعم ةئيب في ةدوحومل ةزهجال نم دننتمسمل اذه في ةدراوال تاملعمل عاشنإ مت تناك اذإ. (يضارتفا) حوسمم نيوكتب دننتمسمل اذه في ةمدختسم ةزهجال عيمج تادب

رمأ يأل لمحتحملا ريثأتلل كمهف نم دكأ تف ،ةرشابم كتكبش

ةيساسأ تامولعم

MPLS L3VPN Recap

ةي ه VPN ةكبش:

- ةيساسأ ةينب ربع ةصاخ ةكبش تامدخ مدقت تنرتنإل لوكتورب يلع ةمئاق ةكبش ةماع.
- ربع صاخ لكشب ضعبل اهضعب عم لصاوتلاب اهل حومسملا عقاوملا نم ةعومجم ةصاخلا وأ ةماعلا تاكبشلا نم اهريغ وأ تنرتنإل

رئاولا وأ قافنألا نم ةلماك ةكبش نيوكت لال خ نم ةيديلقنل VPN تاكبش عاشنإ متي تاكبش نم عونلا اذه سئل . VPN ةكبش يف عقاوملا عيمج يل (PVCs) ةمئادلا ةيضارتفالا يف ةفاح زاهج لك ريغت بلطتي ديدج عقوم ةفاضل نأل ،عيسوتلا وأ ةناصللا لهس VPN (VPN) ةيرهاظلا ةصاخلا ةكبشلا.

ريظنلا جذومن يلع دمتعت و 3 ةقبطلا يف MPLS يل ةدنتسملا VPN تاكبش عاشنإ متي . ةثلاثلا ةقبطلا نم هيحوتلا تامولعم لدابت ليمعلاو ةمدخللا دوزمل ريظنلا جذومن حيتي ليمعلا ةكراشم نود ةالمعلا عقاوم نيبتانايبال ليحرتب ةمدخللا رفوم موقتي .

ةيديلقنل VPN تاكبش ةنراقم ةعسوتلاو ةرادإلا ةلوهسب MPLS VPN تاكبش زيمتت ةمدخللا دوزمل طقف ةفاحلا هجوم ثيدحت مزلي ،MPLS VPN ةكبش يل ديدج عقوم ةفاضل دنع ليمعلا عقومل تامدخللا رفوي ذللا .

MPLS VPN تانوكم يه هذه:

- ليوت ليغشتب PE تاهجوم موقت . رفوملا ةكبش زكرم يف هجوملا -هجوملا (P) رفوملا VPN تاي مسمت مادختسا متي . ةهجوملا مزحلاب VPN تاي مسمت قافراب مقت الو MPLS ليمعلا ةفاح هجوم وأ ةححصلا ةصاخلا ةكبشلا يل تانايبال مزح هيحوتل
- وأ ةهجاوولا يل اذانتسا ةدراوولا مزحلاب VPN ةكبش ةيمسست قافراب موقتي هجوم -PE هجوم MPLS تاي مسمت قافراب موقتي امك ،اهيلع اهلابقتسا متي يتلا ةيعرفلا ةهجاوولا CE . هجومب ةرشابم PE هجوم قافرا متي . ةيساسألا
- ةسسؤملا ةكبش وأ (ISP) تنرتنإلا ةمدخ دوزم يف هجوم - (C) ليمعلا هجوم
- PE هجومب لصتت يتلا ISP ةكبش يل Edge نم هجوم - (CE) Customer Edge نم هجوملا PE هجوم عم CE هجوم هجاوي نأ بحتي . ةكبشلا يلع

L3VPN (MPLS SR) عم EVPN يلع ةماع ةرظن

لثم هدياوفل MPLS EVPN (وأ) VXLAN EVPN ينبتب (DC) تانايبال زكرم رشن تاي لمع تامق POD تافاضاواراكتلاو لقتنلا ةلوهسو تارايلخلا ددعت و EVPN يف مكحتلا يوتسم ميلعت لوكتورب يل ةدنتسملا MPLS L3VPN ةكبش ام وه يساسألا نإف ،لثملابو . ةلوهس رثكأ MPLS L3VPN LDP يلع مئاقلا يديلقنل يساسألا نم لاقنالا وأ (LDP) ةيمستلا عيزوت (SR) عطقملا هيحوت لثم اروطت رثكأ ليل

لثم هدياوفل ةحيشللا هيجوت دامتعا متي:

- ةدحومال MPLS و IGP في مكحتلا تايوتسم
- طسبأ رورم ةكرح ةسدنه قرط
- ةئيهتلا ةلوهس
- SDN دامتعا
- نم تنرتي ةكبش تامدخل همادختسا مت MPLS BGP الى دننسي لحوه (RFC 7432) EVPN
- تانايبلا زكارمل ةيضارتفا ةكبش في يلاتلا ليجلا
- MPLS تايونقت نم VRF و RT و RD لثم عاشنالا لتك نم ديدعلا EVPN ةكبش مدختست ةدوجومال
- NXOS 7.0(3)I6(1) رادصالا في هميدقت مت يذلا SR ربع EVPN L3 رادصالا مدختسي MPLS نمضت عم EVPN Type-5 راسمالا
- قئافلا عادالا وريوطتلا ةيلباقو ونيجاتسمال نم ديدعلا SR ربع EVPN L3 زارطال رفوي ةروطتال تانايبلا زكارم تامدخل

وأ VXLAN ةكبش تانايبلا يوتسم نوكي نأ نكمي، رمتسمال رايتلا في: ةظحالم MPLS.

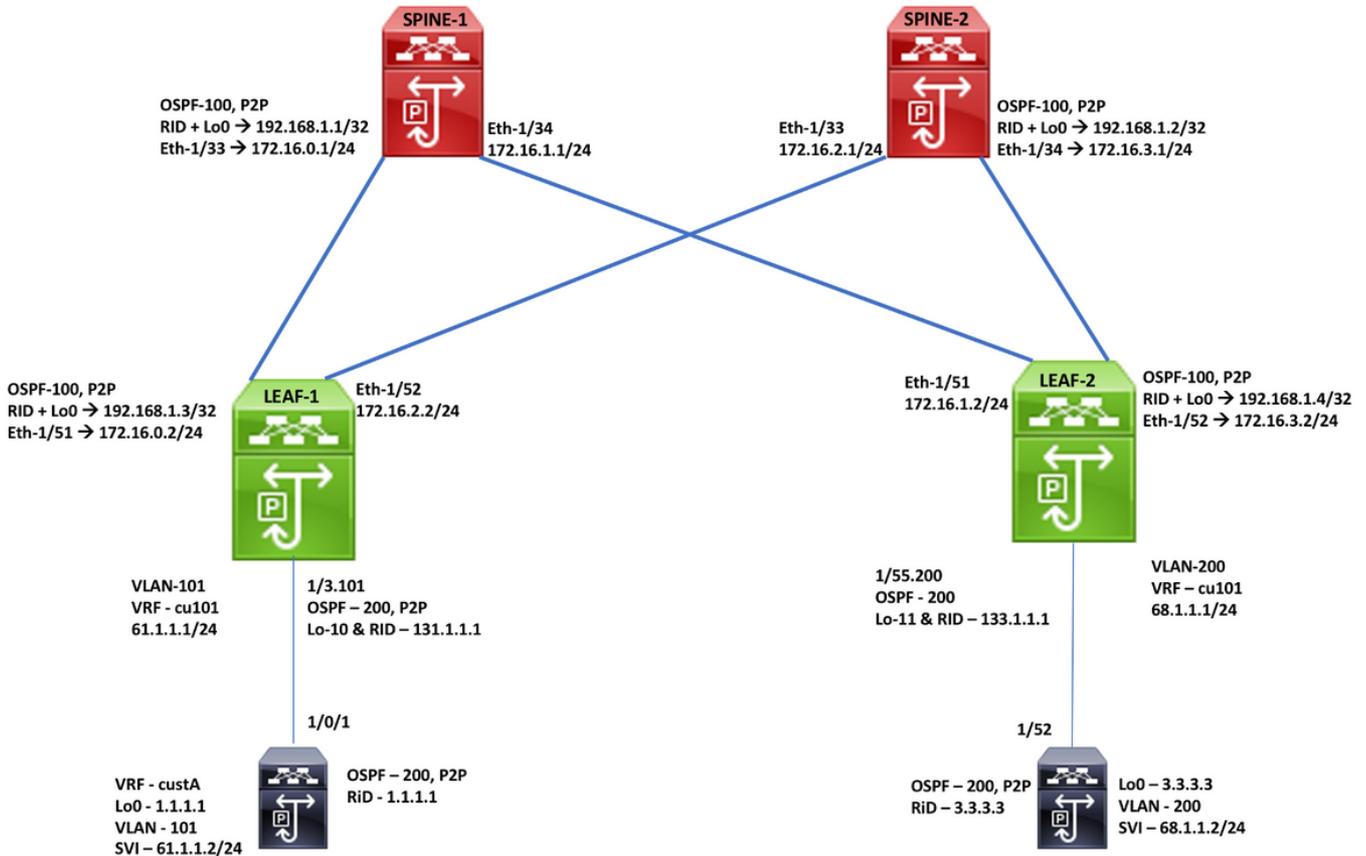
يديلقنللا MPLS L3 VPN

RD و RT و VRF ةسيئرلا ءانبالا لتك
IGP، LDP، و RSVP-TE لقنلل ةيساسالا ةقبطلا
VPNv4 و VPNv6 ةمدخلل ةيشغت ةقبط

SR ربع MPLS L3 VPN

RD و RT و VRF ةسيئرلا ءانبالا لتك
IGP/BGP-LU و SR-TE لقنلل ةيساسالا ةقبطلا
EVPN ةمدخلل ةيشغتلا ةقبط

ةكبشلل يطيختلا مسرلا



نيوكتلا

SPINE-1 Configuration		
Enabling Features, Label-Range, Route-map, Label-Index	OSPF Configuration	BGP/EVPN Configuration
feature-set mpls	interface Ethernet1/33	router bgp 65001
feature ospf	ip address 172.16.0.1/24	router-id 192.168.1.1
feature bgp	ip ospf network point-to-point	address-family ipv4 unicast
feature mpls segment-routing	ip router ospf 100 area 0.0.0.0	network 192.168.1.1/32 route-map label-index-spine1
feature mpls evpn	mpls ip forwarding	allocate-label all
feature interface-vlan	no shutdown	address-family ipv4 labeled-unicast
feature mpls oam		address-family l2vpn evpn
	interface Ethernet1/34	template peer EVPN
	ip address 172.16.1.1/24	remote-as 65001
	ip ospf network point-to-point	update-source loopback0
mpls label range 5000 450000	ip router ospf 100 area 0.0.0.0	address-family l2vpn evpn
segment-routing	mpls ip forwarding	send-community extended
mpls	no shutdown	route-reflector-client
global-block 16000 25000		encapsulation mpls
connected-prefix-sid-map		template peer Labeled-unicast
address-family ipv4	interface loopback0	remote-as 65001
192.168.1.1/32 index 211	ip address 192.168.1.1/32	address-family ipv4 labeled-unicast
	ip router ospf 100 area 0.0.0.0	send-community extended
		route-reflector-client
route-map label-index-spine1 permit 10		next-hop-self
set label-index 211	router ospf 100	soft-reconfiguration inbound always
	segment-routing mpls	neighbor 172.16.0.2
	router-id 192.168.1.1	inherit peer Labeled-unicast
		neighbor 172.16.1.2
		inherit peer Labeled-unicast
		neighbor 192.168.1.3
		inherit peer EVPN
		neighbor 192.168.1.4
		inherit peer EVPN

SPINE-2 Configuration		
Enabling Features, Label-Range, Route-map, Label-Index	OSPF Configuration	BGP/EVPN Configuration
feature-set mpls	interface Ethernet1/33	router bgp 65001
feature ospf	ip address 172.16.2.1/24	router-id 192.168.1.2
feature bgp	ip ospf network point-to-point	address-family ipv4 unicast
feature mpls segment-routing	ip router ospf 100 area 0.0.0.0	network 192.168.1.2/32 route-map label-index-spine2
feature mpls evpn	mpls ip forwarding	allocate-label all
feature interface-vlan	no shutdown	address-family ipv4 labeled-unicast
feature mpls oam		address-family l2vpn evpn
	interface Ethernet1/34	template peer EVPN
	ip address 172.16.3.1/24	remote-as 65001
	ip ospf network point-to-point	update-source loopback0
mpls label range 5000 450000	ip router ospf 100 area 0.0.0.0	address-family l2vpn evpn
segment-routing	mpls ip forwarding	send-community extended
mpls	no shutdown	route-reflector-client
global-block 16000 25000		encapsulation mpls
connected-prefix-sid-map	interface loopback0	template peer Labeled-unicast
address-family ipv4	ip address 192.168.1.2/32	remote-as 65001
192.168.1.2/32 index 221	ip router ospf 100 area 0.0.0.0	address-family ipv4 labeled-unicast
		send-community extended
route-map label-index-spine2 permit 10		route-reflector-client
set label-index 221	router ospf 100	next-hop-self
	segment-routing mpls	soft-reconfiguration inbound always
	router-id 192.168.1.2	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
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

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

ip prefix-list test1 seq 5 permit 61.1.1.0/24
ip prefix-list test1 seq 10 permit 131.1.1.1/32

ip prefix-list test3 seq 5 permit 1.1.1.1/32

route-map bgp65001 permit 10
  match route-type internal
route-map direct1 permit 10
  match ip address prefix-list test1
  set community 65001:10
route-map label-index-leaf-1 permit 10
  set label-index 311
route-map ospf200 permit 10
  match ip address prefix-list test3

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 Ethernet1/51
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

PE-CE
vrf cu101
  address-family ipv4 unicast

interface Ethernet1/3
no shutdown
interface Ethernet1/3.101
encapsulation dot1q 101
vrf member cu101
ip address 61.1.1.1/24
ip ospf network point-to-point
ip router ospf 200 area 0.0.0.0
no shutdown

interface loopback10
vrf member cu101
ip address 131.1.1.1/32
ip router ospf 200 area 0.0.0.0

router ospf 200
vrf cu101
  router-id 131.1.1.1
  redistribute bgp 65001 route-map bgp65001
  
```

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 cu101
  router-id 131.1.1.1
  address-family ipv4 unicast
  advertise l2vpn evpn
  redistribute direct route-map direct1
  redistribute ospf 200 route-map ospf200
  
```

LEAF-2 Configuration

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

```
install feature-set mpls
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

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

ip prefix-list new seq 5 permit 68.1.1.0/24
ip prefix-list new seq 10 permit 133.1.1.1/32

ip prefix-list new1 seq 5 permit 3.3.3.3/32

ip prefix-list redtoospf seq 5 permit 61.1.1.0/24
ip prefix-list redtoospf seq 10 permit 1.1.1.1/32

route-map bgp65001 permit 10
  match route-type internal
route-map direct1 permit 10
  match ip address prefix-list new
route-map label-index-Leaf2 permit 10
  set label-index 321
route-map ospf200 permit 10
  match ip address prefix-list new1

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 Ethernet1/51
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

PE-CE
vrf cu101
  address-family ipv4 unicast
interface Ethernet1/55
no shutdown
interface Ethernet1/55.200
encapsulation dot1q 200
vrf member cu101
ip address 68.1.1.1/24
ip ospf network point-to-point
ip router ospf 200 area 0.0.0.0
no shutdown

interface loopback11
vrf member cu101
ip address 133.1.1.1/32
ip router ospf 200 area 0.0.0.0

router ospf 200
vrf cu101
  router-id 133.1.1.1
  redistribute bgp 65001 route-map bgp65001
```

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 cu101
router-id 133.1.1.1
address-family ipv4 unicast
  advertise l2vpn evpn
  redistribute direct route-map direct1
  redistribute ospf 200 route-map ospf200
```

End-Host Configuration

Host-1 / Cat-3750

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

interface Loopback0
vrf forwarding custA
ip address 1.1.1.1 255.255.255.255

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

interface Vlan101
vrf forwarding custA
ip address 61.1.1.2 255.255.255.0
ip ospf network point-to-point
ip ospf 200 area 0.0.0.0

router ospf 200 vrf custA
router-id 1.1.1.1
network 1.1.1.1 0.0.0.0 area 0.0.0.0
network 61.1.1.0 0.0.0.255 area 0.0.0.0
```

Host-2 / N9K

```
feature ospf
feature interface-vlan

interface Ethernet1/52
switchport
switchport mode trunk
switchport trunk allowed vlan 200
no shutdown

interface Vlan200
no shutdown
ip address 68.1.1.2/24
ip ospf network point-to-point
ip router ospf 200 area 0.0.0.0

interface loopback0
ip address 3.3.3.3/32
ip router ospf 200 area 0.0.0.0

router ospf 200
router-id 3.3.3.3
```

تحصيلنا نم ققحتلا

Host2# show ip int brief

```
IP Interface Status for VRF "default"(1)
Interface      IP Address      Interface Status
Vlan200        68.1.1.2        protocol-up/link-up/admin-up
Vlan1001       100.0.0.100    protocol-down/link-down/admin-up
Lo0            3.3.3.3         protocol-up/link-up/admin-up
```

Host2# show ip route

```
IP Route Table for VRF "default"
*** denotes best ucast next-hop
**** denotes best mcast next-hop
'[x/y]' denotes [preference/metric]
'%<string>' in via output denotes VRF <string>

1.1.1.1/32, ubest/mbest: 1/0
  *via 68.1.1.1, Vlan200, [110/1], 00:29:24, ospf-200, type-2, tag 65001
3.3.3.3/32, ubest/mbest: 2/0, attached
  *via 3.3.3.3, Lo0, [0/0], 20:16:34, local
  *via 3.3.3.3, Lo0, [0/0], 20:16:34, direct
61.1.1.0/24, ubest/mbest: 1/0
  *via 68.1.1.1, Vlan200, [110/1], 00:29:24, ospf-200, type-2, tag 65001
68.1.1.0/24, ubest/mbest: 1/0, attached
  *via 68.1.1.2, Vlan200, [0/0], 20:20:55, direct
68.1.1.2/32, ubest/mbest: 1/0, attached
  *via 68.1.1.2, Vlan200, [0/0], 20:20:55, local
131.1.1.1/32, ubest/mbest: 1/0
  *via 68.1.1.1, Vlan200, [110/1], 00:29:24, ospf-200, type-2, tag 65001
133.1.1.1/32, ubest/mbest: 1/0
  *via 68.1.1.1, Vlan200, [110/41], 20:15:32, ospf-200, intra
```

Host2# traceroute 1.1.1.1

```
traceroute to 1.1.1.1 (1.1.1.1), 30 hops max, 40 byte packets
 1 68.1.1.1 (68.1.1.1)  0.989 ms  0.585 ms  0.407 ms
 2 172.16.3.1 (172.16.3.1)  0.886 ms  172.16.1.1 (172.16.1.1)  0.765 ms  0.731 ms
   [Label=16311 E=0 TTL=1 S=0, Label=492289 E=0 TTL=1 S=1]
   [Label=16311 E=0 TTL=1 S=0, Label=492289 E=0 TTL=1 S=1]
   [Label=16311 E=0 TTL=1 S=0, Label=492289 E=0 TTL=1 S=1]
 3 172.16.0.2 (172.16.0.2)  0.717 ms  172.16.2.2 (172.16.2.2)  0.509 ms  172.16.0.2 (172.16.0.2)  0.678 ms
   [Label=492289 E=0 TTL=1 S=1]
   [Label=492289 E=0 TTL=1 S=1]
   [Label=492289 E=0 TTL=1 S=1]
 4 61.1.1.2 (61.1.1.2)  2.061 ms * 1.315 ms
```

Host2# ping 1.1.1.1 source 3.3.3.3

```
PING 1.1.1.1 (1.1.1.1) from 3.3.3.3: 56 data bytes
64 bytes from 1.1.1.1: icmp_seq=0 ttl=251 time=5.538 ms
64 bytes from 1.1.1.1: icmp_seq=1 ttl=251 time=1.338 ms
64 bytes from 1.1.1.1: icmp_seq=2 ttl=251 time=2.201 ms
64 bytes from 1.1.1.1: icmp_seq=3 ttl=251 time=2.217 ms
64 bytes from 1.1.1.1: icmp_seq=4 ttl=251 time=4.021 ms

--- 1.1.1.1 ping statistics ---
5 packets transmitted, 5 packets received, 0.00% packet loss
round-trip min/avg/max = 1.338/3.063/5.538 ms
```

```
Leaf1# show ip route 3.3.3.3/32 vrf cu101
```

```
IP Route Table for VRF "cu101"  
** denotes best ucast next-hop  
*** denotes best mcast next-hop  
'[x/y]' denotes [preference/metric]  
'<string>' in via output denotes VRF <string>  
  
3.3.3.3/32, ubest/mbest: 1/0  
 *via 192.168.1.4%default, [200/2], 00:44:27, bgp-65001, internal, tag 65001 (mpls-vpn)
```

```
Leaf1# show forwarding mpls 192.168.1.4/32
```

```
slot 1  
=====
```

Local Label	Prefix Table Id	FEC (Prefix/Tunnel id)	Next-Hop	Interface	Out 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

```
Leaf1# show forwarding 3.3.3.3/32 vrf cu101
```

```
slot 1  
=====
```

```
IPv4 routes for table cu101/base
```

Prefix	Next-hop	Interface	Labels	Partial Install
*3.3.3.3/32	172.16.0.1	Ethernet1/51	PUSH 16321 492288	
	172.16.2.1	Ethernet1/52	PUSH 16321 492288	

قلم تاذ تامول عم

- [تالوكوت وربلا ددعتم BGP MPLS VPN](#)
- [Cisco Nexus 9500 و 9300 يساسألا ماظنلا لوجمل يمسرلا ريرقتلا يلع عطاقملا هيحوت و 3100 و 3200 و 9200](#)
- [MPLS تاكبش ربع 3 عقبطلال نم VPN ةكبش و 3 عقبطلال نم EVPN ةكبش نيوكت عطاقملا هيحوتب ةصاخلا](#)

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