

CCIE Service Provider v3.0

Sample Lab

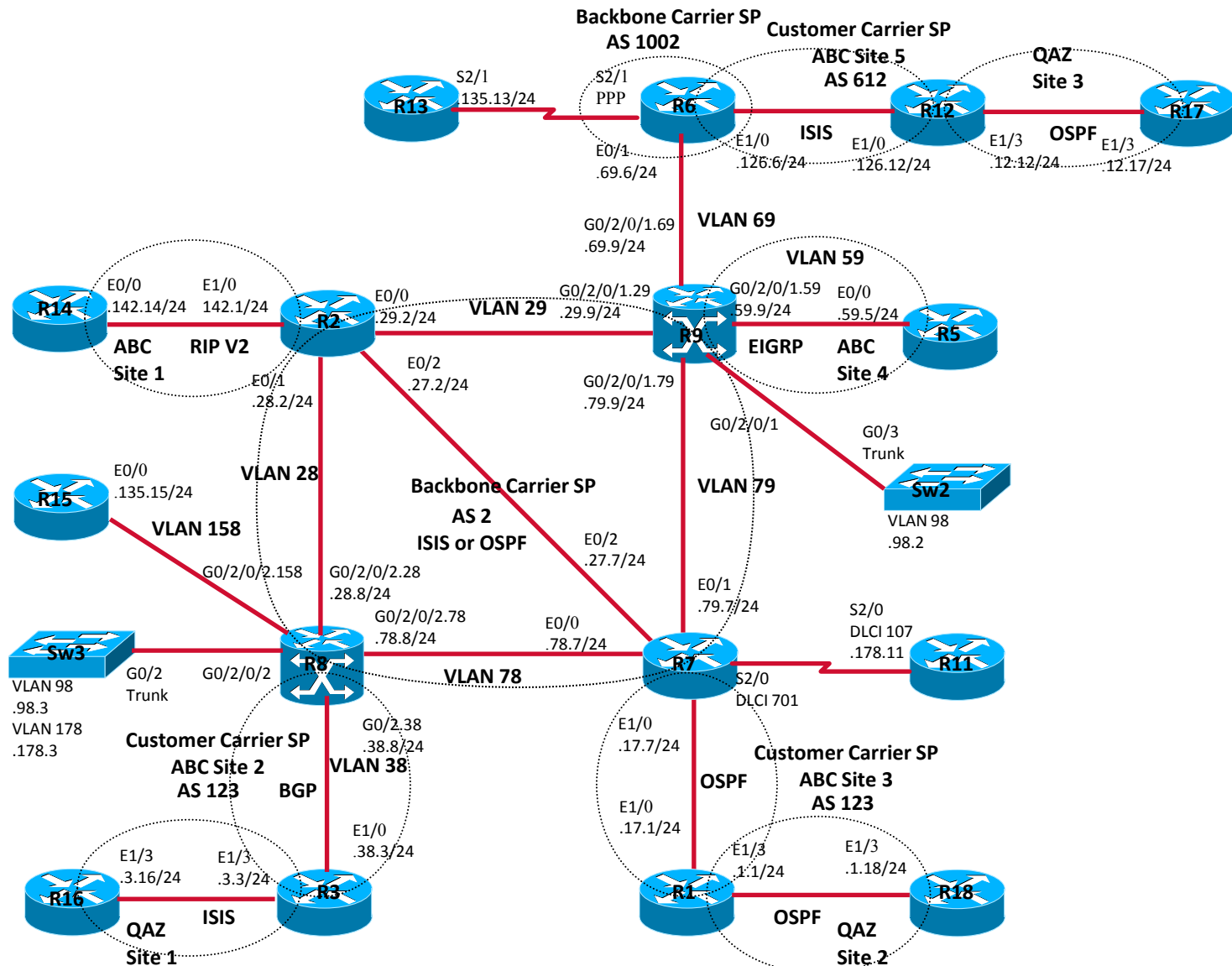
Part 1/7

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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 |

IS-IS Overview

- IS-IS was originally designed for use as a dynamic routing protocol for the ISO Connectionless Network Protocol (CLNP)
- IS-IS is a Link State Protocol similar to the Open Shortest Path First (OSPF)
- Three network protocols play together to deliver the ISO defined Connectionless Network Service
 - CLNP
 - IS-IS
 - ES-IS
- All 3 protocols independently ride over layer 2
- Supports for IPv4 and IPv6 routing
- Supports for MPLS Traffic Engineering

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>

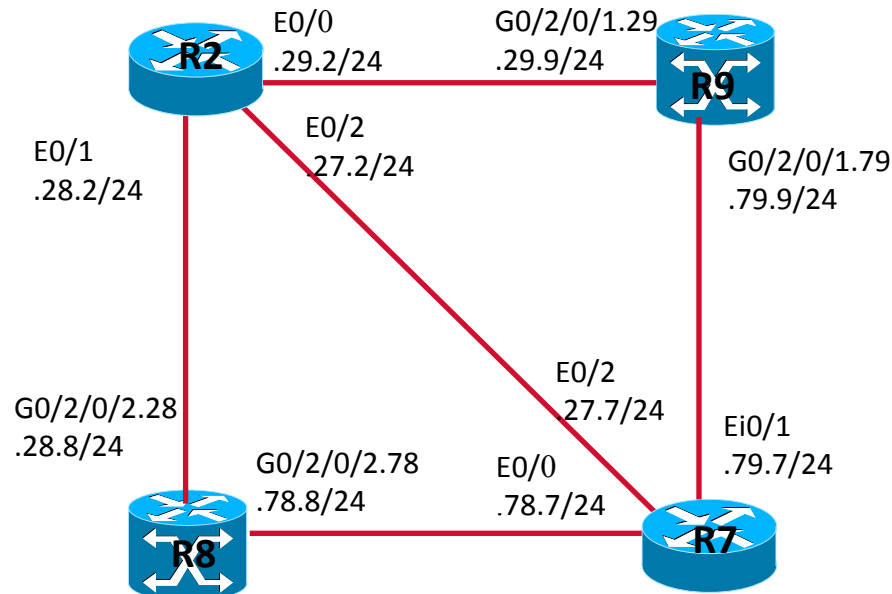
1.0 – Implement, Optimize and Troubleshoot Core IP Technologies

1.3 – Implement, Optimize and Troubleshoot IGP routing

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

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

IS-IS IPv4/IPv6 – Sub Topology and Question



- Configure IS-IS on above routers in area of 47.0002 and put all router into level-1
- Ensure routers have IS-IS IPv4 and IPv6 routes and can ping each other

IS-IS Configuration

R2 (IOS) configuration

```
interface Loopback0
ip address 2.2.0.2 255.255.255.255
ip router isis
ipv6 address 2002:2:2::2/128
ipv6 router isis
!
interface Ethernet0/0
ip address 2.2.29.2 255.255.255.0
ip router isis
ipv6 address 2002:2:2:29::2/64
ipv6 router isis
!
interface Ethernet0/1
ip address 2.2.28.2 255.255.255.0
ip router isis
ipv6 address 2002:2:2:28::2/64
ipv6 router isis
!
```

```
interface Ethernet0/2
ip address 2.2.27.2 255.255.255.0
ip router isis
ipv6 address 2002:2:2:27::2/64
ipv6 router isis
!
router isis
net 47.0002.0000.0000.0002.00
is-type level-1
metric-style wide
!
address-family ipv6
exit-address-family
!
```

IS-IS Configuration (Cont.)

R8 (IOS-XR) configuration

```
interface Loopback0
  ipv4 address 2.2.0.8 255.255.255.255
  ipv6 address 2002:2:2::8/128
!
interface GigabitEthernet0/2/0/2.28
  ipv4 address 2.2.28.8 255.255.255.0
  ipv6 address 2002:2:2:28::8/64
  dot1q vlan 28
!
interface GigabitEthernet0/2/0/2.78
  ipv4 address 2.2.78.8 255.255.255.0
  ipv6 address 2002:2:2:78::8/64
  dot1q vlan 78
!
router isis abc
  net 47.0002.0000.0000.0008.00
  address-family ipv4 unicast
  is-type level-1
  metric-style wide
!
```

```
address-family ipv6 unicast
  single-topology
!
interface Loopback0
  passive
  address-family ipv4 unicast
!
  address-family ipv6 unicast
!
!
interface GigabitEthernet0/2/0/2.28
  address-family ipv4 unicast
!
  address-family ipv6 unicast
!
!
interface GigabitEthernet0/2/0/2.78
  address-family ipv4 unicast
!
  address-family ipv6 unicast
!
```

IS-IS Configuration (Cont.)

R7 (IOS) configuration

```
interface Loopback0
ip address 2.2.0.7 255.255.255.255
ip router isis
ipv6 address 2002:2:2::7/128
ipv6 router isis
!
interface Ethernet0/0
ip address 2.2.78.7 255.255.255.0
ip router isis
ipv6 address 2002:2:2:78::7/64
ipv6 router isis
!
interface Ethernet0/1
ip address 2.2.79.7 255.255.255.0
ip router isis
ipv6 address 2002:2:2:79::7/64
ipv6 router isis
!
```

```
interface Ethernet0/2
ip address 2.2.27.7 255.255.255.0
ip router isis
ipv6 address 2002:2:2:27::7/64
ipv6 router isis
!
router isis
net 47.0002.0000.0000.0007.00
is-type level-1
metric-style wide
!
address-family ipv6
exit-address-family
```

IS-IS Configuration (Cont.)

R9 (IOS-XR) configuration

```
interface Loopback0
  ipv4 address 2.2.0.9 255.255.255.255
  ipv6 address 2002:2:2::9/128
!
interface GigabitEthernet0/2/0/1.29
  ipv4 address 2.2.29.9 255.255.255.0
  ipv6 address 2002:2:2:29::9/64
  dot1q vlan 29
!
interface GigabitEthernet0/2/0/1.79
  ipv4 address 2.2.79.9 255.255.255.0
  ipv6 address 2002:2:2:79::9/64
  dot1q vlan 79
!
router isis abc
  is-type level-1
  net 47.0002.0000.0000.9999.00
  address-family ipv4 unicast
  metric-style wide
!
```

```
address-family ipv6 unicast
  single-topology
!
interface Loopback0
  address-family ipv4 unicast
!
  address-family ipv6 unicast
!
!
interface GigabitEthernet0/2/0/1.29
  address-family ipv4 unicast
!
  address-family ipv6 unicast
!
!
interface GigabitEthernet0/2/0/1.79
  address-family ipv4 unicast
!
  address-family ipv6 unicast
!
```

IS-IS Adjacency

R2#show clns neighbors

| | System Id | Interface | SNPA | State | Holdtime | Type | Protocol |
|----|-----------|-----------|----------------|-------|----------|------|----------|
| R7 | | Et0/2 | 0e00.0000.4620 | Up | 27 | L1 | IS-IS |
| R8 | | Et0/1 | 0015.c75c.3552 | Up | 24 | L1 | IS-IS |
| R9 | | Et0/0 | 0013.7fe1.c551 | Up | 21 | L1 | IS-IS |

R7#show clns neighbors

| | System Id | Interface | SNPA | State | Holdtime | Type | Protocol |
|----|-----------|-----------|----------------|-------|----------|------|----------|
| R2 | | Et0/2 | 0e00.0000.1420 | Up | 29 | L1 | IS-IS |
| R8 | | Et0/0 | 0015.c75c.3552 | Up | 29 | L1 | IS-IS |
| R9 | | Et0/1 | 0013.7fe1.c551 | Up | 25 | L1 | IS-IS |

RP/0/0/CPU0:R8#show isis neighbors

IS-IS abc neighbors:

| | System Id | Interface | SNPA | State | Holdtime | Type | IETF-NSF |
|----|-----------|--------------|----------------|-------|----------|------|----------|
| R2 | | Gi0/2/0/2.28 | 0e00.0000.1410 | Up | 8 | L1 | Capable |
| R7 | | Gi0/2/0/2.78 | 0e00.0000.4600 | Up | 0 | L1 | Capable |

RP/0/0/CPU0:R9#show isis neighbors

IS-IS abc neighbors:

| | System Id | Interface | SNPA | State | Holdtime | Type | IETF-NSF |
|----|-----------|--------------|----------------|-------|----------|------|----------|
| R2 | | Gi0/2/0/1.29 | 0e00.0000.1400 | Up | 7 | L1 | Capable |
| R7 | | Gi0/2/0/1.79 | 0e00.0000.4610 | Up | 9 | L1 | Capable |

IS-IS Database

R2 #show isis database

Tag null:

IS-IS Level-1 Link State Database:

| LSPID | LSP Seq Num | LSP Checksum | LSP Holdtime | ATT/P/OL |
|----------|--------------|--------------|--------------|----------|
| R2.00-00 | * 0x00000F08 | 0xAD29 | 1117 | 0/0/0 |
| R2.02-00 | * 0x00000B3E | 0x14B3 | 417 | 0/0/0 |
| R2.03-00 | * 0x00000B48 | 0x33B4 | 1000 | 0/0/0 |
| R7.00-00 | 0x0000101B | 0x018A | 1135 | 0/0/0 |
| R7.02-00 | 0x00000002 | 0xEC43 | 857 | 0/0/0 |
| R7.03-00 | 0x00000002 | 0xAB58 | 983 | 0/0/0 |
| R8.00-00 | 0x0000205D | 0x68D3 | 1101 | 0/0/0 |
| R8.01-00 | 0x00001C88 | 0x4CC0 | 966 | 0/0/0 |
| R9.00-00 | 0x000039F6 | 0xAAF1 | 1163 | 0/0/0 |

All router have same IS-IS database

IS-IS Routes

R2#show ip route isis

```
i L1  2.2.0.7/32 [115/20] via 2.2.27.7, Ethernet0/2
i L1  2.2.0.8/32 [115/10] via 2.2.28.8, Ethernet0/1
i L1  2.2.0.9/32 [115/10] via 2.2.29.9, Ethernet0/0
i L1  2.2.78.0/24 [115/20] via 2.2.28.8, Ethernet0/1
      [115/20] via 2.2.27.7, Ethernet0/2
i L1  2.2.79.0/24 [115/20] via 2.2.29.9, Ethernet0/0
      [115/20] via 2.2.27.7, Ethernet0/2
```

R2#show ipv6 route isis

```
I1 2002:2:2::7/128 [115/20]
   via FE80::C00:FF:FE00:4620, Ethernet0/2
I1 2002:2:2::8/128 [115/10]
   via FE80::215:C7FF:FE5C:3552, Ethernet0/1
I1 2002:2:2::9/128 [115/10]
   via FE80::213:7FFF:FEE1:C551, Ethernet0/0
I1 2002:2:2:78::/64 [115/20]
   via FE80::215:C7FF:FE5C:3552, Ethernet0/1
   via FE80::C00:FF:FE00:4620, Ethernet0/2
I1 2002:2:2:79::/64 [115/20]
   via FE80::213:7FFF:FEE1:C551, Ethernet0/0
   via FE80::C00:FF:FE00:4620, Ethernet0/2
```

IS-IS Routes (Cont.)

RP/0/0/CPU0:R8#show route ipv4 isis

i L1 2.2.0.2/32 [115/20] via 2.2.28.2, 00:02:47, GigabitEthernet0/2/0/2.28
i L1 2.2.0.7/32 [115/20] via 2.2.78.7, 00:02:44, GigabitEthernet0/2/0/2.78
i L1 2.2.0.9/32 [115/20] via 2.2.78.7, 00:00:16, GigabitEthernet0/2/0/2.78
[115/20] via 2.2.28.2, 00:00:16, GigabitEthernet0/2/0/2.28
i L1 2.2.27.0/24 [115/20] via 2.2.78.7, 00:02:44, GigabitEthernet0/2/0/2.78
[115/20] via 2.2.28.2, 00:02:44, GigabitEthernet0/2/0/2.28
i L1 2.2.29.0/24 [115/20] via 2.2.28.2, 00:02:47, GigabitEthernet0/2/0/2.28
i L1 2.2.79.0/24 [115/20] via 2.2.78.7, 00:02:44, GigabitEthernet0/2/0/2.78

RP/0/0/CPU0:R8#show route ipv6 isis

i L1 2002:2:2::2/128
[115/20] via fe80::c00:ff:fe00:1410, 00:42:41, GigabitEthernet0/2/0/2.28
i L1 2002:2:2::7/128
[115/20] via fe80::c00:ff:fe00:4600, 00:03:29, GigabitEthernet0/2/0/2.78
i L1 2002:2:2::9/128
[115/20] via fe80::c00:ff:fe00:4600, 00:03:26, GigabitEthernet0/2/0/2.78
[115/20] via fe80::c00:ff:fe00:1410, 00:03:26, GigabitEthernet0/2/0/2.28
i L1 2002:2:2:27::/64
[115/20] via fe80::c00:ff:fe00:4600, 00:03:29, GigabitEthernet0/2/0/2.78
[115/20] via fe80::c00:ff:fe00:1410, 00:03:29, GigabitEthernet0/2/0/2.28
i L1 2002:2:2:29::/64
[115/20] via fe80::c00:ff:fe00:1410, 00:03:32, GigabitEthernet0/2/0/2.28
i L1 2002:2:2:79::/64
[115/20] via fe80::c00:ff:fe00:4600, 00:03:29, GigabitEthernet0/2/0/2.78

Connectivity Verification

RP/0/0/CPU0:R8#ping 2.2.0.9 source 2.2.0.8

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2.2.0.9, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 15/18/20 ms

R2#ping 2.2.0.8 source loopback 0

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2.2.0.8, timeout is 2 seconds:

Packet sent with a source address of 2.2.0.2

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/10/12 ms

RP/0/0/CPU0:R9#ping 2.2.0.7 source 2.2.0.9

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2.2.0.7, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 7/11/20 ms

Connectivity Verification (Cont.)

RP/0/0/CPU0:R8#ping 2002:2:2::9 source 2002:2:2::8

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2002:2:2::9, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 4/5/6 ms

RP/0/0/CPU0:R8#ping 2002:2:2::2 source 2002:2:2::8

Type escape sequence to abort.

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

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/3 ms

RP/0/0/CPU0:R8#ping 2002:2:2::7 source 2002:2:2::8

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2002:2:2::7, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/3 ms

OSPF Overview

- OSPF is a link state protocol, uses Dijkstra (Shortest Path First) algorithm to find path.
- OSPF uses two-level hierarchical model
- OSPF supports for CIDR, VLSM, authentication, multipath, and IP unnumbered
- OSPF supports for IPv4 and IPv6 routing
- OSPF supports for MPLS Traffic Engineering

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>

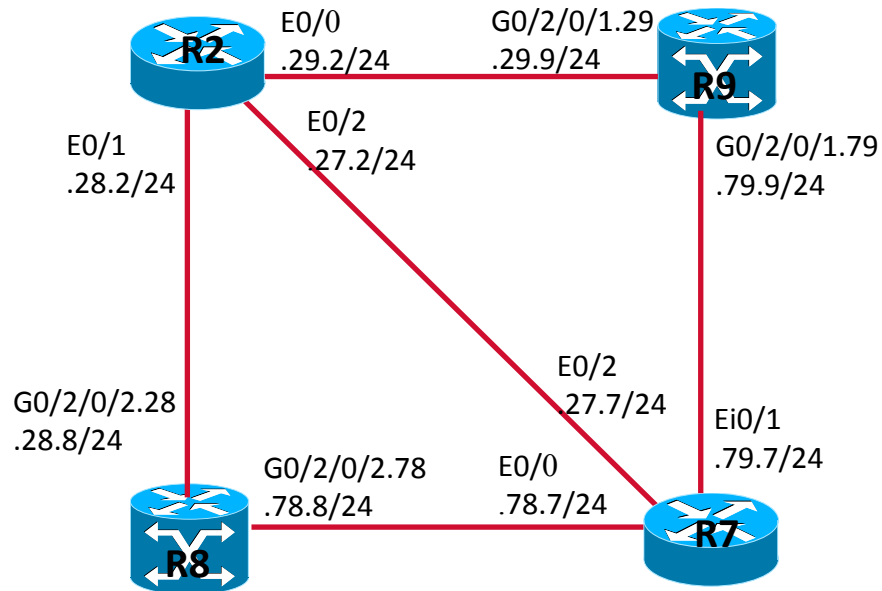
1.0 – Implement, Optimize and Troubleshoot Core IP Technologies

1.3 – Implement, Optimize and Troubleshoot IGP routing

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

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

OSPF IPv4/IPv6 – Sub Topology and Question



- Configure OSPF and OSPFv3 on above routers in area 0
- Ensure routers have OSPF IPv4 and IPv6 routes and can ping each other

OSPF Configuration

R2 (IOS) configuration

```
interface Loopback0
ip address 2.2.0.2 255.255.255.255
ipv6 address 2002:2:2::2/128
ipv6 ospf 300 area 0
!
interface Ethernet0/0
ip address 2.2.29.2 255.255.255.0
ipv6 address 2002:2:2:29::2/64
ipv6 ospf 300 area 0
!
interface Ethernet0/1
ip address 2.2.28.2 255.255.255.0
ipv6 address 2002:2:2:28::2/64
ipv6 ospf 300 area 0
!
```

```
interface Ethernet0/2
ip address 2.2.27.2 255.255.255.0
ipv6 address 2002:2:2:27::2/64
ipv6 ospf 300 area 0
!
router ospf 200
network 2.2.0.0 0.0.255.255 area 0
!
ipv6 router ospf 300
router-id 2.2.0.2
!
```

OSPF Configuration (Cont.)

R8 (IOS-XR) configuration

```
interface Loopback0
  ipv4 address 2.2.0.8 255.255.255.255
  ipv6 address 2002:2:2::8/128
!
interface GigabitEthernet0/2/0/2.28
  ipv4 address 2.2.28.8 255.255.255.0
  ipv6 address 2002:2:2:28::8/64
  dot1q vlan 28
!
interface GigabitEthernet0/2/0/2.78
  ipv4 address 2.2.78.8 255.255.255.0
  ipv6 address 2002:2:2:78::8/64
  dot1q vlan 78
!
```

```
router ospf 200
  area 0
    interface Loopback0
    !
    interface GigabitEthernet0/2/0/2.28
    !
    interface GigabitEthernet0/2/0/2.78
    !
router ospfv3 300
  address-family ipv6
    area 0
      interface Loopback0
      !
      interface GigabitEthernet0/2/0/2.28
      !
      interface GigabitEthernet0/2/0/2.78
      !
```

Note: R7 and R9 configurations are similar to R2 and R8

OSPF Adjacency

R2#show ip ospf neighbor

| Neighbor ID | Pri | State | Dead Time | Address | Interface |
|-------------|-----|---------|-----------|----------|-------------|
| 2.2.0.7 | 1 | FULL/DR | 00:00:32 | 2.2.27.7 | Ethernet0/2 |
| 2.2.0.8 | 1 | FULL/DR | 00:00:30 | 2.2.28.8 | Ethernet0/1 |
| 2.2.0.9 | 1 | FULL/DR | 00:00:38 | 2.2.29.9 | Ethernet0/0 |

RP/0/0/CPU0:R8#show ospf neighbor

Neighbors for OSPF 200

| Neighbor ID | Pri | State | Dead Time | Address | Interface |
|-----------------------------|-----|----------|-----------|----------|---------------------------|
| 2.2.0.2 | 1 | FULL/BDR | 00:00:33 | 2.2.28.2 | GigabitEthernet0/2/0/2.28 |
| Neighbor is up for 00:27:46 | | | | | |
| 2.2.0.7 | 1 | FULL/BDR | 00:00:36 | 2.2.78.7 | GigabitEthernet0/2/0/2.78 |
| Neighbor is up for 00:27:17 | | | | | |

RP/0/0/CPU0:R8#show ospfv3 neighbor

Neighbors for OSPFv3 300

| Neighbor ID | Pri | State | Dead Time | Address | Interface |
|-----------------------------|-----|----------|-----------|----------|---------------------------|
| 2.2.0.2 | 1 | FULL/BDR | 00:00:31 | 2.2.28.2 | GigabitEthernet0/2/0/2.28 |
| Neighbor is up for 00:27:50 | | | | | |
| 2.2.0.7 | 1 | FULL/BDR | 00:00:32 | 2.2.78.7 | GigabitEthernet0/2/0/2.78 |
| Neighbor is up for 00:27:32 | | | | | |

OSPF Routes

R2#show ip route ospf

- O 2.2.0.7/32 [110/11] via 2.2.27.7, 00:54:42, Ethernet0/2
- O 2.2.0.8/32 [110/11] via 2.2.28.8, 00:55:37, Ethernet0/1
- O 2.2.0.9/32 [110/11] via 2.2.29.9, 00:55:37, Ethernet0/0
- O 2.2.78.0/24 [110/11] via 2.2.28.8, 00:55:37, Ethernet0/1
- O 2.2.79.0/24 [110/11] via 2.2.29.9, 00:55:37, Ethernet0/0

R2#show ipv6 route ospf

- O 2002:2:2::7/128 [110/10]
via FE80::C00:FF:FE00:4620, Ethernet0/2
- O 2002:2:2::8/128 [110/10]
via FE80::215:C7FF:FE5C:3552, Ethernet0/1
- O 2002:2:2::9/128 [110/10]
via FE80::213:7FFF:FEE1:C551, Ethernet0/0
- O 2002:2:2:78::/64 [110/11]
via FE80::215:C7FF:FE5C:3552, Ethernet0/1
- O 2002:2:2:79::/64 [110/11]
via FE80::213:7FFF:FEE1:C551, Ethernet0/0

OSPF Routes (Cont.)

RP/0/0/CPU0:R8#show route ipv4 ospf

- O 2.2.0.2/32 [110/2] via 2.2.28.2, 00:53:44, GigabitEthernet0/2/0/2.28
- O 2.2.0.7/32 [110/2] via 2.2.78.7, 00:53:12, GigabitEthernet0/2/0/2.78
- O 2.2.0.9/32 [110/12] via 2.2.78.7, 00:53:12, GigabitEthernet0/2/0/2.78
[110/12] via 2.2.28.2, 00:53:12, GigabitEthernet0/2/0/2.28
- O 2.2.27.0/24 [110/11] via 2.2.78.7, 00:52:44, GigabitEthernet0/2/0/2.78
[110/11] via 2.2.28.2, 00:52:44, GigabitEthernet0/2/0/2.28
- O 2.2.29.0/24 [110/11] via 2.2.28.2, 00:53:44, GigabitEthernet0/2/0/2.28
- O 2.2.79.0/24 [110/11] via 2.2.78.7, 00:53:12, GigabitEthernet0/2/0/2.78

RP/0/0/CPU0:R8#show route ipv6 ospf

- O 2002:2:2::2/128
[110/1] via fe80::c00:ff:fe00:1410, 00:13:14, GigabitEthernet0/2/0/2.28
- O 2002:2:2::7/128
[110/1] via fe80::c00:ff:fe00:4600, 00:14:53, GigabitEthernet0/2/0/2.78
- O 2002:2:2::9/128
[110/11] via fe80::c00:ff:fe00:4600, 00:13:14, GigabitEthernet0/2/0/2.78
[110/11] via fe80::c00:ff:fe00:1410, 00:13:14, GigabitEthernet0/2/0/2.28
- O 2002:2:2:27::/64
[110/11] via fe80::c00:ff:fe00:4600, 00:13:14, GigabitEthernet0/2/0/2.78
[110/11] via fe80::c00:ff:fe00:1410, 00:13:14, GigabitEthernet0/2/0/2.28
- O 2002:2:2:29::/64
[110/11] via fe80::c00:ff:fe00:1410, 00:13:14, GigabitEthernet0/2/0/2.28
- O 2002:2:2:79::/64
[110/11] via fe80::c00:ff:fe00:4600, 00:14:53, GigabitEthernet0/2/0/2.78

Connectivity Verification

RP/0/0/CPU0:R8#ping 2.2.0.9 source 2.2.0.8

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2.2.0.9, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 15/18/20 ms

R2#ping 2.2.0.8 source loopback 0

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2.2.0.8, timeout is 2 seconds:

Packet sent with a source address of 2.2.0.2

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/10/12 ms

RP/0/0/CPU0:R9#ping 2.2.0.7 source 2.2.0.9

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2.2.0.7, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 7/11/20 ms

BGP Overview

- BGP scales Internet routing by connecting ISPs with globally unique AS numbers
 - BGP uses TCP (with port 179) to exchange updates
 - BGP is Path Vector Protocol
 - BGP is composed of IBGP and EBGP
 - BGP has improved to support multi protocol operation
-
- Note: This section describes BGP IPv4 and IPv6 unicast family
MP-BGP will be introduced in further sections

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>

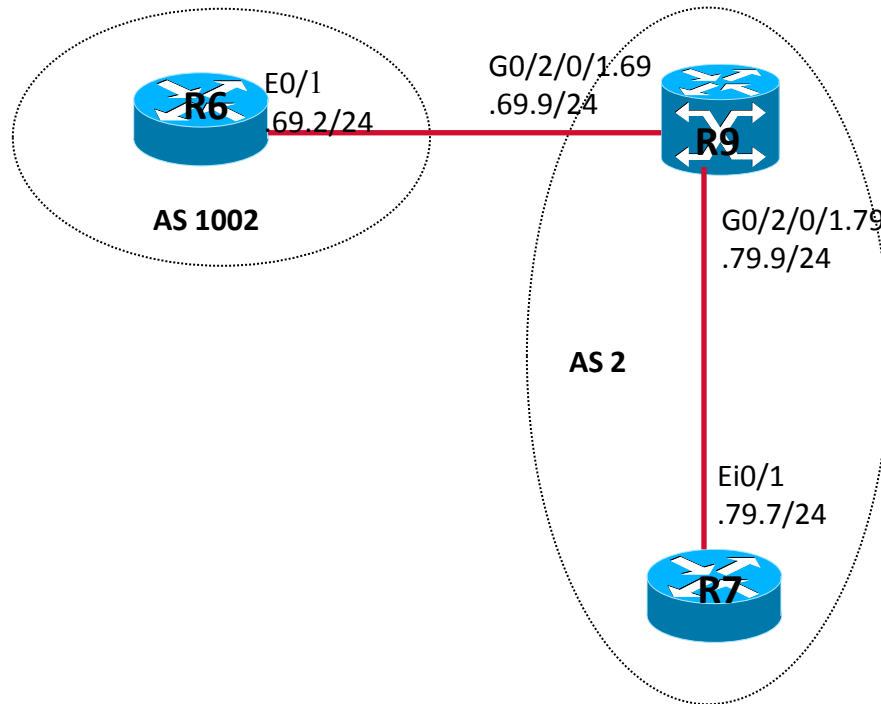
1.0 – Implement, Optimize and Troubleshoot Core IP Technologies

1.6 – Implement, Optimize and Troubleshoot BGP

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

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

BGP Unicast IPv4/IPv6 – Sub Topology and Question



- Configure IBGP IPv4/IPv6 unicast between R7 and R9
- Configure EBGP IPv4/IPv6 unicast between R6 and R9
- Ensure Loopback0 IPV4/IPv6 network is seen as BGP routes and they can ping each other

BGP Configuration

R7 (IOS) configuration

```
interface Loopback0
 ip address 2.2.0.7 255.255.255.255
 ipv6 address 2002:2:2::7/128
!
interface Ethernet0/1
 ip address 2.2.79.7 255.255.255.0
 ipv6 address 2002:2:2:79::7/64
!
router bgp 2
 no bgp default ipv4-unicast
 neighbor 2.2.0.9 remote-as 2
 neighbor 2.2.0.9 update-source Loopback0
 neighbor 2002:2:2::9 remote-as 2
 neighbor 2002:2:2::9 update-source loopback 0
!
```

```
address-family ipv4
 no synchronization
 network 2.2.0.7 mask 255.255.255.255
 neighbor 2.2.0.2 activate
 neighbor 2.2.0.2 send-community
 no auto-summary
 exit-address-family
!
address-family ipv6
 no synchronization
 network 2002:2:2::7/128
 neighbor 2002:2:2::9 activate
 exit-address-family
!
```

BGP Configuration (Cont.)

R9 (IOS-XR) configuration

```
interface Loopback0
  ipv4 address 2.2.0.9 255.255.255.255
  ipv6 address 2002:2:2::9/128
!
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 ipv4 unicast
    network 2.2.0.9/32
  !
  address-family ipv6 unicast
    network 2002:2:2::9/128
  !
  neighbor 2.2.0.7
    remote-as 2
    update-source Loopback0
    address-family ipv4 unicast
      next-hop-self
  !
```

```
address-family vpnv6 unicast
  next-hop-self
!
neighbor 2.2.69.6
  remote-as 1002
  address-family ipv4 unicast
    route-policy default_policy_pass_all in
    route-policy default_policy_pass_all out
  !
neighbor 2002:2:2::7
  remote-as 2
  update-source Loopback0
  address-family ipv6 unicast
    next-hop-self
  !
neighbor 2002:2:2:69::6
  remote-as 1002
  address-family ipv6 unicast
    route-policy default_policy_pass_all in
    route-policy default_policy_pass_all out
```

Note: Configure EBGp in IOS-XR will require defining “route-policy”

BGP Configuration (Cont.)

R6 (IOS) configuration

```
interface Loopback0
ip address 2.2.0.6 255.255.255.255
ipv6 address 2002:2:2::6/128
!
interface Ethernet0/1
ip address 2.2.69.6 255.255.255.0
ipv6 address 2002:2:2:69::6/64
!
router bgp 1002
no bgp default ipv4-unicast
neighbor 2.2.69.9 remote-as 2
neighbor 2002:2:2:69::9 remote-as 2
!
```

```
address-family ipv4
no synchronization
network 2.2.0.6 mask 255.255.255.255
neighbor 2.2.69.9 activate
no auto-summary
exit-address-family
!
address-family ipv6
no synchronization
network 2002:2:2::6/128
neighbor 2002:2:2:69::9 activate
exit-address-family
!
```

BGP Adjacency

R6#show bgp ipv4 unicast summary

| Neighbor | V | AS | MsgRcvd | MsgSent | TblVer | InQ | OutQ | Up/Down | State/PfxRcd |
|----------|---|----|---------|---------|--------|-----|------|----------|--------------|
| 2.2.69.9 | 4 | 2 | 117 | 120 | 30 | 0 | 0 | 01:28:24 | 6 |

R6#show bgp ipv6 unicast summary

| Neighbor | V | AS | MsgRcvd | MsgSent | TblVer | InQ | OutQ | Up/Down | State/PfxRcd |
|----------------|---|----|---------|---------|--------|-----|------|----------|--------------|
| 2002:2:2:69::9 | 4 | 2 | 90 | 99 | 5 | 0 | 0 | 01:25:46 | 2 |

RP/0/0/CPU0:R9#show bgp ipv4 unicast summary

| Neighbor | Spk | AS | MsgRcvd | MsgSent | TblVer | InQ | OutQ | Up/Down | St/PfxRcd |
|----------|-----|------|---------|---------|--------|-----|------|----------|-----------|
| 2.2.0.7 | 0 | 2 | 106312 | 101563 | 0 | 0 | 0 | 1d21h | 0 |
| 2.2.69.6 | 0 | 1002 | 108429 | 100503 | 6635 | 0 | 0 | 01:30:26 | 7 |

RP/0/0/CPU0:R9#show bgp ipv6 unicast summary

| Neighbor | Spk | AS | MsgRcvd | MsgSent | TblVer | InQ | OutQ | Up/Down | St/PfxRcd |
|----------------|-----|------|---------|---------|--------|-----|------|----------|-----------|
| 2002:2:2::7 | 0 | 2 | 104763 | 95205 | 4 | 0 | 0 | 1d21h | 1 |
| 2002:2:2:69::6 | 0 | 1002 | 101 | 92 | 4 | 0 | 0 | 01:27:59 | 1 |

BGP Routes

R6#show ip route bgp

B 2.2.0.7/32 [20/0] via 2.2.69.9, 01:25:50

B 2.2.0.9/32 [20/0] via 2.2.69.9, 01:25:50

R6#show ipv6 route bgp

B 2002:2:2::7/128 [20/0] via FE80::213:7FFF:FEE1:C551, Ethernet0/1

B 2002:2:2::9/128 [20/0] via FE80::213:7FFF:FEE1:C551, Ethernet0/1

RP/0/0/CPU0:R9#show route ipv4 bgp

B 2.2.0.6/32 [20/20] via 2.2.69.6, 01:25:25

RP/0/0/CPU0:R9#show route ipv6 bgp

B 2002:2:2::6/128

[20/0] via fe80::c00:ff:fe00:3c10, 01:35:31, GigabitEthernet0/2/0/1.69

R7#show ip route bgp

B 2.2.0.6/32 [200/20] via 2.2.0.9, 01:29:36

R7#show ipv6 route bgp

B 2002:2:2::6/128 [200/0]

via 2002:2:2::9

Connectivity Verification

R6#ping 2.2.0.9 source loopback 0

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2.2.0.9, timeout is 2 seconds:

Packet sent with a source address of 2.2.0.6

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/10/12 ms

R6#ping 2002:2:2::9 source loopback 0

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2002:2:2::9, timeout is 2 seconds:

Packet sent with a source address of 2002:2:2::6

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/8/12 ms

R6#ping 2.2.0.7 source loopback 0

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2.2.0.7, timeout is 2 seconds:

Packet sent with a source address of 2.2.0.6

!!!!

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

R6#ping 2002:2:2::7 source loopback 0

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2002:2:2::7, timeout is 2 seconds:

Packet sent with a source address of 2002:2:2::6

!!!!

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



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