**Purpose:**

The purpose of this lab is to configure iBGP within an area of OSPF. I also needed to have two routers on the outside of the OSPF area that have eBGP. The main goal was to get everything to ping and to incorporate loopbacks into the system.

**Background:**

For this lab, we had to implement iBGP inside of a different routing protocol. In this case it was OSPF. iBGP differs from eBGP because as said before, iBGP can go inside of a different routing protocol. eBGP stands for external border gateway protocol while iBGP stands for internal border gateway protocol. The main difference between iBGP and eBGP is that eBGP routes received from an eBGP peer can be advertised to all BGP peers, but iBGP routes received from an iBGP peer can’t be advertised to another iBGP peer but can be advertised to an eBGP peer. This means that if there are 4 routers and 3 of them have iBGP and 2 of them have eBGP, then the routers with eBGP are advertised all routes, but if the routers that have iBGP aren’t connected, they aren’t advertised all routes. The main reason iBGP is used is because it is easier to exchange information between multiple other BGP borders.

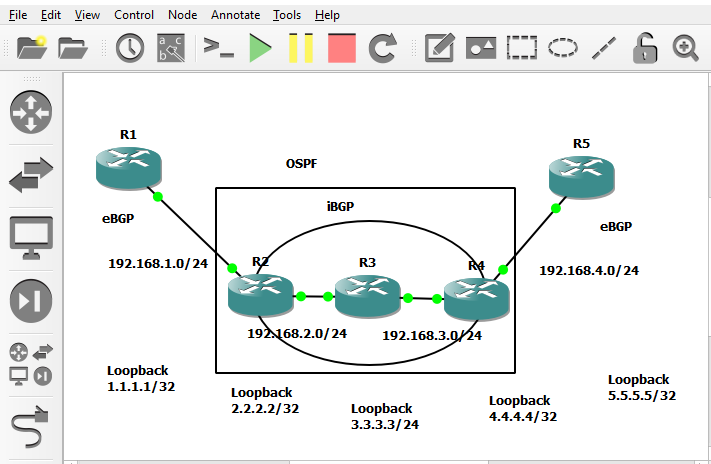
**Lab Summary:**

There was a total of 5 routers, 3 of them had iBGP and OSPF, and there were routers on the outside with eBGP connecting them to the other routers.

**Lab Commands:**

|  |  |
| --- | --- |
| Neighbor \_\_\_ remote-as \_\_ | Sets the specific neighbor for BGP |
| Address-family ipv6 | Sets the BGP routing protocol to IPv6 |
| Ip route \_\_ | It makes a route between routers |
| Router bgp \_\_ | Makes a BGP interface |
| Router ospf \_\_ | Makes an OSPF interface |

**Network Diagram:**



**Router 1 show run:**

hostname R1

ipv6 unicast-routing

ipv6 cef

interface Loopback0

ip address 1.1.1.1 255.255.255.255

interface FastEthernet0/0

ip address 192.168.1.1 255.255.255.0

speed auto

duplex full

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

interface FastEthernet0/1

no ip address

shutdown

speed auto

duplex auto

router bgp 1

bgp router-id 1.1.1.1

bgp log-neighbor-changes

neighbor 2001:ACAD:1::2 remote-as 2

neighbor 192.168.1.2 remote-as 2

address-family ipv4

no neighbor 2001:ACAD:1::2 activate

neighbor 192.168.1.2 activate

exit-address-family

address-family ipv6

redistribute connected

neighbor 2001:ACAD:1::2 activate

neighbor 2001:ACAD:1::2 send-community

exit-address-family

line aux 0

exec-timeout 0 0

privilege level 15

logging synchronous

stopbits 1

line vty 0 4

login

end

**Router 1 show ip route:**

Gateway of last resort is not set

1.0.0.0/32 is subnetted, 1 subnets

C 1.1.1.1 is directly connected, Loopback0

2.0.0.0/32 is subnetted, 1 subnets

B 2.2.2.2 [20/0] via 192.168.1.2, 05:10:07

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

C 192.168.1.0/24 is directly connected, FastEthernet0/0

L 192.168.1.1/32 is directly connected, FastEthernet0/0

B 192.168.2.0/24 [20/0] via 192.168.1.2, 05:41:00

B 192.168.3.0/24 [20/2] via 192.168.1.2, 05:40:30

B 192.168.4.0/24 [20/20] via 192.168.1.2, 05:39:59

**Router 1 show ipv6 route:**

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

via FastEthernet0/0, directly connected

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

via FastEthernet0/0, receive

B 2001:ACAD:2::/64 [20/0]

via FE80::C802:52FF:FE14:8, FastEthernet0/0

B 2001:ACAD:3::/64 [20/2]

via FE80::C802:52FF:FE14:8, FastEthernet0/0

B 2001:ACAD:4::/64 [20/20]

via FE80::C802:52FF:FE14:8, FastEthernet0/0

L FF00::/8 [0/0]

via Null0, receive

**Router 1 show ip bgp neighbors | include BGP:**

BGP neighbor is 192.168.1.2, remote AS 2, external link

BGP version 4, remote router ID 2.2.2.2

BGP state = Established, up for 05:42:47

BGP table version 6, neighbor version 6/0

**Router 2 Show run:**

hostname R2

no ip domain lookup

ipv6 unicast-routing

interface Loopback0

ip address 2.2.2.2 255.255.255.255

interface FastEthernet0/0

ip address 192.168.1.2 255.255.255.0

speed auto

duplex auto

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

interface FastEthernet0/1

ip address 192.168.2.1 255.255.255.0

ip ospf 1 area 1

speed auto

duplex auto

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

ipv6 ospf 1 area 1

router ospf 1

router-id 2.2.2.2

redistribute connected

redistribute bgp 2 subnet

router bgp 2

bgp router-id 2.2.2.2

bgp log-neighbor-changes

neighbor 3.3.3.3 remote-as 2

neighbor 3.3.3.3 update-source Loopback0

neighbor 2001:ACAD:1::1 remote-as 1

neighbor 192.168.1.1 remote-as 1

address-family ipv4

redistribute connected

redistribute ospf 1 match internal external 1 external 2

neighbor 3.3.3.3 activate

no neighbor 2001:ACAD:1::1 activate

neighbor 192.168.1.1 activate

exit address-family

address-family ipv6

redistribute connected

redistribute ospf 1 match internal external 1 external 2

neighbor 2001:ACAD:1::1 activate

neighbor 2001:ACAD:1::1 send-community

exit-address-family

ip route 3.3.3.3 255.255.255.255 192.168.2.2

ipv6 router ospf 1

router-id 2.2.2.2

redistribute connected

redistribute bgp 2

login

end

**Router 2 Show ip route:**

Gateway of last resort is not set

2.0.0.0/32 is subnetted, 1 subnets

C 2.2.2.2 is directly connected, Loopback0

3.0.0.0/32 is subnetted, 1 subnets

S 3.3.3.3 [1/0] via 192.168.2.2

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

C 192.168.1.0/24 is directly connected, FastEthernet0/0

L 192.168.1.2/32 is directly connected, FastEthernet0/0

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

C 192.168.2.0/24 is directly connected, FastEthernet0/1

L 192.168.2.1/32 is directly connected, FastEthernet0/1

O 192.168.3.0/24 [110/2] via 192.168.2.2, 05:52:13, FastEthernet0/1

O E2 192.168.4.0/24 [110/20] via 192.168.2.2, 05:51:29, FastEthernet0/1

**Router 2 Show ipv6 route:**

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

via FastEthernet0/0, directly connected

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

via FastEthernet0/0, receive

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

via FastEthernet0/1, directly connected

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

via FastEthernet0/1, receive

O 2001:ACAD:3::/64 [110/2]

via FE80::C803:41FF:FE00:6, FastEthernet0/1

OE2 2001:ACAD:4::/64 [110/20]

via FE80::C803:41FF:FE00:6, FastEthernet0/1

L FF00::/8 [0/0]

via Null0, receive

**Router 2 Show ip bgp neighbors | include BGP:**

BGP neighbor is 3.3.3.3, remote AS 2, internal link

BGP version 4, remote router ID 3.3.3.3

BGP state = Established, up for 05:55:47

BGP table version 6, neighbor version 6/0

BGP neighbor is 192.168.1.1, remote AS 1, external link

BGP version 4, remote router ID 1.1.1.1

BGP state = Established, up for 05:56:14

BGP table version 6, neighbor version 6/0

**Router 3 Show run:**

hostname R3

ipv6 unicast-routing

interface Loopback0

ip address 3.3.3.3 255.255.255.255

interface FastEthernet0/0

ip address 192.168.3.1 255.255.255.0

ip ospf 1 area 1

speed auto

duplex auto

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

ipv6 ospf 1 area 1

interface FastEthernet0/1

ip address 192.168.2.2 255.255.255.0

ip ospf 1 area 1

speed auto

duplex auto

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

ipv6 ospf 1 area 1

router ospf 1

router-id 3.3.3.3

network 192.168.2.0 0.0.0.255 area 1

network 192.168.3.0 0.0.0.255 area 1

router bgp 2

bgp router-id 3.3.3.3

bgp log-neighbor-changes

neighbor 2.2.2.2 remote-as 2

neighbor 2.2.2.2 update-source Loopback0

neighbor 4.4.4.4 remote-as 2

neighbor 4.4.4.4 update-source Loopback0

ip route 2.2.2.2 255.255.255.255 192.168.2.1

ip route 4.4.4.4 255.255.255.255 192.168.3.2

ipv6 router ospf 1

router-id 3.3.3.3

login

end

**Router 3 Show ip route:**

Gateway of last resort is not set

2.0.0.0/32 is subnetted, 1 subnets

S 2.2.2.2 [1/0] via 192.168.2.1

3.0.0.0/32 is subnetted, 1 subnets

C 3.3.3.3 is directly connected, Loopback0

4.0.0.0/32 is subnetted, 1 subnets

S 4.4.4.4 [1/0] via 192.168.3.2

O E2 192.168.1.0/24 [110/20] via 192.168.2.1, 06:08:27, FastEthernet0/1

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

C 192.168.2.0/24 is directly connected, FastEthernet0/1

L 192.168.2.2/32 is directly connected, FastEthernet0/1

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

C 192.168.3.0/24 is directly connected, FastEthernet0/0

L 192.168.3.1/32 is directly connected, FastEthernet0/0

O E2 192.168.4.0/24 [110/20] via 192.168.3.2, 06:07:53, FastEthernet0/0

**Router 3 show ipv6 route:**

OE2 2001:ACAD:1::/64 [110/20]

via FE80::C802:52FF:FE14:6, FastEthernet0/1

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

via FastEthernet0/1, directly connected

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

via FastEthernet0/1, receive

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

via FastEthernet0/0, directly connected

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

via FastEthernet0/0, receive

OE2 2001:ACAD:4::/64 [110/20]

via FE80::C804:52FF:FE3C:8, FastEthernet0/0

L FF00::/8 [0/0]

via Null0, receive

**Router 3 show ip bgp neighbors | include BGP:**

BGP neighbor is 2.2.2.2, remote AS 2, internal link

BGP version 4, remote router ID 2.2.2.2

BGP state = Established, up for 06:11:09

BGP table version 7, neighbor version 7/0

Bestpath from iBGP peer: 3 n/a

BGP neighbor is 4.4.4.4, remote AS 2, internal link

BGP version 4, remote router ID 4.4.4.4

BGP state = Established, up for 06:10:36

BGP table version 7, neighbor version 7/0

Bestpath from iBGP peer: 3 n/a

**Router 4 show run:**

hostname R4

ipv6 unicast-routing

interface Loopback0

ip address 4.4.4.4 255.255.255.255

interface FastEthernet0/0

ip address 192.168.3.2 255.255.255.0

ip ospf 1 area 1

speed auto

duplex auto

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

ipv6 ospf 1 area 1

interface FastEthernet0/1

ip address 192.168.4.1 255.255.255.0

speed auto

duplex auto

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

router ospf 1

router-id 4.4.4.4

redistribute connected

redistribute bgp 2 subnets

router bgp 2

bgp router-id 4.4.4.4

bgp log-neighbor-changes

neighbor 3.3.3.3 remote-as 2

neighbor 3.3.3.3 update-source Loopback0

neighbor 2001:ACAD:4::2 remote-as 3

neighbor 192.168.4.2 remote-as 3

address-family ipv4

redistribute connected

redistribute ospf 1 match internal external 1 external 2

neighbor 3.3.3.3 activate

no neighbor 2001:ACAD:4::2 activate

neighbor 192.168.4.2 activate

exit-address-family

address-family ipv6

redistribute connected

redistribute ospf 1 match internal external 1 external 2

neighbor 2001:ACAD:4::2 activate

neighbor 2001:ACAD:4::2 send-community

exit-address-family

ip route 3.3.3.3 255.255.255.255 192.168.3.1

ipv6 router ospf 1

router-id 4.4.4.4

redistribute connected

redistribute bgp 2

login

end

**Router 4 show ip route:**

3.0.0.0/32 is subnetted, 1 subnets

S 3.3.3.3 [1/0] via 192.168.3.1

4.0.0.0/32 is subnetted, 1 subnets

C 4.4.4.4 is directly connected, Loopback0

O E2 192.168.1.0/24 [110/20] via 192.168.3.1, 06:11:43, FastEthernet0/0

O 192.168.2.0/24 [110/2] via 192.168.3.1, 06:11:43, FastEthernet0/0

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

C 192.168.3.0/24 is directly connected, FastEthernet0/0

L 192.168.3.2/32 is directly connected, FastEthernet0/0

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

C 192.168.4.0/24 is directly connected, FastEthernet0/1

L 192.168.4.1/32 is directly connected, FastEthernet0/1

**Router 4 show ipv6 route:**

OE2 2001:ACAD:1::/64 [110/20]

via FE80::C803:41FF:FE00:8, FastEthernet0/0

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

via FE80::C803:41FF:FE00:8, FastEthernet0/0

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

via FastEthernet0/0, directly connected

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

via FastEthernet0/0, receive

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

via FastEthernet0/1, directly connected

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

via FastEthernet0/1, receive

L FF00::/8 [0/0]

via Null0, receive

**Router 4 show ip bgp neighbors | include BGP:**

BGP neighbor is 3.3.3.3, remote AS 2, internal link

BGP version 4, remote router ID 3.3.3.3

BGP state = Established, up for 06:14:18

BGP table version 6, neighbor version 6/0

BGP neighbor is 192.168.4.2, remote AS 3, external link

BGP version 4, remote router ID 5.5.5.5

BGP state = Established, up for 06:13:44

BGP table version 6, neighbor version 6/0

R4#

**Router 5 show run:**

hostname R5

ipv6 unicast-routing

interface Loopback0

ip address 5.5.5.5 255.255.255.255

interface FastEthernet0/0

no ip address

shutdown

speed auto

duplex auto

interface FastEthernet0/1

ip address 192.168.4.2 255.255.255.0

speed auto

duplex auto

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

router bgp 3

bgp router-id 5.5.5.5

bgp log-neighbor-changes

neighbor 2001:ACAD:4::1 remote-as 2

neighbor 192.168.4.1 remote-as 2

address-family ipv4

no neighbor 2001:ACAD:4::1 activate

neighbor 192.168.4.1 activate

exit-address-family

address-family ipv6

redistribute connected

neighbor 2001:ACAD:4::1 activate

neighbor 2001:ACAD:4::1 send-community

exit-address-family

login

end

**Router 5 show ip route:**

4.0.0.0/32 is subnetted, 1 subnets

B 4.4.4.4 [20/0] via 192.168.4.1, 06:14:29

5.0.0.0/32 is subnetted, 1 subnets

C 5.5.5.5 is directly connected, Loopback0

B 192.168.1.0/24 [20/20] via 192.168.4.1, 06:14:29

B 192.168.2.0/24 [20/2] via 192.168.4.1, 06:14:29

B 192.168.3.0/24 [20/0] via 192.168.4.1, 06:14:29

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

C 192.168.4.0/24 is directly connected, FastEthernet0/1

L 192.168.4.2/32 is directly connected, FastEthernet0/1

**Router 5 show ipv6 route:**

B 2001:ACAD:1::/64 [20/20]

via FE80::C804:52FF:FE3C:6, FastEthernet0/1

B 2001:ACAD:2::/64 [20/2]

via FE80::C804:52FF:FE3C:6, FastEthernet0/1

B 2001:ACAD:3::/64 [20/0]

via FE80::C804:52FF:FE3C:6, FastEthernet0/1

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

via FastEthernet0/1, directly connected

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

via FastEthernet0/1, receive

L FF00::/8 [0/0]

via Null0, receive

R5#

**Router 5 show ip bgp neighbors | include BGP:**

BGP neighbor is 192.168.4.1, remote AS 2, external link

BGP version 4, remote router ID 4.4.4.4

BGP state = Established, up for 06:16:35

BGP table version 6, neighbor version 6/0

**Router 1 ping to Router 5**

R1#ping 192.168.4.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.4.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 120/124/132 ms

**Router 1 ping to Router 3:**

R1#ping 192.168.3.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.3.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 52/57/64 ms

**Router 5 ping to Router 3:**

R5#ping 192.168.2.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.2.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 56/64/72 ms

**Router 2 ping to Router 4:**

R2#ping 192.168.4.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.4.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 52/66/100 ms

**Problems:**

I had the same problem as last time where it wouldn’t save so I had to copy and paste the show run to a notepad so it would save like that. I had a problem with the loopbacks where it wasn’t showing the route in other ip routes, but I realized that I had to create a different ip route so it would actually show up in the routing table. Another problem I had was getting the motivation to actually do the work because I have a different hard class at Bellevue College so I would spend most of my time on that and not want to do Cisco stuff.

**Conclusion:**

This wasn’t the hardest lab we’ve done, but it was still pretty hard. I was able to ping across the topology without fail and there weren’t many problems with it.