Multi-Area OSPF Lab

Name: Jacob Chen

Date: 9/13/2023

Lab Partner: Aaron Yu

Class: CCNP 2023-2024



**Purpose**

OSPF is an open-source routing protocol that helps to route packets between different networks. In this lab we experimented with multi-area OSPF. The purpose of the lab is to help us review OSPF commands which can be applied to other routing protocols like EIGRP and to help us practice designing lab topologies.

**Background**

Connecting between different networks is an integral part of the modern internet. Segmentation allows for better control, better security practices and better management of resources. This lab covers the key principles their implementation with respect to connecting multiple networks together.

Network design is a key part of this lab. With the way the modern internet works, designing efficient and secure networks are crucial. A big component of this lab was the process of designing the network, troubleshooting any issues, and making sure everything was up to standards.

The second key concept covered in this lab is OSPF. OSPF is a routing protocol, that is it allows devices to talk between different networks. By default, devices on different networks are unable to talk, even if there’s a router between them. Open-source protocols like OSPF allow these routers to communicate information to properly send traffic along. At its core, OSPF is built out of Areas. Areas are separate from networks, and function at the much larger scale. For example, there may be multiple different networks in the same OSPF area. Each area runs its own processes to determine things like a designated router—the main device upon which all forwarding decisions are made. Multi-area OSPF also allows for better segmentation and security. We’re learning how to set up mult-area OSPF because of those benefits. In this lab, we practiced configuring 5 routers to create a simulated network that spanned 3 areas.

**Lab Summary**

First, we created a general topology for the entire setup including 4 different networks, corresponding IPv4 and IPv6 addresses, and the associated wiring.

After wiring up the diagram, on each of the routers we preformed the following rough steps.

1. Set up basic device configuration including hostname, enabled ipv6 routing and general device security.
2. Turned on interfaces and set associated IPv4 and IPv6 addresses on said interfaces.
3. Configured OSPFv2 and OSPFv3 processes as necessitated to set up OSPF based on the topology

**Lab Commands**

**Hostname JacobAaronRX**: Sets a unique hostname to identify the various routers

**IPv6 Unicast-Routing**: Allows the routing of IPv6 packets across the network

**Interface g0/0/X**: Access the interfaces

**No shut**: Turns on the interfaces

**Ip add 192.168.x.x 255.255.255.0**: sets an ipv4 address on an interface

**Ipv6 add 2001:db8:acad:x::x/64**: sets an ipv6 address on an interface

**Ip ospf 1 area x**: Sets an OSPF process id of 1 and an associated area on an interface

**Ipv6 ospf 1 area x**: sets up OSPFv3 with process id of 1 and an associated area

**Router ospf 1**: access ospfv2 configuration on the router

**Ipv6 router ospf 1**: access ospfv3 configuration settings for the router

**Router-id x.x.x.x**: sets a specific router id for that router to use for OSPF

**Network Diagram**

A screenshot of a computer

Description automatically generated

**Configuration:**

Building configuration...

hostname JacobAaronR1

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 FDO214421CF

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface GigabitEthernet0/0/0

ip address 192.168.0.3 255.255.255.0

ip ospf 1 area 1

negotiation auto

ipv6 address 2001:DB8:ACAD::3/64

ipv6 ospf 1 area 1

interface GigabitEthernet0/0/1

ip address 192.168.1.1 255.255.255.0

ip ospf 1 area 0

negotiation auto

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

ipv6 ospf 1 area 0

interface Serial0/1/0

no ip address

interface Serial0/1/1

no ip address

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

negotiation auto

interface Vlan1

no ip address

router ospf 1

router-id 1.1.1.1

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router ospf 1

router-id 1.1.1.1

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

JacobAaronR1#

JacobAaronR2#show run

Building configuration...

Current configuration : 1501 bytes

Last configuration change at 21:22:54 UTC Fri Sep 8 2023

version 15.5

service timestamps debug datetime msec

service timestamps log datetime msec

no platform punt-keepalive disable-kernel-core

hostname JacobAaronR2

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 FDO211216BL

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface GigabitEthernet0/0/0

ip address 192.168.5.1 255.255.255.0

ip ospf 1 area 2

negotiation auto

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

ipv6 ospf 1 area 2

interface GigabitEthernet0/0/1

ip address 192.168.1.2 255.255.255.0

ip ospf 1 area 0

negotiation auto

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

ipv6 ospf 1 area 0

interface Serial0/1/0

no ip address

interface Serial0/1/1

no ip address

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

negotiation auto

interface Vlan1

no ip address

router ospf 1

router-id 2.2.2.2

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

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

JacobAaronR2#

AaronJacobR3#show run

Building configuration...

Current configuration : 1541 bytes

Last configuration change at 21:00:57 UTC Fri Sep 8 2023

version 15.5

service timestamps debug datetime msec

service timestamps log datetime msec

no platform punt-keepalive disable-kernel-core

hostname AaronJacobR3

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 FDO214420G7

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface GigabitEthernet0/0/0

ip address 192.168.5.2 255.255.255.0

ip ospf 1 area 2

negotiation auto

ipv6 address 2001:DB8:ACAD:5::2/64

ipv6 ospf 1 area 2

interface GigabitEthernet0/0/1

ip address 192.168.2.3 255.255.255.0

ip ospf 1 area 2

negotiation auto

ipv6 address 2001:DB8:ACAD:2::3/64

ipv6 ospf 1 area 2

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 3.3.3.3

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router ospf 1

router-id 3.3.3.3

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

AaronJacobR3#

AaronJacobR4#show run

Building configuration...

Current configuration : 1675 bytes

Last configuration change at 21:17:24 UTC Fri Sep 8 2023

version 15.5

service timestamps debug datetime msec

service timestamps log datetime msec

no platform punt-keepalive disable-kernel-core

hostname AaronJacobR4

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 GigabitEthernet0/0/0

ip address 192.168.4.1 255.255.255.0

negotiation auto

ipv6 address 2001:DB8:ACAD:4::1/64

interface GigabitEthernet0/0/1

ip address 192.168.2.4 255.255.255.0

ip ospf 1 area 2

negotiation auto

ipv6 address 2001:DB8:ACAD:2::4/64

ipv6 ospf 1 area 2

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 ospf 1

router-id 4.4.4.4

passive-interface GigabitEthernet0/0/0

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router ospf 1

router-id 4.4.4.4

passive-interface GigabitEthernet0/0/0

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

AaronJacobR4#

JacobAaronR5#show run

Building configuration...

Current configuration : 3850 bytes

Last configuration change at 20:49:19 UTC Fri Sep 8 2023

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 JacobAaronR5

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-2270144787

enrollment selfsigned

subject-name cn=IOS-Self-Signed-Certificate-2270144787

revocation-check none

rsakeypair TP-self-signed-2270144787

crypto pki certificate chain TP-self-signed-2270144787

certificate self-signed 01

30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030

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

69666963 6174652D 32323730 31343437 3837301E 170D3233 30393038 32303439

31395A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649

4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D32 32373031

34343738 37308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201

0A028201 0100CC84 25EA3CBB 0817FA71 DD0D599C 865D82BC AEF07987 63DC0A8D

01BC566A DB1F132E 0183AACC 312B09C9 9149FBF3 5697CD1B 5496E57C 3749D512

5E28510A 8127A2D3 D398F6ED 2279C3C2 5CB45503 5690F9F5 1C046936 9E3A2C48

75659900 A39E3767 7AFCA34B AAB4E884 07D15F4F 21AE4AAC F7A45562 F551943A

A8D4D703 9E768946 FFEC5892 1EACB0D4 1A2EC145 EB5FA08A 416A0C7A 53DAD5AE

9935FBBB 7A9E3DBB ADD25743 52FBE6B7 CDF8C2AC D10288A2 2B732A8F D87AA787

AA882E34 E18C056E 43133456 FFC56CB0 AE4BF4D0 CCFE584B 536A9705 D38D109E

AEE0A225 BAEA8AA2 D39D5040 B5F3AAB5 ACF0B639 66A5623F 84A003B3 E9BA1D76

EF717809 33170203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF

301F0603 551D2304 18301680 14A0E001 3E0CD117 66791986 89C95CB7 8FF94014

74301D06 03551D0E 04160414 A0E0013E 0CD11766 79198689 C95CB78F F9401474

300D0609 2A864886 F70D0101 05050003 82010100 937D2DFF 079AD3E7 40D4DB0D

61F93E34 3FCBD847 8F9023AC 3EFD4E65 8787E61B B2CD4538 A64701DE 47036B26

7C24E711 EB036AFE 354FD31B B00AE9F7 60241FD5 00102607 AB39ECCE 5E9E707D

27703418 65F66452 17F46B6A 52731E87 3C01BC76 97A54B06 DAF7B3F7 FC657C40

E73C8AC1 406D5A91 AE56AF48 06D50FFC 28D6B95E 940771D5 87AC67F4 96921A47

A96989BE 4F7AF919 5DE49AC9 5922C8DE 983704F3 BC9CF864 0370CD96 A49CBA8D

0EC40884 98FF0975 C08128B7 21AB48BF 7897B544 08914896 7D4B2B12 307ECC8C

6663E4DD CA9AF796 9DDC8445 E9C150CF F6BD65FC 58E7654C 41C90908 9F349382

C3ABE0C3 2A315501 764E2B35 80445775 AF4D4F13

quit

license udi pid ISR4321/K9 sn FLM24060912

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface GigabitEthernet0/0/0

ip address 192.168.0.2 255.255.255.0

ip ospf 1 area 1

negotiation auto

ipv6 address 2001:DB8:ACAD::2/64

ipv6 ospf 1 area 1

interface GigabitEthernet0/0/1

ip address 192.168.3.1 255.255.255.0

negotiation auto

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

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 ospf 1

router-id 5.5.5.5

passive-interface GigabitEthernet0/0/1

ip forward-protocol nd

no ip http server

ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router ospf 1

router-id 5.5.5.5

passive-interface GigabitEthernet0/0/1

control-plane

line con 0

transport input none

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

JacobAaronR5#

JacobAaronR1#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, \* - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

a - application route

+ - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.0.0/24 is directly connected, GigabitEthernet0/0/0

L 192.168.0.3/32 is directly connected, GigabitEthernet0/0/0

192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.1.0/24 is directly connected, GigabitEthernet0/0/1

L 192.168.1.1/32 is directly connected, GigabitEthernet0/0/1

O IA 192.168.2.0/24 [110/3] via 192.168.1.2, 00:46:56, GigabitEthernet0/0/1

O IA 192.168.5.0/24 [110/2] via 192.168.1.2, 00:50:30, GigabitEthernet0/0/1

JacobAaronR1#show ipv6 route

IPv6 Routing Table - default - 7 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2

IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external

ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect

O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, a - Application

C 2001:DB8:ACAD::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 2001:DB8:ACAD::3/128 [0/0]

via GigabitEthernet0/0/0, receive

C 2001:DB8:ACAD:1::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 2001:DB8:ACAD:1::1/128 [0/0]

via GigabitEthernet0/0/1, receive

OI 2001:DB8:ACAD:2::/64 [110/3]

via FE80::2F8:2CFF:FE7F:7191, GigabitEthernet0/0/1

OI 2001:DB8:ACAD:5::/64 [110/2]

via FE80::2F8:2CFF:FE7F:7191, GigabitEthernet0/0/1

L FF00::/8 [0/0]

via Null0, receive

JacobAaronR1#

JacobAaronR2#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, \* - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

a - application route

+ - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

O IA 192.168.0.0/24 [110/2] via 192.168.1.1, 00:25:11, GigabitEthernet0/0/1

192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.1.0/24 is directly connected, GigabitEthernet0/0/1

L 192.168.1.2/32 is directly connected, GigabitEthernet0/0/1

O 192.168.2.0/24 [110/2] via 192.168.5.2, 00:20:55, GigabitEthernet0/0/0

192.168.5.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.5.0/24 is directly connected, GigabitEthernet0/0/0

L 192.168.5.1/32 is directly connected, GigabitEthernet0/0/0

JacobAaronR2#show ipv6 route

IPv6 Routing Table - default - 7 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2

IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external

ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect

O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, a - Application

OI 2001:DB8:ACAD::/64 [110/2]

via FE80::B6A8:B9FF:FE47:8E41, GigabitEthernet0/0/1

C 2001:DB8:ACAD:1::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 2001:DB8:ACAD:1::2/128 [0/0]

via GigabitEthernet0/0/1, receive

O 2001:DB8:ACAD:2::/64 [110/2]

via FE80::B6A8:B9FF:FE01:B750, GigabitEthernet0/0/0

C 2001:DB8:ACAD:5::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 2001:DB8:ACAD:5::1/128 [0/0]

via GigabitEthernet0/0/0, receive

L FF00::/8 [0/0]

via Null0, receive

JacobAaronR2#

AaronJacobR3#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, \* - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

a - application route

+ - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

O IA 192.168.0.0/24 [110/3] via 192.168.5.1, 00:49:31, GigabitEthernet0/0/0

O IA 192.168.1.0/24 [110/2] via 192.168.5.1, 00:49:37, GigabitEthernet0/0/0

192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.2.0/24 is directly connected, GigabitEthernet0/0/1

L 192.168.2.3/32 is directly connected, GigabitEthernet0/0/1

192.168.5.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.5.0/24 is directly connected, GigabitEthernet0/0/0

L 192.168.5.2/32 is directly connected, GigabitEthernet0/0/0

AaronJacobR3#show ipv6 route

IPv6 Routing Table - default - 7 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2

IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external

ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect

O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, a - Application

OI 2001:DB8:ACAD::/64 [110/3]

via FE80::2F8:2CFF:FE7F:7190, GigabitEthernet0/0/0

OI 2001:DB8:ACAD:1::/64 [110/2]

via FE80::2F8:2CFF:FE7F:7190, GigabitEthernet0/0/0

C 2001:DB8:ACAD:2::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 2001:DB8:ACAD:2::3/128 [0/0]

via GigabitEthernet0/0/1, receive

C 2001:DB8:ACAD:5::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 2001:DB8:ACAD:5::2/128 [0/0]

via GigabitEthernet0/0/0, receive

L FF00::/8 [0/0]

via Null0, receive

AaronJacobR3#

AaronJacobR4>enable

AaronJacobR4#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, \* - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

a - application route

+ - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

O IA 192.168.0.0/24 [110/4] via 192.168.2.3, 00:44:34, GigabitEthernet0/0/1

O IA 192.168.1.0/24 [110/3] via 192.168.2.3, 00:44:34, GigabitEthernet0/0/1

192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.2.0/24 is directly connected, GigabitEthernet0/0/1

L 192.168.2.4/32 is directly connected, GigabitEthernet0/0/1

192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.4.0/24 is directly connected, GigabitEthernet0/0/0

L 192.168.4.1/32 is directly connected, GigabitEthernet0/0/0

O 192.168.5.0/24 [110/2] via 192.168.2.3, 00:44:34, GigabitEthernet0/0/1

AaronJacobR4#show ipv6 route

IPv6 Routing Table - default - 8 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2

IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external

ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect

O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, a - Application

OI 2001:DB8:ACAD::/64 [110/4]

via FE80::B6A8:B9FF:FE01:B751, GigabitEthernet0/0/1

OI 2001:DB8:ACAD:1::/64 [110/3]

via FE80::B6A8:B9FF:FE01:B751, GigabitEthernet0/0/1

C 2001:DB8:ACAD:2::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 2001:DB8:ACAD:2::4/128 [0/0]

via GigabitEthernet0/0/1, receive

C 2001:DB8:ACAD:4::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 2001:DB8:ACAD:4::1/128 [0/0]

via GigabitEthernet0/0/0, receive

O 2001:DB8:ACAD:5::/64 [110/2]

via FE80::B6A8:B9FF:FE01:B751, GigabitEthernet0/0/1

L FF00::/8 [0/0]

via Null0, receive

AaronJacobR4#

JacobAaronR5#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, \* - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

a - application route

+ - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is not set

192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.0.0/24 is directly connected, GigabitEthernet0/0/0

L 192.168.0.2/32 is directly connected, GigabitEthernet0/0/0

O IA 192.168.1.0/24 [110/2] via 192.168.0.3, 00:53:35, GigabitEthernet0/0/0

O IA 192.168.2.0/24 [110/4] via 192.168.0.3, 00:44:18, GigabitEthernet0/0/0

192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.3.0/24 is directly connected, GigabitEthernet0/0/1

L 192.168.3.1/32 is directly connected, GigabitEthernet0/0/1

O IA 192.168.5.0/24 [110/3] via 192.168.0.3, 00:47:51, GigabitEthernet0/0/0

JacobAaronR5#show ipv6 route

IPv6 Routing Table - default - 8 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2

IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external

ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect

O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, a - Application

C 2001:DB8:ACAD::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 2001:DB8:ACAD::2/128 [0/0]

via GigabitEthernet0/0/0, receive

OI 2001:DB8:ACAD:1::/64 [110/2]

via FE80::B6A8:B9FF:FE47:8E40, GigabitEthernet0/0/0

OI 2001:DB8:ACAD:2::/64 [110/4]

via FE80::B6A8:B9FF:FE47:8E40, GigabitEthernet0/0/0

C 2001:DB8:ACAD:3::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 2001:DB8:ACAD:3::1/128 [0/0]

via GigabitEthernet0/0/1, receive

OI 2001:DB8:ACAD:5::/64 [110/3]

via FE80::B6A8:B9FF:FE47:8E40, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

JacobAaronR5#

**Problems**

One of the largest problems when designing our lab was in the OSPF configuration. We initially thought it was an issue with the ip addresses, or their configuration on interfaces, but the problem still persisted. Ultimately after consulting with some classmates we realized it was the fact that all OSPF areas must be connected to the backbone area, area 0. After making this change OSPF started working.

**Conclusion**

Overall I’m grateful that we started with this lab. Reviewing OSPF was a good practice, especially because the commands are transferable to tother routing protocols like EIGRP. Throughout this lab we practiced setting up mutli area OSPF and their corresponding commands.   
 Despite encountering difficulties in OSPF configuration with the areas, we learned from our mistake and moved on to successfully compete the lab.

A close up of a paper

Description automatically generated