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| bgp labMade by: - Akshat Kansal |
| **CCNP lab 3 – Mr. Mason & Mr. Hansen** **Periods 0,1,2** |

**Purpose**

The goal of this lab was to investigate the functions of BGP and how to configure it. Having to learn how BGP can connect two separate routing protocols (EIGRP and OSPF) and enable them to exchange information as well as create IPv4 and IPv6 routes.

**Background**

BGP or Border Gateway Protocol is also a routing protocol that supports both IPv4 and IPv6. However, it manages how packets are routed from network to network by exchanging routing and reachability information between edge routers. For example, packet exchange between OSPF and EIGRP as used in this exercise. BGP enables redundancy by ensuring that routers can adapt to failures.

If one path fails, another path can be found. The difference between BGP and OSPF is that OSPF is used in internal networks whereas BGP is highly scalable and therefore used in large networks. BGP plays a very important role on the Internet

EIGRP is a routing protocol not yet implemented in previous labs. EIGRP, also known as Enhanced Interior Gateway Routing Protocol, is an OSPF-like routing protocol that enables rapid convergence of network topologies. Achieve network scalability. EIGRP routes are calculated using hop count and DUAL (Diffusion Update Algorithm). The main difference between EIGRP and OSPF is that EIGRP is Cisco proprietary and EIGRP converges faster.

**Lab summary**

We used six Cisco 4321 routers connected in a straight line with Gigabit Ethernet cables on ports g0/0/0 and g0/0/1. I connected port g0/0/0 on router 1 to one terminal (PC1) and port g0/0/1 on router 6 to another terminal (PC2). Using my previously learned OSPF configuration skills, I configured OSPF and OSPFv3 on routers 1-3 in backbone area 0. Routers 4-6 were configured with EIGRP for both IPv4 and IPv6. Then I configured BGP on the network between routers 3 and 4. At Router 4, OSPF and OSPFv3 redistribute information into BGP and vice versa. EIGRP and EIGRP for IPv6 then propagated the information to BGP and vice versa at Router 3. Connectivity was tested by looking at both IPv4 and IPv6 routes on the router and pinging over the network from two end devices.

**Lab commands**

ipv6 unicast routing

router bgp 1

neighbor 10.0.2.2 activate

address-family ipv4

redistribute eigrp 1

router eigrp 1

redistribute bgp 1 metric 10000 100 255 240

**Pings**

R1#ping 192.168.1.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:

!!!!!

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

R1#00:1::1/64

% Bad IP address or host name% Unknown command or computer name, or unable to find computer address

R1#ping 10.0.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.1, timeout is 2 seconds:

!!!!!

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

R1#0:1::1/64

% Bad IP address or host name% Unknown command or computer name, or unable to find computer address

R1#ping 192.168.2.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.2.1, timeout is 2 seconds:

!!!!!

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

R1#ping 10.0.0.2

Sending 5, 100-byte ICMP Echos to 10.0.0.2, timeout is 2 seconds:

!!!!!

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

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 = 1/1/1 ms

R1#ping 10.0.2.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.2.1, timeout is 2 seconds:

!!!!!

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

R1#ping 10.0.1.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.1.2, timeout is 2 seconds:

!!!!!

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

R1#g 10:2::2/64

^

% Invalid input detected at '^' marker.

R1#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 = 1/1/1 ms

R1#ping 192.168.5.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.5.1, timeout is 2 seconds:

!!!!!

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

**router 1**

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

no ip domain lookup

ipv6 unicast-routing

subscriber templating

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO214811ZM

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface Loopback0

ip address 192.168.1.1 255.255.255.0

ipv6 address 100:1::1/64

ipv6 eigrp 1

interface GigabitEthernet0/0/0

ip address 10.0.0.1 255.255.255.0

negotiation auto

ipv6 address 10:1::1/64

ipv6 eigrp 1

interface GigabitEthernet0/0/1

no ip address

shutdown

negotiation auto

interface Serial0/1/0

no ip address

shutdown

interface Serial0/1/1

no ip address

shutdown

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

interface Vlan1

no ip address

shutdown

router eigrp 1

network 10.0.0.0 0.0.0.255

network 192.168.1.0

eigrp 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 eigrp 1

eigrp router-id 1.1.1.1

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

End

R1#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

10.0.0.0/8 is variably subnetted, 6 subnets, 2 masks

C 10.0.0.0/24 is directly connected, GigabitEthernet0/0/0

L 10.0.0.1/32 is directly connected, GigabitEthernet0/0/0

D 10.0.1.0/24 [90/3072] via 10.0.0.2, 00:28:39, GigabitEthernet0/0/0

D 10.0.2.0/24 [90/3328] via 10.0.0.2, 00:27:41, GigabitEthernet0/0/0

D EX 10.0.3.0/24 [170/282112] via 10.0.0.2, 00:16:31, GigabitEthernet0/0/0

D EX 10.0.4.0/24 [170/282112] via 10.0.0.2, 00:16:31, GigabitEthernet0/0/0

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

C 192.168.1.0/24 is directly connected, Loopback0

L 192.168.1.1/32 is directly connected, Loopback0

D 192.168.2.0/24 [90/130816] via 10.0.0.2, 00:28:39, GigabitEthernet0/0/0

D 192.168.3.0/24 [90/131072] via 10.0.0.2, 00:27:41, GigabitEthernet0/0/0

D EX 192.168.4.0/24 [170/282112] via 10.0.0.2, 00:16:31, GigabitEthernet0/0/0

192.168.5.0/32 is subnetted, 1 subnets

D EX 192.168.5.1 [170/282112] via 10.0.0.2, 00:16:31, GigabitEthernet0/0/0

192.168.6.0/32 is subnetted, 1 subnets

D EX 192.168.6.1 [170/282112] via 10.0.0.2, 00:16:31, GigabitEthernet0/0/0

R1#show ipv6 route

IPv6 Routing Table - default - 12 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 10:1::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 10:1::1/128 [0/0]

via GigabitEthernet0/0/0, receive

D 10:2::/64 [90/3072]

via FE80::B6A8:B9FF:FE47:9471, GigabitEthernet0/0/0

D 10:3::/64 [90/3328]

via FE80::B6A8:B9FF:FE47:9471, GigabitEthernet0/0/0

EX 10:5::/64 [170/282112]

via FE80::B6A8:B9FF:FE47:9471, GigabitEthernet0/0/0

C 100:1::/64 [0/0]

via Loopback0, directly connected

L 100:1::1/128 [0/0]

via Loopback0, receive

D 100:2::/64 [90/130816]

via FE80::B6A8:B9FF:FE47:9471, GigabitEthernet0/0/0

D 100:3::/64 [90/131072]

via FE80::B6A8:B9FF:FE47:9471, GigabitEthernet0/0/0

EX 100:5::1/128 [170/282112]

via FE80::B6A8:B9FF:FE47:9471, GigabitEthernet0/0/0

EX 100:6::1/128 [170/282112]

via FE80::B6A8:B9FF:FE47:9471, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

**router 2:**

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

no ip domain lookup

ipv6 unicast-routing

subscriber templating

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO214414TX

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface Loopback0

ip address 192.168.2.1 255.255.255.0

ipv6 address 100:2::1/64

ipv6 eigrp 1

interface GigabitEthernet0/0/0

ip address 10.0.1.1 255.255.255.0

negotiation auto

ipv6 address 10:2::1/64

ipv6 eigrp 1

interface GigabitEthernet0/0/1

ip address 10.0.0.2 255.255.255.0

negotiation auto

ipv6 address 10:1::2/64

ipv6 eigrp 1

interface Serial0/1/0

no ip address

shutdown

interface Serial0/1/1

no ip address

shutdown

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

interface Vlan1

no ip address

shutdown

router eigrp 1

network 10.0.0.0 0.0.0.255

network 10.0.1.0 0.0.0.255

network 192.168.2.0

eigrp 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 eigrp 1

eigrp router-id 2.2.2.2

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

R2#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

10.0.0.0/8 is variably subnetted, 7 subnets, 2 masks

C 10.0.0.0/24 is directly connected, GigabitEthernet0/0/1

L 10.0.0.2/32 is directly connected, GigabitEthernet0/0/1

C 10.0.1.0/24 is directly connected, GigabitEthernet0/0/0

L 10.0.1.1/32 is directly connected, GigabitEthernet0/0/0

D 10.0.2.0/24 [90/3072] via 10.0.1.2, 00:28:52, GigabitEthernet0/0/0

D EX 10.0.3.0/24 [170/281856] via 10.0.1.2, 00:17:42, GigabitEthernet0/0/0

D EX 10.0.4.0/24 [170/281856] via 10.0.1.2, 00:17:42, GigabitEthernet0/0/0

D 192.168.1.0/24 [90/130816] via 10.0.0.1, 00:29:50, GigabitEthernet0/0/1

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

C 192.168.2.0/24 is directly connected, Loopback0

L 192.168.2.1/32 is directly connected, Loopback0

D 192.168.3.0/24 [90/130816] via 10.0.1.2, 00:28:52, GigabitEthernet0/0/0

D EX 192.168.4.0/24 [170/281856] via 10.0.1.2, 00:17:42, GigabitEthernet0/0/0

192.168.5.0/32 is subnetted, 1 subnets

D EX 192.168.5.1 [170/281856] via 10.0.1.2, 00:17:42, GigabitEthernet0/0/0

192.168.6.0/32 is subnetted, 1 subnets

D EX 192.168.6.1 [170/281856] via 10.0.1.2, 00:17:42, GigabitEthernet0/0/0

R2#show ipv6 route

IPv6 Routing Table - default - 13 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 10:1::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 10:1::2/128 [0/0]

via GigabitEthernet0/0/1, receive

C 10:2::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 10:2::1/128 [0/0]

via GigabitEthernet0/0/0, receive

D 10:3::/64 [90/3072]

via FE80::227:90FF:FED4:F31, GigabitEthernet0/0/0

EX 10:5::/64 [170/281856]

via FE80::227:90FF:FED4:F31, GigabitEthernet0/0/0

D 100:1::/64 [90/130816]

via FE80::267E:12FF:FE55:5720, GigabitEthernet0/0/1

C 100:2::/64 [0/0]

via Loopback0, directly connected

L 100:2::1/128 [0/0]

via Loopback0, receive

D 100:3::/64 [90/130816]

via FE80::227:90FF:FED4:F31, GigabitEthernet0/0/0

EX 100:5::1/128 [170/281856]

via FE80::227:90FF:FED4:F31, GigabitEthernet0/0/0

EX 100:6::1/128 [170/281856]

via FE80::227:90FF:FED4:F31, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

**router 3:**

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

no ip domain lookup

ipv6 unicast-routing

subscriber templating

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO214328EH

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface Loopback0

ip address 192.168.3.1 255.255.255.0

ipv6 address 100:3::1/64

ipv6 eigrp 1

interface GigabitEthernet0/0/0

ip address 10.0.2.1 255.255.255.0

negotiation auto

ipv6 address 10:3::1/64

ipv6 eigrp 1

interface GigabitEthernet0/0/1

ip address 10.0.1.2 255.255.255.0

negotiation auto

ipv6 address 10:2::2/64

ipv6 eigrp 1

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 eigrp 1

network 10.0.1.0 0.0.0.255

network 10.0.2.0 0.0.0.255

network 192.168.3.0

redistribute bgp 1 metric 10000 100 255 240 65535

eigrp router-id 3.3.3.3

router bgp 1

bgp log-neighbor-changes

neighbor 10:3::2 remote-as 2

neighbor 10.0.2.2 remote-as 2

address-family ipv4

redistribute eigrp 1

no neighbor 10:3::2 activate

neighbor 10.0.2.2 activate

exit-address-family

address-family ipv6

redistribute eigrp 1

network 10:3::/64

neighbor 10:3::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 eigrp 1

eigrp router-id 3.3.3.3

redistribute bgp 1 metric 10000 100 255 240 65535

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

R3#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

10.0.0.0/8 is variably subnetted, 7 subnets, 2 masks

D 10.0.0.0/24 [90/3072] via 10.0.1.1, 00:32:40, GigabitEthernet0/0/1

C 10.0.1.0/24 is directly connected, GigabitEthernet0/0/1

L 10.0.1.2/32 is directly connected, GigabitEthernet0/0/1

C 10.0.2.0/24 is directly connected, GigabitEthernet0/0/0

L 10.0.2.1/32 is directly connected, GigabitEthernet0/0/0

B 10.0.3.0/24 [20/0] via 10.0.2.2, 00:35:16

B 10.0.4.0/24 [20/2] via 10.0.2.2, 00:35:16

D 192.168.1.0/24 [90/131072] via 10.0.1.1, 00:32:40, GigabitEthernet0/0/1

D 192.168.2.0/24 [90/130816] via 10.0.1.1, 00:32:40, GigabitEthernet0/0/1

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

C 192.168.3.0/24 is directly connected, Loopback0

L 192.168.3.1/32 is directly connected, Loopback0

B 192.168.4.0/24 [20/0] via 10.0.2.2, 00:35:16

192.168.5.0/32 is subnetted, 1 subnets

B 192.168.5.1 [20/2] via 10.0.2.2, 00:35:16

192.168.6.0/32 is subnetted, 1 subnets

B 192.168.6.1 [20/3] via 10.0.2.2, 00:35:16

R3#show ipv6 route

IPv6 Routing Table - default - 13 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

D 10:1::/64 [90/3072]

via FE80::B6A8:B9FF:FE47:9470, GigabitEthernet0/0/1

C 10:2::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 10:2::2/128 [0/0]

via GigabitEthernet0/0/1, receive

C 10:3::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 10:3::1/128 [0/0]

via GigabitEthernet0/0/0, receive

B 10:5::/64 [20/2]

via FE80::2C1:B1FF:FED5:5331, GigabitEthernet0/0/0

D 100:1::/64 [90/131072]

via FE80::B6A8:B9FF:FE47:9470, GigabitEthernet0/0/1

D 100:2::/64 [90/130816]

via FE80::B6A8:B9FF:FE47:9470, GigabitEthernet0/0/1

C 100:3::/64 [0/0]

via Loopback0, directly connected

L 100:3::1/128 [0/0]

via Loopback0, receive

B 100:5::1/128 [20/1]

via FE80::2C1:B1FF:FED5:5331, GigabitEthernet0/0/0

B 100:6::1/128 [20/2]

via FE80::2C1:B1FF:FED5:5331, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

**router 4:**

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

ipv6 unicast-routing

subscriber templating

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO210907U3

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface Loopback0

ip address 192.168.4.1 255.255.255.0

ipv6 address 100:4::1/64

ipv6 ospf 2 area 0

interface GigabitEthernet0/0/0

ip address 10.0.3.1 255.255.255.0

negotiation auto

ipv6 address 10:4::1/64

ipv6 ospf 2 area 0

interface GigabitEthernet0/0/1

ip address 10.0.2.2 255.255.255.0

negotiation auto

ipv6 address 10:3::2/64

interface Serial0/1/0

no ip address

shutdown

interface Serial0/1/1

no ip address

shutdown

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

interface Vlan1

no ip address

shutdown

router ospf 2

router-id 4.4.4.4

redistribute bgp 2 subnets

network 10.0.3.0 0.0.0.255 area 0

network 192.168.4.0 0.0.0.255 area 0

router bgp 2

bgp log-neighbor-changes

neighbor 10:3::1 remote-as 1

neighbor 10.0.2.1 remote-as 1

address-family ipv4

redistribute ospf 2

no neighbor 10:3::1 activate

neighbor 10.0.2.1 activate

exit-address-family

address-family ipv6

redistribute ospf 2

network 10:3::/64

neighbor 10:3::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

ipv6 router ospf 2

redistribute bgp 2

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

R4#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

10.0.0.0/8 is variably subnetted, 7 subnets, 2 masks

B 10.0.0.0/24 [20/3072] via 10.0.2.1, 00:26:09

B 10.0.1.0/24 [20/0] via 10.0.2.1, 00:26:09

C 10.0.2.0/24 is directly connected, GigabitEthernet0/0/1

L 10.0.2.2/32 is directly connected, GigabitEthernet0/0/1

C 10.0.3.0/24 is directly connected, GigabitEthernet0/0/0

L 10.0.3.1/32 is directly connected, GigabitEthernet0/0/0

O 10.0.4.0/24 [110/2] via 10.0.3.2, 00:43:02, GigabitEthernet0/0/0

B 192.168.1.0/24 [20/131072] via 10.0.2.1, 00:26:09

B 192.168.2.0/24 [20/130816] via 10.0.2.1, 00:26:09

B 192.168.3.0/24 [20/0] via 10.0.2.1, 00:26:40

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

C 192.168.4.0/24 is directly connected, Loopback0

L 192.168.4.1/32 is directly connected, Loopback0

192.168.5.0/32 is subnetted, 1 subnets

O 192.168.5.1 [110/2] via 10.0.3.2, 00:43:02, GigabitEthernet0/0/0

192.168.6.0/32 is subnetted, 1 subnets

O 192.168.6.1 [110/3] via 10.0.3.2, 00:43:02, GigabitEthernet0/0/0

R4#show ipv6 route

IPv6 Routing Table - default - 13 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

B 10:1::/64 [20/3072]

via FE80::227:90FF:FED4:F30, GigabitEthernet0/0/1

C 10:3::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 10:3::2/128 [0/0]

via GigabitEthernet0/0/1, receive

C 10:4::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 10:4::1/128 [0/0]

via GigabitEthernet0/0/0, receive

O 10:5::/64 [110/2]

via FE80::B6A8:B9FF:FE01:B5A1, GigabitEthernet0/0/0

B 100:1::/64 [20/131072]

via FE80::227:90FF:FED4:F30, GigabitEthernet0/0/1

B 100:2::/64 [20/130816]

via FE80::227:90FF:FED4:F30, GigabitEthernet0/0/1

C 100:4::/64 [0/0]

via Loopback0, directly connected

L 100:4::1/128 [0/0]

via Loopback0, receive

O 100:5::1/128 [110/1]

via FE80::B6A8:B9FF:FE01:B5A1, GigabitEthernet0/0/0

O 100:6::1/128 [110/2]

via FE80::B6A8:B9FF:FE01:B5A1, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

**router 5:**

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

no ip domain lookup

ipv6 unicast-routing

subscriber templating

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO214421CH

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface Loopback0

ip address 192.168.5.1 255.255.255.0

ipv6 address 100:5::1/64

ipv6 ospf 2 area 0

interface GigabitEthernet0/0/0

ip address 10.0.4.1 255.255.255.0

negotiation auto

ipv6 address 10:5::1/64

ipv6 ospf 2 area 0

interface GigabitEthernet0/0/1

ip address 10.0.3.2 255.255.255.0

negotiation auto

ipv6 address 10:4::2/64

ipv6 ospf 2 area 0

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 ospf 2

router-id 5.5.5.5

network 10.0.3.0 0.0.0.255 area 0

network 10.0.4.0 0.0.0.255 area 0

network 192.168.5.0 0.0.0.255 area 0

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router ospf 2

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

R5#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

10.0.0.0/8 is variably subnetted, 6 subnets, 2 masks

O E2 10.0.0.0/24 [110/1] via 10.0.3.1, 00:14:08, GigabitEthernet0/0/1

O E2 10.0.1.0/24 [110/1] via 10.0.3.1, 00:14:08, GigabitEthernet0/0/1

C 10.0.3.0/24 is directly connected, GigabitEthernet0/0/1

L 10.0.3.2/32 is directly connected, GigabitEthernet0/0/1

C 10.0.4.0/24 is directly connected, GigabitEthernet0/0/0

L 10.0.4.1/32 is directly connected, GigabitEthernet0/0/0

O E2 192.168.1.0/24 [110/1] via 10.0.3.1, 00:14:08, GigabitEthernet0/0/1

O E2 192.168.2.0/24 [110/1] via 10.0.3.1, 00:14:08, GigabitEthernet0/0/1

O E2 192.168.3.0/24 [110/1] via 10.0.3.1, 00:14:08, GigabitEthernet0/0/1

192.168.4.0/32 is subnetted, 1 subnets

O 192.168.4.1 [110/2] via 10.0.3.1, 00:41:30, GigabitEthernet0/0/1

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

C 192.168.5.0/24 is directly connected, Loopback0

L 192.168.5.1/32 is directly connected, Loopback0

192.168.6.0/32 is subnetted, 1 subnets

O 192.168.6.1 [110/2] via 10.0.4.2, 00:46:47, GigabitEthernet0/0/0

R5#show ipv6 route

IPv6 Routing Table - default - 12 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

OE2 10:1::/64 [110/1]

via FE80::2C1:B1FF:FED5:5330, GigabitEthernet0/0/1

C 10:4::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 10:4::2/128 [0/0]

via GigabitEthernet0/0/1, receive

C 10:5::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 10:5::1/128 [0/0]

via GigabitEthernet0/0/0, receive

OE2 100:1::/64 [110/1]

via FE80::2C1:B1FF:FED5:5330, GigabitEthernet0/0/1

OE2 100:2::/64 [110/1]

via FE80::2C1:B1FF:FED5:5330, GigabitEthernet0/0/1

O 100:4::1/128 [110/1]

via FE80::2C1:B1FF:FED5:5330, GigabitEthernet0/0/1

C 100:5::/64 [0/0]

via Loopback0, directly connected

L 100:5::1/128 [0/0]

via Loopback0, receive

O 100:6::1/128 [110/1]

via FE80::B6A8:B9FF:FE47:96B1, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

**router 6:**

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

no ip domain lookup

ipv6 unicast-routing

subscriber templating

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO214414VU

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface Loopback0

ip address 192.168.6.1 255.255.255.0

ipv6 address 100:6::1/64

ipv6 ospf 2 area 0

interface GigabitEthernet0/0/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/0/1

ip address 10.0.4.2 255.255.255.0

negotiation auto

ipv6 address 10:5::2/64

ipv6 ospf 2 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

interface Vlan1

no ip address

shutdown

router ospf 2

router-id 6.6.6.6

network 10.0.4.0 0.0.0.255 area 0

network 192.168.6.0 0.0.0.255 area 0

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router ospf 2

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

R6#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

10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks

O E2 10.0.0.0/24 [110/1] via 10.0.4.1, 00:12:31, GigabitEthernet0/0/1

O E2 10.0.1.0/24 [110/1] via 10.0.4.1, 00:12:31, GigabitEthernet0/0/1

O 10.0.3.0/24 [110/2] via 10.0.4.1, 00:43:21, GigabitEthernet0/0/1

C 10.0.4.0/24 is directly connected, GigabitEthernet0/0/1

L 10.0.4.2/32 is directly connected, GigabitEthernet0/0/1

O E2 192.168.1.0/24 [110/1] via 10.0.4.1, 00:12:31, GigabitEthernet0/0/1

O E2 192.168.2.0/24 [110/1] via 10.0.4.1, 00:12:31, GigabitEthernet0/0/1

O E2 192.168.3.0/24 [110/1] via 10.0.4.1, 00:12:31, GigabitEthernet0/0/1

192.168.4.0/32 is subnetted, 1 subnets

O 192.168.4.1 [110/3] via 10.0.4.1, 00:39:53, GigabitEthernet0/0/1

192.168.5.0/32 is subnetted, 1 subnets

O 192.168.5.1 [110/2] via 10.0.4.1, 00:45:09, GigabitEthernet0/0/1

192.168.6.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.6.0/24 is directly connected, Loopback0

L 192.168.6.1/32 is directly connected, Loopback0

R6#show ipv route

IPv6 Routing Table - default - 11 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

OE2 10:1::/64 [110/1]

via FE80::B6A8:B9FF:FE01:B5A0, GigabitEthernet0/0/1

O 10:4::/64 [110/2]

via FE80::B6A8:B9FF:FE01:B5A0, GigabitEthernet0/0/1

C 10:5::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 10:5::2/128 [0/0]

via GigabitEthernet0/0/1, receive

OE2 100:1::/64 [110/1]

via FE80::B6A8:B9FF:FE01:B5A0, GigabitEthernet0/0/1

OE2 100:2::/64 [110/1]

via FE80::B6A8:B9FF:FE01:B5A0, GigabitEthernet0/0/1

O 100:4::1/128 [110/2]

via FE80::B6A8:B9FF:FE01:B5A0, GigabitEthernet0/0/1

O 100:5::1/128 [110/1]

via FE80::B6A8:B9FF:FE01:B5A0, GigabitEthernet0/0/1

C 100:6::/64 [0/0]

via Loopback0, directly connected

L 100:6::1/128 [0/0]

via Loopback0, receive

L FF00::/8 [0/0]

via Null0, receive

**problems**

The issue we had with EIGRP was that it used metrics, which were not configured for OSPF. This was resolved by learning about metrics and configuring one for EIGRP routes. While configuring BGP for IPv4 was relatively simple, we encountered numerous issues when configuring BGP for IPv6.  This was resolved by configuring OSPF on router 3's g0/0/1 interface and EIGRP on router 4's g0/0/0 interface. Another issue we discovered was that BGP has IPv4 unicast enabled by default, which is why IPv6 routes were not being shared across BGP.

**Conclusion**

In this lab, we used BPG to connect an OSPF and EIGRP network for both IPv4 and IPv6. Six routers were connected in a straight line, with routers 1–3 configured with OSPF and routers 4–6 configured with EIGRP. On routers 3 and 4, BGP was configured to redistribute OSPF and EIGRP information to BGP . The main issue we encountered in this lab was configuring BGP for IPv6. The network's functionality was confirmed at the end by checking the IP routes on each router and pinging across the network by connecting end devices on different ends of the network.