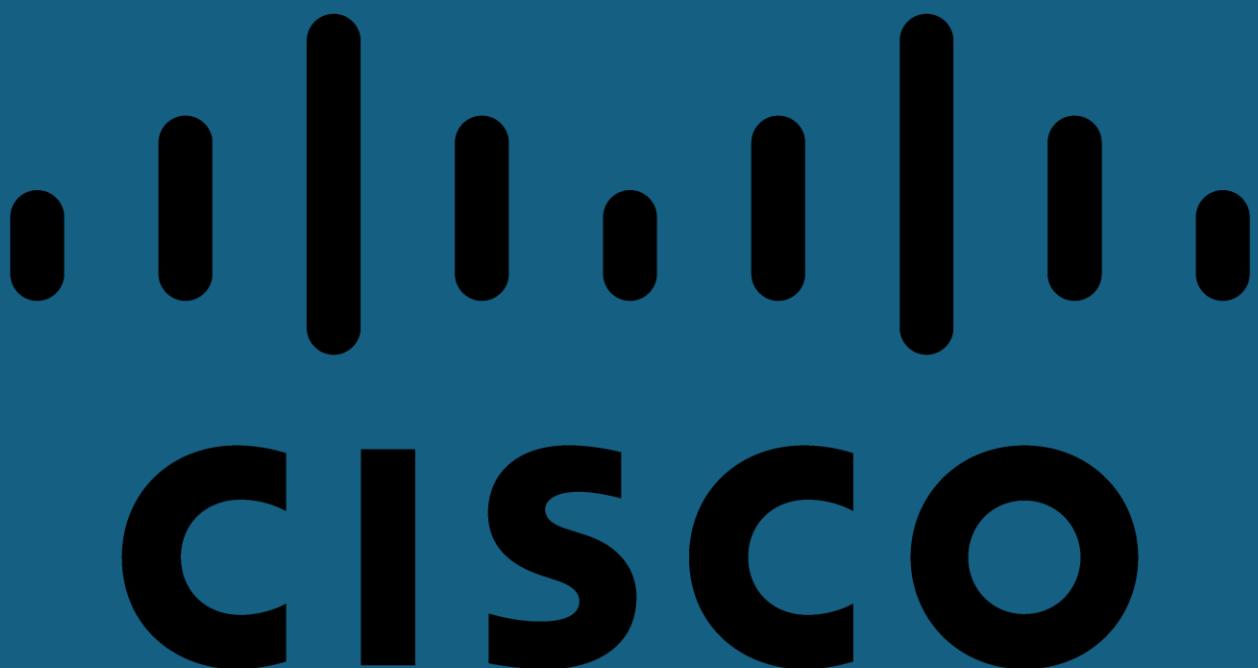


2024-2025 LAB PORTFOLIO



Liu, Charles

NEWPORT CISCO NETWORKING ACADEMY

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Configuring Multi-Area OSPF

ADVANCED CISCO PERIOD 3-4
LIU, CHARLES

Purpose

The purpose of Open Shortest Path First protocol is to optimize network efficiency by improving the scalability of the network and make it more manageable by creating smaller areas that can be better managed. This makes it extremely important for large networks like networks for companies. In this lab, we configured multi-area OSPF on 5 routers, 1 multilayer switch, and 2 end devices, creating extremely efficient routes for data that is transmitted from one end of the network to another.

Background Information on lab concepts

The goal of our lab was to create a network that can use OSPF. OSPF is an example of a routing protocol, which determines the exact path that packets will take to reach their destination. Some examples of routing protocols include RIP, IS-IS, OSPF, and EIGRP. OSPF is one of the most efficient routing protocols, which is why it is so commonly used and configured in real life situations.

Open Shortest Path First is a routing protocol in which routers identify the best way to transmit a packet to its destination. Routers will send Hello Packets to discover OSPF neighbors, who they will establish adjacencies with. They will then run calculations to find the shortest path possible, and then propagate routes to the routing table for future use. OSPF networks are broken down into areas which makes the network more manageable and scalable.

By calculating optimal paths for packets, OSPF is very efficient in sending packets in the network to its destination because it always takes the shortest and most efficient route. This is another reason why OSPF has an administrative distance of 110, with only a few other routing protocols with a shorter one.

Additionally, we used a multilayer switch in our topology which acts as a router as well as a switch, making it extremely useful for sending packets and layer 2 MAC addresses. The other routers used were all configured to run optimally.

Lab Summary

We were able to configure multi-Area OSPF on 4 routers and a multi-layer switch, ultimately creating a network that allows for pings across the network from 2 end devices. The 2 desktops that we used to configure the devices with through puTTY were able to send packets to each other. This successfully creates a network that uses the open shortest path first routing protocol in OSPF.

Lab Commands

Router0 Configuration (R0 - Area 0)

IPv4 Addresses:

G0/0/0: 192.168.0.1/24 (to Tashfeen - PC0)

G0/0/1: 192.168.1.1/30 (to Router1)

IPv6 Addresses:

```
G0/0/0: 2001:db8:0:0::1/64 (to Tashfeen - PC0)
G0/0/1: 2001:db8:0:1::1/126 (to Router1)
enable
configure terminal
```

```
# Enable OSPF for IPv4
router ospf 1
router-id 1.1.1.1
network 192.168.0.0 0.0.0.255 area 0
network 192.168.1.0 0.0.0.3 area 0
```

```
# Enable OSPF for IPv6
ipv6 unicast-routing
ipv6 router ospf 1
router-id 1.1.1.1
```

```
# Configure interfaces for OSPFv2 and OSPFv3
interface GigabitEthernet0/0/0
ip address 192.168.0.1 255.255.255.0
ipv6 address 2001:db8:0:0::1/64
ip ospf 1 area 0
ipv6 ospf 1 area 0
no shutdown
```

```
interface GigabitEthernet0/0/1
ip address 192.168.1.1 255.255.255.252
ipv6 address 2001:db8:0:1::1/126
ip ospf 1 area 0
ipv6 ospf 1 area 0
no shutdown
exit
```

Router1 Configuration (R1 - Area 0)

IPv4 Addresses:

G0/0/0: 192.168.1.2/30 (to Router0)

G0/0/1: 192.168.2.1/30 (to Router2)

IPv6 Addresses:

G0/0/0: 2001:db8:0:1::2/126 (to Router0)

G0/0/1: 2001:db8:0:2::1/126 (to Router2)

enable

configure terminal

```
# Enable OSPF for IPv4
```

```

router ospf 1
router-id 2.2.2.2
network 192.168.1.0 0.0.0.3 area 0
network 192.168.2.0 0.0.0.3 area 0

# Enable OSPF for IPv6
ipv6 unicast-routing
ipv6 router ospf 1
router-id 2.2.2.2

# Configure interfaces for OSPFv2 and OSPFv3
interface GigabitEthernet0/0/0
ip address 192.168.1.2 255.255.255.252
ipv6 address 2001:db8:0:1::2/126
ip ospf 1 area 0
ipv6 ospf 1 area 0
no shutdown

interface GigabitEthernet0/0/1
ip address 192.168.2.1 255.255.255.252
ipv6 address 2001:db8:0:2::1/126
ip ospf 1 area 0
ipv6 ospf 1 area 0
no shutdown
exit

```

Router2 Configuration (R2 - Area 0)

IPv4 Addresses:

G0/0/0: 192.168.2.2/30 (to Router1)

G0/0/1: 192.168.3.1/30 (to Router3)

IPv6 Addresses:

G0/0/0: 2001:db8:0:2::2/126 (to Router1)

G0/0/1: 2001:db8:0:3::1/126 (to Router3)

enable

configure terminal

```

# Enable OSPF for IPv4
router ospf 1
router-id 3.3.3.3
network 192.168.2.0 0.0.0.3 area 0
network 192.168.3.0 0.0.0.3 area 0

```

```

# Enable OSPF for IPv6
ipv6 unicast-routing
ipv6 router ospf 1
router-id 3.3.3.3

# Configure interfaces for OSPFv2 and OSPFv3
interface GigabitEthernet0/0/0
ip address 192.168.2.2 255.255.255.252
ipv6 address 2001:db8:0:2::2/126
ip ospf 1 area 0
ipv6 ospf 1 area 0
no shutdown

interface GigabitEthernet0/0/1
ip address 192.168.3.1 255.255.255.252
ipv6 address 2001:db8:0:3::1/126
ip ospf 1 area 0
ipv6 ospf 1 area 0
no shutdown
exit

```

Router3 Configuration (R3 - Area 2)

IPv4 Addresses:

G0/0/0: 192.168.3.2/30 (to Router2)

G0/0/1: 192.168.4.1/30 (to Router4)

IPv6 Addresses:

G0/0/0: 2001:db8:0:3::2/126 (to Router2)

G0/0/1: 2001:db8:0:4::1/126 (to Router4)

enable

configure terminal

Enable OSPF for IPv4

router ospf 1

router-id 4.4.4.4

network 192.168.3.0 0.0.0.3 area 2

network 192.168.4.0 0.0.0.3 area 2

Enable OSPF for IPv6

ipv6 unicast-routing

ipv6 router ospf 1

router-id 4.4.4.4

```
# Configure interfaces for OSPFv2 and OSPFv3
interface GigabitEthernet0/0/0
ip address 192.168.3.2 255.255.255.252
ipv6 address 2001:db8:0:3::2/126
ip ospf 1 area 2
ipv6 ospf 1 area 2
no shutdown

interface GigabitEthernet0/0/1
ip address 192.168.4.1 255.255.255.252
ipv6 address 2001:db8:0:4::1/126
ip ospf 1 area 2
ipv6 ospf 1 area 2
no shutdown
exit
```

Router4 Configuration (R4 - Area 2)

IPv4 Addresses:

G0/0/0: 192.168.4.2/30 (to Router3)
G0/0/1: 192.168.5.1/30 (to Switch - S1)

IPv6 Addresses:

G0/0/0: 2001:db8:0:4::2/126 (to Router3)
G0/0/1: 2001:db8:0:5::1/126 (to Switch - S1)

```
enable
configure terminal
```

```
# Enable OSPF for IPv4
router ospf 1
router-id 5.5.5.5
network 192.168.4.0 0.0.0.3 area 2
network 192.168.5.0 0.0.0.3 area 2
```

```
# Enable OSPF for IPv6
ipv6 unicast-routing
ipv6 router ospf 1
router-id 5.5.5.5
```

```
# Configure interfaces for OSPFv2 and OSPFv3
interface GigabitEthernet0/0/0
ip address 192.168.4.2 255.255.255.252
ipv6 address 2001:db8:0:4::2/126
```

```
ip ospf 1 area 2
ipv6 ospf 1 area 2
no shutdown

interface GigabitEthernet0/0/1
ip address 192.168.5.1 255.255.255.252
ipv6 address 2001:db8:0:5::1/126
ip ospf 1 area 2
ipv6 ospf 1 area 2
no shutdown
exit
```

Catalyst 3560 Configuration (S1 - Area 2)

IPv4 Addresses:

FastEthernet0/1: 192.168.5.2/30 (to Router4)

FastEthernet0/2: 192.168.6.1/24 (to PC1 - Charles)

IPv6 Addresses:

FastEthernet0/1: 2001:db8:0:5::2/126 (to Router4)

FastEthernet0/2: 2001:db8:0:6::1/64 (to PC1 - Charles)

enable

configure terminal

```
# Enable IPv4 and IPv6 routing
```

```
ip routing
```

```
ipv6 unicast-routing
```

```
# Enable OSPF for IPv4
```

```
router ospf 1
```

```
router-id 6.6.6.6
```

```
network 192.168.5.0 0.0.0.3 area 2
```

```
network 192.168.6.0 0.0.0.255 area 2
```

```
# Enable OSPF for IPv6
```

```
ipv6 router ospf 1
```

```
router-id 6.6.6.6
```

```
# Configure interfaces for OSPFv2 and OSPFv3
```

```
interface FastEthernet0/1
```

```
no switchport
```

```
ip address 192.168.5.2 255.255.255.252
```

```
ipv6 address 2001:db8:0:5::2/126
```

```
ip ospf 1 area 2
```

```
ipv6 ospf 1 area 2
```

no shutdown

```
interface FastEthernet0/2
no switchport
ip address 192.168.6.1 255.255.255.0
ipv6 address 2001:db8:0:6::1/64
no shutdown
Exit
```

PC Configuration (Tashfeen - PC0 and Charles - PC1)

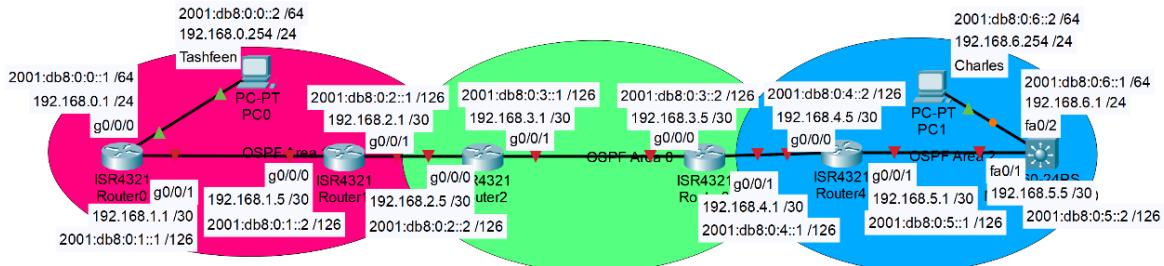
PC0 (Tashfeen):

IPv4 Address: 192.168.0.254/24
IPv6 Address: 2001:db8:0:0::2/64

PC1 (Charles):

IPv4 Address: 192.168.6.254
IPv6 Address: 2001:db8:0:6::2/64

Network Diagram with IP's



Configurations

R0(Text)

Building configuration..

```
Current configuration : 3891 bytes
Last configuration change at 16:19:49 UTC Mon Sep 23 2024
version 16.9
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80
```

```
platform punt-keepalive disable-kernel-core
hostname R0!
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
login on-success log
subscriber templating
vtp domain cisco
vtp mode transparent
ipv6 unicast-routing
multilink bundle-name authenticated
crypto pki trustpoint TP-self-signed-859896477
enrollment selfsigned
subject-name cn=IOS-Self-Signed-Certificate-859896477
revocation-check none
rsakeypair TP-self-signed-859896477
crypto pki certificate chain TP-self-signed-859896477
certificate self-signed 01
3082032E 30820216 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
30312E30 2C060355 04031325 494F532D 53656C66 2D536967 6E65642D 43657274
69666963 6174652D 38353938 39363437 37301E17 0D323430 39323331 35323932
355A170D 33303031 30313030 30303030 5A303031 2E302C06 03550403 1325494F
532D5365 6C662D53 69676E65 642D4365 72746966 69636174 652D3835 39383936
34373730 82012230 0D06092A 864886F7 0D010101 05000382 010F0030 82010A02
82010100 D44286A1 DE502712 DCED7C03 F15F68F0 9133D470 28990D1C 4CDC93DE
D5F4DE7D 2CAB2D15 25CD17E0 2C5B90A5 9012EAA5 6E0C8677 D8DF274E A297F341
AE666CAC A0989B65 17013E2B AE2CB467 7573F01C 9F63F9DA 807C2F60 B38E1E2F
714C6169 4F2BE12F 896EB299 B6AC52A4 4CD5CB17 7722D965 73A93AFC 47141C23
12ACD498 3EE6B333 454A59DE 90D467B2 477E6373 F4A7E189 EE4B2FBB BB4E2612
049853F1 9821EF8C DFAE8C4E 2877D72A D538F8A2 7DA8E73E FF6A1F55 CF924D8E
6DAD6CB1 3AE3F743 FE52981C 905A4E72 2A906620 2FD9C84C 78E4B3EF EF458646
F54BADD4 06EE80C3 D84494B8 DB50D060 4E69800F 191C4B07 F77B1538 07EDAE30
70BE71A3 02030100 01A35330 51300F06 03551D13 0101FF04 05300301 01FF301F
0603551D 23041830 16801411 56127FAB AF4B8386 1C7BA308 9D8346FF CD37C030
1D060355 1D0E0416 04141156 127FABA 4B83861C 7BA3089D 8346FFCD 37C0300D
06092A86 4886F70D 01010505 00038201 0100A994 EF765B48 653F7D97 C226D8FA
9C08095B B5F2A61A 022FE399 62A8E146 CE68FE81 9DFD9371 2D11084D 60D3A49C
91C1C57C 1A3EDA35 02EAA416 6B3B5571 63995FB7 2BD2EBC3 42790995 D3050504
38ACB400 7123C880 58BD591F 57501B05 E852E6C0 424CF241 F348E948 83B96139
```

F4FEE9F5 6118A0E3 4FE9B6EC 97774C50 CACBEDCA 959BC21E 4A277BCD 0370AB6E
8DDC686F CE2EED1D 86535975 66685BC6 326C951F 5E929C69 1FC8F8CA 8F732D76
D5A2BEBF 4A2C3237 9AE43F43 064E92A4 E08B8C97 AD9C3206 465F60B9 F4986936
4B422EB4 CBCF22FB 085C82E7 D34AC1FF 666F1978 88AB911F C15EECB3 023EC5E9
8F925C27 A5762D27 37A95B58 166F2974 212A

Quit

license udi pid ISR4321/K9 sn FLM240608PJ

no license smart enable

diagnostic bootup level minimal

!

spanning-tree extend system-id

redundancy

mode none

interface GigabitEthernet0/0/0

ip address 192.168.0.1 255.255.255.0

ip ospf 1 area 1

negotiation auto

ipv6 address 2001:DB8:0:0::1/64

ipv6 ospf 1 area 1

interface GigabitEthernet0/0/1

ip address 192.168.1.1 255.255.255.252

ip ospf 1 area 1

negotiation auto

interface GigabitEthernet0/1/0

no ip address

negotiation auto

interface GigabitEthernet0/1/1

no ip address

negotiation auto

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

router ospf 1

router-id 1.1.1.1

network 192.168.0.0 0.0.0.255 area 1

network 192.168.1.0 0.0.0.3 area 1

ip forward-protocol nd

ip http server

ip http authentication local

ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router ospf 1

```
control-plane
line con 0
logging synchronous
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

R1(Text)

```
Building configuration...
Current configuration : 4030 bytes
! Last configuration change at 16:20:13 UTC Mon Sep 23 2024
version 16.9
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80
platform punt-keepalive disable-kernel-core
hostname R2
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
login on-success log
subscriber templating
vtp domain cisco
vtp mode transparent
ipv6 unicast-routing
multilink bundle-name authenticated
crypto pki trustpoint TP-self-signed-4288135047
enrollment selfsigned
subject-name cn=IOS-Self-Signed-Certificate-4288135047
revocation-check none
rsakeypair TP-self-signed-4288135047
crypto pki certificate chain TP-self-signed-4288135047
certificate self-signed 01
```

30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274
69666963 6174652D 34323838 31333530 3437301E 170D3234 30393233 31353130
33365A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649
4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D34 32383831
33353034 37308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201
0A028201 0100C30E 3476F02C 27A2E74A 19DC77FD F85842FE 01AF9F63 017F8624
484DB384 3DFA7112 971B8528 9FEF60ED AD862E78 745F2494 F466FBB1 E088CC7B
71101284 AC004A67 B71C2822 47C11D84 6DD2C1E8 96D9BF2E 3BF24C96 3383681E
1D1CFCE5 E1932C84 D4DC11C2 0613AF04 16BC47BF E80B144C 1DAA2D1B E1BD3296
D082D162 B5890D26 5723DD1F AAC45A6D 7C027CDB D013CF5F 31AE3D3F 95227C7D
73A4BD2A B5C6A825 49F55D89 59835C43 50B044F8 FB57DF5D 2ED818C8 9000BADE
A843C53D 331678FF DA67C297 0F45A67B 7408C8CD D29DD428 67209BAB C759F366
050B9388 7E3280A0 1974CED9 50461D1B F15C5DD5 92FCEF95 46A613B4 38E37D9E
ED466A8F 9ED30203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF
301F0603 551D2304 18301680 14616F84 A87B55F0 1236983F 2F49F280 11A543C0
BB301D06 03551D0E 04160414 616F84A8 7B55F012 36983F2F 49F28011 A543C0BB
300D0609 2A864886 F70D0101 05050003 82010100 081867DF F328EDFD B5237EFC
9936633E CC0097AC 4C38322C ABA82F68 519B2463 529697E0 31C9CE3C 038120F9
2842A1CB EA86C7EE 2B0DC545 64155C92 EFE3A370 51723DA8 4D981E9A 9FD162C8
6ACB206B ADD3B62B D19501C7 8067DEF3 B89A66A3 A3CF189F 86D780C7 6618D0C8
2D81B029 46D500D8 E453B33E 5C49CA05 5B3A8C93 52A17A81 D62A61D7 EA85F07E
D3968F96 EC4846A4 8DFBFFC8 C72ACFA4 E32C7187 09F5F02E 64F6A08B 1DA114B4
4620F650 5FC09333 249524D4 A1BBF7C7 9DA281F8 89A9CEB9 1B9AA832 8F52DEB3
86A66071 115F2C05 BEF23192 5509F5E9 F97D8752 44711BCE 1C414CF4 EE3B511A
86EEB117 8E5F2B1B 4ED6F0C2 CCECD671 9B0CF223

quit

license udi pid ISR4321/K9 sn FLM2406090M

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface GigabitEthernet0/0/0

ip address 192.168.1.2 255.255.255.252

ip ospf 1 area 0

negotiation auto

ipv6 address 2001:DB8:0:1::2/126

ipv6 ospf 1 area 0

interface GigabitEthernet0/0/1

ip address 192.168.2.1 255.255.255.252

ip ospf 1 area 0

negotiation auto

ipv6 address 2001:DB8:0:2::1/64

```
ipv6 ospf 1 area 0
interface GigabitEthernet0/1/0
no ip address
shutdown
negotiation auto
interface GigabitEthernet0/1/1
no ip address
shutdown
negotiation auto
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
router ospf 1
network 192.168.2.0 0.0.0.3 area 0
network 192.168.1.0 0.0.0.3 area 0
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
ip tftp source-interface GigabitEthernet0
ipv6 router ospf 1
control-plane
line con 0
logging synchronous
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

R2(Text)

Building configuration...
Current configuration : 4030 bytes
Last configuration change at 16:20:13 UTC Mon Sep 23 2024
version 16.9
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80

```
platform punt-keepalive disable-kernel-core
hostname R2
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
login on-success log
subscriber templating
vtp domain cisco
vtp mode transparent
ipv6 unicast-routing
multilink bundle-name authenticated
crypto pki trustpoint TP-self-signed-4288135047
enrollment selfsigned
subject-name cn=IOS-Self-Signed-Certificate-4288135047
revocation-check none
rsakeypair TP-self-signed-4288135047
crypto pki certificate chain TP-self-signed-4288135047
certificate self-signed 01
30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274
69666963 6174652D 34323838 31333530 3437301E 170D3234 30393233 31353130
33365A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649
4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D34 32383831
33353034 37308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201
0A028201 0100C30E 3476F02C 27A2E74A 19DC77FD F85842FE 01AF9F63 017F8624
484DB384 3DFA7112 971B8528 9fef60ed AD862E78 745F2494 F466FBB1 E088CC7B
71101284 AC004A67 B71C2822 47C11D84 6DD2C1E8 96D9BF2E 3BF24C96 3383681E
1D1CFCE5 E1932C84 D4DC11C2 0613AF04 16BC47BF E80B144C 1DAA2D1B E1BD3296
D082D162 B5890D26 5723DD1F AAC45A6D 7C027CDB D013CF5F 31AE3D3F 95227C7D
73A4BD2A B5C6A825 49F55D89 59835C43 50B044F8 FB57DF5D 2ED818C8 9000BADE
A843C53D 331678FF DA67C297 0F45A67B 7408C8CD D29DD428 67209BAB C759F366
050B9388 7E3280A0 1974CED9 50461D1B F15C5DD5 92FCEF95 46A613B4 38E37D9E
ED466A8F 9ED30203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF
301F0603 551D2304 18301680 14616F84 A87B55F0 1236983F 2F49F280 11A543C0
BB301D06 03551D0E 04160414 616F84A8 7B55F012 36983F2F 49F28011 A543C0BB
300D0609 2A864886 F70D0101 05050003 82010100 081867DF F328EDFD B5237EFC
9936633E CC0097AC 4C38322C ABA82F68 519B2463 529697E0 31C9CE3C 038120F9
2842A1CB EA86C7EE 2B0DC545 64155C92 EFE3A370 51723DA8 4D981E9A 9FD162C8
6ACB206B ADD3B62B D19501C7 8067DEF3 B89A66A3 A3CF189F 86D780C7 6618D0C8
```

2D81B029 46D500D8 E453B33E 5C49CA05 5B3A8C93 52A17A81 D62A61D7 EA85F07E
D3968F96 EC4846A4 8DFBFFC8 C72ACFA4 E32C7187 09F5F02E 64F6A08B 1DA114B4
4620F650 5FC09333 249524D4 A1BBF7C7 9DA281F8 89A9CEB9 1B9AA832 8F52DEB3
86A66071 115F2C05 BEF23192 5509F5E9 F97D8752 44711BCE 1C414CF4 EE3B511A
86EEB117 8E5F2B1B 4ED6F0C2 CCECD671 9B0CF223

quit

license udi pid ISR4321/K9 sn FLM2406090M

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface GigabitEthernet0/0/0

ip address 192.168.2.2 255.255.255.252

ip ospf 1 area 0

negotiation auto

ipv6 address 2001:DB8:0:2::2/126

ipv6 ospf 1 area 0

interface GigabitEthernet0/0/1

ip address 192.168.3.1 255.255.255.252

ip ospf 1 area 0

negotiation auto

ipv6 address 2001:DB8:0:3::1/64

ipv6 ospf 1 area 0

interface GigabitEthernet0/1/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/1/1

no ip address

shutdown

negotiation auto

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

router ospf 1

network 192.168.2.0 0.0.0.3 area 0

network 192.168.3.0 0.0.0.3 area 0

ip forward-protocol nd

ip http server

ip http authentication local

ip http secure-server

```
ip tftp source-interface GigabitEthernet0
ipv6 router ospf 1
control-plane
line con 0
logging synchronous
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

R3(Text)

```
Building configuration...
Current configuration : 4030 bytes
Last configuration change at 16:20:13 UTC Mon Sep 23 2024
version 16.9
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80
platform punt-keepalive disable-kernel-core
hostname R2
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
login on-success log
subscriber templating
vtp domain cisco
vtp mode transparent
ipv6 unicast-routing
multilink bundle-name authenticated
crypto pki trustpoint TP-self-signed-4288135047
enrollment selfsigned
subject-name cn=IOS-Self-Signed-Certificate-4288135047
revocation-check none
rsakeypair TP-self-signed-4288135047
crypto pki certificate chain TP-self-signed-4288135047
```

certificate self-signed 01
30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274
69666963 6174652D 34323838 31333530 3437301E 170D3234 30393233 31353130
33365A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649
4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D34 32383831
33353034 37308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201
0A028201 0100C30E 3476F02C 27A2E74A 19DC77FD F85842FE 01AF9F63 017F8624
484DB384 3DFA7112 971B8528 9FEF60ED AD862E78 745F2494 F466FBB1 E088CC7B
71101284 AC004A67 B71C2822 47C11D84 6DD2C1E8 96D9BF2E 3BF24C96 3383681E
1D1CFCE5 E1932C84 D4DC11C2 0613AF04 16BC47BF E80B144C 1DAA2D1B E1BD3296
D082D162 B5890D26 5723DD1F AAC45A6D 7C027CDB D013CF5F 31AE3D3F 95227C7D
73A4BD2A B5C6A825 49F55D89 59835C43 50B044F8 FB57DF5D 2ED818C8 9000BADE
A843C53D 331678FF DA67C297 0F45A67B 7408C8CD D29DD428 67209BAB C759F366
050B9388 7E3280A0 1974CED9 50461D1B F15C5DD5 92FCEF95 46A613B4 38E37D9E
ED466A8F 9ED30203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF
301F0603 551D2304 18301680 14616F84 A87B55F0 1236983F 2F49F280 11A543C0
BB301D06 03551D0E 04160414 616F84A8 7B55F012 36983F2F 49F28011 A543C0BB
300D0609 2A864886 F70D0101 05050003 82010100 081867DF F328EDFD B5237EFC
9936633E CC0097AC 4C38322C ABA82F68 519B2463 529697E0 31C9CE3C 038120F9
2842A1CB EA86C7EE 2B0DC545 64155C92 EFE3A370 51723DA8 4D981E9A 9FD162C8
6ACB206B ADD3B62B D19501C7 8067DEF3 B89A66A3 A3CF189F 86D780C7 6618D0C8
2D81B029 46D500D8 E453B33E 5C49CA05 5B3A8C93 52A17A81 D62A61D7 EA85F07E
D3968F96 EC4846A4 8DFBFFC8 C72ACFA4 E32C7187 09F5F02E 64F6A08B 1DA114B4
4620F650 5FC09333 249524D4 A1BBF7C7 9DA281F8 89A9CEB9 1B9AA832 8F52DEB3
86A66071 115F2C05 BEF23192 5509F5E9 F97D8752 44711BCE 1C414CF4 EE3B511A
86EEB117 8E5F2B1B 4ED6F0C2 CCECD671 9B0CF223

quit

license udi pid ISR4321/K9 sn FLM2406090M

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface GigabitEthernet0/0/0

ip address 192.168.2.2 255.255.255.252

ip ospf 1 area 0

negotiation auto

ipv6 address 2001:DB8:0:2::2/126

ipv6 ospf 1 area 0

interface GigabitEthernet0/0/1

ip address 192.168.3.1 255.255.255.252

ip ospf 1 area 0

negotiation auto

```
ipv6 address 2001:DB8:0:3::1/64
ipv6 ospf 1 area 0
interface GigabitEthernet0/1/0
no ip address
shutdown
negotiation auto
interface GigabitEthernet0/1/1
no ip address
shutdown
negotiation auto
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
router ospf 1
network 192.168.2.0 0.0.0.3 area 0
network 192.168.3.0 0.0.0.3 area 0
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
ip tftp source-interface GigabitEthernet0
ipv6 router ospf 1
control-plane
line con 0
logging synchronous
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

R4(Text)

Building configuration...

Current configuration : 4030 bytes

Last configuration change at 16:20:13 UTC Mon Sep 23 2024

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

```
platform qfp utilization monitor load 80
platform punt-keepalive disable-kernel-core
hostname R2
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
login on-success log
subscriber templating
vtp domain cisco
vtp mode transparent
ipv6 unicast-routing
multilink bundle-name authenticated
crypto pki trustpoint TP-self-signed-4288135047
enrollment selfsigned
subject-name cn=IOS-Self-Signed-Certificate-4288135047
revocation-check none
rsakeypair TP-self-signed-4288135047
crypto pki certificate chain TP-self-signed-4288135047
certificate self-signed 01
30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274
69666963 6174652D 34323838 31333530 3437301E 170D3234 30393233 31353130
33365A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649
4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D34 32383831
33353034 37308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201
0A028201 0100C30E 3476F02C 27A2E74A 19DC77FD F85842FE 01AF9F63 017F8624
484DB384 3DFA7112 971B8528 9FEF60ED AD862E78 745F2494 F466FBB1 E088CC7B
71101284 AC004A67 B71C2822 47C11D84 6DD2C1E8 96D9BF2E 3BF24C96 3383681E
1D1CFCE5 E1932C84 D4DC11C2 0613AF04 16BC47BF E80B144C 1DAA2D1B E1BD3296
D082D162 B5890D26 5723DD1F AAC45A6D 7C027CDB D013CF5F 31AE3D3F 95227C7D
73A4BD2A B5C6A825 49F55D89 59835C43 50B044F8 FB57DF5D 2ED818C8 9000BADE
A843C53D 331678FF DA67C297 0F45A67B 7408C8CD D29DD428 67209BAB C759F366
050B9388 7E3280A0 1974CED9 50461D1B F15C5DD5 92FCEF95 46A613B4 38E37D9E
ED466A8F 9ED30203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF
301F0603 551D2304 18301680 14616F84 A87B55F0 1236983F 2F49F280 11A543C0
BB301D06 03551D0E 04160414 616F84A8 7B55F012 36983F2F 49F28011 A543C0BB
300D0609 2A864886 F70D0101 05050003 82010100 081867DF F328EDFD B5237EFC
9936633E CC0097AC 4C38322C ABA82F68 519B2463 529697E0 31C9CE3C 038120F9
2842A1CB EA86C7EE 2B0DC545 64155C92 EFE3A370 51723DA8 4D981E9A 9FD162C8
```

6ACB206B ADD3B62B D19501C7 8067DEF3 B89A66A3 A3CF189F 86D780C7 6618D0C8
2D81B029 46D500D8 E453B33E 5C49CA05 5B3A8C93 52A17A81 D62A61D7 EA85F07E
D3968F96 EC4846A4 8DFBFFC8 C72ACFA4 E32C7187 09F5F02E 64F6A08B 1DA114B4
4620F650 5FC09333 249524D4 A1BBF7C7 9DA281F8 89A9CEB9 1B9AA832 8F52DEB3
86A66071 115F2C05 BEF23192 5509F5E9 F97D8752 44711BCE 1C414CF4 EE3B511A
86EEB117 8E5F2B1B 4ED6F0C2 CCECD671 9B0CF223

quit

license udi pid ISR4321/K9 sn FLM2406090M

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface GigabitEthernet0/0/0

ip address 192.168.4.2 255.255.255.252

ip ospf 1 area 0

negotiation auto

ipv6 address 2001:DB8:0:4::2/126

ipv6 ospf 1 area 0

interface GigabitEthernet0/0/1

ip address 192.168.5.1 255.255.255.252

ip ospf 1 area 0

negotiation auto

ipv6 address 2001:DB8:0:5::1/64

ipv6 ospf 1 area 0

interface GigabitEthernet0/1/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/1/1

no ip address

shutdown

negotiation auto

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

router ospf 1

network 192.168.4.0 0.0.0.3 area 2

network 192.168.5.0 0.0.0.3 area 2

ip forward-protocol nd

ip http server

ip http authentication local

```
ip http secure-server
ip tftp source-interface GigabitEthernet0
ipv6 router ospf 1
control-plane
line con 0
logging synchronous
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

SW1(text)

Building configuration...

```
Current configuration : 4277 bytes
!
version 12.2
no service pad
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname S1
!
boot-start-marker
boot-end-marker
!
!
!
!
no aaa new-model
system mtu routing 1500
authentication mac-move permit
ip subnet-zero
ip routing
!
!
ipv6 unicast-routing
!
```

!

crypto pki trustpoint TP-self-signed-1177695488

enrollment selfsigned

subject-name cn=IOS-Self-Signed-Certificate-1177695488

revocation-check none

rsakeypair TP-self-signed-1177695488

!

!

crypto pki certificate chain TP-self-signed-1177695488

certificate self-signed 01

3082023F 308201A8 A0030201 02020101 300D0609 2A864886 F70D0101 04050030

31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274

69666963 6174652D 31313737 36393534 3838301E 170D3933 30333031 30303031

30395A17 0D323030 31303130 30303030 305A3031 312F302D 06035504 03132649

4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D31 31373736

39353438 3830819F 300D0609 2A864886 F70D0101 01050003 818D0030 81890281

81009BA7 5D515ED9 A2A60CBD FEF3B307 42447A1F FF454570 8623B852 60BDB99C

E94A5557 07EAFFE6 E6AC5C9A1 D09D2C71 E67F5C33 0AE029E4 4F68FB96 D8227244

E0C6EF10 77F541C0 289A25E6 FE065345 0EB877E0 B484D28E 59F4DC84 475A26F1

AF972318 A0C7D9B5 95468F8C 819094DB 1BA32020 7AA35359 78E91238 EBFD7B15

71970203 010001A3 67306530 0F060355 1D130101 FF040530 030101FF 30120603

551D1104 0B300982 07537769 7463682E 301F0603 551D2304 18301680 14B2905D

FF7DEF6F F37AE97A 3E7E2453 E28D3222 E8301D06 03551D0E 04160414 B2905DFF

7DEF6FF3 7AE97A3E 7E2453E2 8D3222E8 300D0609 2A864886 F70D0101 04050003

81810013 CE796CD1 38436520 1A6F4A4F 20098202 59B8AF3A 69195984 0FE7EEDF

447DACC E48924CE 300EAEC4 25C60AD4 9FB80238 2B019025 9FC9DC7C 660B79DB

EF756F9B E37E8811 FE96DF02 55E1CF70 46900CDC 9C876A6B 09427470 1C29DD4C

DC6EC62B A564A013 6326CA1C CAB2E1D4 91EDF5EA EAB8E802 63461A20 DA278642

AE82AB

quit

!

!

!

spanning-tree mode pvst

spanning-tree etherchannel guard misconfig

spanning-tree extend system-id

!

vlan internal allocation policy ascending

!

!

!

!

interface FastEthernet0/1

no switchport

```
ip address 192.168.5.2 255.255.255.252
ip ospf 1 area 1
ipv6 address 2001:DB8:0:5::2/126
ipv6 ospf 1 area 1
!
interface FastEthernet0/2
no switchport
ip address 192.168.6.1 255.255.255.252
ip ospf 1 area 0
ipv6 address 2001:DB8:0:6::1/64
ipv6 ospf 1 area 0
interface FastEthernet0/3
interface FastEthernet0/4
interface FastEthernet0/5
interface FastEthernet0/6
interface FastEthernet0/7
interface FastEthernet0/8
interface FastEthernet0/9
interface FastEthernet0/10
interface FastEthernet0/11
interface FastEthernet0/12
interface FastEthernet0/13
interface FastEthernet0/14
interface FastEthernet0/15
interface FastEthernet0/16
interface FastEthernet0/17
interface FastEthernet0/18
interface FastEthernet0/19
interface FastEthernet0/20
interface FastEthernet0/21
interface FastEthernet0/22
interface FastEthernet0/23
interface FastEthernet0/24
interface FastEthernet0/25
interface FastEthernet0/26
interface FastEthernet0/27
interface FastEthernet0/28
interface FastEthernet0/29
interface FastEthernet0/30
interface FastEthernet0/31
interface FastEthernet0/32
interface FastEthernet0/33
interface FastEthernet0/34
interface FastEthernet0/35
```

```
interface FastEthernet0/36
interface FastEthernet0/37
interface FastEthernet0/38
interface FastEthernet0/39
interface FastEthernet0/40
interface FastEthernet0/41
interface FastEthernet0/42
interface FastEthernet0/43
interface FastEthernet0/44
interface FastEthernet0/45
interface FastEthernet0/46
interface FastEthernet0/47
interface FastEthernet0/48
interface GigabitEthernet0/1
interface GigabitEthernet0/2
interface GigabitEthernet0/3
interface GigabitEthernet0/4
interface Vlan1
no ip address
router ospf 1
router-id 6.6.6.6
log-adjacency-changes
network 192.168.5.0 0.0.0.255 area 2
network 192.168.6.0 0.0.0.255 area 2
ip classless
ip http server
ip http secure-server
ip sla enable reaction-alerts
ipv6 router ospf 1
log-adjacency-changes
line con 0
line vty 0 4
login
line vty 5 15
login
end
```

Problems

One of the main problems during this lab was communicating with my lab partner. We both were absent for some time, and it usually made it very difficult for the other person to keep working on the lab, meaning that we did not use all the time we could have. The other communication issue was that we changed our IP addresses many times, and that resulted in miscommunication while configuring the lab since the IP addresses sometimes conflicted with each other.

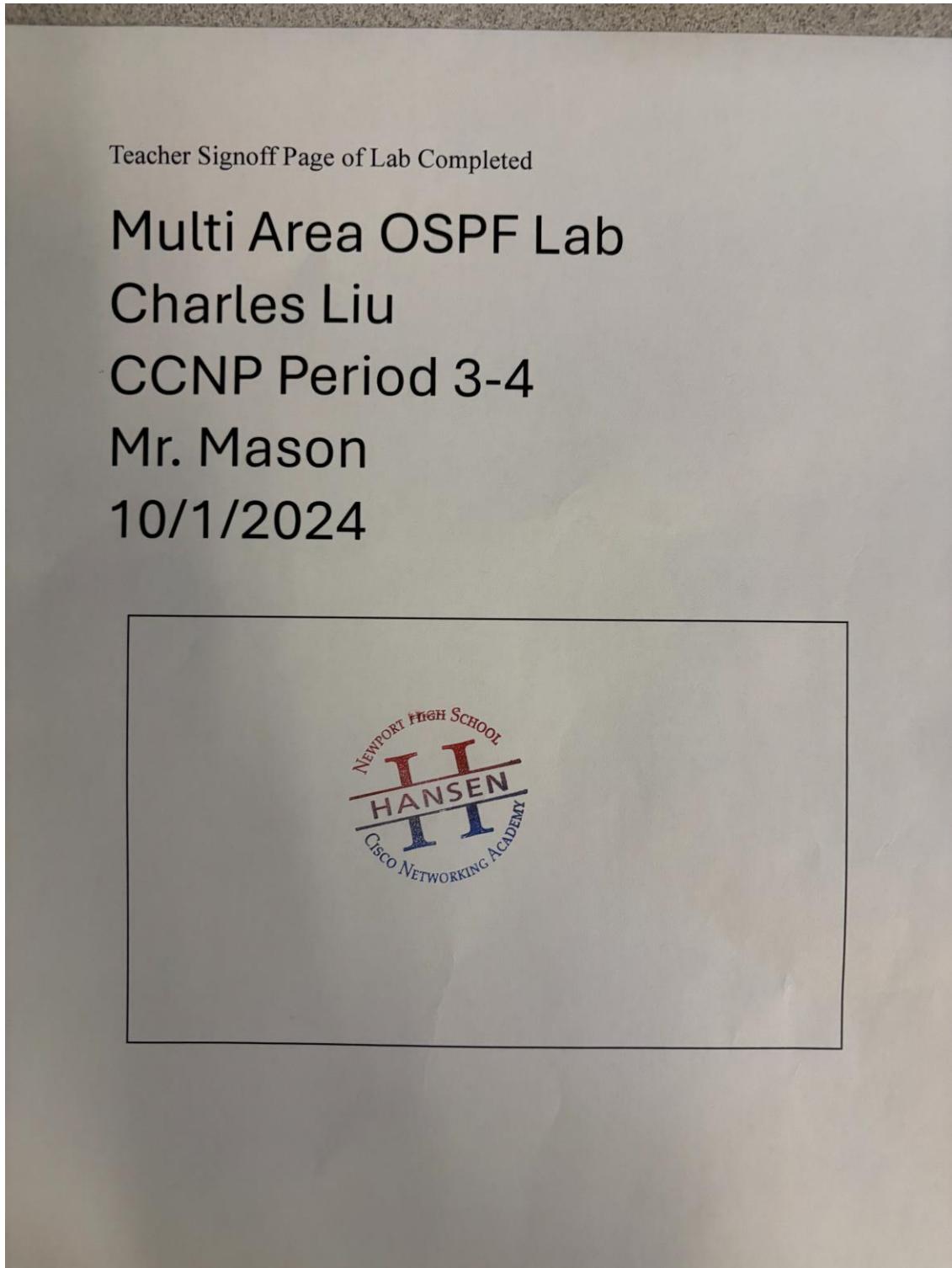
Specifically, we had issues with IPv6 subnetting which we could have simplified. We also had many issues switched IP addresses, which we couldn't solve sometimes, which made us restart a couple of times instead of deliberately working on trouble shooting because of time restraints.

If I were to do this lab again, I would work on a Packet Tracer network to double check commands and better prepare myself for actual configuration on the physical racks. We underestimated this lab's difficulty and by better planning we could have avoided a lot of the troubleshooting we had to do.

Conclusion

In conclusion, this lab allowed us to create a network that runs efficiently because of the routing protocol OSPF. There were many challenges regarding the IP addresses used and we learned many things about how to configure multi area OSPF instead of single area which we were already familiar with because of the CCNA course. This was a very good learning experience as now we were able to get a refresh on OSPF configuration and successfully create a network that works at an industry level.

Teacher Signoff Page of Lab Completed





Configuring a Multiprotocol Network with Interior BGP

ADVANCED CISCO PERIOD 3-4
LIU, CHARLES

Purpose

Having a multiprotocol network has many benefits. Mainly, it provides flexibility on how packets are transmitted throughout the network with many different strategies that lie in the types of routing protocols that are configured. Organizations with various routing protocols can have them suited for certain tasks without being locked into a single standard. Additionally, networks are more scalable as new technology and versions are released, ensuring that organizations can grow and increase their network capacity. Another benefit of creating a multiprotocol network is redundancy, where if one malfunctions, there would be others that can take over and provide an alternate path for data transmission. Specifically, iBGP routing allows for separation between interior and exterior routing, which is extremely beneficial for managing complex networks. By configuring this lab, we are learning vital skills in creating a network that would be used in professional settings with routing protocols that are applicable for real life networks.

Background Information on lab concepts

This network will be configured with 3 routing protocols. Routing protocols determine the exact path that packets will take to reach their destination. Some examples of routing protocols include RIP, IS-IS, OSPF, and EIGRP.

Open Shortest Path First (OSPF)

Open Shortest Path First is a routing protocol in which routers identify the best way to transmit a packet to its destination. Routers will send Hello Packets to discover OSPF neighbors, who they will establish adjacencies with. They will then run calculations to find the shortest path possible, and then propagate routes to the routing table for future use. OSPF networks are broken down into areas which makes the network more manageable and scalable.

By calculating optimal paths for packets, OSPF is very efficient in sending packets in the network to its destination because it always takes the shortest and most efficient route. This is another reason why OSPF has an administrative distance of 110, with only a few other routing protocols with a shorter one.

Enhanced Interior Gateway Routing Protocol (EIGRP)

Enhanced Interior Gateway Routing Protocol is a routing protocol that determines the best path for transmitting packets. Routers also use Hello packets to discover and set adjacencies. They then use Diffusing Update Algorithm (DUAL) to calculate the best path based on criteria like bandwidth, delay, and reliability.

EIGRP is both scalable and efficient, which is why it is used in many large networks. It is extremely flexible for many different uses. It maintains a routing and topology table, which

makes it easily adapt to changes in the network. It has an administrative distance of 90, being one of the most preferred routing protocols.

Border Gateway Protocol

Border Gateway Protocol is a protocol that is used to exchange routing information between autonomous systems on the internet. External BGP, or eBGP focuses on connections between different autonomous systems, which is what we are going to be using this lab. It uses the routing information to then determine the best path for data transmission.

eBGP routers establish sessions with TCP to make sure there is a stable connection. They then exchange routing updates with information like path information, which allows them to make educated decisions on how to route packets. eBGP is also scalable and resilient, and allows for networks to interconnect. Overall, eBGP is essential to creating robust and flexible connections between networks, meaning that it is significant in global, real world infrastructure.

Lab Summary

We were able to configure multi-protocol network on 7 routers, ultimately creating a network that allows for pings across the network from 2 end devices. The 2 desktops that we used to configure the devices with through puTTY were able to send packets to each other. This successfully creates a network that uses the OSPF, EIGRP, and BGP protocols.

Lab Commands

Router 1

```
en
conf t
hostname Router1
no ip domain lookup
ipv6 unicast-routing
int g0/0/0
ip add 192.168.2.2 255.255.255.0
ipv6 add 2::2/64
ipv6 ospf 1 area 1
no shut
exit
int g0/0/1
ip add 192.168.1.1 255.255.255.0
ipv6 add 1::1/64
ipv6 ospf 1 area 1
```

```
no shut
exit
router ospf 1
router-id 1.1.1.1
redistribute bgp 1
redistribute connected
network 192.168.1.0 0.0.0.255 area 1
network 192.168.2.0 0.0.0.255 area 1
ipv6 router ospf 1
redistribute connected
router bgp 1
redistribute ospf 1 metric 10
redistribute connected
```

Router 2

```
en
conf t
hostname Router2
no ip domain lookup
ipv6 unicast-routing
int g0/0/0
ip add 192.168.2.1 255.255.255.0
ipv6 add 2::1/64
ipv6 ospf 1 area 1
no shut
exit
int g0/0/1
ip add 192.168.3.1 255.255.255.0
ipv6 add 3::1/64
no shut
exit
router ospf 1
router-id 2.2.2.2
network 192.168.2.0 0.0.0.255 area 1
network 192.168.1.0 0.0.0.255 area 1
redistribute bgp 1
redistribute connected
ipv6 router ospf 1
router-id 2.2.2.2
redistribute connected
redistribute bgp 1
router bgp 1
bgp router-id 2.2.2.2
neighbor 192.168.3.2 remote-as 2
neighbor 3::2 remote-as 2
```

```
address-family ipv4
network 192.168.3.0 mask 255.255.255.0
redistribute connected
redistribute ospf 1 metric 10
neighbor 192.168.3.2 activate
address-family ipv6
network 3::0/64
redistribute connected
redistribute ospf 1 metric 10
neighbor 3::2 activate
```

Router 3

```
en
conf t
hostname Router3
no ip domain lookup
ipv6 unicast-routing
int g0/0/0
ip add 192.168.3.2 255.255.255.0
ipv6 add 3::2/64
ipv6 ospf 1 area 0
no shut
exit
int g0/0/1
ip add 192.168.4.1 255.255.255.0
ipv6 add 4::1/64
no shut
exit
router ospf 1
redistribute bgp 2
redistribute connected
network 192.168.4.0 0.0.0.255 area 0
router bgp 2
bgp router-id 3.3.3.3
neighbor 192.168.3.1 remote-as 1
neighbor 3::1 remote-as 1
address-family ipv4
network 192.168.3.0 mask 255.255.255.0
redistribute connected
redistribute ospf 1 metric 10
neighbor 192.168.3.1 activate
address-family ipv6
network 3::0/64
redistribute connected
redistribute ospf 1 metric 10
neighbor 3::1 activate
router ospf 1
```

```
router-id 3.3.3.3  
network 192.168.3.0 0.0.0.255 area 0
```

Router 4

```
en  
conf t  
hostname Router4  
no ip domain lookup  
ipv6 unicast-routing  
int g0/0/0  
ip add 192.168.4.2 255.255.255.0  
ipv6 add 4::2/64  
ipv6 ospf 1 area 0  
no shut  
exit  
int g0/0/1  
ip add 192.168.5.1 255.255.255.0  
ipv6 add 5::1/64  
ipv6 ospf 1 area 0  
no shut  
exit  
router ospf 1  
router-id 4.4.4.4  
network 192.168.4.0 0.0.0.255 area 0  
network 192.168.5.0 0.0.0.255 area 0
```

Router 5

```
en  
conf t  
hostname Router5  
no ip domain lookup  
ipv6 unicast-routing  
int g0/0/0  
ip add 192.168.6.2 255.255.255.0  
ipv6 add 6::2/64  
no shut  
exit  
int g0/0/1  
ip add 192.168.5.2 255.255.255.0  
ipv6 add 5::2/64  
ipv6 ospf 1 area 0  
no shut  
exit  
router ospf 1  
router-id 5.5.5.5  
network 192.168.5.0 0.0.0.255 area 0
```

```
router bgp 2
bgp router-id 5.5.5.5
neighbor 192.168.6.1 remote-as 3
neighbor 6::1 remote-as 3
address-family ipv4
network 192.168.6.0 mask 255.255.255.0
redistribute connected
redistribute eigrp 1
redistribute ospf 1
neighbor 192.168.6.1 activate
address-family ipv6
network 6::0/64
redistribute eigrp
redistribute connected
neighbor 6::1 activate
```

Router 6

```
en
conf t
hostname Router6
no ip domain lookup
ipv6 unicast-routing
int g0/0/0
ip add 192.168.7.1 255.255.255.0
ipv6 add 7::1/64
ipv6 eigrp 1
no shut
exit
int g0/0/1
ip add 192.168.6.1 255.255.255.0
ipv6 add 6::1/64
no shut
exit
router bgp 3
bgp router-id 6.6.6.6
neighbor 192.168.6.2 remote-as 2
neighbor 6::2 remote-as 2
address-family ipv4
network 192.168.6.0 mask 255.255.255.0
redistribute connected
redistribute eigrp 1
neighbor 192.168.6.2 activate
address-family ipv6
network 6::0/64
redistribute connected
```

```
redistribute ospf 1 metric 10
neighbor 6::2 activate
router eigrp 1
eigrp router-id 6.6.6.6
network 192.168.7.0 0.0.0.255
default-metric 10000 100 255 1 1500
redistribute connected
redistribute bgp 3
```

Router 7

```
en
conf t
hostname Router7
no ip domain lookup
ipv6 unicast-routing
int g0/0/0
ip add 192.168.8.1 255.255.255.0
ipv6 add 8::1/64
ipv6 eigrp 1
no shut
exit
int g0/0/1
ip add 192.168.7.2 255.255.255.0
ipv6 add 7::2/64
ipv6 eigrp 1
no shut
exit
router eigrp 1
default-metric 10000 100 255 1 1500
eigrp router-id 7.7.7.7
network 192.168.6.0 0.0.0.255
network 192.168.7.0 0.0.0.255
redistribute connected
```

Network Diagram with IP's

Configurations Show run on all routers involved

Router 1

```
Building configuration...
Current configuration : 1879 bytes
Last configuration change at 23:28:14 UTC Thu Dec 12 2024
version 15.5
service timestamps debug datetime msec
service timestamps log datetime msec
no platform punt-keepalive disable-kernel-core
hostname Router1
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
no ip domain lookup
ipv6 unicast-routing
subscriber templating
vtp domain cisco
vtp mode transparent
multilink bundle-name authenticated
license udi pid ISR4321/K9 sn FDO21281AAT
spanning-tree extend system-id
redundancy
mode none
vlan internal allocation policy ascending
interface GigabitEthernet0/0/0
ip address 192.168.2.2 255.255.255.0
negotiation auto
ipv6 address 2::2/64
ipv6 ospf 1 area 1
interface GigabitEthernet0/0/1
ip address 192.168.1.1 255.255.255.0
negotiation auto
ipv6 address 1::1/64
ipv6 ospf 1 area 1
interface GigabitEthernet0/1/0
no ip address
```

```
shutdown
negotiation auto
interface GigabitEthernet0/1/1
no ip address
shutdown
negotiation auto
interface Service-Engine0/2/0
no ip address
shutdown
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
interface Vlan1
no ip address
shutdown
router ospf 1
router-id 1.1.1.1
redistribute connected subnets
redistribute bgp 1 subnets
network 192.168.1.0 0.0.0.255 area 1
network 192.168.2.0 0.0.0.255 area 1
router bgp 1
bgp log-neighbor-changes
redistribute connected
redistribute ospf 1 metric 10
ip forward-protocol nd
no ip http server
no ip http secure-server
ip tftp source-interface GigabitEthernet0
ipv6 router ospf 1
redistribute connected
control-plane
line con 0
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

Router 2

Building configuration...

Current configuration : 2181 bytes
Last configuration change at 23:44:25 UTC Thu Dec 12 2024

version 15.5
service timestamps debug datetime msec
service timestamps log datetime msec
no platform punt-keepalive disable-kernel-core

hostname Router2

boot-start-marker
boot-end-marker

vrf definition Mgmt-intf

address-family ipv4
exit-address-family

address-family ipv6
exit-address-family

no aaa new-model

no ip domain lookup

ipv6 unicast-routing

subscriber templating
vtp domain cisco
vtp mode transparent
multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO21491LXF

spanning-tree extend system-id

redundancy
mode none

vlan internal allocation policy ascending

interface GigabitEthernet0/0/0
ip address 192.168.2.1 255.255.255.0
negotiation auto
ipv6 address 2::1/64
ipv6 ospf 1 area 1

interface GigabitEthernet0/0/1
ip address 192.168.3.1 255.255.255.0
negotiation auto
ipv6 address 3::1/64

```
interface Serial0/1/0
no ip address
shutdown
```

```
interface Serial0/1/1
no ip address
shutdown
```

```
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
```

```
interface Vlan1
no ip address
shutdown
```

```
router ospf 1
router-id 2.2.2.2
redistribute connected subnets
redistribute bgp 1 subnets
network 192.168.1.0 0.0.0.255 area 1
network 192.168.2.0 0.0.0.255 area 1
```

```
router bgp 1
bgp router-id 2.2.2.2
bgp log-neighbor-changes
neighbor 3::2 remote-as 2
neighbor 192.168.3.2 remote-as 2
```

```
address-family ipv4
network 192.168.3.0
redistribute connected
redistribute ospf 1 metric 10
no neighbor 3::2 activate
neighbor 192.168.3.2 activate
exit-address-family
```

```
address-family ipv6
redistribute connected
redistribute ospf 1 metric 10 match internal external 1 external 2
network 3::/64
neighbor 3::2 activate
exit-address-family
```

```
ip forward-protocol nd
no ip http server
no ip http secure-server
ip tftp source-interface GigabitEthernet0
```

```
ipv6 router ospf 1
router-id 2.2.2.2
redistribute connected
redistribute bgp 1
```

```
control-plane
```

```
line con 0
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
```

end

Router 3

Router 3

Building configuration...

Current configuration : 2311 bytes

Last configuration change at 23:23:16 UTC Thu Dec 12 2024

version 15.5

service timestamps debug datetime msec

service timestamps log datetime msec

no platform punt-keepalive disable-kernel-core

hostname Router3

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

no ip domain lookup

ipv6 unicast-routing

subscriber templating
vtp domain cisco
vtp mode transparent
multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FLM240607Q1

spanning-tree extend system-id

redundancy
mode none

vlan internal allocation policy ascending

interface GigabitEthernet0/0/0
ip address 192.168.3.2 255.255.255.0
negotiation auto
ipv6 address 3::2/64
ipv6 ospf 1 area 0

```
interface GigabitEthernet0/0/1
ip address 192.168.4.1 255.255.255.0
negotiation auto
ipv6 address 4::1/64
ipv6 ospf 1 area 0
```

```
interface GigabitEthernet0/1/0
no ip address
shutdown
negotiation auto
```

```
interface GigabitEthernet0/1/1
no ip address
shutdown
negotiation auto
```

```
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
```

```
interface Vlan1
no ip address
shutdown
```

```
router ospf 1
router-id 3.3.3.3
redistribute connected subnets
redistribute bgp 2 subnets
network 192.168.3.0 0.0.0.255 area 0
network 192.168.4.0 0.0.0.255 area 0
network 192.168.5.0 0.0.0.255 area 0
```

```
router bgp 2
bgp router-id 3.3.3.3
bgp log-neighbor-changes
neighbor 3::1 remote-as 1
neighbor 192.168.3.1 remote-as 1
```

```
address-family ipv4
network 192.168.3.0
redistribute connected
redistribute ospf 1 metric 10 match internal external 1 external 2
no neighbor 3::1 activate
neighbor 192.168.3.1 activate
exit-address-family
```

```
address-family ipv6
redistribute connected
redistribute ospf 1 metric 10 match internal external 1 external 2
network 3::/64
neighbor 3::1 activate
exit-address-family
```

```
ip forward-protocol nd
no ip http server
no ip http secure-server
ip tftp source-interface GigabitEthernet0
```

```
ipv6 router ospf 1
redistribute connected
redistribute bgp 2
```

```
control-plane
```

```
line con 0
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
```

```
end
```

Router 4

Building configuration...

Current configuration : 3922 bytes

Last configuration change at 23:28:37 UTC Thu Dec 12 2024

```
version 16.9
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80
platform punt-keepalive disable-kernel-core
```

hostname Router4

```
boot-start-marker
boot-end-marker
```

```
vrf definition Mgmt-intf
```

```
address-family ipv4  
exit-address-family
```

```
address-family ipv6  
exit-address-family
```

```
no aaa new-model
```

```
no ip domain lookup
```

```
login on-success log
```

```
subscriber templating  
vtp domain cisco  
vtp mode transparent  
ipv6 unicast-routing  
multilink bundle-name authenticated
```

```
crypto pki trustpoint TP-self-signed-3458782570  
enrollment selfsigned  
subject-name cn=IOS-Self-Signed-Certificate-3458782570  
revocation-check none  
rsakeypair TP-self-signed-3458782570
```

crypto pki certificate chain TP-self-signed-3458782570
certificate self-signed 01
30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274
69666963 6174652D 33343538 37383235 3730301E 170D3234 31323132 31383234
31395A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649
4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D33 34353837
38323537 30308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201
0A028201 01008FE3 64AF17C4 3AD45635 FEFD00E2 304A0609 A00C0683 B6D5EF74
2635F21F 56842140 33D2FF9E E41A026B E397C4D5 F2FC8BF2 B67CAA14 DD3C560D
7E061EB6 7D29D724 2BD6C94E 5EAF8942 38D37A93 2C220F4B 777041E4 C1292877
12F54452 C8775051 D11C8CD0 83778114 83E3616D FE94DEB5 FFD7B52E 60B27E1A
9264A080 ABCF0435 8D42FEC1 28BF158E 7AE390CC 0F75A628 5746BE5C 70D26D0C
799A98CF E5EE8C00 3EB45B89 6C5EA313 83D0CCEC 2598262E 25A50B8F F1EEFC2C
5A2C5FCF 89D5BA59 1D9E385F 5AFBB0DE 22F11A14 A002569F 9D9A30DD 49320F3C
6C161BA3 29BC39E7 95D11478 D03AD6CE D31D7521 B36C65BE 6A32D722 D81D066F
4AF1C759 5B170203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF
301F0603 551D2304 18301680 14B3B9A7 44DB4A28 0038A860 1473499F CEC3907D
C0301D06 03551D0E 04160414 B3B9A744 DB4A2800 38A86014 73499FCE C3907DC0
300D0609 2A864886 F70D0101 05050003 82010100 8DA5033A 8231A976 DDBBCBC2
F702E8EF 50F2FD3D 7B6872F2 7F9E2E64 941340CD A5F9DF65 3F684A3B 44485188
F04599B7 2D5C082D 96117F7D 6D83EF4F 675B8953 5FBA48A4 8F21CB01 88EFD386
ABAFA9CA A025F368 99EF008A C8A5F3AB DE9CB7A9 96BC8E7F B528896A 9F0FD261
16573CC4 C7E9FE1C 1A8B7C34 32CB240A 479FCCC2 AB0C683F ABC07432 B3A46D2D
64EDCCB4 603759D7 C682A140 88AA01EB 2F613FF7 8D389B4B CA7B8A03 FBAE8D09
293893DC BDDB5BCC 38F4C31F 04BD3A9C B3EE50AF D34AACBA 1C95F720 98002ABE
12B270AB 9FFAA6B0 9D1AF9BC 93A3B715 036565FC F44AA745 8F653F6A 633533D8
1BD11B6F 5509FC32 F2E259D0 6ABB4A51 12407694
quit

license udi pid ISR4321/K9 sn FLM240800D6
no license smart enable
diagnostic bootup level minimal

spanning-tree extend system-id

redundancy
mode none

```
interface GigabitEthernet0/0/0
ip address 192.168.4.2 255.255.255.0
negotiation auto
ipv6 address 4::2/64
ipv6 ospf 1 area 0
```

```
interface GigabitEthernet0/0/1
ip address 192.168.5.1 255.255.255.0
negotiation auto
ipv6 address 5::1/64
ipv6 ospf 1 area 0
```

```
interface Serial0/1/0
no ip address
shutdown
```

```
interface Serial0/1/1
no ip address
shutdown
```

```
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
```

```
router ospf 1
router-id 4.4.4.4
network 192.168.4.0 0.0.0.255 area 0
network 192.168.5.0 0.0.0.255 area 0
```

```
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
ip tftp source-interface GigabitEthernet0
```

```
ipv6 router ospf 1
router-id 4.4.4.4
redistribute connected
redistribute bgp 1
```

control-plane

```
line con 0
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
```

end

Router 5

```
Router 5
Building configuration...
```

Current configuration : 4568 bytes

Last configuration change at 23:15:35 UTC Thu Dec 12 2024

```
version 16.9
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80
platform punt-keepalive disable-kernel-core
```

hostname Router5

```
boot-start-marker
boot-end-marker
```

vrf definition Mgmt-intf

```
address-family ipv4
exit-address-family
```

```
address-family ipv6
exit-address-family
```

no aaa new-model

no ip domain lookup

login on-success log

subscriber templating
vtp domain cisco
vtp mode transparent
ipv6 unicast-routing
multilink bundle-name authenticated

crypto pki trustpoint TP-self-signed-2667303412
enrollment selfsigned
subject-name cn=IOS-Self-Signed-Certificate-2667303412
revocation-check none
rsakeypair TP-self-signed-2667303412

crypto pki certificate chain TP-self-signed-2667303412
certificate self-signed 01
30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274
69666963 6174652D 32363637 33303334 3132301E 170D3234 31323132 31383039
31365A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649
4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D32 36363733
30333431 32308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201
0A028201 0100B38D 053DE2A4 00CBA53 4CE57FF1 41EC6D89 69038F31 770ABEC2
AF0992CF EE914E45 B2D479CA 7A410CBB D1D5FAD4 B9D3AA97 2B8A6BD5 BBA4B76C
9AABF266 6D8B26D0 263E53A7 371DF196 C6832921 0A0CDBAC 9908C7D4 5F8C1345
2651E3DD 38B1CBE0 BB05CBC5 D9C881E9 EC63F474 29780132 C2A18523 577ACCD2
881E647D 15519170 A273EBF0 5999572E 997A687F DFE22C1C 0C391500 D1D2F64A
198E72F6 61F6AE0B 022613DB ABE58636 59BA0C12 8F95D74D EC524BE8 A6D40E5F
F7AD1C47 C06131E1 AF1676AD 637056E7 ED1C075C D8BA44B9 09A3EF0D 081B9293
33BFA947 D2295B4F 0D350279 F96B41ED 6290B9CF FCF414B7 A4C91EEB FA9D7259
3B5F473C B9C90203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF
301F0603 551D2304 18301680 14CE92FB 6D94A003 CC3D41BF 39189450 1C9635EB
DC301D06 03551D0E 04160414 CE92FB6D 94A003CC 3D41BF39 1894501C 9635EBDC
300D0609 2A864886 F70D0101 05050003 82010100 261C4C7A 3649FD82 0BB55C44
774E90E6 A69AFCA2 091115C6 813E1955 DDBE5570 FFE459A2 596952CF 313B5F11
EDADDF16D 245D8215 B62A5B2A 66CE1B99 C48B2326 6F7060F2 6DFB92E6 EE9785F3
1A07D8F1 D711AF27 2EB15E45 E9137176 5668C7A9 E1AD3861 1C7620CB A037C6F8
1D1C85D9 3366350E C836855B 3CD3D3D7 EBBDD39D 1860D8FF 2DDE28BC B7EF8B28

```
FB354D30 EF2263B9 7AEF98ED EFDCFF27 E950EDFF C6BF6E0A FC552194 F7E759C6
46DF0FB0 4FFE5C88 B76F5959 4BD8B7A6 60FB0F0E C9FA9C90 EF458A65 1165A7EA
06933B51 4FE21B8B 9D9D78AE BC63B0AC CDF0A1D8 D2B4EA14 9E1CFEE5 A6EA16CF
CC15BE9E B7702538 9AAAFFA1 6FA4AB74 AC9853EC
```

```
quit
```

```
license udi pid ISR4321/K9 sn FLM2407011F
no license smart enable
diagnostic bootup level minimal
```

```
spanning-tree extend system-id
```

```
redundancy
mode none
```

```
interface GigabitEthernet0/0/0
ip address 192.168.6.2 255.255.255.0
negotiation auto
ipv6 address 6::2/64
```

```
interface GigabitEthernet0/0/1
ip address 192.168.5.2 255.255.255.0
negotiation auto
ipv6 address 5::2/64
ipv6 ospf 1 area 0
```

```
interface GigabitEthernet0/1/0
no ip address
shutdown
negotiation auto
```

```
interface GigabitEthernet0/1/1
no ip address
shutdown
negotiation auto
```

```
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
```

```
router ospf 1
router-id 5.5.5.5
redistribute connected metric 10 subnets
redistribute bgp 2 metric 10 subnets
network 192.168.5.0 0.0.0.255 area 0
```

```
router bgp 2
bgp router-id 5.5.5.5
bgp log-neighbor-changes
neighbor 6::1 remote-as 3
neighbor 192.168.6.1 remote-as 3
```

```
address-family ipv4
network 192.168.6.0
redistribute connected
redistribute ospf 1 match internal external 1 external 2
redistribute eigrp 1
no neighbor 6::1 activate
neighbor 192.168.6.1 activate
exit-address-family
```

```
address-family ipv6
redistribute connected metric 10
```

```
redistribute ospf 1 metric 10 match internal external 1 external 2
network 6::/64
neighbor 6::1 activate
exit-address-family
```

```
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
ip tftp source-interface GigabitEthernet0
```

```
ipv6 router ospf 1
router-id 5.5.5.5
redistribute connected metric 10
redistribute bgp 2 metric 10
```

```
control-plane
```

```
line con 0
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
```

```
end
```

Router 6

```
Router 6
Building configuration...
```

Current configuration : 4515 bytes
Last configuration change at 23:07:49 UTC Thu Dec 12 2024

version 16.9
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80
platform punt-keepalive disable-kernel-core

hostname Router6

boot-start-marker
boot-end-marker

vrf definition Mgmt-intf

address-family ipv4
exit-address-family

address-family ipv6
exit-address-family

no aaa new-model

no ip domain lookup

login on-success log

subscriber templating

```
vtp domain cisco
vtp mode transparent
ipv6 unicast-routing
multilink bundle-name authenticated
```

```
crypto pki trustpoint TP-self-signed-2949602955
enrollment selfsigned
subject-name cn=IOS-Self-Signed-Certificate-2949602955
revocation-check none
rsakeypair TP-self-signed-2949602955
```

```
crypto pki certificate chain TP-self-signed-2949602955
certificate self-signed 01
30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274
69666963 6174652D 32393439 36303239 3535301E 170D3234 31323132 31383032
32335A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649
4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D32 39343936
30323935 35308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201
0A028201 01009C64 7753BEFF 9754B355 C5AE216D 1BEC8425 3DF49C15 9C0C7BE9
22933A08 DF00BA28 4CB26F86 323ACDD6 25D50381 6C4C6AB1 A2F7837F D142DAB5
FEEC14E0 2ECD913D BADD47D9 97C0EA74 6100A1FF 68748FEF 7F6A7223 751FBEBE
EA3D5208 119DC8D2 0A05862A 1ECDF3E9 16B07170 56DD96F3 87B37103 6324D6E6
A953CB4D 67745649 EBCB9FF4 C102B98B B10AC2F7 7855E433 20DA0F30 A9E28249
9BE42C4E F4180A29 C9F0B346 B94B6274 3974A6D4 7F9621EB 50FA19C9 F3A4151B
BE308639 AB4C262F 24172A46 D5D3B801 C2C92A0F 8422E07E BF5F45DA 82530866
B3734316 3E8AAA4A 67BACE91 F1BD65D6 0DA12C3D 3F2924DB CBA89A95 98C54D44
0A0B26DF EB210203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF
301F0603 551D2304 18301680 14316050 2306CDF9 FE2FEB9C 8D228370 791FDB6C
12301D06 03551D0E 04160414 31605023 06CDF9FE 2FEB9C8D 22837079 1FDB6C12
300D0609 2A864886 F70D0101 05050003 82010100 67A46E4E 2750B93E 3BA1BD7C
58EAB032 35103DD4 70B0DEE0 01E3EF86 339D7014 839CEFD1 BE8E89CB ABBD2870
```

```
1C239214 A18C782D 8A55B6FD A63DCDC2 C9FD6385 0C5469C7 2BD0AC0E 01BA3FD5
43BD15FC 3EF87B00 D4E388FA 393D2CCB 1562427F 3A974297 FCA90239 28304486
FF293DD1 F1B8066A D4803CF7 5C671DE2 D3250804 A0D6457F EFFF0765 0B3CED03
E78F0C73 BD2A7185 F00D3917 CBDA084C 015119A7 D60D2AF4 54B58C98 B1EF99AB
BC5B50DF B4E1C027 512434A4 F66106A1 2225BE0D 744982A2 4D0E73C3 8B2DCA4A
14EA85C7 D30025AD 5F7DCB8C 766B520F 98602D3E 56B95BD4 754B5AD3 F6E831C2
67FADDA7 10F5368F 1409FEAD 9B925698 2BDA8C6C
```

```
quit
```

```
license udi pid ISR4321/K9 sn FDO214420HW
license boot level appxk9
no license smart enable
diagnostic bootup level minimal
```

```
spanning-tree extend system-id
```

```
redundancy
mode none
```

```
interface GigabitEthernet0/0/0
ip address 192.168.7.1 255.255.255.0
negotiation auto
ipv6 address 7::1/64
ipv6 enable
ipv6 eigrp 1
```

```
interface GigabitEthernet0/0/1
ip address 192.168.6.1 255.255.255.0
negotiation auto
ipv6 address 6::1/64
ipv6 enable
```

```
interface Serial0/1/0
interface Serial0/1/1
```

```
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
```

```
router eigrp 1
default-metric 10000 100 255 1 1500
network 192.168.7.0
redistribute connected
redistribute bgp 3
eigrp router-id 6.6.6.6
```

```
router bgp 3
bgp router-id 6.6.6.6
bgp log-neighbor-changes
neighbor 6::2 remote-as 2
neighbor 192.168.6.2 remote-as 2
```

```
address-family ipv4
network 192.168.6.0
redistribute connected
redistribute eigrp 1
no neighbor 6::2 activate
neighbor 192.168.6.2 activate
exit-address-family
```

```
address-family ipv6
redistribute connected
redistribute eigrp 1
redistribute ospf 1 metric 10 match internal external 1 external 2
```

```
network 6::/64
neighbor 6::2 activate
exit-address-family
```

```
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
ip tftp source-interface GigabitEthernet0
```

```
ipv6 router eigrp 1
eigrp router-id 6.6.6.6
redistribute bgp 3
redistribute connected
default-metric 10000 100 255 1 1500
```

```
control-plane
```

```
line con 0
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
```

```
end
```

Router 7

```
Router 7
Building configuration...
```

Current configuration : 3944 bytes
version 16.9
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80
platform punt-keepalive disable-kernel-core
hostname Router7
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
no ip domain lookup
login on-success log
subscriber templating
ipv6 unicast-routing
multilink bundle-name authenticated
crypto pki trustpoint TP-self-signed-214699181
enrollment selfsigned
subject-name cn=IOS-Self-Signed-Certificate-214699181
revocation-check none
rsakeypair TP-self-signed-214699181
crypto pki certificate chain TP-self-signed-214699181
certificate self-signed 01
3082032E 30820216 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
30312E30 2C060355 04031325 494F532D 53656C66 2D536967 6E65642D 43657274
69666963 6174652D 32313436 39393138 31301E17 0D323431 32313231 38323330
345A170D 33303031 30313030 30303030 5A303031 2E302C06 03550403 1325494F
532D5365 6C662D53 69676E65 642D4365 72746966 69636174 652D3231 34363939
31383130 82012230 0D06092A 864886F7 0D010101 05000382 010F0030 82010A02
82010100 BA8E0506 440B6DEF 1718DB10 0BEE7320 67F7D93C B1AEA2F8 7C7C98A3
E9041356 87D1F70B 1042F3BC 7199AB64 1DF15867 86809292 6F6A1772 02BDFAD4
A5D8E971 067A3A7C F92BA6AF 46DB9147 007181D0 62709DF4 E09DC39C 23CF690B
AA5F8A1C 950F5CA5 B72CE6F2 90AEE14C 672EC26D B26B0E11 13A6B7E4 3B68F6DE
C16EF6CD 7AEEA8B1 3B7026AB 0FB80EC8 0A3145B3 94064CE2 4774AF62 DE4A20A3
F5C5D247 CAFD64C8 06ADB6BF 7C5C7D44 C6E8F873 B20F004E B6CCD504 42869E0D
A338F1F2 0E84BCF8 4D907FDE E6F896CE 4B28D240 D6AB19A5 E3DC2828 9008059F
C98A5AB9 C5117C5B 0129EEE6 DEBBBD617 533619AD 53AC530E 38D2CA81 42B6C7E9
71385D81 02030100 01A35330 51300F06 03551D13 0101FF04 05300301 01FF301F

0603551D 23041830 16801415 E47481F9 83C5E473 BFFB6F2D F66EA747 1A2A2B30
1D060355 1D0E0416 041415E4 7481F983 C5E473BF FB6F2DF6 6EA7471A 2A2B300D
06092A86 4886F70D 01010505 00038201 01009EB4 962315B5 0928676E 34FE556E
1BCA95AF 938F9466 A5191B7D 224F61F5 0BB02D04 81750EE2 DA2E65DF 7FF8A4F9
7A1FD955 FD2C8DE2 BE175B20 6D154803 C9DABF1A 0A47C0C0 4030897E 6FDB00E4
6EA83A68 2B7ECD09 ACA40CDE 2E567702 CFA5E02D E1EAC9EC A0AB31A7 5F96B904
A1655F68 1313ED1B 6CE4F0BB 720B7661 5C4EBA90 A1F87D6D 0AD1C799 C24A043E
F6A1B3AC 24047768 7BB7AB6C 6499C3DA F126C231 59DAA392 D3ACF777 7E58FAC3
95F8396A 5EF4A60B 76421780 D80CD2CB 2068EBC6 89E1B686 8599BDED 139E6605
221D87CB A700B6ED B20F7923 087122C3 7F9D5CC0 88762A16 4FF7FE9C 2B3529AD
FBBA10D2 EF7D0D94 28548961 47D1D25F 5927
quit
license udi pid ISR4321/K9 sn FDO21442167
no license smart enable
diagnostic bootup level minimal
spanning-tree extend system-id
redundancy
mode none
interface GigabitEthernet0/0/0
ip address 192.168.8.1 255.255.255.0
negotiation auto
ipv6 address 8::1/64
ipv6 eigrp 1
interface GigabitEthernet0/0/1
ip address 192.168.7.2 255.255.255.0
negotiation auto
ipv6 address 7::2/64
ipv6 eigrp 1
interface Serial0/1/0
no ip address
shutdown
interface Serial0/1/1
no ip address
shutdown
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
router eigrp 1
default-metric 10000 100 255 1 1500
network 192.168.6.0
network 192.168.7.0
redistribute connected

```
eigrp router-id 7.7.7.7
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
ip tftp source-interface GigabitEthernet0
ipv6 router eigrp 1
eigrp router-id 7.7.7.7
redistribute connected
redistribute bgp 3
default-metric 10000 100 255 1 1500
control-plane
line con 0
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

Show IP route on all routers

```

P Echos to 6::1, Reply from 192.168.8.2: bytes=32 time=1ms TTL=121
Reply from 192.168.8.2: bytes=32 time=1ms TTL=121
nt (0/5)
      Ping statistics for 192.168.8.2:
        abort.
          Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
P Echos to 6::2, Approximate round trip times in milli-seconds:
          Minimum = 1ms, Maximum = 1ms, Average = 1ms
cent (5/5), rour
C:\Users\Charles Liu>tracert 192.168.8.2

Tracing route to DESKTOP-NH2TPB2 [192.168.8.2]
over a maximum of 30 hops:
?
  1  <1 ms    <1 ms    <1 ms  192.168.1.1
  2  <1 ms    <1 ms    <1 ms  192.168.2.1
  3  <1 ms    <1 ms    <1 ms  192.168.3.2
  4  1 ms    <1 ms    <1 ms  192.168.4.2
  5  1 ms    1 ms    <1 ms  192.168.5.2
  6  1 ms    1 ms    1 ms  192.168.6.1
  7  1 ms    1 ms    1 ms  192.168.7.2
  8  1 ms    1 ms    1 ms  DESKTOP-NH2TPB2 [192.168.8.2]

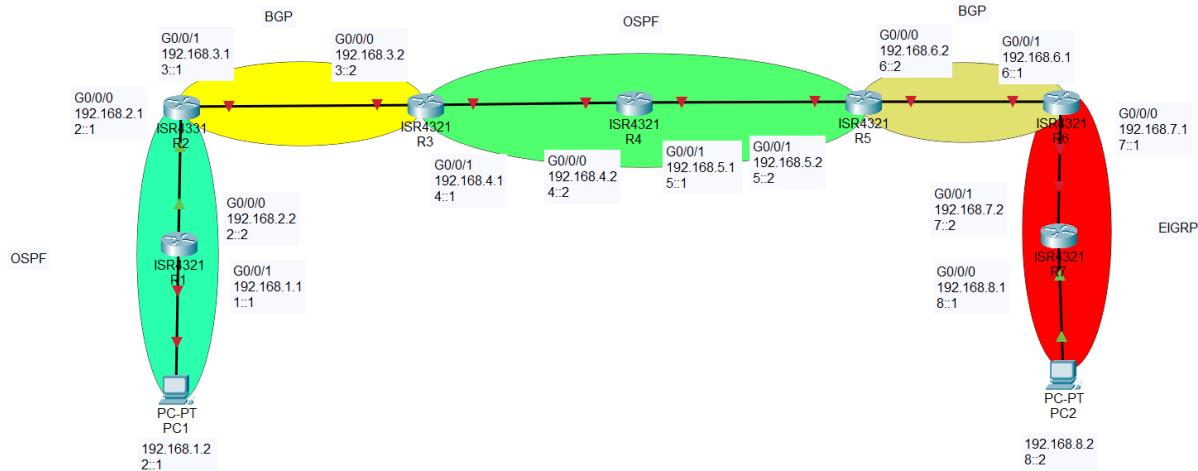
Trace complete.
C:\Users\Charles Liu>

```

to abort.

CMP Echos to 1::2, timeout is 2 seconds:

ercent (5/5), round-trip min/avg/max = 1/1/1 ms



Problems

This lab had an extremely long troubleshooting phase because of the number of commands that we needed to configure that had many small errors.

One of the main problems during this lab was communicating with my lab partner. We both were absent for some time, and it usually made it very difficult for the other person to keep working on the lab, meaning that we did not use all the time we could have. The other communication issue was that we changed our IP addresses many times, and that resulted in miscommunication while configuring the lab since the IP addresses sometimes conflicted with each other.

Specifically, we had issues with IPv6 subnetting which we could have simplified. We also had many issues switched IP addresses, which we couldn't solve sometimes, which made us restart a couple of times instead of deliberately working on trouble shooting because of time restraints.

If I were to do this lab again, I would work on a Packet Tracer network to double check commands and better prepare myself for actual configuration on the physical racks. We underestimated this lab's difficulty and by better planning we could have avoided a lot of the troubleshooting we had to do.

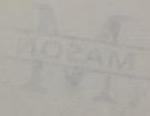
Conclusion

In conclusion, this lab allowed us to create a network that runs efficiently because of how it uses diverse routing protocols to connect networks. There were many challenges regarding the IP addresses used and we learned many things about how to configure multi area OSPF instead of single area which we were already familiar with because of the CCNA course, as well as EIGRP and eBGP configuration. This was a very good learning experience as now we were able to get a refresh on network configuration and successfully create a network that works at an industry level.

Teacher Signoff Page of Lab Completed

Configuring a multiprotocol Network
with eBGP

Charles Liu P3-4 CCNP Mr. Mason





2024-2025 Lab portfolioConfiguring a Multiprotocol Network (OSPF, EIGRP) with iBGP

ADVANCED CISCO PERIOD 3-4
LIU, CHARLES

Purpose

Having a multiprotocol network has many benefits. Mainly, it provides flexibility on how packets are transmitted throughout the network with many different strategies that lie in the types of routing protocols that are configured. Organizations with various routing protocols can have them suited for certain tasks without being locked into a single standard. Additionally, networks are more scalable as new technology and versions are released, ensuring that organizations can grow and increase their network capacity. Another benefit of creating a multiprotocol network is redundancy, where if one malfunctions, there would be others that can take over and provide an alternate path for data transmission. By configuring this lab, we are learning vital skills in creating a network that would be used in professional settings with routing protocols that are applicable for real life networks.

Background Information on lab concepts

This network will be configured with 3 routing protocols. Routing protocols determine the exact path that packets will take to reach their destination. Some examples of routing protocols include RIP, IS-IS, OSPF, and EIGRP.

Open Shortest Path First (OSPF)

Open Shortest Path First is a routing protocol in which routers identify the best way to transmit a packet to its destination. Routers will send Hello Packets to discover OSPF neighbors, who they will establish adjacencies with. They will then run calculations to find the shortest path possible, and then propagate routes to the routing table for future use. OSPF networks are broken down into areas which makes the network more manageable and scalable.

By calculating optimal paths for packets, OSPF is very efficient in sending packets in the network to its destination because it always takes the shortest and most efficient route. This is another reason why OSPF has an administrative distance of 110, with only a few other routing protocols with a shorter one.

Enhanced Interior Gateway Routing Protocol (EIGRP)

Enhanced Interior Gateway Routing Protocol is a routing protocol that determines the best path for transmitting packets. Routers also use Hello packets to discover and set adjacencies. They then use Diffusing Update Algorithm (DUAL) to calculate the best path based on criteria like bandwidth, delay, and reliability.

EIGRP is both scalable and efficient, which is why it is used in many large networks. It is extremely flexible for many different uses. It maintains a routing and topology table, which

makes it easily adapt to changes in the network. It has an administrative distance of 90, being one of the most preferred routing protocols.

Border Gateway Protocol

Border Gateway Protocol is a protocol that is used to exchange routing information between autonomous systems on the internet. Internal BGP, or iBGP, focuses on routing information within the same Autonomous system (AS). It uses connections to create stable links, share routing updates, and adapt to different situations with information. It also is an extremely scalable protocol, making it very common to use in large networks because of their redundancy and flexibility.

Lab Summary

Lab Commands

Router 1

```
en
conf t
hostname Router1
no ip domain lookup
ipv6 unicast-routing
int g0/0/0
ip add 192.168.2.2 255.255.255.0
ipv6 add 2::2/64
ipv6 ospf 1 area 1
no shut
exit
int g0/0/1
ip add 192.168.1.1 255.255.255.0
ipv6 add 1::1/64
ipv6 ospf 1 area 1
exit
router ospf 1
router-id 1.1.1.1
redistribute bgp 1
network 192.168.1.0 0.0.0.255 area 1
network 192.168.2.0 0.0.0.255 area 1
router bgp 1
redistribute ospf 1 metric 10
```

Router 2

```
en
conf t
hostname Router2
no ip domain lookup
ipv6 unicast-routing
int g0/0/0
ip add 192.168.2.1 255.255.255.0
ipv6 add 2::1/64
ipv6 ospf 1 area 1
no shut
exit
int g0/0/1
ip add 192.168.3.1 255.255.255.0
ipv6 add 3::1/64
exit
router ospf 1
router-id 2.2.2.2
network 192.168.2.0 0.0.0.255 area 1
network 192.168.3.0 0.0.0.255 area 1
redistribute bgp 1 subnets
router bgp 1
bgp router-id 2.2.2.2
neighbor 192.168.3.2 remote-as 1
neighbor 3::2 remote-as 1
address-family ipv4
network 192.168.3.0 mask 255.255.255.0
redistribute connected
redistribute ospf 1 metric 10
neighbor 192.168.3.2 activate
address-family ipv6
network 3::0/64
redistribute connected
redistribute ospf 1 metric 10
neighbor 3::2 activate
```

Router 3

```
en
conf t
hostname Router3
no ip domain lookup
ipv6 unicast-routing
int g0/0/0
ip add 192.168.3.2 255.255.255.0
ipv6 add 3::2/64
ipv6 ospf 1 area 2
no shut
exit
```

```
int g0/0/1
ip add 192.168.4.1 255.255.255.0
ipv6 add 4::1/64
exit
router ospf 1
redistribute bgp 2 subnets
router bgp 2
bgp router-id 3.3.3.3
neighbor 192.168.3.1 remote-as 1
neighbor 3::1 remote-as 1
address-family ipv4
network 192.168.3.0 mask 255.255.255.0
redistribute connected
redistribute ospf 1 metric 10
neighbor 192.168.3.1 activate
address-family ipv6
network 3::0/64
redistribute connected
redistribute ospf 1 metric 10
neighbor 3::1 activate
router ospf 1
router-id 3.3.3.3
network 192.168.3.0 0.0.0.255 area 2
```

Router 4

```
en
conf t
hostname Router4
no ip domain lookup
ipv6 unicast-routing
int g0/0/0
ip add 192.168.4.2 255.255.255.0
ipv6 add 4::2/64
ipv6 ospf 1 area 2
no shut
exit
int g0/0/1
ip add 192.168.5.1 255.255.255.0
ipv6 add 5::1/64
ipv6 ospf 1 area 2
exit
router ospf 1
router-id 4.4.4.4
network 192.168.4.0 0.0.0.255 area 2
network 192.168.5.0 0.0.0.255 area 2
```

Router 5

```
en
conf t
hostname Router5
no ip domain lookup
ipv6 unicast-routing
int g0/0/0
ip add 192.168.6.2 255.255.255.0
ipv6 add 6::2/64
no shut
exit
int g0/0/1
ip add 192.168.5.2 255.255.255.0
ipv6 add 5::2/64
ipv6 ospf 1 area 2
exit
router ospf 1
router-id 5.5.5.5
network 192.168.5.0 0.0.0.255 area 2
router eigrp 1
redistribute ospf 1 metric 10
redistribute bgp 1 metric 10
router bgp 2
bgp router-id 5.5.5.5
neighbor 192.168.6.1 remote-as 1
neighbor 6::1 remote-as 1
address-family ipv4
network 192.168.6.0 mask 255.255.255.0
redistribute connected
redistribute ospf 1 metric 10
neighbor 192.168.6.1 activate
address-family ipv6
network 6::0/64
redistribute connected
redistribute ospf 1 metric 10
neighbor 6::1 activate
```

Router 6

```
en
conf t
hostname Router6
no ip domain lookup
ipv6 unicast-routing
int g0/0/0
```

```
ip add 192.168.7.1 255.255.255.0
ipv6 add 7::1/64
ipv6 eigrp 1
no shut
exit
int g0/0/1
ip add 192.168.8.1 255.255.255.0
ipv6 add 6::1/64
exit
router eigrp 1
redistribute ospf 1 metric 10
redistribute eigrp 1 metric 10
router bgp 3
bgp router-id 6.6.6.6
neighbor 192.168.6.2 remote-as 1
neighbor 6::2 remote-as 1
address-family ipv4
network 192.168.6.0 mask 255.255.255.0
redistribute connected
redistribute eigrp 1 metric 10
neighbor 192.168.6.2 activate
address-family ipv6
network 6::0/64
redistribute connected
redistribute ospf 1 metric 10
neighbor 6::2 activate
router eigrp 1
eigrp router-id 6.6.6.6
Router(config-router)#network 192.168.7.0 0.0.0.255
```

Router 7

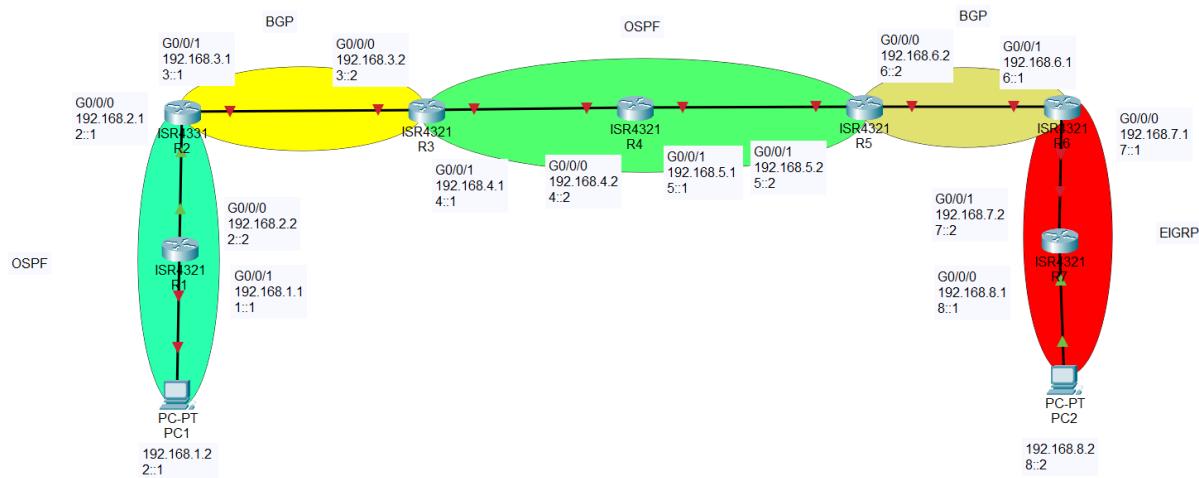
```
en
conf t
hostname Router7
no ip domain lookup
ipv6 unicast-routing
int g0/0/0
ip add 192.168.8.1 255.255.255.0
ipv6 add 8::1/64
ipv6 eigrp 1
no shut
exit
int g0/0/1
ip add 192.168.7.2 255.255.255.0
ipv6 add 7::2/64
ipv6 eigrp 1
exit
```

```

router eigrp 1
eigrp router-id 7.7.7.7
network 192.168.6.0 0.0.0.255
network 192.168.7.0 0.0.0.255

```

Network Diagram with IP's



Configurations Show run on all routers involved

C:\Users\Charles Liu>tracert 10.0.20.2

Tracing route to DESKTOP-27SAP3J [10.0.20.2]
over a maximum of 30 hops:

```

1 <1 ms <1 ms <1 ms 10.0.30.1
2 <1 ms <1 ms <1 ms 10.0.3.1
3 1 ms <1 ms <1 ms 192.168.1.1

```

```
4 <1 ms <1 ms <1 ms 10.0.2.1
5 1 ms <1 ms <1 ms 10.0.1.1
6 1 ms 1 ms 1 ms 192.168.0.1
7 1 ms 1 ms 1 ms 10.0.0.1
8 1 ms 1 ms 1 ms DESKTOP-27SAP3J [10.0.20.2]
```

Trace complete.

```
C:\Users\Charles Liu>tracert 1:20::2
```

Tracing route to 1:20::2 over a maximum of 30 hops

```
1 <1 ms <1 ms <1 ms 1:30::1
2 <1 ms <1 ms <1 ms 1:3::1
3 1 ms <1 ms 1 ms 2:1::1
4 1 ms <1 ms <1 ms 1:2::1
5 1 ms 1 ms 1 ms 1:1::1
6 1 ms 1 ms 1 ms 2::1
7 1 ms 1 ms 1 ms 1::1
8 1 ms 1 ms 1 ms 1:20::2
```

Trace complete.

Show IP route on all routers

```
vbnCopyBuilding configuration...
Current configuration : 3796 bytes
Last configuration change at 18:15:57 UTC Thu Jan 16 2025version 16.9service
timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80platform punt-keepalive disable-
kernel-core
hostname R1
```

```

boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
  address-family ipv4
  exit-address-family
  address-family ipv6
  exit-address-family
no aaa new-model
login on-success log
subscriber templating
vtp domain cisco
vtp mode transparent
ipv6 unicast-routing
multilink bundle-name authenticated
crypto pki trustpoint TP-self-signed-2731081846 enrollment selfsigned
  subject-name cn=IOS-Self-Signed-Certificate-2731081846 revocation-check none
  rsakeypair TP-self-signed-2731081846 crypto pki certificate chain TP-self-
signed-2731081846 certificate self-signed 0130820330 30820218 A0030201
02020101 300D0609 2A864886 F70D0101 0505003031312F30 2D060355 04031326
494F532D 53656C66 2D536967 6E65642D 4365727469666963 6174652D 32373331
30383138 3436301E 170D3235 30313136 3138313531345A17 0D333030 31303130
30303030 305A3031 312F302D 06035504 031326494F532D53 656C662D 5369676E
65642D43 65727469 66696361 74652D32 3733313038313834 36308201 22300D06
092A8648 86F70D01 01010500 0382010F 003082010A028201 0100B537 2700E952
9D630904 252067A7 8BCEA5CE 9439514E 68363CE0
  2B3DF725 B7FB6903 5BA104CC D6CAE577 CF62E7D3 E97A8E50 8D2F5CAC FBA393CE
  57A4ADD0 97D90F09 43212616 2687CE7A 3D2A5FD4 79EA9513 8624FD9F D94F2265
  3C53339D 95DC393A 88229E45 6DCC4CB0 84014093 9668209D 4C79025C 4AD05483
  B3393CB7 ACF842B7 C21B0BB1 41EF3EAB 0C5DE046 0ADDCEE5 F5ACFA12 CA024296
  DBEAEE77 9B3C085D 842403CB D039D595 D78CF3D9 C8AAEA7E 63FB34CF 977A591B
  5EFC1C11 A9C11E09 57BDC322 A0A897BF 4E16542E F999D78D 19F7BE7B 66B26F12
  C2F8E590 5F25D5C1 7320A6EF A109FC1F D31A8930 932B1852 0EF7DE36 6D7E68F6
  B0DF19D1 6C690203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF
  301F0603 551D2304 18301680 14276E22 3005A3C8 76B0556F BDA30A42 B536DEA8
  38301D06 03551D0E 04160414 276E2230 05A3C876 B0556FBD A30A42B5 36DEA838
  300D0609 2A864886 F70D0101 05050003 82010100 01D9FAD7 F90B8CE8 6577DFA3
  EB7CCC90 3406C492 95DEC630 E8413391 FA5AD861 55155656 FCEC0340 9F7C6D02
  AEB99C01 C4721C8F E1A6B662 4E8B8F5F 9209B545 FC2EBF11 17022C86 EBEF88D2
  58A31027 F8A19574 4E54F165 CF84CBD7 860C502A 9DDE6C5C 0C7D0B1C 77F3D910
  F29FA19D 0AE234A6 45323E5B F2EE73E5 A72FC633 4023E01A AD750142 E22F72DC
  454E880A 08B75E76 C3F1C3E8 99D2F1E1 8ADA5CC7 A7DF53C9 2789C37D 10D4B5B3
  2B7E3910 036E2D52 564F1B96 B397C592 D6F7DFB9 31A499C6 2B3C646E 6E1D06C2
  967C4220 4BE72518 84B97B09 843B30A3 B9ADDE12 BF54FADF 2C8093E8
314525224D0BDF34 9B13D692 ED74C639 963E8DE6 B7382D4F
quit
license udi pid ISR4321/K9 sn FDO21432ZLS
no license smart enable
diagnostic bootup level minimal
spanning-tree extend system-id
redundancy
  mode noneinterface GigabitEthernet0/0/0 ip address 10.0.20.1 255.255.255.0
negotiation auto ipv6 address 1:20::1/64 ipv6 ospf 1 area 0 interface
GigabitEthernet0/0/1 ip address 10.0.0.1 255.255.255.0 negotiation auto ipv6
address 1::1/64 ipv6 ospf 1 area 0 interface Serial0/1/0 interface
Serial0/1/1 interface GigabitEthernet0
vrf forwarding Mgmt-intf
  no ip address

```

```
shutdown
negotiation autorouter ospf 1 router-id 1.1.1.1 network 10.0.0.0 0.0.0.255
area 0 network 10.0.20.0 0.0.0.255 area 0
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
ip tftp source-interface GigabitEthernet0
ipv6 router ospf 1
  router-id 1.1.1.1
control-plane
line con 0
  transport input none
  stopbits 1
line aux 0
  stopbits 1
line vty 0 4
  login
end
```

Building configuration...

Current configuration : 4404 bytes

Last configuration change at 19:20:36 UTC Thu Jan 16 2025

version 16.9

```
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80
platform punt-keepalive disable-kernel-core
hostname R2
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
login on-success log
subscriber templating
vtp domain cisco
vtp mode transparent
```

ipv6 unicast-routing
multilink bundle-name authenticated
crypto pki trustpoint TP-self-signed-48848711
enrollment selfsigned
subject-name cn=IOS-Self-Signed-Certificate-48848711
revocation-check none
rsakeypair TP-self-signed-48848711
crypto pki certificate chain TP-self-signed-48848711
certificate self-signed 01
3082032C 30820214 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
2F312D30 2B060355 04031324 494F532D 53656C66 2D536967 6E65642D 43657274
69666963 6174652D 34383834 38373131 301E170D 32353031 31363138 32343339
5A170D33 30303130 31303030 3030305A 302F312D 302B0603 55040313 24494F53
2D53656C 662D5369 676E6564 2D436572 74696669 63617465 2D343838 34383731
31308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201 0A028201
0100A500 164FE693 2C86D9B4 1B4F90BC 93CD953D 945A2106 785FAFAA 15E6DC53
CB28FC3D 4FE3356B 22E41DC2 33E65517 47F75398 81C736C9 EA64FADB 25F43EF2
2D20F567 DA9B1B6F 9C63770F 7E784D43 18CD9DBC C4BD1FCC D5E5EB08 728DFFC0
CBF8C4AB F8BE8D84 8E3BBD58 FE8546B6 0AA5BCFE BF5C2563 14BBD9A2 65B0E0D4
7A29759A B11147E4 A5E84585 0E8CF817 6F96B108 D1F56EA4 10188C66 213B8F12
5124F2FD BFE60CCC F15C4822 77A21E32 A0A59B56 F8E363E8 A3ADAC4C 99EA5F54
07CEBFD3 6103174E 07FA7CEF EBB7AA3B 746EB0AE A6383152 E8D66B4E 392361F5
652F2C0F 8845D1E7 B033E2B4 7506FAFE 875B0D15 3A70243E 667A7E7C 91455CCD
A4C30203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF 301F0603
551D2304 18301680 140287DB 12589751 61896C66 22935EE9 5864F613 49301D06
03551D0E 04160414 0287DB12 58975161 896C6622 935EE958 64F61349 300D0609
2A864886 F70D0101 05050003 82010100 21CF449D AE508557 5923962B C2CF0691
EA75BCC9 9D93FA49 E7B34A05 9CA7C8BF 81624ADA 97050B2F B4D4BC87 1344A6C7
CD6A7658 B850CCE5 95F785F3 6C62E95C 89F0B427 923A2028 562A8F03 A66B6B81
B6961EA7 B05AC847 8401D91F 245A3119 2A1B8E6E C57FED5B 2FD2B3B4 541B83CA
1054CE88 1D1E4C2A D488D7C0 0F50A3B9 B376DDB0 9D871EBE C62FC22E CC60FEFC
B270A9EA DA2145AB DAADF0B4 D2C810D7 106FA269 2812870E DB34F3C0 187DEEBB
E8BF3FEE AEA973F0 181446A0 E05DEC97 A83DA0A4 FE34DB0F CDC5D815 76B9ADCC
DCAC1222 761631EF 229E3FA5 7AF4E910 408E4B24 1AC1E0FD B34F2F07 4BEEDFC7
C16E8AC8 14C25300 32C24D31 0A1A793A
quit
license udi pid ISR4321/K9 sn FDO214328HZ
no license smart enable
diagnostic bootup level minimal
spanning-tree extend system-id
redundancy
mode none
interface GigabitEthernet0/0/0
ip address 10.0.0.2 255.255.255.0
negotiation auto
ipv6 address 1::2/64

```
ipv6 ospf 1 area 0
interface GigabitEthernet0/0/1
ip address 192.168.0.1 255.255.255.0
negotiation auto
ipv6 address 2::1/64
ipv6 ospf 1 area 0
interface Serial0/1/0
interface Serial0/1/1
interface GigabitEthernet0/2/0
no ip address
shutdown
negotiation auto
interface GigabitEthernet0/2/1
no ip address
shutdown
negotiation auto
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
router ospf 1
router-id 2.2.2.2
redistribute bgp 1 metric 10 subnets
network 10.0.0.0 0.0.0.255 area 0
network 192.168.0.0 0.0.0.255 area 0
router bgp 1
bgp router-id 2.2.2.2
bgp log-neighbor-changes
neighbor 2::2 remote-as 2
neighbor 192.168.0.2 remote-as 2
address-family ipv4
  redistribute connected
  redistribute ospf 1
  no neighbor 2::2 activate
  neighbor 192.168.0.2 activate
exit-address-family
address-family ipv6
  redistribute connected
  redistribute ospf 1 metric 10
  neighbor 2::2 activate
exit-address-family
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
```

```
ip tftp source-interface GigabitEthernet0
ipv6 router ospf 1
router-id 2.2.2.2
redistribute bgp 1 metric 10
control-plane
line con 0
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

```
Building configuration...
Current configuration : 4840 bytes
Last configuration change at 19:01:37 UTC Thu Jan 16 2025
version 16.9
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80
platform punt-keepalive disable-kernel-core
hostname R3
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
login on-success log
subscriber templating
vtp domain cisco
vtp mode transparent
ipv6 unicast-routing
multilink bundle-name authenticated
crypto pki trustpoint TP-self-signed-1411542050
enrollment selfsigned
subject-name cn=IOS-Self-Signed-Certificate-1411542050
revocation-check none
rsakeypair TP-self-signed-1411542050
crypto pki certificate chain TP-self-signed-1411542050
certificate self-signed 01
```

30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274
69666963 6174652D 31343131 35343230 3530301E 170D3235 30313136 31383230
35345A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649
4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D31 34313135
34323035 30308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201
0A028201 0100B13B 289A462D 5CFD7FAB 67FA9A16 1E54BECE 54DFFDA4 64102093
E5C2BE41 DF5BCD1C 07BB3A92 ABCE5E99 A0D72046 AE2A201F 579D0CA0 42835E96
8393DB8F AE6D86E1 794EBFB0 5F151933 6822C9F3 81368B4E 4F24FE2B 09E6709E
293B2443 22465697 1CBBFD42 C3A5BF60 89EC86D0 B0BD541C BB362B65 7486AB82
0EBBC7FD 5EEF5F61 B74AD26B C9293A25 45A9E751 852981FB A8B26FC5 388F896A
42BEB94B 593FBA83 0CF5DA76 F85ED774 042AA620 DF4282B1 9C6DA171 74C5493D
40CE9BA7 B18370D8 E1C9B685 48083EA3 A700D982 5A011B2F 8539F3C4 AA56A423
6CC4F9DC B2F92140 41A01B5D 34104378 22628E5D 7C22C9BA 0D991BD1 BB4D9D93
E981D0EB 725F0203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF
301F0603 551D2304 18301680 149AEC6F 18E8D0E4 D8768796 08A6E760 EA884515
7C301D06 03551D0E 04160414 9AEC6F18 E8D0E4D8 76879608 A6E760EA 8845157C
300D0609 2A864886 F70D0101 05050003 82010100 54F7D5B3 B7AD653B AAED22C2
2FE65FA3 1C7262A0 E0ED8778 EEEF4166 89E48F4B BD56BD67 51708291 CAC39BAE
FFF46010 C188E18A DCD25A61 8397A9E8 2EA5A912 FC57BA5A E3EBA17E ED6A8EDE
05297332 B9067D2E 598239D9 69BBDCA2 F029054D A3E2EBEA C6B9B8FC DDAC8EFF
8FCDC8B 320E9FE0 B9F52802 A8B0DBB0 AB2FFCF1 D91E6D80 A1C6D86C AE2AC7FD
141FBC43 C208C6F2 240D7B44 223ED4EB 405D0188 599DC000 34AD8141 DA731208
4DB472DE 44D8F5F1 6EA11428 1FD85795 CA6AC1E3 4A3C51D4 1BFD9089 BC04946E
24D47FFD 832C0357 85EB6B53 2BEAFF8A 89AB1935 1E1F21F1 4E8AF08E CFCEBCDB
62998380 EA5CEF3C 9755C8B6 4142BD84 AEF52912

quit

license udi pid ISR4321/K9 sn FDO215009PN

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface Loopback0

ip address 3.3.3.3 255.255.255.255

ipv6 address 100:3::3/128

ipv6 eigrp 1

interface GigabitEthernet0/0/0

ip address 192.168.0.2 255.255.255.0

negotiation auto

ipv6 address 2::2/64

ipv6 eigrp 1

interface GigabitEthernet0/0/1

ip address 10.0.1.1 255.255.255.0

negotiation auto

ipv6 address 1:1::1/64

```
ipv6 eigrp 1
interface Serial0/1/0
no ip address
shutdown
interface Serial0/1/1
no ip address
shutdown
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
router eigrp 1
network 3.3.3.3 0.0.0.0
network 10.0.1.0 0.0.0.255
network 192.168.0.0
eigrp router-id 3.3.3.3
router bgp 2
bgp router-id 3.3.3.3
bgp log-neighbor-changes
neighbor 2::1 remote-as 1
neighbor 100:4::4 remote-as 2
neighbor 100:4::4 update-source Loopback0
neighbor 100:7::7 remote-as 2
neighbor 100:7::7 update-source Loopback0
neighbor 4.4.4.4 remote-as 2
neighbor 4.4.4.4 update-source Loopback0
neighbor 7.7.7.7 remote-as 2
neighbor 7.7.7.7 update-source Loopback0
neighbor 192.168.0.1 remote-as 1
address-family ipv4
  redistribute connected
  no neighbor 2::1 activate
  no neighbor 100:4::4 activate
  no neighbor 100:7::7 activate
  neighbor 4.4.4.4 activate
  neighbor 7.7.7.7 activate
  neighbor 7.7.7.7 next-hop-self
  neighbor 192.168.0.1 activate
exit-address-family
address-family ipv6
  redistribute connected
  neighbor 2::1 activate
  neighbor 100:4::4 activate
  neighbor 100:7::7 activate
  neighbor 100:7::7 next-hop-self
```

```
exit-address-family
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
ip tftp source-interface GigabitEthernet0
ipv6 router eigrp 1
eigrp router-id 3.3.3.3
control-plane
line con 0
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

```
Building configuration...
Current configuration : 2641 bytes
version 16.9
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80
platform punt-keepalive disable-kernel-core
hostname R4
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
login on-success log
subscriber templating
ipv6 unicast-routing
multilink bundle-name authenticated
license udi pid ISR4321/K9 sn FDO214420HS
no license smart enable
diagnostic bootup level minimal
spanning-tree extend system-id
redundancy mode none
interface Loopback0
```

```
ip address 4.4.4.4 255.255.255.255
ipv6 address 100:4::4/128
ipv6 eigrp 1
interface GigabitEthernet0/0/0
ip address 10.0.2.2 255.255.255.0
negotiation auto
ipv6 address 1:2::2/64
ipv6 eigrp 1
interface GigabitEthernet0/0/1
ip address 192.168.1.1 255.255.255.0
negotiation auto
ipv6 address 2:1::1/64
ipv6 eigrp 1
interface Serial0/1/0
no ip address
interface Serial0/1/1
no ip address
interface GigabitEthernet0/2/0
no ip address
negotiation auto
interface GigabitEthernet0/2/1
no ip address
negotiation auto
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
negotiation auto
router eigrp 1
network 4.4.4.4 0.0.0.0
network 10.0.2.0 0.0.0.255
network 192.168.1.0
eigrp router-id 4.4.4.4
router bgp 2
bgp router-id 4.4.4.4
bgp log-neighbor-changes
neighbor 2:1::2 remote-as 3
neighbor 100:3::3 remote-as 2
neighbor 100:3::3 update-source Loopback0
neighbor 100:7::7 remote-as 2
neighbor 100:7::7 update-source Loopback0
neighbor 3.3.3.3 remote-as 2
neighbor 3.3.3.3 update-source Loopback0
neighbor 7.7.7.7 remote-as 2
neighbor 7.7.7.7 update-source Loopback0
neighbor 192.168.1.2 remote-as 3
address-family ipv4
```

```
redistribute connected
no neighbor 2:1::2 activate
no neighbor 100:3::3 activate
no neighbor 100:7::7 activate
neighbor 3.3.3.3 activate
neighbor 7.7.7.7 activate
neighbor 7.7.7.7 next-hop-self
neighbor 192.168.1.2 activate
exit-address-family
address-family ipv6
redistribute connected
neighbor 2:1::2 activate
neighbor 100:3::3 activate
neighbor 100:7::7 activate
neighbor 100:7::7 next-hop-self
exit-address-family
ip forward-protocol nd
no ip http server
ip http secure-server
ipv6 router eigrp 1
eigrp router-id 4.4.4.4
control-plane
line con 0
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

Building configuration...

Current configuration : 4248 bytes

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname R5

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

```
address-family ipv6
exit-address-family
no aaa new-model
login on-success log
subscriber templating
ipv6 unicast-routing
multilink bundle-name authenticated
crypto pki trustpoint TP-self-signed-187689846
enrollment selfsigned
subject-name cn=IOS-Self-Signed-Certificate-187689846
revocation-check none
rsakeypair TP-self-signed-187689846
crypto pki certificate chain TP-self-signed-187689846
certificate self-signed 01
3082032E 30820216 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
30312E30 2C060355 04031325 494F532D 53656C66 2D536967 6E65642D 43657274
69666963 6174652D 31383736 38393834 36301E17 0D323530 31313631 38303134
305A170D 33303031 30313030 30303030 5A303031 2E302C06 03550403 1325494F
532D5365 6C662D53 69676E65 642D4365 72746966 69636174 652D3138 37363839
38343630 82012230 0D06092A 864886F7 0D010101 05000382 010F0030 82010A02
82010100 BBCD8874 5EE3ED58 1589BA8C 3219ADD7 187EC23D FDFAE0C7 D4388D0E
7C15CA19 BD23291A 5F6545DE C5F985D3 700330CF 2DE3E80A 3C06D44E C804E6CE
BBE46282 97E1E509 9D3EC9D9 E7D0BBCB 274E14EF 747AF87B 8F15C122 2B830FF9
A13F55F9 8E04E20F C59C81F6 700D732E ECFF43A4 A311D48D 4C168297 E3219702
9E531200 7CED4CA9 D5590218 F241C84F 3D126BB1 D9AC1B44 B47E06E9 DB91DF4F
795A1D65 A4CADF8F 9D19CE02 F395EC4D 54E8F456 85620D5F 3F8DBA2D 7F669DC2
753EEFD2 B052EE63 CBAE88E5 3CEC4068 F6A457DB 2E629890 FA0A323D B203E388
2DA5520F 06C6EE0C 09C9C378 1EC2CE3B 3EEAD82B C12FDD88 A88010B4 32D27EB5
7834238D 02030100 01A35330 51300F06 03551D13 0101FF04 05300301 01FF301F
0603551D 23041830 16801402 AEEC4805 500EEA03 48F11A6E 50560BCB 5ADC1530
1D060355 1D0E0416 041402AE EC480550 0EEA0348 F11A6E50 560BCB5A DC15300D
06092A86 4886F70D 01010505 00038201 010005A8 B8995375 79724FB4 6A64F874
037B3893 6F640E7C 86016DBC 197F0E8C 58D5F63D 821FA9D0 D0F6B9BC 7952D3B3
1716EC21 87B1BE30 9EC2FC2D FC7AFEA8 C0FBE53F 410BF999 D7E043DA 6A7A30E6
0FA39604 C49C6A60 3FC25490 F5EF21A5 1AF79B39 AE51552B 35DDB32D 42A2668E
7BB75450 0FCE86A9 BD19532B 4740B6B2 3159A387 D95A28F6 85FCD707 886754E4
8D4997AA EC94BB02 2B9FAE83 893AFE73 3A52156E D38329E9 9A611833 369919D2
EC0EF7EC EB2B4FCF F6753E3C 738CBCEE DAF77791 BC2C7B6F 4A824820 2FF1778B
DBD5A684 16A7B179 2EB9D0A8 F5ED1AA1 F2FC4FD0 C46E7570 A13E8BBE 24917837
643A1AA3 1B121A5A AF9DEB60 2CA6CD24 68C9
quit
license udi pid ISR4321/K9 sn FLM2407014H
no license smart enable
diagnostic bootup level minimal
spanning-tree extend system-id
redundancy mode none
```

```
interface GigabitEthernet0/0/0
ip address 192.168.1.2 255.255.255.0
ip router isis
negotiation auto
ipv6 address 2:1::2/64
ipv6 router isis
interface GigabitEthernet0/0/1
ip address 10.0.3.1 255.255.255.0
ip router isis
negotiation auto
ipv6 address 1:3::1/64
ipv6 router isis
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
router isis
net 49.0012.0000.0000.0005.00
is-type level-1
metric-style wide
log-adjacency-changes
redistribute bgp 3 metric 30 level-1
address-family ipv6
    redistribute bgp 3 metric 30 level-1
exit-address-family
router bgp 3
bgp router-id 5.5.5.5
bgp log-neighbor-changes
no bgp default ipv4-unicast
neighbor 2:1::1 remote-as 2
neighbor 192.168.1.1 remote-as 2
address-family ipv4
    redistribute connected
    redistribute isis level-1 metric 10
    neighbor 192.168.1.1 activate
exit-address-family
address-family ipv6
    redistribute connected
    redistribute isis metric 10 level-1
    neighbor 2:1::1 activate
exit-address-family
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
```

```
ip tftp source-interface GigabitEthernet0
control-plane
line con 0
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

```
Building configuration...
Current configuration : 1624 bytes
version 15.5
service timestamps debug datetime msec
service timestamps log datetime msec
no platform punt-keepalive disable-kernel-core
hostname R6
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
ipv6 unicast-routing
subscriber templating
vtp domain cisco
vtp mode transparent
multilink bundle-name authenticated
license udi pid ISR4321/K9 sn FDO214421BU
spanning-tree extend system-id
redundancy mode none
vlan internal allocation policy ascending
interface GigabitEthernet0/0/0
ip address 10.0.3.2 255.255.255.0
ip router isis
negotiation auto
ipv6 address 1:3::2/64
ipv6 router isis
interface GigabitEthernet0/0/1
ip address 10.0.30.1 255.255.255.0
ip router isis
```

```
negotiation auto
ipv6 address 1:30::1/64
ipv6 router isis
interface Serial0/1/0
no ip address
shutdown
interface Serial0/1/1
no ip address
shutdown
interface Service-Engine0/2/0
no ip address
shutdown
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
interface Vlan1
no ip address
shutdown
router isis
net 49.0012.0000.0000.0006.00
is-type level-1
metric-style wide
log-adjacency-changes
ip forward-protocol nd
no ip http server
no ip http secure-server
ip tftp source-interface GigabitEthernet0
control-plane
line con 0
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

Building configuration...
Current configuration : 2536 bytes
version 15.5
service timestamps debug datetime msec
service timestamps log datetime msec
no platform punt-keepalive disable-kernel-core

```
hostname R7
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
ipv6 unicast-routing
subscriber templating
multilink bundle-name authenticated
license udi pid ISR4321/K9 sn FDO21442B21
spanning-tree extend system-id
redundancy mode none
vlan internal allocation policy ascending
interface Loopback0
ip address 7.7.7.7 255.255.255.255
ipv6 address 100:7::7/128
ipv6 eigrp 1
interface GigabitEthernet0/0/0
ip address 10.0.1.2 255.255.255.0
negotiation auto
ipv6 address 1:1::2/64
ipv6 eigrp 1
interface GigabitEthernet0/0/1
ip address 10.0.2.1 255.255.255.0
negotiation auto
ipv6 address 1:2::1/64
ipv6 eigrp 1
interface Serial0/1/0
no ip address
interface Serial0/1/1
no ip address
interface GigabitEthernet0/2/0
no ip address
negotiation auto
interface GigabitEthernet0/2/1
no ip address
negotiation auto
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
negotiation auto
interface Vlan1
no ip address
```

```
router eigrp 1
network 7.7.7.7 0.0.0.0
network 10.0.1.0 0.0.0.255
network 10.0.2.0 0.0.0.255
eigrp router-id 7.7.7.7
router bgp 2
bgp router-id 7.7.7.7
bgp log-neighbor-changes
neighbor 100:3::3 remote-as 2
neighbor 100:3::3 update-source Loopback0
neighbor 100:4::4 remote-as 2
neighbor 100:4::4 update-source Loopback0
neighbor 3.3.3.3 remote-as 2
neighbor 3.3.3.3 update-source Loopback0
neighbor 4.4.4.4 remote-as 2
neighbor 4.4.4.4 update-source Loopback0
address-family ipv4
  no neighbor 100:3::3 activate
  no neighbor 100:4::4 activate
  neighbor 3.3.3.3 activate
  neighbor 3.3.3.3 route-reflector-client
  neighbor 4.4.4.4 activate
  neighbor 4.4.4.4 route-reflector-client
exit-address-family
address-family ipv6
  neighbor 100:3::3 activate
  neighbor 100:3::3 route-reflector-client
  neighbor 100:4::4 activate
  neighbor 100:4::4 route-reflector-client
exit-address-family
ip forward-protocol nd
no ip http server
no ip http secure-server
ip tftp source-interface GigabitEthernet0
ipv6 router eigrp 1
eigrp router-id 7.7.7.7
control-plane
line con 0
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

Problems

We faced many problems in converting our past BGP lab into iBGP because it was difficult to find the necessary commands. Again, troubleshooting was difficult and our PC IP addresses were faulty at times and that gave us issues while trying to ping across the network. We also had some router troubles but they seemed to have gone away when we reload the routers after someone else had ran configurations on them.

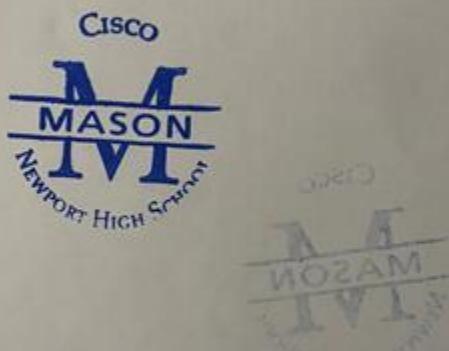
Conclusion

In conclusion, this lab allowed us to create a network that runs efficiently because of how it uses diverse routing protocols to connect networks. There were many challenges regarding the IP addresses used and we learned many things about how to configure multi area OSPF instead of single area which we were already familiar with because of the CCNA course, as well as EIGRP and eBGP configuration. This was a very good learning experience as now we were able to get a refresh on network configuration and successfully create a network that works at an industry level.

Teacher Signoff Page of Lab Completed

Configuring a multiprotocol Network with iBGP

Charles Liu P3-4 CCNP Mr. Mason





Configuring an Access Point with WPA and Radius

ADVANCED CISCO PERIOD 3-4
LIU, CHARLES

Purpose

The purpose of configuring an access point is to allow for wireless connection to a network. This is useful for services that involve many clients that are not stationary or constantly changing. For example, many businesses, like Starbucks, use wireless services so that their customers will be able to use their Wi-Fi while being able to move around and quickly connect and disconnect to service.

Background Information on lab concepts

Access Points are devices that “distribute” wireless signal to devices so that they can be connected to a network without having to be connected to it physically through something like an ethernet cord. These are extremely common in places like restaurants, company buildings, and schools. For example, in Antigua, Access Points were extremely important in setting up Wi-Fi for schools because it allowed for wireless access (which allows students to use portable laptops) and let many devices to be able to access one network that had internet access. These many access points connected to one central switch let us create networks that could reach multiple classrooms and provide internet access for dozens of students.

We used the Graphic User Interface (GUI) that was built into the access point to configure the SSIDs (Service Set Identifiers) that show up when you try and connect to the internet. This made it a lot easier to configure our access point and decreased the time it took to get the access point to be functional.

Our access point used many different security measures that are used for unique purposes:

Our Guest network had no security, allowing for access without a password. This is useful for situations where there is a designated place on the network for guests to use Wi-Fi and makes it a lot easier for guests to connect when they are not using their home networks.

Our secure network used WPA2-PSK, which is commonly used in all areas, such as company buildings or home networks, to authenticate users and devices before allowing access to the network. This is done through using a pre-shared key, which is functionally a password and unique username. WPA2-PSK also uses AES to encrypt data packages during transmission, making it more secure for use.

The third security type is through a RADIUS server, which was set up through freeradius, which manages user authentication, authorization, and accounting for all users. RADIUS allows for central management, which is vital for large networks where there are many users.

We used VLANs on our switch to allow for better management and efficiency of our network. This is done through network segmentation, enhanced security, and improved management. These virtual LANs allow for segmentation that can let us use different security measures on our access point. These were configured on the switch, which was connected to our router and the internet.

Lab Summary

We were able to configure a functioning access point, which was able to provide internet access through 3 unique SSIDs, all with unique security measures. This configuration could be used in a professional environment, allowing for guests and employees to access the internet through different methods. Being able to provide internet with adequate security and speed is a very common goal for network engineers, and we were able to learn how to accomplish this goal.

Lab Commands

R1:

```
g0/0/0.1: 192.168.1.1 255.255.255.0      vlan 1, native  
g0/0/0.10: 192.168.10.1 255.255.255.0    vlan 10  
g0/0/0.20: 192.168.20.1 255.255.255.0    vlan 20  
g0/0/0.30: 192.168.30.1 255.255.255.0    vlan 30  
g0/0/1: dhcp from 192.168.40.0 255.255.255.0  
dhcp pool GUEST:      network 192.168.10.0 255.255.255.0  
dhcp pool SECURE:     network 192.168.20.0 255.255.255.0  
dhcp pool RADIUS:     network 192.168.30.0 255.255.255.0  
all pools: dns-server 8.8.8.8, default-router 192.168.1.1
```

access list:

```
permit 192.168.1.0 0.0.0.255,  
permit 192.168.10.0 0.0.0.255  
permit 192.168.20.0 0.0.0.255
```

```
permit 192.168.30.0 0.0.0.255  
ip nat inside source list 1 int g0/0/1 overload
```

S1:

```
enable  
configure terminal  
hostname aceSwitch  
interface vlan 1  
ip address 192.168.1.2 255.255.255.0  
no shutdown  
exit  
ip default-gateway 192.168.1.1  
vlan 10  
name aceGuest  
exit  
vlan 20  
name aceSecure  
exit  
vlan 30  
name aceRadius  
exit  
interface fastEthernet 0/1  
switchport mode trunk
```

```
switchport trunk native vlan 1
spanning-tree portfast
exit
interface fastEthernet 0/2
switchport mode access
switchport access vlan 1
spanning-tree portfast
exit
interface fastEthernet 0/22
switchport mode trunk
switchport trunk native vlan 1
spanning-tree portfast
exit
interface fastEthernet 0/23
switchport mode trunk
switchport trunk native vlan 1
spanning-tree portfast
exit
end

AP:
BVI1: 192.168.1.245 255.255.255.0
aceGuest: vlan 10, no encryption
aceSecure: vlan 20, WPA2 PSK, password: 123456789
```

aceRadius: vlan 30, WPA Enterprise

Radius:

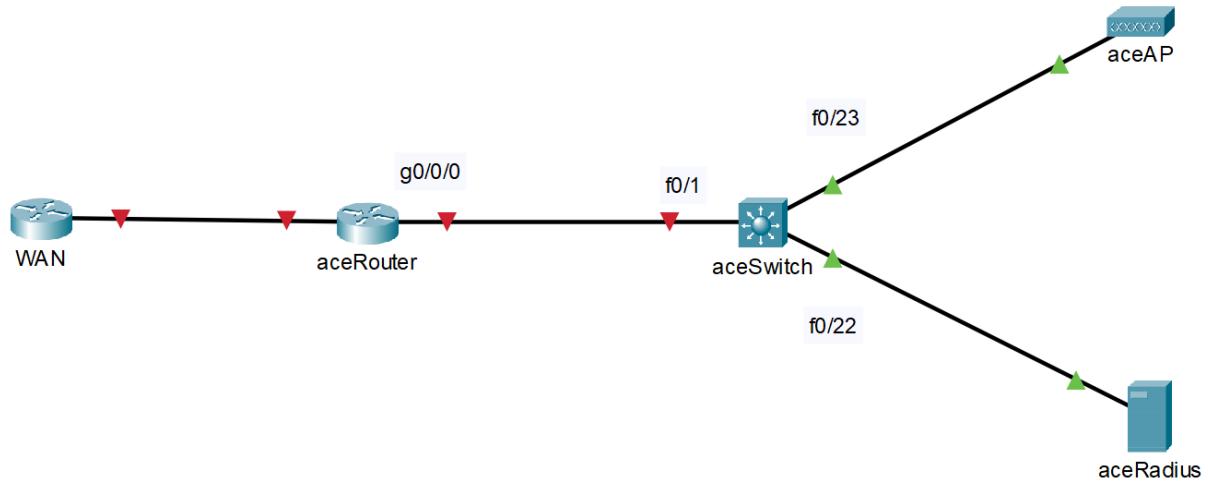
IP: 192.168.1.20

user: ace

password: class

server secret: class

Network Diagram with IP's



Configurations Show run on all routes involved

Access Point (aceAP)

```
version 15.3  
no service pad  
service timestamps debug datetime msec  
service timestamps log datetime msec  
service password-encryption
```

```
hostname ACE
logging rate-limit console 9
enable secret 5 $1$q.Mn$RQDAU5abolsVay.La2vRt1
aaa new-model
aaa group server radius rad_eap
server name 192.168.1.20
aaa group server radius rad_mac
aaa group server radius rad_acct
server name 192.168.1.20
aaa group server radius rad_admin
server name 192.168.1.20
aaa group server tacacs+ tac_admin
aaa group server radius rad_pmip
aaa group server radius dummy
aaa authentication login eap_methods group rad_eap
aaa authentication login mac_methods local
aaa authorization exec default local
aaa accounting network acct_methods start-stop group rad_acct
aaa session-id common
no ip source-route
no ip cef
dot11 pause-time 100
dot11 syslog
dot11 ssid aceGuest
vlan 10
authentication open
guest-mode
dot11 ssid aceRadius
vlan 30
```

```
authentication open eap eap_methods
authentication network-eap eap_methods
authentication key-management wpa
mbssid guest-mode
dot11 ssid aceSecure
vlan 20
authentication open
authentication key-management wpa version 2
guest-mode
mbssid guest-mode
wpa-psk ascii 7 08701E1D5D4C53404A52
no ipv6 cef
username Cisco password 7 1531021F0725
bridge irb
interface Dot11Radio0
no ip address
ssid aceGuest
antenna gain 0
station-role root
bridge-group 1
bridge-group 1 subscriber-loop-control
bridge-group 1 spanning-disabled
bridge-group 1 block-unknown-source
no bridge-group 1 source-learning
no bridge-group 1 unicast-flooding
interface Dot11Radio0.10
encapsulation dot1Q 10
bridge-group 10
bridge-group 10 subscriber-loop-control
```

```
bridge-group 10 spanning-disabled
bridge-group 10 block-unknown-source
no bridge-group 10 source-learning
no bridge-group 10 unicast-flooding
interface Dot11Radio1
no ip address
encryption vlan 20 mode ciphers aes-ccm
encryption vlan 30 mode ciphers aes-ccm tkip
ssid aceRadius
ssid aceSecure
antenna gain 0
peakdetect
dfs band 3 block
mbssid
channel dfs
station-role root
bridge-group 1
bridge-group 1 subscriber-loop-control
bridge-group 1 spanning-disabled
bridge-group 1 block-unknown-source
no bridge-group 1 source-learning
no bridge-group 1 unicast-flooding
interface Dot11Radio1.20
encapsulation dot1Q 20
bridge-group 20
bridge-group 20 subscriber-loop-control
bridge-group 20 spanning-disabled
bridge-group 20 block-unknown-source
no bridge-group 20 source-learning
```

```
no bridge-group 20 unicast-flooding
interface Dot11Radio1.30
encapsulation dot1Q 30
bridge-group 30
bridge-group 30 subscriber-loop-control
bridge-group 30 spanning-disabled
bridge-group 30 block-unknown-source
no bridge-group 30 source-learning
no bridge-group 30 unicast-flooding
interface Dot11Radio1.201
interface GigabitEthernet0
no ip address
duplex auto
speed auto
bridge-group 1
bridge-group 1 spanning-disabled
no bridge-group 1 source-learning
interface GigabitEthernet0.10
encapsulation dot1Q 10
bridge-group 10
bridge-group 10 spanning-disabled
no bridge-group 10 source-learning
interface GigabitEthernet0.20
encapsulation dot1Q 20
bridge-group 20
bridge-group 20 spanning-disabled
no bridge-group 20 source-learning
interface GigabitEthernet0.30
encapsulation dot1Q 30
```

```
bridge-group 30
bridge-group 30 spanning-disabled
no bridge-group 30 source-learning
interface GigabitEthernet0.201
interface BVI1
mac-address 44d3.ca03.7dce
ip address 192.168.1.245 255.255.255.0
ipv6 address dhcp
ipv6 address autoconfig
ipv6 enable
ip forward-protocol nd
ip http server
no ip http secure-server
ip http help-path
http://www.cisco.com/warp/public/779/smbiz/prodconfig/help/eag
ip radius source-interface BVI1
radius-server attribute 32 include-in-access-req format %h
radius server 192.168.1.20
address ipv4 192.168.1.20 auth-port 1812 acct-port 1813
key 7 121A09160118
bridge 1 route ip
line con 0
line vty 0 4
transport input all
end
```

Switch (aceSwitch)

```
version 12.2
no service pad
```

```
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
hostname aceSwitch
boot-start-marker
boot-end-marker
no aaa new-model
system mtu routing 1500
authentication mac-move permit
ip subnet-zero
spanning-tree mode pvst
spanning-tree etherchannel guard misconfig
spanning-tree extend system-id
vlan internal allocation policy ascending
interface FastEthernet0/1
switchport trunk encapsulation dot1q
switchport mode trunk
spanning-tree portfast trunk
interface FastEthernet0/2
switchport mode access
spanning-tree portfast
interface FastEthernet0/3
interface FastEthernet0/4
interface FastEthernet0/
interface FastEthernet0/6
interface FastEthernet0/7
interface FastEthernet0/8
interface FastEthernet0/9
interface FastEthernet0/10
```

```
interface FastEthernet0/11
interface FastEthernet0/12
interface FastEthernet0/13
interface FastEthernet0/14
interface FastEthernet0/15
interface FastEthernet0/16
interface FastEthernet0/17
interface FastEthernet0/18
interface FastEthernet0/19
interface FastEthernet0/20
interface FastEthernet0/21
interface FastEthernet0/22
switchport trunk encapsulation dot1q
switchport mode trunk
spanning-tree portfast trunk
interface FastEthernet0/23
switchport trunk encapsulation dot1q
switchport mode trunk
spanning-tree portfast trunk
interface FastEthernet0/24
interface GigabitEthernet0/1
interface GigabitEthernet0/2
interface Vlan1
ip address 192.168.1.2 255.255.255.0
ip classless
ip http server
ip http secure-server
ip sla enable reaction-alerts
line con 0
```

```
line vty 5 15
end

Router (aceRouter)
version 15.5

service timestamps debug datetime msec
service timestamps log datetime msec
no platform punt-keepalive disable-kernel-core
hostname aceRouter
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
ip dhcp excluded-address 192.168.1.1 192.168.1.5
ip dhcp excluded-address 192.168.10.1 192.168.10.5
ip dhcp excluded-address 192.168.20.1 192.168.20.5
ip dhcp excluded-address 192.168.30.1 192.168.30.5
ip dhcp excluded-address 192.168.1.20
ip dhcp excluded-address 192.168.1.245
!
ip dhcp pool GUEST
network 192.168.10.0 255.255.255.0
dns-server 8.8.8.8
default-router 192.168.1.1
!
```

```
ip dhcp pool SECURE
network 192.168.20.0 255.255.255.0
dns-server 8.8.8.8
default-router 192.168.1.1
ip dhcp pool RADIUS
network 192.168.30.0 255.255.255.0
dns-server 8.8.8.8
default-router 192.168.1.1
subscriber templating
vtp domain cisco
vtp mode transparent
multilink bundle-name authenticated
license udi pid ISR4321/K9 sn FDO21281AAT
spanning-tree extend system-id
redundancy
mode none
vlan internal allocation policy ascending
interface GigabitEthernet0/0/0
no ip address
negotiation auto
interface GigabitEthernet0/0/0.1
encapsulation dot1Q 1 native
ip address 192.168.1.1 255.255.255.0
ip nat inside
interface GigabitEthernet0/0/0.10
encapsulation dot1Q 10
ip address 192.168.10.1 255.255.255.0
ip nat inside
interface GigabitEthernet0/0/0.20
```

```
encapsulation dot1Q 20
ip address 192.168.20.1 255.255.255.0
ip nat inside
interface GigabitEthernet0/0/0.30
encapsulation dot1Q 30
ip address 192.168.30.1 255.255.255.0
ip nat inside
interface GigabitEthernet0/0/1
ip address dhcp
ip nat outside
negotiation auto
interface GigabitEthernet0/1/0
negotiation auto
interface GigabitEthernet0/1/1
negotiation auto
interface Service-Engine0/2/0
no ip address
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
interface Vlan1
no ip address
shutdown
ip nat inside source list 1 interface GigabitEthernet0/0/1 overload
ip forward-protocol nd
no ip http server
no ip http secure-server
```

```

ip tftp source-interface GigabitEthernet0

access-list 1 permit 192.168.1.0 0.0.0.255

access-list 1 permit 192.168.10.0 0.0.0.255

access-list 1 permit 192.168.20.0 0.0.0.255

access-list 1 permit 192.168.30.0 0.0.0.255

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

```

The screenshot shows the Cisco Aironet 1040 Series Access Point interface. The main title is "Cisco Aironet 1040 Series Access Point". On the left, there's a navigation bar with "Home", "Summary", "Easy Setup", and "Network Assistant". The main content area has a teal header "Home - Summary Status". Below it, there are sections for "Association", "Network Identity", "Interfaces", and "Event Log".

Association		
Client: 0	Infrastructure client: 0	
IP Address	192.168.1.245	
Ethernet Address	E800-00C1-C4FF-E9B3-7DCE	
MAC Address	44C1:C4FF:E9B3	

Network Identity		
Interface	MAC Address	Transmission Rate
Wireless	44C1:C4FF:E9B3	100Mbps
Railroad-102-K9P	00A0-0007-7010	Mbps Index 10
Railroad-102-K9I	00B0-0007-0390	Mbps Index 10

Event Log		
Time	Severity	Description
Mar 19 03:25:190	Notification	Configured from console by console
Mar 19 03:25:879	Warning	No SSID configured. Dot11Radio0 not started.
Mar 19 03:25:873	Notification	Link protocol on Interface Dot11Radio0 changed state to up
Mar 19 03:25:879	Information	Interface Dot11Radio0 changed state to reset
Mar 19 03:25:873	Information	Interface Dot11Radio0 changed state to up
Mar 19 03:25:845	Notification	Link protocol on Interface Dot11Radio0 changed state to down
Mar 19 03:25:850	Notification	Interface Dot11Radio0 changed state to reset
Mar 19 03:25:853	Information	Interface Dot11Radio0 changed state to down
Mar 19 03:25:853	Warning	No SSID configured. Dot11Radio0 not started.
Mar 19 03:25:853	Notification	Link protocol on Interface Dot11Radio0 changed state to up

Access Point GUI Summary

Problems

1. Factory resetting the access point led to the access point to be stuck in the bootloader. It seemed that it was trying to load the image “flash: /c1140-k9w7-xx.153-3.JD9/c1140-k9w7-xx.153-3.JD9” and the image “flash:/ c1140-k9w7-mx.153-3.JD9/c1140-k9w7-mx.153-3.JD9”. However, the first image was too small, leading us to believe that it somehow got corrupted, and the second image didn’t exist. Instead, we found that the correct image was stored at “flash: /c1140-k9w7-mx.153-3.JD9/c1140-k9w7-xx.153-3.JD9”. To fix this, we set the BOOT environmental variable to “flash: /c1140-k9w7-mx.153-3.JD9/c1140-k9w7-xx.153-3.JD9”, and booted it through the correct image.
2. Our original topology only has one Layer 3 Switch as the networking device, as opposed to one switch and one router. This did not allow us to perform router on a stick, which allows both easier configuration and allows devices from inside the network to communicate within specific VLANs relating to their IP address.
3. There were native VLAN mismatches between the router/switch and the access point, leading to some tagged traffic to be untagged and be lost within the network, which at some points made us lose administrative access to the access point. We redid and cleaned up our VLAN settings to ensure this did not happen.
4. In our freeRADIUS configuration, we initially set up a private network in the clients.conf file. However, the correct configuration is to set a client for the access point with the IP address of the access point.
5. Using the default configuration for setting up the WPA Enterprise SSID did not set the radius server to be used. Instead, it only placed the information of the radius server within the access point. We had to manually configure the WPA Enterprise SSID to use the radius server as the default.
6. The default radius authentication and accounting ports in the access point are 1645 and 1646. However, the more common default and the default for freeRadius is 1812 and 1813. Correcting these allowed the access point to use the radius server for authentication.

Conclusion

This was a wonderful opportunity to learn more about configuring access points, which have many real-life applications. It was interesting to see how the access points we used in Antigua were configured and implemented in the Antiguan schools. Access points are very often used in our day to day lives, which adds to the value of knowing how to configure one if it were to come up in a networking situation.

Teacher Signoff Page of Lab Complete

Configuring an Access Point with WPA and Radius

Charles Liu P3-4 CCNP Mr. Mason





Configuring a network with the IS-IS Routing Protocol

ADVANCED CISCO PERIOD 3-4
LIU, CHARLES

Purpose

The purpose of this lab is to create a network that uses the routing protocol of IS-IS to create a more efficient network.

Background Information on lab concepts

Intermediate System to Intermediate System (IS-IS) is a routing protocol that was improved by Radia Perlman. It has an administrative distance of 115, meaning that it is less preferred than some newer routing protocols such as BGP and OSPF. IS-IS creates areas of subdomains in the network and uses these to communicate with each other. Routing within an area is known as Level 1 routing and routing between areas is known as Level 2 routing.

This is a link state routing protocol like OSPF, which means that it can create a complete picture of the network topology. This is useful in large networks and makes troubleshooting more centralized.

It is an Interior Gateway Protocol used commonly in large networks for providers and sometimes enterprise networks as well. This is since IS-IS is easily scalable and has a fast convergence time when changes are made, making it a popular protocol to use.

IS-IS operates strictly in the Layer 2 of the OSI model, meaning that it does not have encapsulated IPs and requires an Integrated IS-IS model to support IP routing.

Lab Summary

We were able to configure multi-protocol network on 6 routers, ultimately creating a network that allows for pings across the network from 2 end devices. The 2 desktops that we used to configure the devices with through pUTTY were able to send packets to each other. This successfully creates a network that uses the IS-IS protocols.

Lab Commands

Router R1

hostname R1

interface GigabitEthernet0/0/0

ip address 192.168.1.1 255.255.255.0

```
ip router isis companyA

interface GigabitEthernet0/0/1
    ip address 192.168.0.1 255.255.255.0

ip router isis companyA

interface GigabitEthernet0/1/0
    shutdown

interface GigabitEthernet0/1/1
    shutdown

interface Service-Engine0/2/0
    shutdown

interface GigabitEthernet0
    shutdown

interface Vlan1
    shutdown

router isis companyA
    net 49.0000.1920.1680.0001.00
    is-type level-1
    redistribute connected
    ip tftp source-interface GigabitEthernet0
    no ip http server
    no ip http secure-server
    line vty 0 4
    login
```

Router R2

hostname R2

interface GigabitEthernet0/0/0

ip address 192.168.1.2 255.255.255.0

ip router isis companyA

interface GigabitEthernet0/0/1

ip address 192.168.2.1 255.255.255.0

ip router isis companyA

interface GigabitEthernet0

shutdown

interface Vlan1

shutdown

router isis companyA

net 49.0000.1920.1680.0002.00

redistribute connected

ip tftp source-interface GigabitEthernet0

no ip http server

no ip http secure-server

line vty 0 4

login

Router R3

```
hostname R3

interface GigabitEthernet0/0/0
    ip address 192.168.3.1 255.255.255.0
    ip router isis companyB

interface GigabitEthernet0/0/1
    ip address 192.168.2.2 255.255.255.0
    ip router isis companyB

interface GigabitEthernet0/1/0
    shutdown

interface GigabitEthernet0/1/1
    shutdown

interface GigabitEthernet0
    shutdown

interface Vlan1
    shutdown

router isis companyB
    net 49.0000.1920.1680.0003.00
    redistribute connected
    ip tftp source-interface GigabitEthernet0
    no ip http server
    no ip http secure-server
    line vty 0 4
    login
```

Router R4

hostname R4

login on-success log

interface GigabitEthernet0/0/0

ip address 192.168.3.2 255.255.255.0

ip router isis companyB

interface GigabitEthernet0/0/1

ip address 192.168.4.1 255.255.255.0

ip router isis companyB

interface Serial0/1/0

shutdown

interface Serial0/1/1

shutdown

interface GigabitEthernet0

shutdown

router isis companyB

net 49.0000.1920.1680.0004.00

metric-style narrow

redistribute connected

ip http server

ip http authentication local

ip http secure-server

```
ip tftp source-interface GigabitEthernet0  
line con 0  
transport input none  
line vty 0 4  
login
```

```
Router R5  
hostname R5  
login on-success log  
interface GigabitEthernet0/0/0  
ip address 192.168.5.1 255.255.255.0  
ip router isis companyC  
interface GigabitEthernet0/0/1  
ip address 192.168.4.2 255.255.255.0  
ip router isis companyC  
interface GigabitEthernet0/1/0  
shutdown  
interface GigabitEthernet0/1/1  
shutdown  
interface GigabitEthernet0  
shutdown  
router isis companyC  
net 49.0000.1920.1680.0005.00
```

```
metric-style narrow  
redistribute connected  
ip http server  
ip http authentication local  
ip http secure-server  
ip tftp source-interface GigabitEthernet0  
line con 0  
transport input none  
line vty 0 4  
login
```

```
Router R6  
hostname R6  
login on-success log  
interface GigabitEthernet0/0/0  
ip address 192.168.5.2 255.255.255.0  
ip router isis companyC  
interface GigabitEthernet0/0/1  
ip address 192.168.6.1 255.255.255.0  
ip router isis companyC  
interface Serial0/1/0  
shutdown  
interface Serial0/1/1
```

```
shutdown

interface GigabitEthernet0

shutdown

router isis companyC

net 49.0000.1920.1680.0006.00

is-type level-1

metric-style narrow

redistribute connected

ip http server

ip http authentication local

ip http secure-server

ip tftp source-interface GigabitEthernet0

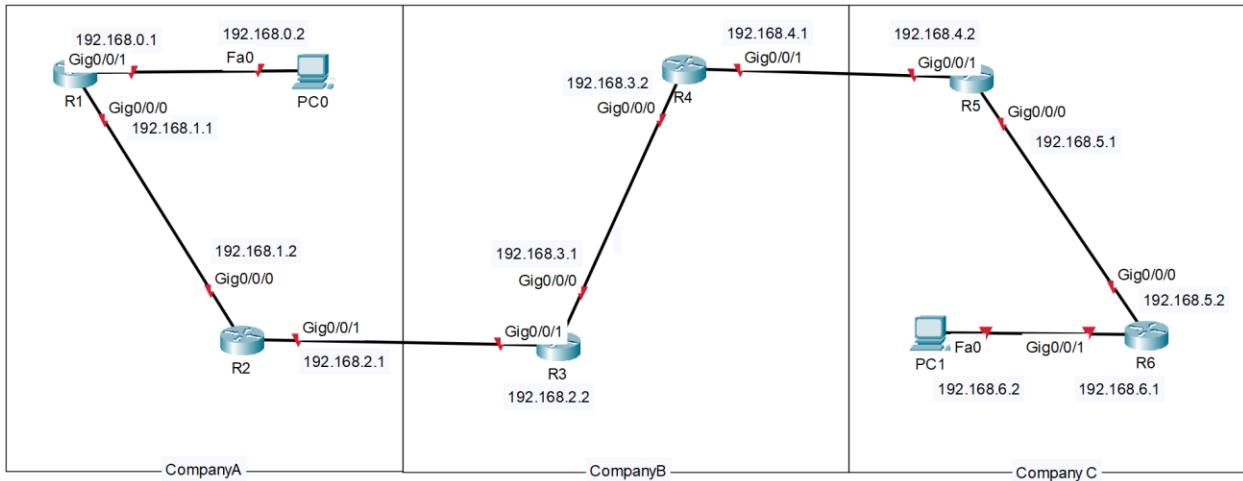
line con 0

transport input none

line vty 0 4

login
```

Network Diagram with IP's



Configurations Show run on all routes involved

R1

version 15.5

service timestamps debug datetime msec

service timestamps log datetime msec

no platform punt-keepalive disable-kernel-core

hostname R1

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

```
no aaa new-model

subscriber templating

vtp domain cisco

vtp mode transparent

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO21281AAT

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface GigabitEthernet0/0/0

ip address 192.168.1.1 255.255.255.0

ip router isis companyA

negotiation auto

interface GigabitEthernet0/0/1

ip address 192.168.0.1 255.255.255.0

ip router isis companyA

negotiation auto

interface GigabitEthernet0/1/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/1/1
```

```
no ip address

shutdown

negotiation auto

interface Service-Engine0/2/0

no ip address

shutdown

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

interface Vlan1

no ip address

shutdown

router isis companyA

net 49.0000.1920.1680.0001.00

is-type level-1

redistribute connected

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane
```

```
line con 0
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
R2
version 15.5
service timestamps debug datetime msec
service timestamps log datetime msec
no platform punt-keepalive disable-kernel-core
hostname R2
boot-start-marker
boot-end-marker
vrf definition Mgmt-intf
address-family ipv4
exit-address-family
address-family ipv6
exit-address-family
no aaa new-model
subscriber templating
vtp domain cisco
```

```
vtp mode transparent  
multilink bundle-name authenticated  
license udi pid ISR4321/K9 sn FDO21491LXF  
spanning-tree extend system-id  
redundancy  
mode none  
vlan internal allocation policy ascending  
interface GigabitEthernet0/0/0  
ip address 192.168.1.2 255.255.255.0  
ip router isis companyA  
negotiation auto  
interface GigabitEthernet0/0/1  
ip address 192.168.2.1 255.255.255.0  
ip router isis companyA  
negotiation auto  
interface Serial0/1/0  
interface Serial0/1/1  
interface GigabitEthernet0  
vrf forwarding Mgmt-intf  
no ip address  
shutdown  
negotiation auto  
interface Vlan1
```

```
no ip address

shutdown

router isis companyA

net 49.0000.1920.1680.0002.00

redistribute connected

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

R3

version 15.5

service timestamps debug datetime msec

service timestamps log datetime msec

no platform punt-keepalive disable-kernel-core

hostname R3
```

```
boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

subscriber templating

vtp domain cisco

vtp mode transparent

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FLM240607Q1

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface GigabitEthernet0/0/0

ip address 192.168.3.1 255.255.255.0

ip router isis companyB

negotiation auto

interface GigabitEthernet0/0/1

ip address 192.168.2.2 255.255.255.0
```

```
ip router isis companyB  
negotiation auto  
interface GigabitEthernet0/1/0  
no ip address  
shutdown  
negotiation auto  
interface GigabitEthernet0/1/1  
no ip address  
shutdown  
negotiation auto  
interface GigabitEthernet0  
vrf forwarding Mgmt-intf  
no ip address  
shutdown  
negotiation auto  
interface Vlan1  
no ip address  
shutdown  
router isis companyB  
net 49.0000.1920.1680.0003.00  
redistribute connected  
ip forward-protocol nd  
no ip http server
```

```
no ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

R4

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname R4

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6
```

```
exit-address-family  
no aaa new-model  
login on-success log  
subscriber templating  
vtp domain cisco  
vtp mode transparent  
multilink bundle-name authenticated  
license udi pid ISR4321/K9 sn FLM240800D6  
no license smart enable  
diagnostic bootup level minimal  
spanning-tree extend system-id  
redundancy  
mode none  
interface GigabitEthernet0/0/0  
ip address 192.168.3.2 255.255.255.0  
ip router isis companyB  
negotiation auto  
interface GigabitEthernet0/0/1  
ip address 192.168.4.1 255.255.255.0  
ip router isis companyB  
negotiation auto  
interface Serial0/1/0  
no ip address
```

```
shutdown

interface Serial0/1/1

no ip address

shutdown

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

router isis companyB

net 49.0000.1920.1680.0004.00

metric-style narrow

redistribute connected

ip forward-protocol nd

ip http server

ip http authentication local

ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane

line con 0

transport input none

stopbits 1

line aux 0
```

```
stopbits 1

line vty 0 4

login

end

R5

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname R5

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

login on-success log

subscriber templating

vtp domain cisco

vtp mode transparent
```

```
multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FLM2407011F

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface GigabitEthernet0/0/0

ip address 192.168.5.1 255.255.255.0

ip router isis companyC

negotiation auto

interface GigabitEthernet0/0/1

ip address 192.168.4.2 255.255.255.0

ip router isis companyC

negotiation auto

interface GigabitEthernet0/1/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/1/1

no ip address

shutdown

negotiation auto
```

```
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
router isis companyC
net 49.0000.1920.1680.0005.00
metric-style narrow
redistribute connected
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
ip tftp source-interface GigabitEthernet0
control-plane
line con 0
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

R6

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname R6

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

login on-success log

subscriber templating

vtp domain cisco

vtp mode transparent

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO214420HW

license boot level appxk9

no license smart enable

```
diagnostic bootup level minimal  
spanning-tree extend system-id  
redundancy  
mode none  
  
interface GigabitEthernet0/0/0  
ip address 192.168.5.2 255.255.255.0  
ip router isis companyC  
negotiation auto  
  
interface GigabitEthernet0/0/1  
ip address 192.168.6.1 255.255.255.0  
ip router isis companyC  
negotiation auto  
  
interface Serial0/1/0  
no ip address  
shutdown  
  
interface Serial0/1/1  
no ip address  
shutdown  
  
interface GigabitEthernet0  
vrf forwarding Mgmt-intf  
no ip address  
shutdown  
negotiation auto
```

```
router isis companyC
net 49.0000.1920.1680.0006.00
is-type level-1
metric-style narrow
redistribute connected
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
ip tftp source-interface GigabitEthernet0
control-plane
line con 0
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
end
```

Problems

We didn't face many issues with this lab. We had to do some basic troubleshooting, but the overall process of configuring the network was straightforward. IS-IS protocol commands are simply and easy to understand, making this lab a lot easier than other ones such as BGP and OSPF.

Conclusion

We were able to successfully configure a network that used 3 different regions with the IS-IS routing protocol. We could ping across the entire network, creating a functional network of multiple routers.

Teacher Signoff Page of Lab Complete

Configuring a Network with IS-IS Routing Protocol

Charles Liu P3-4 CCNP Mr. Mason





OSI Layer 2 Hacking Methods Lab

ADVANCED CISCO PERIOD 3-4
LIU, CHARLES

Purpose

The purpose of this lab is to find ways to effectively attack a network at the layer 2 level, which is named the data link layer. Our goal is to cause network performance issues to the network we configured through slowdowns, delays, and possibly instability.

Background Information on lab concepts

The Data Link layer is layer 2 of the OSI (Open Systems Interconnection) network model. This layer is responsible for the transmission of data through directly connected devices in the same LAN, which we will configure. It also works to correct errors possibly made in Layer 1, the physical layer. Layer 2 is extremely important because of the domino effect of OSI, which means if layer 2 is not functional, all other layers will not be able to work.

One important component of the Data Link Layer is the use of MAC (Media Access Control) Addresses. Layer 2 uses MAC addresses to identify and locate devices across a network. These are permanently assigned to devices by the manufacturer on the NIC (Network Interface Card) of devices like routers and switches. Switches are extremely important within layer 2 since they are responsible for most LAN traffic. ARP tables map MAC addresses to IP addresses while CAM tables map MAC addresses to switchports. These tables are limited to how much information they can store and are actively collecting data about the network they are connected to.

We will use 3 different methods to exploit loopholes in a Layer 2 network.

MAC Attack

This attack exploits the limited amount of information that can be stored in a CAM table. Switches build these MAC tables through flooding switchports when they don't know where to send a packet. It then uses responses to build a CAM table that makes it more effective at its job. Through directing switches to send packets to MAC addresses that don't exist in a network, you can fill up the CAM table. Using Dsniff (macof), you can generate over 480,000 MAC entries per second. This means it would take around 70 seconds to completely fill up a CAM table. Once the table is full, traffic without a CAM entry floods onto the VLAN, but not existing traffic with an existing CAM entry. Once the CAM table is full, switches will begin to flood switchports with traffic in hopes of reaching the correct destination. You can intercept this traffic with a tool like Wireshark, ultimately hacking into a network to obtain sensitive information.

DHCP Starvation

The objective of this attack is to create bogus discover packets so that the DHCP pool on a network does not have any addresses for actual devices to communicate. Dynamic host

Configuration Protocol is responsible for automatically assigning addresses to devices. These are configured with a limited pool, so when that pool uses all the addresses, the network cannot assign new devices' addresses, making it unusable. To prevent this attack from happening, you can limit the number of addresses given out to certain things, allowing for addresses to still be available for actual devices to use.

ARP Spoofing

Devices will send fake ARP messages to associate with the MAC addresses of devices, and the network will assign these malicious ARP messages to correct MAC addresses, limiting communication and the amount of traffic that will be successfully delivered. To prevent these attacks, you can have static ARP addresses, which is useful for small addresses or initiate switchport security to overcome this attack.

Lab Summary

We were able to successfully limit network traffic in our attacks find ways to prevent these attacks as well. This was a great way to learn about how vital security is in the real world and how important it is to know how to create a network responsibly.

Lab Commands

Setup network

1. On the router, configure an IP address for connectivity and configure a DHCP server to distribute IP addresses.
2. Connect both the attacker and victim to the network and ensure that they can receive IP addresses.

DHCP Starvation Attack

1. On the attacker, install Yersinia sudo apt install yersinia
2. Disconnect the victim and attacker from the switch, and release all DHCP bindings on the router clear ip dhcp bindings *
3. Reconnect the attacker to gain an IP address through DHCP.
4. On the attacker, run the DHCP Discover flood attack.
 - a. Bring up the Yersinia GUI sudo yersinia -G
 - b. Click “Launch Attack” and select the DHCP Discover flood attack
5. On the router, show DHCP bindings to demonstrate the attack. show ip dhcp pool
6. Connect the victim to the network. Note that the PC is unable to receive an IP address.

7. To reset the network, clear DHCP bindings again. clear ip dhcp bindings *

DHCP Starvation Prevention

On the switch, enable port-security on all untrusted ports and set a maximum of 2 MAC addresses along with the following configurations.

```
switchport mode access
switchport port-security
switchport port-security maximum 2
switchport port-security violation restrict
switchport port-security mac-address sticky
```

ARP Spoofing Attack

1. On the attacker, install Dsniff sudo apt install dsniff
2. Connect both attacker and victim to the switch and ensure they receive IP addresses from DHCP.
3. On the router, show the arp table and record the IP and MAC addresses of both devices. show arp
4. On the attacker, run the ARP spoofing attack.
 - a. Identify the correct interface ip a
 - b. Run the attack sudo arpspoof -i [interface] -t [gateway IP] [victim IP]
5. On the router, show the arp table and note the difference in MAC addresses from before. show arp
6. Stop the attack with Ctrl-C on the attacker. This will automatically return the MAC addresses to normal.

ARP Spoofing Prevention

On the switch, enable DHCP snooping and ARP inspection, and set the router port to be trusted.

```
ip dhcp snooping
```

```
ip dhcp snooping vlan 1
```

```
ip arp inspection vlan 1
```

```
interface FastEthernet0/1
```

```
ip dhcp snooping trust
```

```
ip arp inspection trust
```

MAC Flooding Attack

1. On the attacker, install Dsniff sudo apt install dsniff
2. Connect both attacker and victim to the switch and ensure they receive IP addresses from DHCP.
3. On the router, show the mac table and note how many dynamic entries there are. show mac address-table dynamic
4. On the attacker, run the MAC flooding attack.
 - a. Identify the correct interface ip a
 - b. Run the attack sudo macof -i [interface]
5. On the router, show the mac table again. show mac address-table dynamic
6. Clear the mac table clear mac address-table dynamic

MAC Flooding Prevention

On the switch, enable port-security on all untrusted ports and set a maximum of 1 MAC address along with the following configurations.

switchport mode access

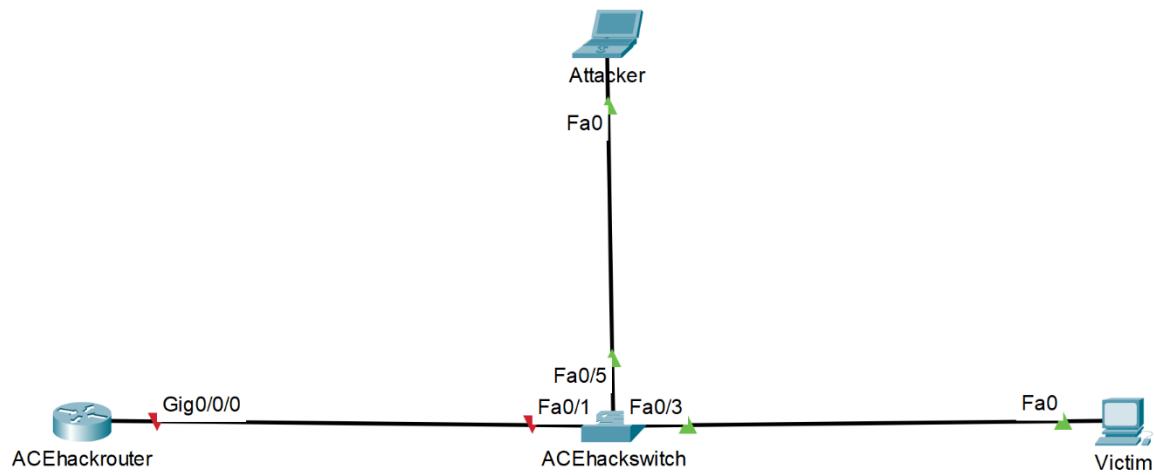
switchport port-security

switchport port-security maximum 1

switchport port-security violation restrict

switchport port-security mac-address sticky

Network Diagram with IP's



Configurations Show run on all routes involved

```
ACEhackswitch
```

```
version 12.2
```

```
no service pad
```

```
service timestamps debug datetime msec
```

```
service timestamps log datetime msec
```

```
no service password-encryption
```

```
hostname ACEhackswitch
```

```
boot-start-marker
```

```
boot-end-marker
```

```
no aaa new-model
```

```
system mtu routing 1500
```

```
authentication mac-move permit
```

```
ip subnet-zero
```

```
ip dhcp snooping vlan 1
ip dhcp snooping
ip arp inspection vlan 1
spanning-tree mode pvst
spanning-tree etherchannel guard misconfig
spanning-tree extend system-id
vlan internal allocation policy ascending
interface FastEthernet0/1
ip arp inspection trust
spanning-tree portfast
ip dhcp snooping trust
interface FastEthernet0/2
interface FastEthernet0/3
interface FastEthernet0/4
interface FastEthernet0/5
switchport mode access
switchport port-security
switchport port-security violation restrict
switchport port-security mac-address sticky
switchport port-security mac-address sticky 5091.e368.6297 vlan access
spanning-tree portfast
interface FastEthernet0/6
interface FastEthernet0/7
interface FastEthernet0/8
interface FastEthernet0/9
interface FastEthernet0/10
```

```
interface FastEthernet0/11
interface FastEthernet0/12
interface FastEthernet0/13
interface FastEthernet0/14
interface FastEthernet0/15
interface FastEthernet0/16
interface FastEthernet0/17
interface FastEthernet0/18
interface FastEthernet0/19
interface FastEthernet0/20
interface FastEthernet0/21
interface FastEthernet0/22
interface FastEthernet0/23
interface FastEthernet0/24
interface GigabitEthernet0/1
interface GigabitEthernet0/2
interface Vlan1
no ip address
ip classless
ip http server
ip http secure-server
ip sla enable reaction-alerts
line con 0
line vty 5 15
end
```

ACEhackrouter

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname ACEhackrouter

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

ip dhcp excluded-address 192.168.0.0 192.168.0.9

ip dhcp pool SERVER

network 192.168.0.0 255.255.255.0

dns-server 8.8.8.8

default-router 192.168.0.1

login on-success log

subscriber templating

vtp domain cisco

vtp mode transparent

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO21281AAT

```
no license smart enable  
diagnostic bootup level minimal  
spanning-tree extend system-id  
redundancy  
mode none  
interface GigabitEthernet0/0/0  
ip address 192.168.0.1 255.255.255.0  
negotiation auto  
interface GigabitEthernet0/0/1  
no ip address  
negotiation auto  
interface GigabitEthernet0/1/0  
no ip address  
shutdown  
negotiation auto  
interface GigabitEthernet0/1/1  
no ip address  
shutdown  
negotiation auto  
interface Service-Engine0/2/0  
no ip address  
interface GigabitEthernet0  
vrf forwarding Mgmt-intf  
no ip address  
shutdown  
negotiation auto
```

```
ip forward-protocol nd  
ip http server  
ip http authentication local  
ip http secure-server  
ip tftp source-interface GigabitEthernet0  
control-plane  
line con 0  
transport input none  
stopbits 1  
line aux 0  
stopbits 1  
line vty 0 4  
login  
end
```

Problems

This lab was initially difficult given my limited knowledge of using Linux in comparison to programs we usually use like PUTTY. We were able to gain knowledge of using Linux and successfully issue the commands to hack successfully.

Conclusion

This was a wonderful opportunity to learn more about configuring access points, which have many real-life applications. It was interesting to see how the access points we used in Antigua were configured and implemented in the Antiguan schools. Access points are very often used in our day to day lives, which adds to the value of knowing how to configure one if it were to come up in a networking situation.

Teacher Signoff Page of Lab Complete

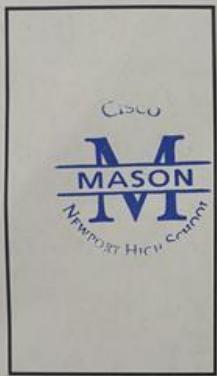
Layer 2 Attacks

Charles Liu

P3-4 CCNP

Mr. Mason

DHCP Starvation



ARP Spoofing



MAC Flooding





AWS Academy Cloud 2024-2025 Lab portfolio Foundations Labs 1-3

ADVANCED CISCO PERIOD 3-4
LIU, CHARLES

AWS Academy Cloud Foundations Lab 1 (Introduction to AWS IAM)

Purpose

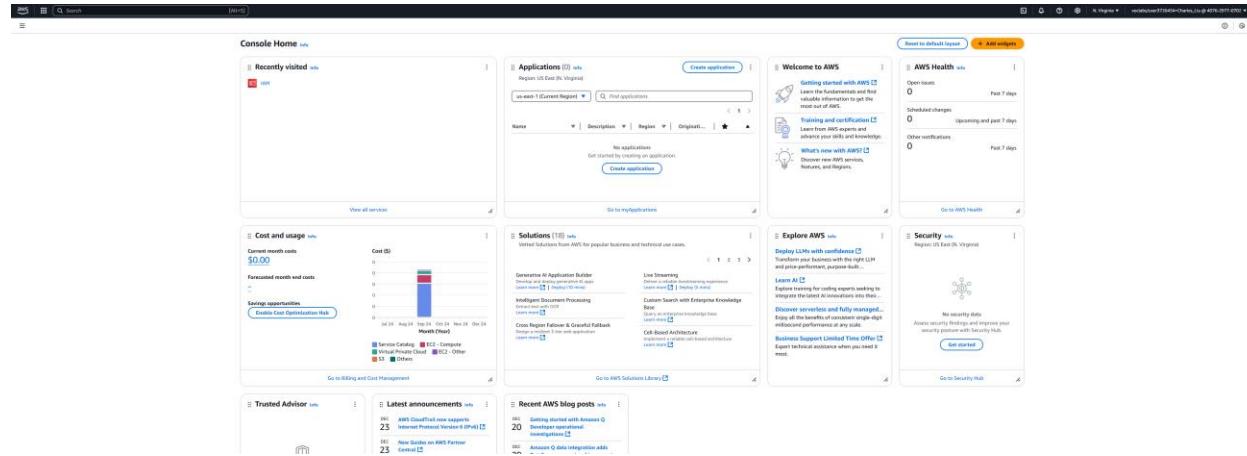
The purpose of this lab is to familiarize students with how to use the AWS Identity Access Management software. This lab teaches users how to view users, assign them permissions and access, and change the permission and access settings.

Background Information on lab concepts

Amazon Web Services IAM is a way for Users and Groups to be assigned policies that have specific capabilities needed to run a functional network with users and administrators. With users that have specific permissions, one can increase network security by ensuring that only those who need access and administrative powers can have access to sensitive data and information.

IAM allows networks to have an access system similar to physical data centers in that sensitive data can only be accessed by certain individuals. When using a cloud server, this is especially important because there is a higher risk that someone with malicious intent could infiltrate a company's servers and gain access to valuable data that could be harmful.

Lab Summary



The screenshot shows two related AWS IAM management pages:

- User groups (3) [info]**: A list of three user groups: `root`, `root-access`, and `ss-support`. Each group has three members with "Defined" permissions. All groups were created 3 minutes ago.
- Users (4) [info]**: A list of four IAM users: `student`, `user_1`, `user_2`, and `user_3`. Each user has a path of `/` and is associated with the `root-access` group. Their access status varies: `student` has `Access denied`, while `user_1`, `user_2`, and `user_3` have `Access allowed`. All users were created 4 minutes ago and have their console access disabled.

Problems

The main problems with this lab were getting familiar with the AWS software and how to use the provided tools. However, the lab guide was extremely useful and informative which made this lab a lot easier and more comprehensible.

Conclusion

This lab taught valuable skills in delegating roles to users based off what they should do. This reflects what a real server should do in order to maintain security and access so that users are able to ensure that they can have access to the things they need to and not give unwanted access to those who might have malicious intent.

Teacher Signoff Page of Lab Completed

Total score	40/40
TASK 2a - Added user-1 to S3-Support group	5/5
TASK 2b - Added user-2 to EC2-Support group	5/5
TASK 2c - Added user-3 to EC2-Admin group	5/5
TASK 3a - user-1 logged in	5/5
TASK 3b - user-2 logged in	5/5
TASK 3c - user-2 ec2 stop instance attempt	5/5
TASK 3d - user-3 logged in	5/5
TASK 3e - user-3 EC2 stop instance attempt EN	5/5

AWS Academy Cloud Foundations Lab 2 (Build your VPC and Launch a Web Server)

Purpose

The purpose of this lab was to create a VPC (Virtual Private Cloud) and use it to launch a web server, like a website. This allows us to use AWS's resources in creating a functional site that one might use if they were using AWS in a professional setting. For example, if I was using AWS to run a company's website, creating a VPC is what I would have to do in order to have the web server running.

Background Information on lab concepts

Virtual Private Clouds are private networks within a public cloud that allows groups like companies to host resources. Amazon Web Services uses VPC to create hybrid connections, build networks, and more. VPCs reflect the flexibility aspect of using a cloud network in that it follows the pay as you go program and allows for optimal spending and resource allocation instead of buying and building a physical data center.

The Web Server we launched was getting data from AWS's servers, ultimately allowing it to function like any other Web Server that could have been hosted by a physical data center in a traditional infrastructure.

Lab Summary

The screenshot shows the AWS VPC console interface. At the top, there are buttons for 'Create a VPC' and 'Launch EC2 Instances'. Below this, a message says 'Hello! Your lab will launch in the US East (US-EAST-1) region.' A 'Refresh Resources' button is also present. The main area is titled 'Resources by Region' and lists various VPC components across three regions: US East 1, US East 2, and US East 3. Components include VPCs, Subnets, Route Tables, Internet Gateways, Egress-only Internet Gateways, Direct Connect gateways, Endpoints, Instance Connect Endpoints, and Endpoint Services. Each component has a 'See all regions' link. To the right, there is a 'Service Health' section with a 'View complete service health details' link, a 'Settings' section with 'Block Public Access', 'Topics', and 'Console Experiments', and an 'Additional Information' section with links to 'VPC Documentation', 'All VPC Resources', 'Forums', and 'Report an issue'. Below these is the 'AWS Network Manager' section, which provides tools for managing and monitoring your network on AWS. It includes sections for 'AWS Network Manager', 'AWS Site-to-Site VPN Connections', and 'AWS Direct Connect Connections'. A 'Get started with Network Manager' button is available. At the bottom, there is a 'Preview' section showing a hierarchical diagram of the VPC structure:

```
graph LR; VPC[VPC Show details] --- Subnets[Subnets (2)]; Subnets --- us-east-1a[us-east-1a]; us-east-1a --- subnet1[1ab-subnet-public1-us-east-1a]; us-east-1a --- subnet2[1ab-subnet-private1-us-east-1a]; Subnets --- routeTables[Route tables (2)]; routeTables --- rtb1[1ab-rtb-public]; routeTables --- rtb2[1ab-rtb-private1-us-east-1a]; Subnets --- networkConnections[Network connections (2)]; networkConnections --- igw[1ab-igw]; networkConnections --- nat[nat-public1-us-east-1a]
```

Create VPC workflow

Success	
Details	
<ul style="list-style-type: none"> ○ Create VPC: vpc-0fd93fe78f55b7e8 ○ Enable DNS hostnames ○ Enable DNS resolution ○ Verifying VPC creation: vpc-0fd93fe78f55b7e8 ○ Create subnet: subnet-0e1b303696e7acd ○ Create subnet: subnet-06c13916e8518715d ○ Create internet gateway: igw-01ce88e49e945bbf ○ Attach internet gateway to the VPC ○ Create route table: rtb-07cb553db8e3e9624 ○ Create route ○ Associate route table ○ Allocate elastic IP: eipalloc-08fc6a6d6fa9d0fb ○ Create NAT gateway: nat-0790ac659e153b076 ○ Wait for NAT Gateways to activate ○ Create route table: rtb-0fc6a1e98747d7f5a ○ Create route ○ Associate route table ○ Verifying route table creation 	
View VPC	

Subnets (7) Info														
Find resources by attribute or tag Last updated Actions Create subnet 														
Name	Subnet ID	State	VPC	Block Public...	IPv4 CIDR	IPv6 CIDR	IPv6 CDR association ID	Available IPv4 addresses	Availability Zone	Availability Zone ID	Network border group	Route table	Network ACL	
subnet-09264a489715a314	subnet-09264a489715a314	Available	vpc-0fd93fe78f55b7e8	○ OFF	173.1.144.0/20	-	-	4091	us-east-1f	us-east-1	-	rtb-05360466f77bda	acl-05106566f77bda	
subnet-048299a6712509	subnet-048299a6712509	Available	vpc-0fd93fe78f55b7e8	○ OFF	10.0.0.0/24	-	-	250	us-east-1a	us-east-1	-	rtb-02154a49e95d1f9dc	acl-09f62c17450d221	
Work Public Subnet	Work Public Subnet	Available	vpc-0fd93fe78f55b7e8	Work	○ OFF	172.31.80.0/20	-	-	4091	us-east-1b	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda
subnet-004320107f0504	subnet-004320107f0504	Available	vpc-0fd93fe78f55b7e8	○ OFF	172.31.131.0/20	-	-	4091	us-east-1e	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda	
-	-	Available	vpc-0fd93fe78f55b7e8	-	○ OFF	172.31.148.0/20	-	-	4091	us-east-1d	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda
subnet-00346013b190057	subnet-00346013b190057	Available	vpc-0fd93fe78f55b7e8	○ OFF	172.31.132.0/20	-	-	4091	us-east-1c	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda	
subnet-0616a12042e015b	subnet-0616a12042e015b	Available	vpc-0fd93fe78f55b7e8	○ OFF	172.31.160.0/20	-	-	4091	us-east-1c	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda	
subnet-0fb00459a27459f	subnet-0fb00459a27459f	Available	vpc-0fd93fe78f55b7e8	○ OFF	172.31.161.0/20	-	-	4091	us-east-1c	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda	

Subnets (11) Info														
Find resources by attribute or tag Last updated Actions Create subnet 														
Name	Subnet ID	State	VPC	Block Public...	IPv4 CIDR	IPv6 CIDR	IPv6 CDR association ID	Available IPv4 addresses	Availability Zone	Availability Zone ID	Network border group	Route table	Network ACL	
subnet-0008a4a89715a314	subnet-0008a4a89715a314	Available	vpc-0fd93fe78f55b7e8	○ OFF	172.31.144.0/20	-	-	4091	us-east-1f	us-east-1	-	rtb-05360466f77bda	acl-05106566f77bda	
Work Public Subnet	Work Public Subnet	Available	vpc-0fd93fe78f55b7e8	Work	○ OFF	10.0.0.0/24	-	-	250	us-east-1a	us-east-1	-	rtb-02154a49e95d1f9dc	acl-09f62c17450d221
-	-	Available	vpc-0fd93fe78f55b7e8	-	○ OFF	172.31.80.0/20	-	-	4091	us-east-1b	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda
subnet-004320107f0504	subnet-004320107f0504	Available	vpc-0fd93fe78f55b7e8	○ OFF	172.31.131.0/20	-	-	4091	us-east-1e	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda	
subnet-00346013b190057	subnet-00346013b190057	Available	vpc-0fd93fe78f55b7e8	○ OFF	172.31.132.0/20	-	-	4091	us-east-1d	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda	
subnet-0616a12042e015b	subnet-0616a12042e015b	Available	vpc-0fd93fe78f55b7e8	○ OFF	172.31.160.0/20	-	-	4091	us-east-1c	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda	
subnet-0fb00459a27459f	subnet-0fb00459a27459f	Available	vpc-0fd93fe78f55b7e8	○ OFF	172.31.161.0/20	-	-	4091	us-east-1c	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda	
subnet-05052039305605030	subnet-05052039305605030	Available	vpc-0fd93fe78f55b7e8	○ OFF	172.31.162.0/20	-	-	4091	us-east-1c	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda	
T1b-subnet-public1-us-east-1a	T1b-subnet-public1-us-east-1a	Available	vpc-0fd93fe78f55b7e8	T1b-pub	○ OFF	10.0.0.0/24	-	-	250	us-east-1a	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda
T1b-subnet-public2	T1b-subnet-public2	Available	vpc-0fd93fe78f55b7e8	T1b-pub	○ OFF	10.0.2.0/24	-	-	251	us-east-1b	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda
T1b-subnet-private1-us-east-1a	T1b-subnet-private1-us-east-1a	Available	vpc-0fd93fe78f55b7e8	T1b-priv	○ OFF	10.0.1.0/24	-	-	251	us-east-1a	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda
T1b-subnet-private2	T1b-subnet-private2	Available	vpc-0fd93fe78f55b7e8	T1b-priv	○ OFF	10.0.3.0/24	-	-	251	us-east-1b	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda
Lab subnet private2	Lab subnet private2	Available	vpc-0fd93fe78f55b7e8	Lab-priv	○ OFF	10.0.3.0/24	-	-	251	us-east-1b	us-east-1	-	rtb-05360466f77bda	acl-05360466f77bda

Available subnets (2/4)													
Filter subnet associations Cancel Save associations 													
Name	Subnet ID	IPv4 CIDR	IPv6 CIDR	Route table ID									
1ab-subnet-public1-us-east-1a	subnet-0e1b30b3696e7acd	10.0.0.0/24	-	rtb-07cb553db8e3e9624 / 1ab-rtb-pu...									
1ab-subnet-public2	subnet-0335b5f435029db6cd	10.0.2.0/24	-	Main (rtb-017e2c3622facd563)									
<input checked="" type="checkbox"/> lab-subnet-private1-us-east-1a	subnet-06c13916e8518715d	10.0.1.0/24	-	rtb-0fc6a1e98747d7f5a / 1ab-rtb-priv...									
<input checked="" type="checkbox"/> lab-subnet-private2	subnet-02637f3bc6f967f2	10.0.3.0/24	-	Main (rtb-017e2c3622facd563)									

Selected subnets	
subnet-06c13916e8518715d / lab-subnet-private1-us-east-1a	X
subnet-02637f3bc6f967f2 / lab-subnet-private2	X

Create security group [Info](#)

A security group acts as a virtual firewall for your instance to control inbound and outbound traffic. To create a new security group, complete the fields below.

Basic details

Security group name [Info](#)
Web Security Group
Name cannot be edited after creation.

Description [Info](#)
Enable HTTP access

VPC Info
vpc-0f0d95fe78f55b7e8 (lab-vpc)

Inbound rules [Info](#)

Type	Protocol	Port range	Source	Description - optional
HTTP	TCP	80	Anywhere	Permit web requests

[Add rule](#)

⚠️ Rules with source of 0.0.0.0/0 or ::/0 allow all IP addresses to access your instance. We recommend setting security group rules to allow access from known IP addresses only.

Outbound rules [Info](#)

Type	Protocol	Port range	Destination	Description - optional
All traffic	All	All	Custom	0.0.0.0/0

[Add rule](#)

⚠️ Rules with destination of 0.0.0.0/0 or ::/0 allow your instances to send traffic to any IPv4 or IPv6 address. We recommend setting security group rules to be more restrictive and to only allow traffic to specific known IP addresses.

Instance type [Info](#) | [Get advice](#)

Instance type

t2.micro
Family: t2 1 vCPU 1 GiB Memory Current generation: true
On-Demand Windows base pricing: 0.0162 USD per Hour On-Demand Ubuntu Pro base pricing: 0.0134 USD per Hour
On-Demand SUSE base pricing: 0.0116 USD per Hour On-Demand RHEL base pricing: 0.026 USD per Hour
On-Demand Linux base pricing: 0.0116 USD per Hour

Additional costs apply for AMIs with pre-installed software

Key pair (login) [Info](#)
You can use a key pair to securely connect to your instance. Ensure that you have access to the selected key pair before you launch the instance.
Key pair name - required
vokey [Create new key pair](#)

Network settings [Info](#)

VPC - required [Info](#)
vpc-0f0d95fe78f55b7e8 (lab-vpc) [Create new subnet](#)

Subnet [Info](#)
subnet-033b5f435029db6cd 1ab-subnet-public-2
VPC: vpc-0f0d95fe78f55b7e8 Owner: 375275408397 Availability Zone: us-east-1b
Zone type: Availability Zone IP addresses available: 251 CIDR: 10.0.0.0/16

Auto-assign public IP [Info](#)
Enable [Select existing security group](#)

Firewall (security groups) [Info](#)
A security group is a set of firewall rules that control the traffic for your instance. Add rules to allow specific traffic to reach your instance.
 Create security group Select existing security group

Common security groups [Info](#)
Select security groups [Compare security group rules](#)

Web Security Group sg-07751fc28af641497 [X](#)
VPC: vpc-0f0d95fe78f55b7e8

Security groups that you add or remove here will be added to or removed from all your network interfaces.

Advanced network configuration

Summary
Successfully created launch of instance i-045d2ffeb6ca01202

Next Steps

Create billing and free tier usage alerts
Create Connect an RDS database
Create an RDS snapshot policy
Manage detailed monitoring
Create AWS budget
Manage CloudWatch alarms
Monitor for suspicious runtime activities
Get instance screenshot
Get system log

Instances (1/2) View all instances																	
Find instance by attribute or tag (Case-sensitive) Last updated: 1 minute ago																	
Connect Instance state ▾ Actions ▾ Launch instance ▾																	
Name	Instance ID	Instance state	Alarm type	Status check	Alarm status	Availability Zone	Public IPv4 DNS	Public IPv4 —	Elastic IP	IPv6 IPs	Monitoring	Security group name	Key name	Launch time	Platform	Managed	Operator
Route Host	i-045d2ffeb6ca01202	Running	12/2 checks passed	View alarms +	us-east-1a	us-east-1a	ec2-44-200-37-196.compute-1.amazonaws.com	44.200.37.196	-	-	disabled	Rt2SecurityGroup	vockey	2024/3/26 10:04 GMT-8	Linux/UNIX	False	-
Web Server 1	i-045d2ffeb6ca01202	Running	12/2 checks passed	View alarms +	us-east-1b	us-east-1b	ec2-44-202-83-76.compute-1.amazonaws.com	44.202.83.76	-	-	disabled	Web Security Group	vockey	2024/3/26 10:04 GMT-8	Linux/UNIX	False	-

i-045d2ffeb6ca01202 (Web Server 1)

[Details](#) [Status and alarms](#) [Monitoring](#) [Security](#) [Networking](#) [Storage](#) [Tags](#)

Instance summary

Instance ID: i-045d2ffeb6ca01202

Hostname type: IP name: ip-10-0-2-188.ec2.internal

Answer private resource DNS name:

Public IPv4 address: ec2-44-202-83-76.compute-1.amazonaws.com | Open address

Private IP DNS name (IPv4 only): ip-10-0-2-188.ec2.internal | Open address

Public IPv6 address: -

Elastic IP addresses:

<https://ec2-44-202-83-76.compute-1.amazonaws.com/>

<https://www.google.com/>

Search Google or type a URL:

Google search results:

- Search results for "Google" on Google
- Search results for "Google" on YouTube
- Search results for "Google" on Instagram
- Search results for "Google" on Discord
- Search results for "Google" on Facebook
- Search results for "Google" on Google
- Search results for "Google" on LinkedIn
- Search results for "Google" on Wikipedia
- Search results for "Google" on DeviantArt
- Search results for "Google" on All About Tech

Problems

One of the main problems with this lab was the creation of the original VPC. I made mistakes in the initial configuration which made me redo the lab in order to receive credit for that section.

Conclusion

In conclusion, this lab taught the skills required to create a Virtual Private Cloud and use it to create and support a web server. This is a big step in being able to fully use what AWS provides in creating solutions for businesses that involve a cloud computing system.

Teacher Signoff Page of Lab Completed

Total score	30/30
Task 1 - VPC created correctly	5/5
Task 2a - New subnets created correctly	5/5
Task 2b - Subnet route table association	5/5
Task 3 - Security group created correctly	5/5
Task 4a - EC2 instance created correctly	5/5
Task 4b - EC2 instance website accessible	5/5

AWS Academy Cloud Foundations Lab 3 (Introduction to Amazon EC2)

Purpose

The purpose of this lab is to familiarize the student with Amazon Elastic Compute Cloud software and how to use it. This tool is very useful one in that it has many uses that provide secure, resizable compute capacity in the cloud. It has many options that help you build and run pretty much any application one can think of.

Background Information on lab concepts

Amazon EC2 is the AWS you use to create and run virtual machines in the cloud (virtual machines also can be called “instances”). This is the backbone of a lot of AWS’s functions in that it is what a lot of real-world companies use to run their instances because of how flexible it is. EC2 is especially useful for applications like code repositories, web applications, microservices, small and medium databases, and web servers.

Lab Summary

▼ Summary

Number of instances | [Info](#)

1

Software Image (AMI)

Amazon Linux 2023 AMI 2023.6.2...[read more](#)

ami-01816d07b1128cd2d

Virtual server type (instance type)

t2.micro

Firewall (security group)

New security group

Storage (volumes)

1 volume(s) - 8 GiB

i **Free tier:** In your first year includes 750 hours of t2.micro (or t3.micro in the Regions in which t2.micro is unavailable) instance usage on free tier AMIs per month, 750 hours of public IPv4 address usage per month, 30 GiB of EBS storage, 2 million IOs, 1 GB of snapshots, and 100 GB of bandwidth to the internet.

X

[Cancel](#)

[Launch instance](#)

 [Preview code](#)

Instances (1/2) Info											
Find instance by attribute or tag (case-sensitive) Last update: less than a minute ago											
Name	Instance ID	Instance state	Instance type	Alarm status	Availability Zone	Public IPv4 DNS	Public IPv4 ...	Elastic IP	IPv4 IPs	Monitoring	Security group name
Box Host	i-0caef880808e2c19	Running	12.micro	2/2 checks passed	us-east-1a	ec2-44-202-148-78.co...	44.202.148.78	-	-	disabled	Ec2SecurityGroup
Web Server	i-0bc758223967a7ced	Running	12.micro	0/1 installing	us-east-1a	ec2-34-227-28-159.co...	34.227.28.159	-	-	disabled	Web Server security group

i-0bc758223967a7ced (Web Server)

[Details](#) [Status and alarms](#) [Monitoring](#) [Security](#) [Networking](#) [Storage](#) [Tags](#)

Instance summary [Info](#)

Instance ID: i-0bc758223967a7ced
Private IP address: 34.227.28.159 [Open address](#)
Instance state: Running
IPV4 address:
Instance type: 12.micro
Instance type: 12.micro
Private IP address: 10.0.1.10 [Open address](#)
Public IP/DNS: ec2-34-227-28-159.compute-1.amazonaws.com [Open address](#)
Auto-assigned IP address: 34.227.28.159 (Public IP)
IAM Role: -
Auto Scaling Group Name: -
Status Checks [Info](#)

Recent launched instances can take up to 5 minutes to display associated alarms.

Find alarms by name	Instance status checks
Name State Description Metric name State reason	Instance has no associated alarms

i-0bc758223967a7ced (Web Server)

[Details](#) [Status and alarms](#) [Monitoring](#) [Security](#) [Networking](#) [Storage](#) [Tags](#)

CloudWatch agent metrics [Info](#)

The monitoring view will now include metrics related to a single instance in the CloudWatch namespace. If you want metrics that are emitted from the CloudWatch agent to be displayed, include them in the CloudWatch namespace.

Include metrics in the CloudWatch namespace [Learn more](#)

Exclude metrics in the CloudWatch namespace [Learn more](#)

Alarm recommendations [Info](#)

Configure CloudWatch agent [Manage detailed monitoring](#)

Get system log [Info](#)

When you experience issues with your EC2 instance, reviewing system logs can help you pinpoint the cause.

System log

Review system log for instance i-0bc758223967a7ced as of Thu Dec 26 2024 13:44:05 GMT-0800 (Pacific Standard Time)

[Copy log](#) [Download](#)

For boot or networking issues, use the EC2 serial console for troubleshooting. Choose the Connect button to start a session.

Cancel

[Get instance screenshot](#) Info

[Instance screenshot](#)

i-0bc738223967a7ced (Web Server) on 2024-12-26 at T13:44:33.979 -08:00



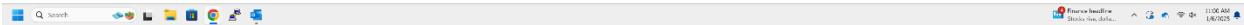
[Download](#)

```
Amazon Linux 2023.6.20241212
Kernel 6.1.119-129.201.amzn2023.x86_64 on an x86_64 (-)

ip-10-0-1-10 login: [ 29.895022] zram_generator::config[2341]: zram0: system has too much memory (949MB), limit is 800MB, ignoring.
[ 31.244633] zram_generator::config[3998]: zram0: system has too much memory (949MB), limit is 800MB, ignoring.
```

ⓘ For boot or networking issues, use the EC2 serial console for troubleshooting. Choose the [Connect](#) button to start a session.

[Connect](#)



The screenshot shows the AWS Service Quotas console. On the left, there's a sidebar with 'Service Quotas' and 'AWS services'. The main area is titled 'AWS services' with a search bar. A long list of AWS services is displayed, including: Access Analyzer, Amazon API Gateway, Amazon AppStream 2.0, Amazon Athena, Amazon Bedrock, Amazon Braket, Amazon Chime, Amazon CloudFront, Amazon CloudWatch, Amazon CloudWatch Application Insights, Amazon CloudWatch Events, Amazon CloudWatch Logs, Amazon CloudWatch Network Metrics, Amazon CloudWatch Observability Metrics Metrics, Amazon CloudWatch RUM, Amazon CloudWatch Profiler, Amazon CodeGuru Reviewer, Amazon Cognito Federated Identities, Amazon Cognito Sync, Amazon Cognito User Pools, Amazon Comprehend, Amazon Comprehend Medical, Amazon Connect, and Amazon Connect Application Integrations.

This screenshot shows the 'Amazon Elastic Compute Cloud (Amazon EC2)' quota page. The sidebar on the left is identical to the previous one. The main content area is titled 'Amazon Elastic Compute Cloud (Amazon EC2)'. It contains a brief description of EC2 and a 'Service quotas' section. Below that is a table titled 'Quota name' with 10 matches found. The table has columns for 'Quota name', 'Applied account-level quota value', 'AWS default quota value', 'Utilization', and 'Adjustability'. The rows list various EC2 instance types with their respective quota values and utilization levels.

Quota name	Applied account-level quota value	AWS default quota value	Utilization	Adjustability
Running On-Demand Bt instances	16	0	0	Account level
Running On-Demand F instances	64	0	0	Account level
Running On-Demand G and GT instances	0	0	0	Account level
Running On-Demand High Memory instances	0	0	0	Account level
Running On-Demand HPC instances	192	0	0	Account level
Running On-Demand I2 instances	6	0	0	Account level
Running On-Demand P instances	0	0	0	Account level
Running On-Demand Standard (A, C, D, H, I, M, S, T, Z) instances	256	5	1	Account level
Running On-Demand T1 instances	6	0	0	Account level
Running On-Demand X instances	0	0	0	Account level

This screenshot shows the 'Request Increase at account level' interface. It features a large input field for entering a new quota value, with a placeholder 'Enter new quota value' and a unit selector 'instances'. Below the input field is a 'Request Increase' button.

Problems

I found that some of the instructions about how to allow traffic to access the webpage difficult to understand, but overall, it was easy to complete the lab because of the guided instructions.

Teacher Sign Off Page of Lab Completed

Total score **25/25**

Task 1 - EC2 instance created correctly **5/5**

Task 2 - get system log requested **5/5**

Task 3 - security group updated **5/5**

Task 4 - EC2 instance updated **5/5**

Task 6 - Instance stopped on second try **5/5**



AWS Academy Cloud Foundations Labs 4-6

ADVANCE CISCO PERIOD 3-4
LIU, CHARLES (STUDENT)

AWS Academy Cloud Foundations Lab 4 (Working with EBS)

Purpose

The purpose of this lab is to familiarize the student with Amazon Elastic Compute Cloud software and how to use it. This tool is very useful one in that it has many uses that provide secure, resizable compute capacity in the cloud. It has many options that help you build and run pretty much any application one can think of.

Background Information on lab concepts

Amazon Elastic Block Store offers persistent storage for EC2 instances. They are independent from the life of an instance. It has the ability to create point-in-time consistent snapshots of your volumes that are stored in Amazon S3. This is extremely important for tracking your network activity.

Lab Summary

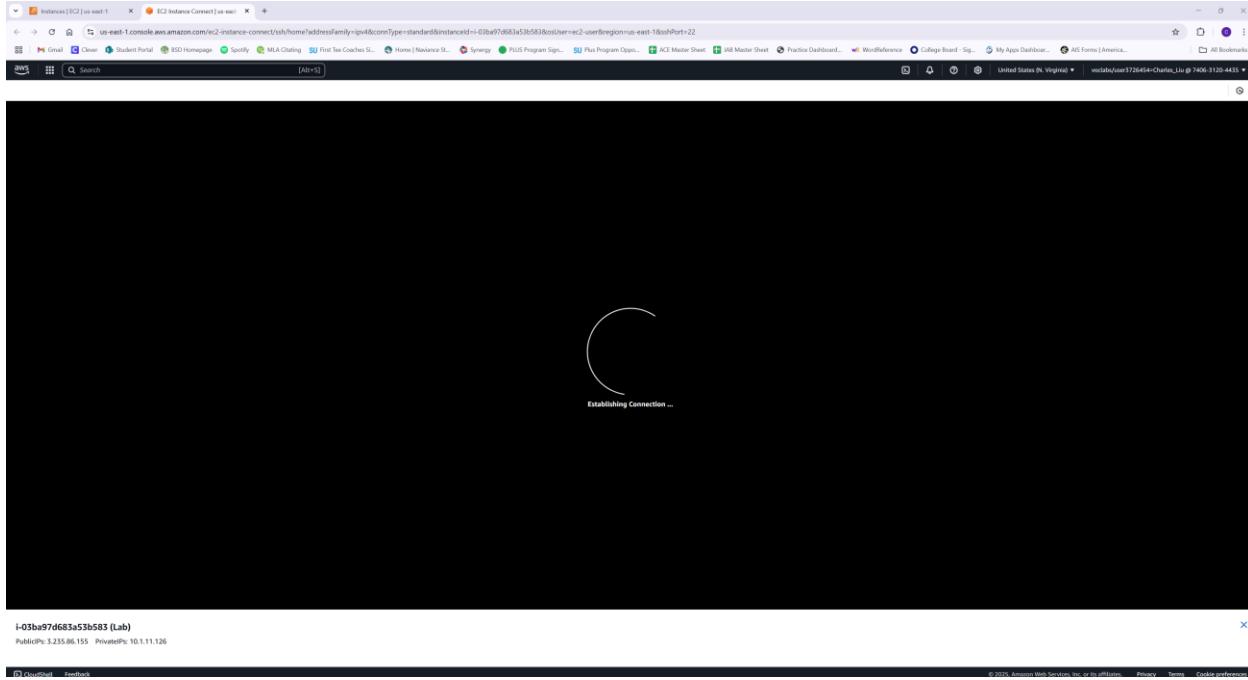
The screenshot shows the AWS Cloud Foundations Lab 4 interface. On the left, there's a navigation sidebar with links like Dashboard, EC2 Global View, Events, Instances, Images, AMI Catalog, and various AWS services like Volumes, Snapshots, Lifecycle Manager, Network & Security, Load Balancing, and Auto Scaling. The main content area is titled "Volumes (EC2) us-east-1" and shows a table of existing volumes. One volume is selected, and its details are shown in a modal window. Below the table, there's a section for "Fault tolerance for all volumes in this Region" with a "Snapshot summary" table. At the bottom, a success message says "Successfully created volume vol-011ade2e4099cf1d0".

Name	Volume ID	Type	Size	IOPS	Throughput	Snapshot ID	Created	Availability Zone	Volume state	Alarm status	Attached resources	Volume sta...	Encryption	KMS k...
vol-068a4e12772c99a8d	gp3	9 GiB	3000	125	snap-063dbdf...	2025/01/21 10:09 GMT-8	us-east-1a	in-use	No alarms	+ i-040073a6c48639a06 (Res...	Okay	Not encrypted	-	
vol-0965ff9f77b203e4	gp3	8 GiB	3000	125	snap-063dbdf...	2025/01/21 10:09 GMT-8	us-east-1a	in-use	No alarms	+ i-03ba97d683a53b583 (La...	Okay	Not encrypted	-	

Recently backed up volumes / Total # volumes
0 / 2

Success message: Successfully created volume vol-011ade2e4099cf1d0.

Successfully created volume vol-011ade2e4099bf1d.															
Volumes (2) Info															
Actions Create volume															
Choose filter set Search															
Name	Volume ID	Type	Size	IOPS	Throughput	Snapshot ID	Created	Availability Zone	Volume state	Alarm status	Attached resources	Volume state	Encryption	KMS key	
vol-068a4e12772c99a8d	gp3	9 GiB	3000	125		snap-0653dbff...	2025/01/21 10:09 GMT-8	us-east-1a	In-use	No alarms	+ i-040073af6c48635a6 (Baseline)	Okay	Not encrypted	-	
vol-0965fb9f7fb203e4	gp3	8 GiB	3000	125		snap-0653dbff...	2025/01/21 10:09 GMT-8	us-east-1a	In-use	No alarms	+ i-03ba97d683a53b583 (Baseline)	Okay	Not encrypted	-	



Instances | EC2 | us-east-1 EC2 Instance Connect | us-east-1

us-east-1.console.aws.amazon.com/ec2-instance-connect/ssh/home?addressFamily=ipv4&connType=standard&instanceId=i-03ba97d683

Gmail Clever Student Portal BSD Homepage Spotify MLA Citating SU First Tee Coaches Si... Home | Naviance St... Synergy PL

aws Search [Alt+S]

```
'#  
~\ _###_ Amazon Linux 2023  
~~ \###| https://aws.amazon.com/linux/amazon-linux-2023  
~~ \#/ V~,-->  
~~ .-. / /  
~/m/ [ec2-user@ip-10-1-11-126 ~]$ 
```


Instances | EC2 | us-east-1 EC2 Instance Connect | us-east-1

us-east-1.console.aws.amazon.com/ec2-instance-connect/ssh/home?addressFamily=ipv4&connType=standard&instanceId=i-03ba97d683&conUserRegion=us-east-1&sshPort=22

Gmail Clever Student Portal BSD Homepage Spotify MLA Citating SU First Tee Coaches Si... Home | Naviance St... Synergy PLUS Program Sign-in ACI Master Sheet All Program Options All Master Sheet Practice Dashboard... WordReference College Board - Sign-in My Apps Dashboard AIS Forms | America... United States (N. Virginia) verifiableuser773644-Charts_Lin@1406-3120-4435

aws Search [Alt+S]

```
'#  
~\ _###_ Amazon Linux 2023  
~~ \###| https://aws.amazon.com/linux/amazon-linux-2023  
~~ \#/ V~,-->  
~/m/ [ec2-user@ip-10-1-11-126 ~]$ ls  
[ec2-user@ip-10-1-11-126 ~]$ cd -h  
[ec2-user@ip-10-1-11-126 ~]$ cd  
[ec2-user@ip-10-1-11-126 ~]$ ls  
[ec2-user@ip-10-1-11-126 ~]$ ls  
[ec2-user@ip-10-1-11-126 ~]$ ls  
[ec2-user@ip-10-1-11-126 ~]$ ls  
[ec2-user@ip-10-1-11-126 ~]$ df -h  
[ec2-user@ip-10-1-11-126 ~]$ df -h  
Filesystem      1K-blocks   Used   Available  Use%  Mounted on  
devtmpfs            4.0M     0  4.0M   0%  /dev  
tmpfs              4.0M   4.0M  0 100%  /run  
tmpfs             190M  452K  190M  1%  /run/lock  
/dev/xvda1        8.0G  1.6G  6.4G  20%  /  
tmpfs              4.0M   4.0M  0 100%  /tmp  
/dev/xvda12B       10M  1.3M  8.7M  13%  /boot/efi  
tmpfs              59M   0  59M  0%  /run/user/1000  
[ec2-user@ip-10-1-11-126 ~]$ 
```

Instances [EC2] | us-east-1 | EC2 Instance Connect | us-east-1 | +

← → ⌂ ⓘ 🔍 Search [Alt+S]

https://aws.amazon.com/linux/amazon-linux-2023

```
[ec2-user@ip-10-1-1-126 ~]$ df -h
lsblk: df: command not found
[ec2-user@ip-10-1-1-126 ~]$ 
[ec2-user@ip-10-1-1-126 ~]$ 
[ec2-user@ip-10-1-1-126 ~]$ 
[ec2-user@ip-10-1-1-126 ~]$ 
[ec2-user@ip-10-1-1-126 ~]$ df -h
Filesystem Size Used Avail Mounted on
/dev/xvda1 4.0M 0 4.0M /dev/shm
tmpfs 475M 0 475M /dev/shm
tmpfs 190M 45K 190M /run
tmpfs 1.0G 40K 990M /tmp
tmpfs 475M 0 475M /tmp
tmpfs 1.0G 13K 990M /var/tmp
tmpfs 950M 0 950M /run/user/1000
[ec2-user@ip-10-1-1-126 ~]$ sudo mksfs ext3 /dev/xvd
[ec2-user@ip-10-1-1-126 ~]$ mkfs.ext3 -F /dev/xvd1
mkfs.ext3: invalid block "/dev/xvd1" on device "ext3"
[ec2-user@ip-10-1-1-126 ~]$ sudo mksfs ext3 /dev/xvd
mkfs.ext3: invalid block "/dev/xvd" on device "ext3"
[ec2-user@ip-10-1-1-126 ~]$ sudo mount /dev/xvd /mnt/data-store
[ec2-user@ip-10-1-1-126 ~]$ sudo mount /dev/xvd /mnt/data-store ext3 defaults,noatime 1 2* | sudo tee -a /etc/fstab
> cat /etc/fstab
< df -h
> sudo mount /dev/xvd /mnt/data-store ext3 defaults,noatime 1 2* | sudo tee -a /etc/fstab
> df -h
> sudo mount /dev/xvd /mnt/data-store ext3 defaults,noatime 1 2* | sudo tee -a /etc/fstab
> df -h
> mount
mount: bad usage
Try 'mount --help' for more information.
# UID=233754-4b4b-41f8-a08-bc93bb1c1 / xfs defaults,noatime 1
# UID=974C-C689 /boot/xvda1 vfat defaults,noatime,uid=0,gid=0,umask=0077,shortname=winnt,x-systemd.automount 0
# UID=974C-C689 /dev/xvda1 4.0M 0 4.0M /dev/shm
tmpfs 475M 0 475M /dev/shm
tmpfs 190M 45K 190M /run
tmpfs 1.0G 40K 990M /tmp
tmpfs 475M 0 475M /tmp
tmpfs 1.0G 13K 990M /var/tmp
tmpfs 950M 0 950M /run/user/1000
[ec2-user@ip-10-1-1-126 ~]$
```

i-03ba97d683a53b583 (Lab)

PublicIPs: 3.235.86.155 PrivateIPs: 10.1.11.126

Snapshots (1) info

Owned by me | Search

Name	Snapshot ID	Volume size	Description	Storage tier	Snapshot status	Started	Progress	Encryption	KMS key ID	KMS key al...	Outposts ARN
My Snapshot	snap-09e24e9a48e4287b	1 GiB	-	Standard	Pending	2025/01/21 10:23 GMT-8	99%	Not encrypted	-	-	-

Instances [EC2] | us-east-1 | EC2 Instance Connect | us-east-1 | +

← → ⌂ ⓘ 🔍 Search [Alt+S]

https://aws.amazon.com/linux/amazon-linux-2023

```
[ec2-user@ip-10-1-1-126 ~]$ df -h
lsblk: df: command not found
[ec2-user@ip-10-1-1-126 ~]$ 
[ec2-user@ip-10-1-1-126 ~]$ 
[ec2-user@ip-10-1-1-126 ~]$ 
[ec2-user@ip-10-1-1-126 ~]$ df -h
Filesystem Size Used Avail Mounted on
/dev/xvda1 4.0M 0 4.0M /dev/shm
tmpfs 475M 0 475M /dev/shm
tmpfs 190M 45K 190M /run
tmpfs 1.0G 40K 990M /tmp
tmpfs 475M 0 475M /tmp
tmpfs 1.0G 13K 990M /var/tmp
tmpfs 950M 0 950M /run/user/1000
[ec2-user@ip-10-1-1-126 ~]$ sudo mksfs ext3 /dev/xvd
[ec2-user@ip-10-1-1-126 ~]$ mkfs.ext3 -F /dev/xvd1
mkfs.ext3: invalid block "/dev/xvd1" on device "ext3"
[ec2-user@ip-10-1-1-126 ~]$ sudo mksfs ext3 /dev/xvd
mkfs.ext3: invalid block "/dev/xvd" on device "ext3"
[ec2-user@ip-10-1-1-126 ~]$ sudo mount /dev/xvd /mnt/data-store
[ec2-user@ip-10-1-1-126 ~]$ sudo mount /dev/xvd /mnt/data-store ext3 defaults,noatime 1 2* | sudo tee -a /etc/fstab
> cat /etc/fstab
< df -h
> sudo mount /dev/xvd /mnt/data-store ext3 defaults,noatime 1 2* | sudo tee -a /etc/fstab
> df -h
> sudo mount /dev/xvd /mnt/data-store ext3 defaults,noatime 1 2* | sudo tee -a /etc/fstab
> cat /etc/fstab
< mount
mount: bad usage
Try 'mount --help' for more information.
# UID=233754-4b4b-41f8-a08-bc93bb1c1 / xfs defaults,noatime 1
# UID=974C-C689 /boot/xvda1 vfat defaults,noatime,uid=0,gid=0,umask=0077,shortname=winnt,x-systemd.automount 0
# UID=974C-C689 /dev/xvda1 4.0M 0 4.0M /dev/shm
tmpfs 475M 0 475M /dev/shm
tmpfs 190M 45K 190M /run
tmpfs 1.0G 40K 990M /tmp
tmpfs 475M 0 475M /tmp
tmpfs 1.0G 13K 990M /var/tmp
tmpfs 950M 0 950M /run/user/1000
[ec2-user@ip-10-1-1-126 ~]$
```

i-03ba97d683a53b583 (Lab)

PublicIPs: 3.235.86.155 PrivateIPs: 10.1.11.126

Problems

I found that some of the instructions about how to allow traffic to access the webpage difficult to understand, but overall, it was easy to complete the lab because of the guided instructions.

Teacher Sign Off Page of Lab Completed\

Total score	25/25
Task 1 - EC2 instance created correctly	5/5
Task 2 - get system log requested	5/5
Task 3 - security group updated	5/5
Task 4 - EC2 instance updated	5/5
Task 6 - Instance stopped on second try	5/5

AWS Academy Cloud Foundations Lab 5 (Building your DB Server and Interacting with Your DB Using an App)

Purpose

The lab is designed to reinforce the concept of leveraging AWS databases for solving relational database needs.

Background Information on lab concepts

Amazon Elastic Block Store offers persistent storage for EC2 instances. They are independent from the life of an instance. It can create point-in-time consistent snapshots of your volumes that are stored in Amazon S3. This is extremely important for tracking your network activity.

Lab Summary

Security group (sg-0840619f499f68c99 | DB Security Group) was created successfully

sg-0840619f499f68c99 - DB Security Group

Details

Security group name DB Security Group	Security group ID sg-0840619f499f68c99	Description Permit access from Web Security Group
Owner 067115181932	Inbound rules count 1 Permission entry	VPC ID vpc-0c30591dc80d9eed3
Outbound rules count 1 Permission entry		

[Inbound rules](#) [Outbound rules](#) [Sharing - new](#) [VPC associations - new](#) [Tags](#)

Inbound rules (1)

<input type="checkbox"/>	Name	Security group rule ID	IP version	Type	Protocol	Port range	Source	Description
<input type="checkbox"/>	-	sgr-0ce65bee44c74c82	-	MySQL/Aurora	TCP	3306	sg-0a5aae159f5ccc9ee...	-

[Manage tags](#) [Edit inbound rules](#)

Create DB subnet group

To create a new subnet group, give it a name and a description, and choose an existing VPC. You will then be able to add subnets related to that VPC.

Subnet group details

Name
You won't be able to modify the name after your subnet group has been created.

Must contain from 1 to 255 characters. Alphanumeric characters, spaces, hyphens, underscores, and periods are allowed.

Description

VPC
Choose a VPC identifier that corresponds to the subnets you want to use for your DB subnet group. You won't be able to choose a different VPC identifier after your subnet group has been created.

Add subnets

Availability Zones
Choose the Availability Zones that include the subnets you want to add.

Subnets
Choose the subnets that you want to add. The list includes the subnets in the selected Availability Zones.

For Multi-AZ DB clusters, you must select 3 subnets in 3 different Availability Zones.

Subnets selected (2)

Availability zone	Subnet name	Subnet ID	CIDR block
us-east-1a	Private Subnet 1	subnet-0e64a8ece8ffd4ef8	10.0.1.0/24
us-east-1b	Private Subnet 2	subnet-03cfa88baa86b9797	10.0.3.0/24

[Cancel](#) [Create](#)

Databases (1)

[Group resources](#) [Modify](#) [Actions](#) [Restore from S3](#) [Create database](#)

DB identifier	Status	Role	Engine	Region & AZ	Size	Recommendations	CPU	Current activity	Maintenance	VPC	Multi-AZ
lab-db	Creating	Instance	MySQL Comm...	-	db.t3.micro	-	-	none	vpc-0ad8ea559ca579cb9	Yes	

Amazon RDS

lab-db

Summary

Status: Creating

Role: Instance

Engine: MySQL Community

Region & AZ: us-east-1b

Recommendations

Connectivity & security

Endpoint & port

Endpoint: lab-db

Port: -

Networking

VPC: Lab-VPC (vpc-d8d8ea559ca579cb9)

Subnet group: db-subnet-group

Subnets: subnet-d8d8a1707632236bf
subnet-d8d8a1706b215

Security

VPC security groups: Lab Security Group (sg-0da80f5162ff42aa08)

Certificate authority: info
rds-ca-rsa2048-g1

Certificate authority date: May 25, 2061, 16:54 (UTC-07:00)

DB instance certificate expiration date: January 23, 2026, 10:29 (UTC-08:00)

Connected compute resources (0) info

No connected compute resources were created automatically by RDS.

Resource identifier: Filter by compute resources

Resource type: VPC security group

Availability Zone: Compute resource security group

Actions

RDS

Load Test

RDS

Meta-Data

Value

InstanceId: i-0bb5163737f7b9d07

Availability Zone: us-east-1b

Current CPU Load: 1%

aws Load Test RDS

Executing Command: mysql -u main -plib-password -h lab-db.cqojrz4psyze.us-east-1.rds.amazonaws.com lab < sql/addressbook.sql

Writing config out to rds.conf.php

Redirecting to rds.php in 10 seconds (or click [here](#))



Load Test

RDS

Address Book

Last name	First name	Phone	Email	Admin
Add Contact				
Doe	Jane	010-110-1101	janed@someotheraddress.org	Edit Remove
Johnson	Roberto	123-456-7890	robertoj@someaddress.com	Edit Remove

Problems

I found that some of the instructions about how to allow traffic to access the webpage difficult to understand, but overall, it was easy to complete the lab because of the guided instructions. One challenge I had though was connecting to my Database because it had some initial configuration errors.

Teacher Sign Off Page of Lab Completed

Total score	20/20
Task 1 - Security Group created	5/5
Task 2 - DB subnet group	5/5
Task 3 - DB created	5/5
Task 4 - App connected to DB	5/5

AWS Academy Cloud Foundations Lab 6 (Scale and Load Balance Your Architecture)

Purpose

The purpose of this lab is to optimize our infrastructure so that we can automatically scale networks and keep things running at a professional standard.

Background Information on lab concepts

We will use Elastic Load Balancing and Auto scaling services so that we can optimize our network capabilities. We will create an Amazon Machine Image from a running instance, create a load balancer, and create a launch template and an Auto Scaling group.

Lab Summary

Currently creating AMI ami-05055085b754aba from instance i-07842e2af7a43e8a. Check that the AMI status is 'available' before deleting the instance or carrying out other actions related to this AMI.																
Instances (1/2) Info												Last updated less than a minute ago	Connect	Instance state	Actions	Launch instances
<input type="text" value="Find Instance by attribute or tag (Case-sensitive)"/>	Name	ID	Instance state	Instance type	Instance check	Alarm status	Availability Zone	Public IPv4 DNS	Public IPv4 ...	Elastic IP	IPv6 IPs	Monitoring	Security group name	Key name		
	All states															
<input checked="" type="checkbox"/> Web Server 1	i-07842e2af7a43e8a	Running		12.micro	2/2 checks passed	View alarms	+ 1	us-east-1a	–	3.92.49.47	–	–	disabled	Web Security Group	vockey	
<input type="checkbox"/> Bastion Host	i-0d16ac2b1a9f52021	Running		12.micro	2/2 checks passed	View alarms	+ 1	us-east-1a	–	54.173.155.163	–	–	disabled	c138865a3550749b093...	vockey	

Successfully created the target group: **LabGroup**. Anomaly detection is automatically applied to all registered targets. Results can be viewed in the **Targets** tab.

LabGroup

Details

arn:aws:elasticloadbalancing:us-east-1:004495767577:targetgroup/LabGroup/0a1cf03f1efd3c0e

Target type Instance	Protocol : Port HTTP: 80	Protocol version HTTP1	VPC vpc-0da2bde98100665ed		
IP address type IPv4	Load balancer None associated				
0 Total targets	0 Healthy	0 Unhealthy	0 Unused	0 Initial	0 Draining
	0 Anomalous				

Targets | [Monitoring](#) | [Health checks](#) | [Attributes](#) | [Tags](#)

Registered targets (0) Info

Anomaly mitigation: Not applicable [Edit](#) [Deregister](#) [Register targets](#)

Target groups route requests to individual registered targets using the protocol and port number specified. Health checks are performed on all registered targets according to the target group's health check settings. Anomaly detection is automatically applied to HTTP/HTTPS target groups with at least 3 healthy targets.

<input type="checkbox"/> Filter targets	Instance ID	Name	Port	Zone	Health status	Health status details	Administrative ...	Override details	Launch time	▲
No registered targets You have not registered targets to this group yet										Register targets

Success Successfully created load balancer: LabELB
It might take a few minutes for your load balancer to fully set up and route traffic. Targets will also take a few minutes to complete the registration process and pass initial health checks.

LabELB			
Actions			
▼ Details			
Load balancer type Application	Status Provisioning	VPC vpc-0da2bde98100665ed	Load balancer IP address type IPv4
Scheme Internet-facing	Hosted zone Z35SXDOTRQ7X7K	Availability Zones subnet-0e715aa78ba62330c us-east-1b (use1-az4) subnet-0218d91aabbb6225d us-east-1a (use1-az2)	Date created January 24, 2025, 10:58 (UTC-08:00)
Load balancer ARN arn:aws:elasticloadbalancing:us-east-1:004495767577:loadbalancer/app/LabELB/4326bd19f4969c34	DNS name info LabELB-1304264941.us-east-1.elb.amazonaws.com (A Record)		

[Listeners and rules](#) [Network mapping](#) [Resource map - new](#) [Security](#) [Monitoring](#) [Integrations](#) [Attributes](#) [Capacity - new](#) [Tags](#)

Listeners and rules (1) Info		Manage rules	Manage listener	Add listener
A listener checks for connection requests on its configured protocol and port. Traffic received by the listener is routed according to the default action and any additional rules.				
Filter listeners	Protocol:Port	Default action	Rules	ARN

Success Successfully created LabConfigIt-0f55e7e0a41997caf

[Actions log](#)

Next Steps

[Launch an instance](#)

With On-Demand Instances, you pay for compute capacity by the second (for Linux, with a minimum of 60 seconds) or by the hour (for all other operating systems) with no long-term commitments or upfront payments. Launch an On-Demand Instance from your launch template.

[Launch instance from this template](#)

[Create an Auto Scaling group from your template](#)

Amazon EC2 Auto Scaling helps you maintain application availability and allows you to scale your Amazon EC2 capacity up or down automatically according to conditions you define. You can use Auto Scaling to help ensure that you are running your desired number of Amazon EC2 instances during demand spikes to maintain performance and decrease capacity during lulls to reduce costs.

[Create Auto Scaling group](#)

[Create Spot Fleet](#)

A Spot Instance is an unused EC2 instance that is available for less than the On-Demand price. Because Spot Instances enable you to request unused EC2 instances at steep discounts, you can lower your Amazon EC2 costs significantly. The hourly price for a Spot Instance (of each instance type in each Availability Zone) is set by Amazon EC2, and adjusted gradually based on the long-term supply of and demand for Spot Instances. Spot instances are well-suited for data-analysis, batch jobs, background processing, and optional tasks.

[Create Spot Fleet](#)

[View launch templates](#)

Step 1

- Choose launch template
- Choose instance launch options
- Step 3 - optional
- Integrate with other services
- Step 4 - optional
- Configure group size and scaling
- Step 5 - optional
- Add notifications
- Step 6 - optional
- Add tags
- Step 7

Review [Info](#)

Step 1: Choose launch template

Group details

Auto Scaling group name: Lab Auto Scaling Group

Launch template

Launch template	Version	Description
LabConfig Edit	Default	

Step 2: Choose instance launch options

Network

VPC: vpc-0da2bde98100665ed [Edit](#)

Availability Zones and subnets

Availability Zone	Subnet	Subnet CIDR range
us-east-1a	subnet-0602208de79063b36 Edit	10.0.1.0/24
us-east-1b	subnet-014b187e7f531a058 Edit	10.0.3.0/24

Availability Zone distribution

Balanced best effort

Instance type requirements

This Auto Scaling group will adhere to the launch template.

Step 3: Integrate with other services

Load balancing

Load balancer 1

Name	Type	Target group
LabELB Edit	Application/HTTP	LabGroup Edit

VPC Lattice integration options

Instances (4) [Info](#)

Find Instance by attribute or tag (case-sensitive)

All states [▼](#)

<input type="checkbox"/>	Name Edit	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone
<input type="checkbox"/>	Lab Instance	i-092c6800e4fc337fc	Running View alarms Edit	t2.micro	Initializing	View alarms Edit	us-east-1b
<input type="checkbox"/>	Web Server 1	i-07842e2eaf7a43e8a	Running View alarms Edit	t2.micro	2/2 checks passed	View alarms Edit	us-east-1a
<input type="checkbox"/>	Bastion Host	i-0d16ac2b1a9f32021	Running View alarms Edit	t2.micro	2/2 checks passed	View alarms Edit	us-east-1a
<input type="checkbox"/>	Lab Instance	i-0f54a7b7ad41184f3	Running View alarms Edit	t2.micro	Initializing	View alarms Edit	us-east-1a

Alarms (2)

Search

Alarm state: Any [▼](#) Alarm type: Any [▼](#) Actions status: Any [▼](#)

<input type="checkbox"/>	Name	State	Last state update (UTC)	Conditions	Actions
<input type="checkbox"/>	TargetTracking-Lab Auto Scaling Group-AlarmHigh-ed5f25ac-d158-de74-beef-fa453b06936c	OK	2025-01-24 19:33:43	CPUUtilization > 60 for 3 datapoints within 3 minutes	Actions enabled
<input type="checkbox"/>	TargetTracking-Lab Auto Scaling Group-AlarmLow-055712b5-2b76-d47a-0bb6-5821b7be474	Insufficient data	2025-01-24 19:31:40	CPUUtilization < 54 for 15 datapoints within 15 minutes	Actions enabled

Alarms (1/2)

Search

Alarm state: Any [▼](#) Alarm type: Any [▼](#) Actions status: Any [▼](#)

<input type="checkbox"/>	Name	State	Last state update (UTC)	Conditions	Actions
<input checked="" type="checkbox"/>	TargetTracking-Lab Auto Scaling Group-AlarmHigh-b3de69bb-e3c6-4a5b-9a0b-4ba02ba7a7cha	In alarm	2025-01-24 19:44:09	CPUUtilization > 50 for 5 datapoints within 5 minutes	Actions enabled
<input type="checkbox"/>	TargetTracking-Lab Auto Scaling Group-AlarmLow-e0f93a8-6999-4e5f-ba6e-7a3ef7e1e979	OK	2025-01-24 19:41:56	CPUUtilization < 37.5 for 15 datapoints within 15 minutes	Actions enabled

Instances (8) [Info](#)

Find Instance by attribute or tag (case-sensitive)

All states [▼](#)

<input type="checkbox"/>	Name Edit	Instance ID	Instance state	Status check	Alarm status	Availability Zone	Public IPv4 DNS	Public IPv4 ...	Elastic IP	IPv6 IPs	Monitoring	Security group name	Key name
<input type="checkbox"/>	Lab Instance	i-092c6800e4fc337fc	Running View alarms Edit	2/2 checks passed	View alarms Edit	us-east-1b	-	-	-	-	enabled	Web Security Group	vockey
<input type="checkbox"/>	Lab Instance	i-06ca48f5232f9bc27	Running View alarms Edit	2/2 checks passed	View alarms Edit	us-east-1b	-	-	-	-	enabled	Web Security Group	vockey
<input type="checkbox"/>	Lab Instance	i-08db3096d814ff0fb	Running View alarms Edit	Initializing	View alarms Edit	us-east-1b	-	-	-	-	enabled	Web Security Group	vockey
<input type="checkbox"/>	Web Server 1	i-07842e2eaf7a43e8a	Running View alarms Edit	2/2 checks passed	View alarms Edit	us-east-1a	-	3.92.49.47	-	-	disabled	Web Security Group	vockey
<input type="checkbox"/>	Bastion Host	i-0d16ac2b1a9f32021	Running View alarms Edit	2/2 checks passed	View alarms Edit	us-east-1a	-	54.173.155.163	-	-	disabled	c138065a35507499003...	vockey
<input type="checkbox"/>	Lab Instance	i-0f7643842cc14e43	Running View alarms Edit	Initializing	View alarms Edit	us-east-1a	-	-	-	-	enabled	Web Security Group	vockey
<input type="checkbox"/>	Lab Instance	i-0654a931a7ff1460	Running View alarms Edit	2/2 checks passed	View alarms Edit	us-east-1a	-	-	-	-	enabled	Web Security Group	vockey
<input type="checkbox"/>	Lab Instance	i-0f54a7b7ad41184f3	Running View alarms Edit	2/2 checks passed	View alarms Edit	us-east-1a	-	-	-	-	enabled	Web Security Group	vockey

Problems

I found that some of the instructions about how to allow traffic to access the webpage difficult to understand, but overall, it was easy to complete the lab because of the guided instructions. One challenge I had though was connecting to my Database because it had some initial configuration errors so I had to do the lab multiple times in order to get full score.

Teacher Sign Off Page of Lab Completed

Total score

35/35

Task 1 - AMI created 5/5

Task 2 - Load Balancer created 5/5

Task 3a - Launch Template created 5/5

Task 3b - Auto Scaling Group created 5/5

Task 4 - Load Balancer check 5/5

Task 5 - Auto Scaling check 5/5

Task 6 - Web Server 1 5/5