

# **CCIE Service Provider v3.0**

## **Sample Lab**

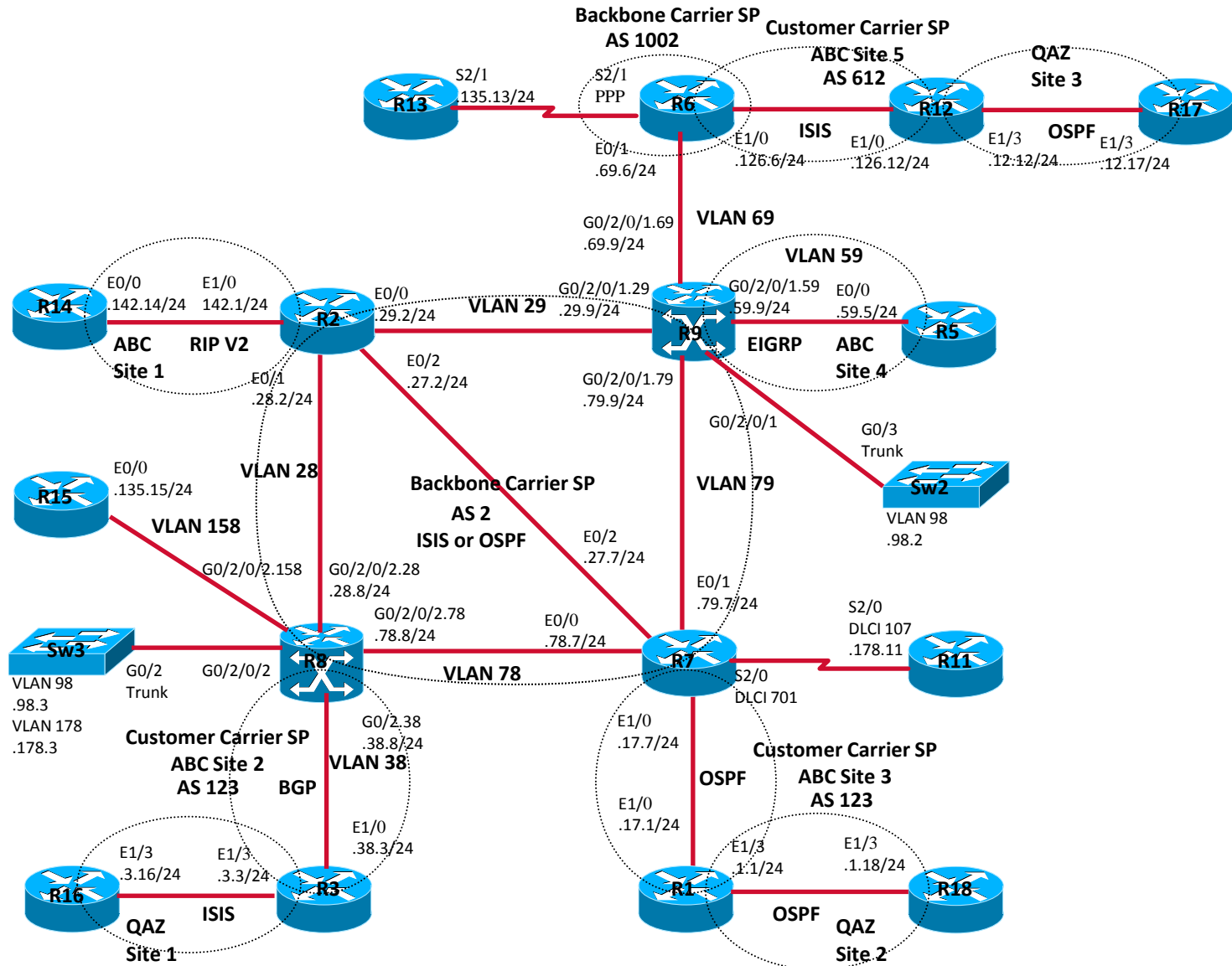
### **Part 5/7**

**Vincent Jun Ling Zhou**

**CCIE Service Provider – Product Manager**

**Cisco Systems**

# SP Sample Lab – Main Topology



# SP Sample Lab – Addressing Scheme

- Backbone Carrier SP network Prefix: 2.2.0.0/24, 2002:2:2::/64
- Backbone Carrier SP router Loopback0: 2.2.0.Z/32, 2002:2:2::Z/128
- Customer Carrier SP/VPN network Prefix: 172.2.0.0/24, 2002:172:2::/64
- Customer Carrier SP/VPN router Loopback0: 172.2.0.Z/32, 2002:172:2::Z/128
- End Customer VPN network Prefix: 192.2.0.0/24
- End Customer VPN router Loopback0: 192.2.0.Z/32
- L2 VPN Customer network Prefix: 172.2.0.0/24
- L2 VPN Customer router Loopback0: 172.2.0.Z/32

“Z” is router number, for example “Z” value for R12 is “12”

# SP Sample Lab – Setup

- Hardware

  - Two XR-12404 with two GigabitEthernet interfaces or equivalent

  - Thirteen Cisco 7200 series routers with Ethernet interfaces or equivalent

  - Three Cisco 3560G series or equivalent

- Software Operating System

  - XR12000-iosxr-k9-3.9.1.tar

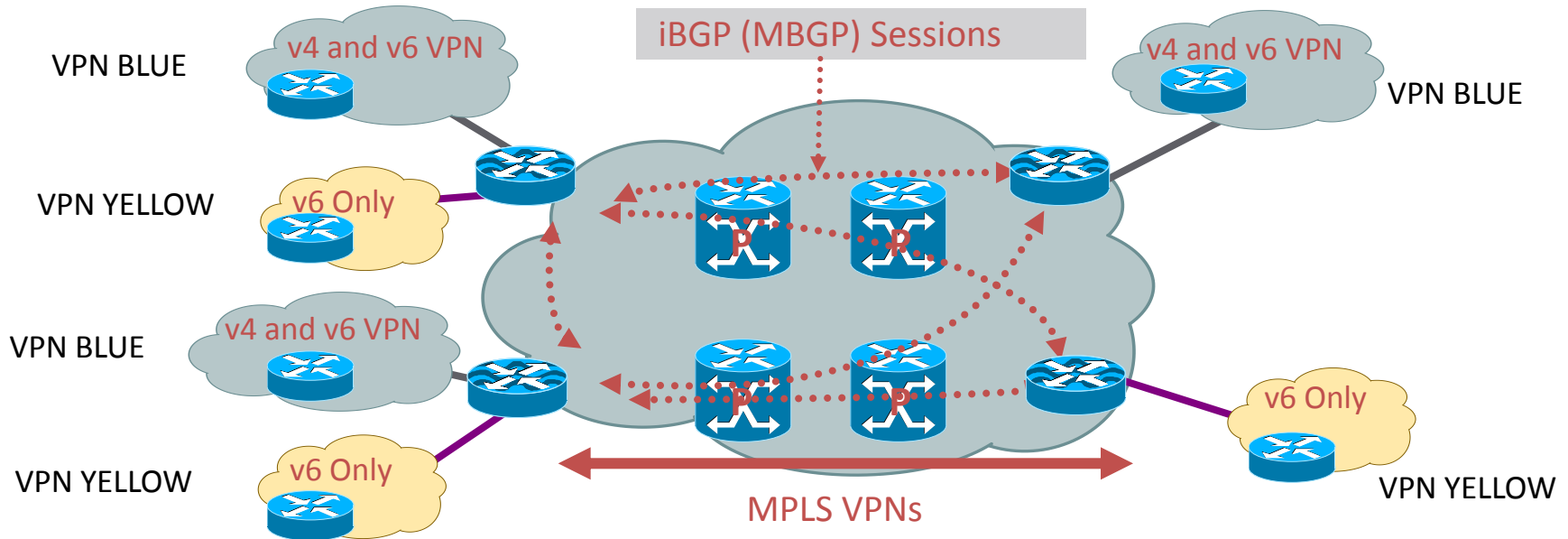
  - c7200-spservices-mz.122-33.SRE2.bin

  - c3560-advipservicesk9-mz.122-46.SE.bin

# SP Sample Lab Questions

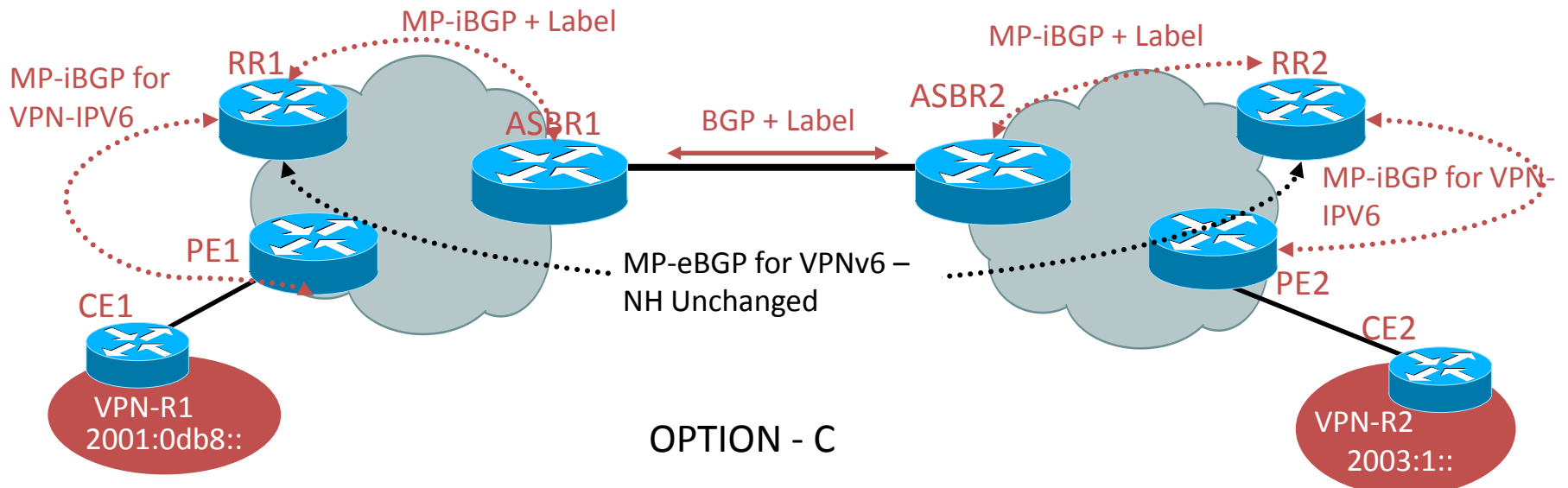
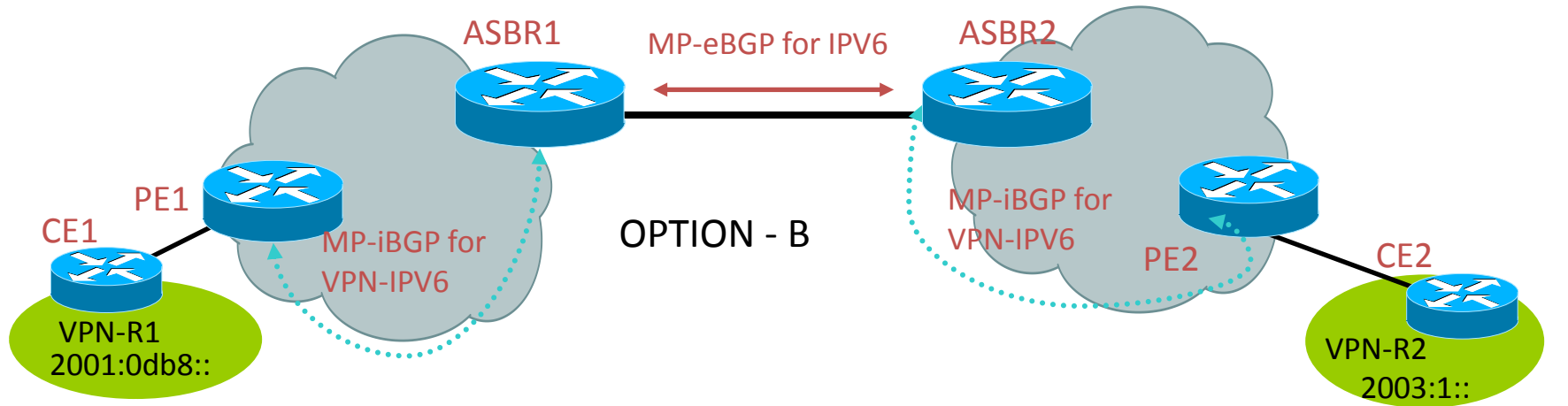
	Question, Configuration and Verification
1	IS-IS IPv4/IPv6
2	OSPF IPv4/IPv6
3	BGP unicast IPv4/IPv6
4	MPLS LDP
5	MPLS TE
6	MPLS TE FRR
7	MP-BGP intra-AS VPNv4
8	MP-BGP inter-AS VPNv4
9	CSC
10	MP-BGP VPNv6 - 6VPE
11	Multicast VPN
12	AToM
13	VPLS
14	L2TPv3

# MP-BGP VPNv6 - 6VPE Deployment



- 6VPE ~ IPv6 + BGP-MPLS  
IPv4 VPN + 6PE
- Cisco 6VPE is an implementation of RFC4659
- VPNv6 address:
  - Address including the 64 bits route distinguisher and the 128 bits IPv6 address
- MP-BGP VPNv6 address-family:
  - AFI “IPv6” (2), SAFI “VPN” (128)
- VPN IPv6 MP\_REACH\_NLRI
  - With VPNv6 next-hop (192bits) and NLRI in the form of <length, IPv6-prefix, label>
- Encoding of the BGP next-hop

# MP-BGP Inter-AS VPNv6 Options



# Mapping to Lab Exam Blueprint

- This question of the sample lab maps to following sections/sub-sections in the Lab Exam Blueprint document below;

<https://learningnetwork.cisco.com/docs/DOC-9991>

3.0 – Implement, Optimize and Troubleshoot L3VPN Technologies

3.1 – Implement, Optimize and Troubleshoot Intra-AS L3VPN

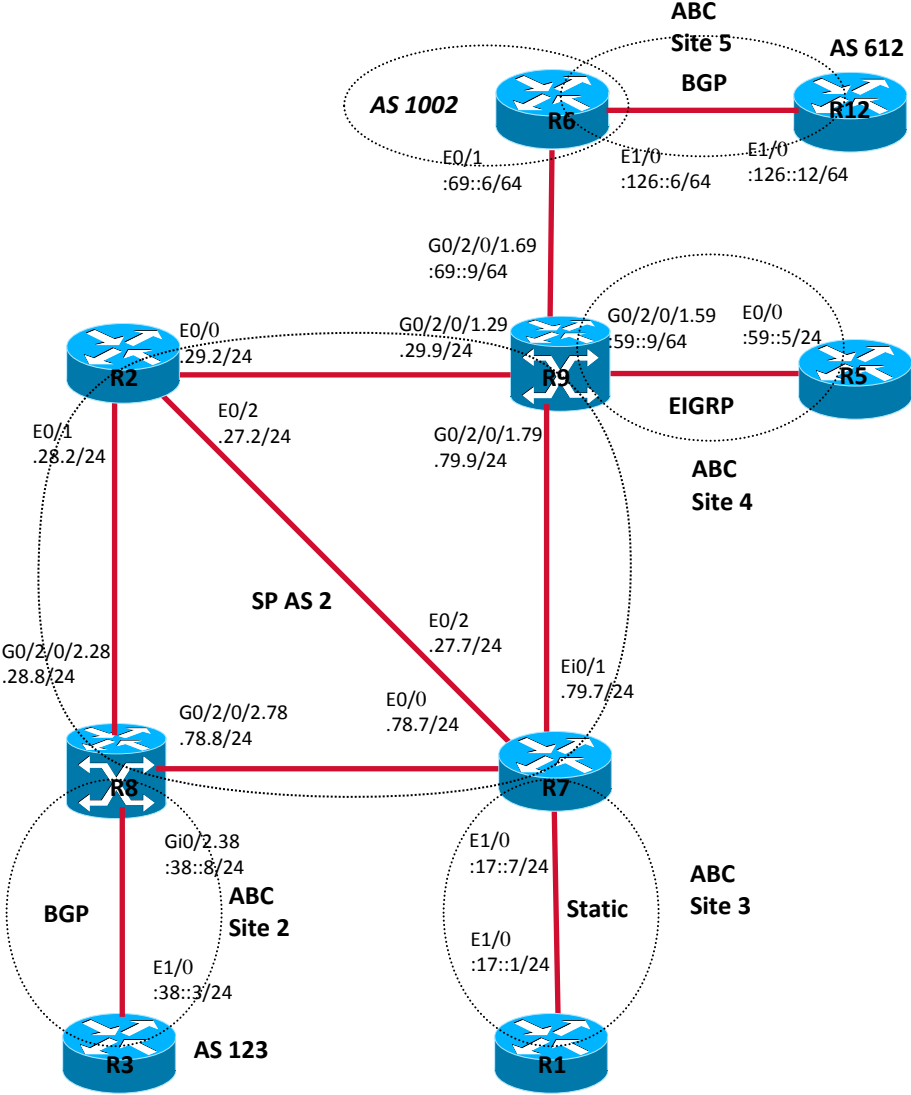
3.2 – Implement, Optimize and Troubleshoot Inter-AS L3VPN

- For more details, please review the Lab Exam Checklist document below;

<https://learningnetwork.cisco.com/docs/DOC-10145>



# MP-BGP VPNv6 - 6VPE – Sub Topology



# MP-BGP VPNv6 - 6VPE - Question

- Configure R2, R7, R8 and R9 to support MP-BGP intra AS VPNv6 (6VPE) information exchange. R9 is VPNv6 route-reflector to R2, R7 and R8.
- Ensure R1, R3 and R5 can ping each other via IPv6
- Configure MP-BGP Inter-AS VPNv6 (6VPE) on R6 and R9
- Ensure R1, R3, R5 and R12 can ping each other via IPv6.

# 6VPE Configuration

## R7 (IOS) configuration

vrf definition ABC

rd 2:2

!

address-family ipv6

route-target export 2:2

route-target import 2:2

route-target import 1002:2

exit-address-family

!

interface Ethernet1/0

vrf forwarding ABC

ipv6 address 2002:172:2:17::7/64

!

router bgp 2

neighbor 2.2.0.9 remote-as 2

neighbor 2.2.0.9 update-source Loopback0

!

address-family vpnv6

neighbor 2.2.0.9 activate

neighbor 2.2.0.9 send-community both

exit-address-family

!

address-family ipv6 vrf ABC

redistribute static

no synchronization

exit-address-family

!

ipv6 route vrf ABC 2002:172:2::1/128 Ethernet1/0

FE80::C00:FF:FE00:A01

# 6VPE Configuration (Cont.)

## R8 (IOS-XR) configuration

```
vrf ABC
!
address-family ipv6 unicast
import route-target
  2:2
  1002:2
!
export route-target
  2:2
!
!
!
interface GigabitEthernet0/2/0/2.38
vrf ABC
ipv6 address 2002:172:2:38::8/64
dot1q vlan 38
!
```

```
router bgp 2
address-family vpnv6 unicast
!
neighbor 2.2.0.9
remote-as 2
update-source Loopback0
address-family vpnv6 unicast
!
!
vrf ABC
rd 2:2
!
neighbor 2002:172:2:38::3
remote-as 123
address-family ipv6 unicast
route-policy default_policy_pass_all in
route-policy default_policy_pass_all out
!
```

# 6VPE Configuration (Cont.)

## R9 (IOS-XR) configuration

```
vrf ABC
address-family ipv6 unicast
import route-target
 2:2
1002:2
!
export route-target
 2:2
!
!
interface GigabitEthernet0/2/0/1.59
vrf ABC
ipv6 address 2002:172:2:59::9/64
dot1q vlan 59
!
interface GigabitEthernet0/2/0/1.69
ipv4 address 2.2.69.9 255.255.255.0
ipv6 address 2002:2:2:69::9/64
dot1q vlan 69
!
```

```
router bgp 2
address-family vpnv6 unicast
!
neighbor 2.2.0.2
remote-as 2
update-source Loopback0
address-family vpnv6 unicast
route-reflector-client
next-hop-self
!
neighbor 2.2.0.7
remote-as 2
update-source Loopback0
address-family vpnv6 unicast
route-reflector-client
next-hop-self
!
neighbor 2.2.0.8
remote-as 2
update-source Loopback0
address-family vpnv6 unicast
route-reflector-client
next-hop-self
!
```

```
neighbor 2.2.69.6
remote-as 1002
address-family vpnv6 unicast
route-policy default_policy_pass_all in
route-policy default_policy_pass_all out
!
vrf ABC
rd 2:2
address-family ipv6 unicast
redistribute eigrp 100
!
!
router eigrp 100
vrf ABC
address-family ipv6
default-metric 100000 10 250 1 1500
autonomous-system 100
redistribute bgp 2
interface GigabitEthernet0/2/0/1.59
!
!
```

# 6VPE Configuration (Cont.)

## R6 (IOS) configuration

```
vrf definition ABC
rd 1002:2
!
address-family ipv6
route-target export 1002:2
route-target import 1002:2
route-target import 2:2
exit-address-family
!
interface Ethernet1/0
vrf forwarding ABC
ipv6 address 2002:172:2:126::6/64
!
```

```
router bgp 1002
no bgp default route-target filter
neighbor 2.2.69.9 remote-as 2
!
address-family vpnv6
neighbor 2.2.69.9 activate
neighbor 2.2.69.9 send-community both
exit-address-family
!
address-family ipv6 vrf ABC
no synchronization
neighbor 2002:172:2:126::12 remote-as 612
neighbor 2002:172:2:126::12 activate
neighbor 2002:172:2:126::12 send-community both
exit-address-family
!
```

# 6VPE Configuration (Cont.)

## R1 configuration

```
interface Loopback0
  ipv6 address 2002:172:2::1/128
!
interface Ethernet1/0
  ipv6 address 2002:172:2:17::1/64
!
ipv6 route 2002:172:2::/48 Ethernet1/0
FE80::C00:FF:FE00:4601
```

## R3 configuration

```
interface Loopback0
  ipv6 address 2002:172:2::3/128
!
interface Ethernet1/0
  ipv6 address 2002:172:2:38::3/64
!
router bgp 123
  neighbor 2002:172:2:38::8 remote-as 2
!
  address-family ipv6
    no synchronization
    network 2002:172:2::3/128
    neighbor 2002:172:2:38::8 activate
    neighbor 2002:172:2:38::8 send-community both
  exit-address-family
!
```

# 6VPE Configuration (Cont.)

## R5 configuration

```
interface Loopback0
  ipv6 address 2002:172:2::5/128
  ipv6 eigrp 100
!
interface Ethernet0/0
  ipv6 address 2002:172:2:59::5/64
  ipv6 eigrp 100
!
ipv6 router eigrp 100
  no shutdown
```

## R12 configuration

```
interface Loopback0
  ipv6 address 2002:172:2::12/128
!
interface Ethernet1/0
  ipv6 address 2002:172:2:126::12/64
!
router bgp 612
  neighbor 2002:172:2:126::6 remote-as 1002
!
address-family ipv6
  no synchronization
  network 2002:172:2::12/128
  neighbor 2002:172:2:126::6 activate
  neighbor 2002:172:2:126::6 send-community both
```



# 6VPE Adjacency

## R9 6VPE neighbor

RP/0/0/CPU0:R9#show bgp vpnv6 unicast summary

Process	RcvTblVer	bRIB/RIB	LabelVer	ImportVer	SendTblVer	StandbyVer
Speaker	4025	4025	4025	4025	4025	4025

Neighbor	Spk	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	St/PfxRcd
2.2.0.2	0	2	112319	109696	4025	0	0	4d22h	1
2.2.0.7	0	2	111068	105904	4025	0	0	4d21h	2
2.2.0.8	0	2	100455	109877	4025	0	0	4d22h	3
2.2.69.6	0	1002	113188	104835	4025	0	0	3d01h	2

## R6 6VPE neighbor

R6#show ip bgp vpnv6 unicast all summary

BGP router identifier 2.2.0.6, local AS number 1002

Neighbor	V	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	State/PfxRcd
2002:172:2:126::12									
	4	612	264	268	32	0	0	03:47:37	1
2.2.69.9	4	2	4453	4883	32	0	0	3d01h	8

# 6VPE Adjacency (Cont.)

## R7 6VPE neighbor

R7#show ip bgp vpnv6 unicast all summary

BGP router identifier 2.2.0.77, local AS number 2

Neighbor	V	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	State/PfxRcd
2.2.0.9	4	2	1309	1421	25	0	0	21:21:52	8

## R8 6VPE neighbor

RP/0/0/CPU0:R8#show bgp vpnv6 unicast summary

BGP router identifier 2.2.0.8, local AS number 2

Process	RcvTblVer	bRIB/RIB	LabelVer	ImportVer	SendTblVer	StandbyVer
Speaker	3687	3687	3687	3687	3687	3687

Neighbor	Spk	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	St/PfxRcd
2.2.0.9	0	2	117546	108682	3687	0	0	22:33:14	7

## R2 6VPE neighbor

R2#show ip bgp vpnv6 unicast all summary

BGP router identifier 2.2.0.2, local AS number 2

Neighbor	V	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	State/PfxRcd
2.2.0.9	4	2	1320	1431	24	0	0	21:24:08	9

# VPNv6 table

## R9 VPNv6 table

RP/0/0/CPU0:R9#show bgp vpnv6 unicast vrf ABC

BGP router identifier 2.2.0.9, local AS number 2

Status codes: s suppressed, d damped, h history, \* valid, > best  
i - internal, S stale

Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
---------	----------	--------	--------	--------	------

Route Distinguisher: 2:2 (default for vrf ABC)

*>i2002:172:2::1/128	2.2.0.7	0	100	0	?
*>i2002:172:2::3/128	2.2.0.8	0	100	0	123 i
*> 2002:172:2::5/128	fe80::c00:ff:fe00:3200	130816	32768	?	
*> 2002:172:2::12/128	2.2.69.6			0	1002 612 i
*>i2002:172:2:17::/64	2.2.0.7	0	100	0	?
*>i2002:172:2:38::/64	2.2.0.8	0	100	0	?
*> 2002:172:2:59::/64	::	0	32768	?	
*> 2002:172:2:126::/64	2.2.69.6	0		0	1002 ?

# VPNv6 table (Cont.)

## R7 VPNv6 table

```
R7#show ip bgp vpnv6 unicast vrf ABC
```

```
BGP table version is 86, local router ID is 2.2.0.7
```

```
Network      Next Hop      Metric LocPrf Weight Path
```

```
Route Distinguisher: 2:2 (default for vrf ABC)
```

```
*> 2002:172:2::1/128
      ::          0      32768 ?
*>i2002:172:2::3/128
      ::FFFF:2.2.0.8      0 100  0 123 i
*>i2002:172:2::5/128
      ::FFFF:2.2.0.9     130816 100  0 ?
*>i2002:172:2::12/128
      ::FFFF:2.2.0.9           100  0 1002 612 i
*> 2002:172:2:17::/64
      ::          0      32768 ?
*>i2002:172:2:38::/64
      ::FFFF:2.2.0.8      0 100  0 ?
*>i2002:172:2:59::/64
      ::FFFF:2.2.0.9      0 100  0 ?
*>i2002:172:2:126::/64
      ::FFFF:2.2.0.9      0 100  0 1002 ?
```

# VPNv6 table (Cont.)

## R6 VPNv6 table

R6#show ip bgp vpnv6 unicast vrf ABC

BGP table version is 32, local router ID is 2.2.0.6

Network Next Hop Metric LocPrf Weight Path  
Route Distinguisher: 1002:2 (default for vrf ABC)

```
*> 2002:172:2::1/128
      ::FFFF:2.2.69.9          0 2 ?
*> 2002:172:2::3/128
      ::FFFF:2.2.69.9          0 2 123 i
*> 2002:172:2::5/128
      ::FFFF:2.2.69.9 130816      0 2 ?
*> 2002:172:2::12/128
      2002:172:2:126::12
      0          0 612 i
*> 2002:172:2:17::/64
      ::FFFF:2.2.69.9          0 2 ?
*> 2002:172:2:38::/64
      ::FFFF:2.2.69.9          0 2 ?
*> 2002:172:2:59::/64
      ::FFFF:2.2.69.9          0      0 2 ?
*> 2002:172:2:126::/64
      ::          0      32768 ?
```

# VPNv6 table (Cont.)

## R8 VPNv6 table

RP/0/0/CPU0:R8#show bgp vpnv6 unicast vrf ABC

BGP router identifier 2.2.0.8, local AS number 2

Network	Next Hop	Metric	LocPrf	Weight	Path
---------	----------	--------	--------	--------	------

Route Distinguisher: 2:2 (default for vrf ABC)

*>i2002:172:2::1/128	2.2.0.7	0	100	0	?
*> 2002:172:2::3/128	2002:172:2:38::3	0	123	i	
*>i2002:172:2::5/128	2.2.0.9	130816	100	0	?
*>i2002:172:2::12/128	2.2.0.9	100	0	1002	612 i
*>i2002:172:2:17::/64	2.2.0.7	0	100	0	?
*> 2002:172:2:38::/64	::	0	32768	?	
*>i2002:172:2:59::/64	2.2.0.9	0	100	0	?
*>i2002:172:2:126::/64	2.2.0.9	0	100	0	1002 ?

# IPv6 routes

## R1 ipv6 routes

R1#show ipv6 route

```
S 2002:172:2::/48 [1/0]
  via FE80::C00:FF:FE00:4601, Ethernet1/0
LC 2002:172:2::1/128 [0/0]
  via Loopback0, receive
C 2002:172:2:17::/64 [0/0]
  via Ethernet1/0, directly connected
L 2002:172:2:17::1/128 [0/0]
  via Ethernet1/0, receive
L FF00::/8 [0/0]
  via Null0, receive
```

## R3 ipv6 routes

R3#show ipv6 route bgp

```
B 2002:172:2::1/128 [20/0]
  via FE80::215:C7FF:FE5C:3552, Ethernet1/0
B 2002:172:2::5/128 [20/0]
  via FE80::215:C7FF:FE5C:3552, Ethernet1/0
B 2002:172:2::12/128 [20/0]
  via FE80::215:C7FF:FE5C:3552, Ethernet1/0
B 2002:172:2:17::/64 [20/0]
  via FE80::215:C7FF:FE5C:3552, Ethernet1/0
B 2002:172:2:59::/64 [20/0]
  via FE80::215:C7FF:FE5C:3552, Ethernet1/0
B 2002:172:2:126::/64 [20/0]
  via FE80::215:C7FF:FE5C:3552, Ethernet1/0
```

# IPv6 routes (Cont.)

## R5 ipv6 routes

R5#show ipv6 route eigrp

```
EX 2002:172:2::1/128 [170/309760]
  via FE80::213:7FFF:FEE1:C551, Ethernet0/0
EX 2002:172:2::3/128 [170/309760], tag 123
  via FE80::213:7FFF:FEE1:C551, Ethernet0/0
EX 2002:172:2::12/128 [170/309760], tag 1002
  via FE80::213:7FFF:FEE1:C551, Ethernet0/0
EX 2002:172:2:17::/64 [170/309760]
  via FE80::213:7FFF:FEE1:C551, Ethernet0/0
D 2002:172:2:38::/64 [90/281856]
  via FE80::213:7FFF:FEE1:C551, Ethernet0/0
EX 2002:172:2:126::/64 [170/309760], tag 1002
  via FE80::213:7FFF:FEE1:C551, Ethernet0/0
```

## R12 ipv6 routes

R12#show ipv6 route bgp

```
B 2002:172:2::1/128 [20/0]
  via FE80::A8BB:CCFF:FE00:3C01, Ethernet1/0
B 2002:172:2::3/128 [20/0]
  via FE80::A8BB:CCFF:FE00:3C01, Ethernet1/0
B 2002:172:2::5/128 [20/0]
  via FE80::A8BB:CCFF:FE00:3C01, Ethernet1/0
B 2002:172:2:17::/64 [20/0]
  via FE80::A8BB:CCFF:FE00:3C01, Ethernet1/0
B 2002:172:2:38::/64 [20/0]
  via FE80::A8BB:CCFF:FE00:3C01, Ethernet1/0
B 2002:172:2:59::/64 [20/0]
  via FE80::A8BB:CCFF:FE00:3C01, Ethernet1/0
```



# IPv6 routes (Cont.)

## R8 VRF ABC ipv6 route

```
RP/0/0/CPU0:R8#show route vrf ABC ipv6
```

- B 2002:172:2::1/128  
[200/0] via ::ffff:2.2.0.7 (nexthop in vrf default), 02:11:12
- B 2002:172:2::3/128  
[20/0] via fe80::c00:ff:fe00:1e01, 4d22h, GigabitEthernet0/2/0/2.38
- B 2002:172:2::5/128  
[200/130816] via ::ffff:2.2.0.9 (nexthop in vrf default), 4d21h
- B 2002:172:2::12/128  
[200/0] via ::ffff:2.2.0.9 (nexthop in vrf default), 04:06:06
- B 2002:172:2:17::/64  
[200/0] via ::ffff:2.2.0.7 (nexthop in vrf default), 4d21h
- C 2002:172:2:38::/64 is directly connected,  
8w5d, GigabitEthernet0/2/0/2.38
- L 2002:172:2:38::8/128 is directly connected,  
8w5d, GigabitEthernet0/2/0/2.38
- B 2002:172:2:59::/64  
[200/0] via ::ffff:2.2.0.9 (nexthop in vrf default), 4d21h
- B 2002:172:2:126::/64  
[200/0] via ::ffff:2.2.0.9 (nexthop in vrf default), 04:10:07

# IPv6 routes (Cont.)

## R9 VRF ABC ipv6 route

```
RP/0/0/CPU0:R9#show route vrf ABC ipv6
```

- B 2002:172:2::1/128  
[200/0] via ::ffff:2.2.0.7 (nexthop in vrf default), 02:12:12
- B 2002:172:2::3/128  
[200/0] via ::ffff:2.2.0.8 (nexthop in vrf default), 4d20h
- D 2002:172:2::5/128  
[90/130816] via fe80::c00:ff:fe00:3200, 4d21h, GigabitEthernet0/2/0/1.59
- B 2002:172:2::12/128  
[20/0] via ::ffff:2.2.69.6 (nexthop in vrf default), 04:07:02
- B 2002:172:2:17::/64  
[200/0] via ::ffff:2.2.0.7 (nexthop in vrf default), 4d20h
- B 2002:172:2:38::/64  
[200/0] via ::ffff:2.2.0.8 (nexthop in vrf default), 4d20h
- C 2002:172:2:59::/64 is directly connected,  
10w1d, GigabitEthernet0/2/0/1.59
- L 2002:172:2:59::9/128 is directly connected,  
10w1d, GigabitEthernet0/2/0/1.59
- B 2002:172:2:126::/64  
[20/0] via ::ffff:2.2.69.6 (nexthop in vrf default), 04:11:02

# IPv6 routes (Cont.)

## R7 VRF ABC ipv6 route

R7#show ipv6 route vrf ABC

```
S 2002:172:2::1/128 [1/0]
  via FE80::C00:FF:FE00:A01, Ethernet1/0
B 2002:172:2::5/128 [200/130816]
  via 2.2.0.9%default, indirectly connected
B 2002:172:2::8/128 [200/0]
  via 2.2.0.8%default, indirectly connected
B 2002:172:2::12/128 [200/0]
  via 2.2.0.9%default, indirectly connected
C 2002:172:2:17::/64 [0/0]
  via Ethernet1/0, directly connected
L 2002:172:2:17::7/128 [0/0]
  via Ethernet1/0, receive
B 2002:172:2:38::/64 [200/0]
  via 2.2.0.8%default, indirectly connected
B 2002:172:2:59::/64 [200/0]
  via 2.2.0.9%default, indirectly connected
B 2002:172:2:126::/64 [200/0]
  via 2.2.0.9%default, indirectly connected
L FF00::/8 [0/0]
  via Null0, receive
```

# IPv6 routes (Cont.)

## R6 VRF ABC ipv6 route

R6#show ipv6 route vrf ABC

- B 2002:172:2::1/128 [20/0]  
via 2.2.69.9%default, indirectly connected
- B 2002:172:2::3/128 [20/0]  
via 2.2.69.9%default, indirectly connected
- B 2002:172:2::5/128 [20/130816]  
via 2.2.69.9%default, indirectly connected
- B 2002:172:2::12/128 [20/0]  
via FE80::A8BB:CCFF:FE00:7801, Ethernet1/0
- B 2002:172:2:17::/64 [20/0]  
via 2.2.69.9%default, indirectly connected
- B 2002:172:2:38::/64 [20/0]  
via 2.2.69.9%default, indirectly connected
- B 2002:172:2:59::/64 [20/0]  
via 2.2.69.9%default, indirectly connected
- C 2002:172:2:126::/64 [0/0]  
via Ethernet1/0, directly connected
- L 2002:172:2:126::6/128 [0/0]  
via Ethernet1/0, receive
- L FF00::/8 [0/0]  
via Null0, receive

# MPLS forwarding table

## R9 mpls forwarding table

RP/0/0/CPU0:R9#show mpls forwarding

Local Label	Outgoing Label	Prefix or ID	Outgoing Interface	Next Hop	Bytes Switched
16002	Unlabelled	2002:172:2::5/128[V]	Gi0/2/0/1.59	fe80::c00:ff:fe00:3200	\
16016	16010	2002:172:2::3/128[V]	point2point	0	\
16019	16000	2002:172:2:38::/64[V]	point2point	0	\
16028	16022	1002:2:172.2.126.0/24	Gi0/2/0/1.69	2.2.69.6	0
16046	16019	1002:2:2002:172:2::12/128	Gi0/2/0/1.69	2.2.69.6	825
16048	16021	1002:2:172.2.0.12/32	Gi0/2/0/1.69	2.2.69.6	0
16049	46	2002:172:2::1/128[V]	point2point	0	\
16051	29	2002:172:2:17::/64[V]	point2point	0	\
16053	16020	1002:2:2002:172:2:126::/64	Gi0/2/0/1.69	2.2.69.6	0

# MPLS forwarding table (Cont.)

## R6 mpls forwarding table

R6#show mpls forwarding-table

Local Label	Outgoing Label or VC	Prefix or Tunnel Id	Bytes Switched	Label	Outgoing interface	Next Hop
16011	16019	[2:2]2002:172:2:38::/64	\	0	Et0/1	2.2.69.9
16012	16021	[2:2]2002:172:2:59::/64	\	0	Et0/1	2.2.69.9
16013	16051	[2:2]2002:172:2:17::/64	\	0	Et0/1	2.2.69.9
16015	16049	[2:2]2002:172:2::1/128	\	0	Et0/1	2.2.69.9
16017	16016	[2:2]2002:172:2::3/128	\	0	Et0/1	2.2.69.9
16018	16002	[2:2]2002:172:2::5/128	\	0	Et0/1	2.2.69.9
16019	No Label	2002:172:2::12/128[V]	\	4830	Et1/0	FE80::A8BB:CCFF:FE00:7801
16020	Pop Label	2002:172:2:126::/64[V]	\	570	aggregate/ABC	

# MPLS forwarding table(Cont.)

## R8 mpls forwarding table

RP/0/0/CPU0:R8#show mpls forwarding

Local Label	Outgoing Label	Prefix or ID	Outgoing Interface	Next Hop Switched	Bytes
16010	Unlabelled	2002:172:2::3/128[V]	Gi0/2/0/2.38	fe80::c00:ff:fe00:1e01	5280

## R7 mpls forwarding table

R7#show mpls forwarding-table

Local Label	Outgoing Label	Prefix or VC or Tunnel Id	Bytes Label Switched	Outgoing interface	Next Hop
46	No Label	2002:172:2::1/128[V]	1710	Et1/0	FE80::C00:FF:FE00:A01

# Connectivity verification

```
R3#ping 2002:172:2::1 source loopback 0
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2002:172:2::1, timeout is 2 seconds:

Packet sent with a source address of 2002:172:2::3

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 16/19/20 ms

```
R3#traceroute 2002:172:2::1
```

Type escape sequence to abort.

Tracing the route to 2002:172:2::1

```
1 2002:172:2:38::8 [AS 2] 12 msec 8 msec 12 msec
```

```
2 2002:172:2:17::7 [AS 2] [MPLS: Label 46 Exp 0] 20 msec 20 msec 20 msec
```

```
3 2002:172:2:17::1 [AS 2] 20 msec 20 msec 20 msec
```



# Connectivity verification (Cont.)

```
R3#ping 2002:172:2::12 source loopback 0
```

```
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 2002:172:2::12, timeout is 2 seconds:
```

```
Packet sent with a source address of 2002:172:2::3
```

```
!!!!
```

```
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/41/56 ms
```

```
R3#traceroute 2002:172:2::12
```

```
Type escape sequence to abort.
```

```
Tracing the route to 2002:172:2::12
```

```
1 2002:172:2:38::8 [AS 2] 12 msec 8 msec 8 msec
```

```
2 2002:2:2:29::2 [MPLS: Labels 52/16046 Exp 0] 44 msec 40 msec 36 msec
```

```
3 2002:2:2:29::9 [MPLS: Label 16046 Exp 0] 40 msec 40 msec 40 msec
```

```
4 2002:172:2:126::6 [AS 1002] [MPLS: Label 16019 Exp 0] 40 msec 40 msec 40 msec
```

```
5 2002:172:2:126::12 [AS 1002] 40 msec 40 msec 44 msec
```

# Connectivity verification (Cont.)

```
R1#ping 2002:172:2::12 source loopback 0
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2002:172:2::12, timeout is 2 seconds:

Packet sent with a source address of 2002:172:2::1

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 16/19/20 ms

```
R1#traceroute 2002:172:2::12
```

Type escape sequence to abort.

Tracing the route to 2002:172:2::12

```
1 2002:172:2:17::7 4 msec 0 msec 0 msec
```

```
2 2002:2:2:79::9 [MPLS: Label 16046 Exp 0] 24 msec 20 msec 20 msec
```

```
3 2002:172:2:126::6 [MPLS: Label 16019 Exp 0] 20 msec 20 msec 20 msec
```

```
4 2002:172:2:126::12 20 msec 20 msec 20 msec
```

# Connectivity verification (Cont.)

```
R5#ping 2002:172:2::1 source loopback 0
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2002:172:2::1, timeout is 2 seconds:

Packet sent with a source address of 2002:172:2::5

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 0/2/4 ms

```
R5#ping 2002:172:2::3 source loopback 0
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2002:172:2::3, timeout is 2 seconds:

Packet sent with a source address of 2002:172:2::5

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 0/4/8 ms

```
R5#ping 2002:172:2::12 source loopback 0
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2002:172:2::12, timeout is 2 seconds:

Packet sent with a source address of 2002:172:2::5

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 0/2/4 ms

# Connectivity verification (Cont.)

```
R12#ping 2002:172:2::1 source loopback 0
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2002:172:2::1, timeout is 2 seconds:

Packet sent with a source address of 2002:172:2::12

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 0/2/4 ms

```
R12#ping 2002:172:2::3 source loopback 0
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2002:172:2::3, timeout is 2 seconds:

Packet sent with a source address of 2002:172:2::12

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 4/4/4 ms

```
R12#ping 2002:172:2::5 source loopback 0
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2002:172:2::5, timeout is 2 seconds:

Packet sent with a source address of 2002:172:2::12

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 0/2/4 ms



**CISCO**