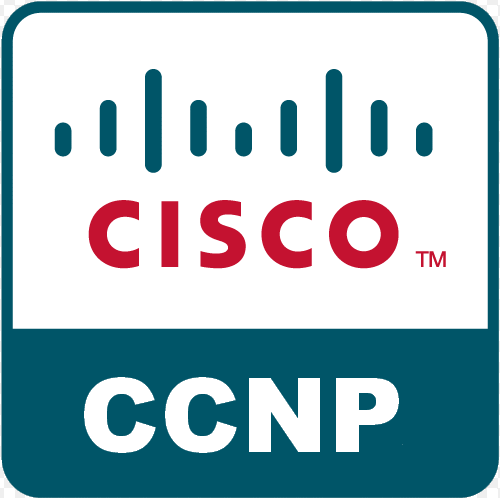
Border Gateway Protocol

(BGP)

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# Purpose:

The Point of this lab was to establish a network that used three different routing protocols. One would be OSPF, one would be EIGRP and the one connecting the two would be BGP. All three protocols would be operational for IPv4 and IPv6.

# Background information:

BGP stands for Border Gateway Protocol which is used to connect different autonomous systems across the internet. BGP is crucial factor in the keeping the internet running because there are many different autonomous systems being used. BGP exchanges routes and information between all of them. It only advertises the best possible route, which improves efficiency and avoids congestion this is called the Next-hop Paradigm.

BGP uses TCP because it needs to be able to talk with the rest of internet which also uses TCP. TCP guarantees that packets are sent and received across the internet. BGP also supports CIDR (Classless Inter-Domain Routing). It is a way that IP address are allocated so you can use them for IP routing. CIDR removes the need for the different IP address classes and instead utilizes CIDR blocks and dynamically allocates the IP addresses.

BGP does not have any built-in security features, but it does support other existing security measures. BGP is able to improve efficiency by making sure the right peer is identified and reachable. It also sends updates to make sure it uses relevant and accurate information when deciding what path to advertise.

BGP has a feature called route flap damping. Flapping is when BGP keeps sending update messages that are not needed. So, this feature reduces how many of these messages are send which will in turn reduce how much work the router has to do. Importantly it is still advertising when it needs to do but not too much so that it can stay efficient.

Lab summary:

Create an OSPF area and an EIGRP area and redistribute those routes between one and other using BGP.

Lab Commands:

#Router bgp 1

#neighbor (#) activate

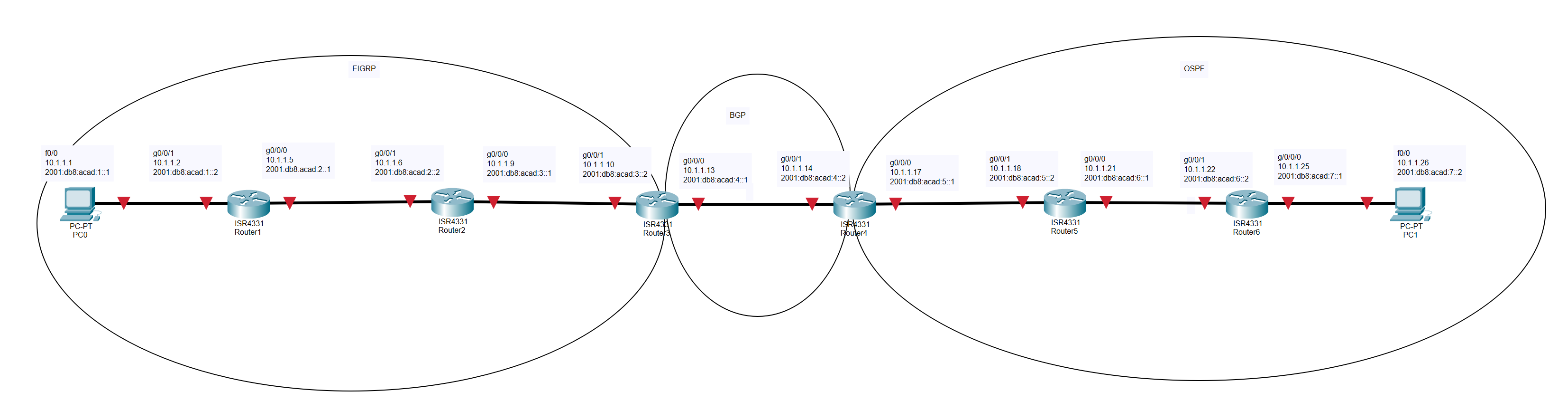
#address-family (ipv4/6)

#redistribute eigrp

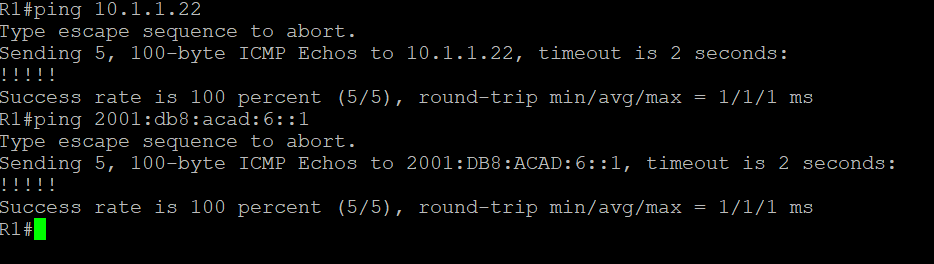
#redistruibute ospf

#redistribute BGP metric 10000 100 255 240 65535

Network Diagram:



PING:



Configurations:

# R1:

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 FDO21482HZX

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 10

interface GigabitEthernet0/0/0

ip address 10.1.1.5 255.255.255.252

negotiation auto

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

ipv6 eigrp 10

interface GigabitEthernet0/0/1

no ip address

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

interface Vlan1

no ip address

shutdown

router eigrp 10

network 10.1.1.4 0.0.0.3

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 10

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 10.1.1.4/30 is directly connected, GigabitEthernet0/0/0

L 10.1.1.5/32 is directly connected, GigabitEthernet0/0/0

D 10.1.1.8/30 [90/3072] via 10.1.1.6, 00:51:38, GigabitEthernet0/0/0

D 10.1.1.12/30 [90/3328] via 10.1.1.6, 00:42:00, GigabitEthernet0/0/0

D EX 10.1.1.16/30

[170/282112] via 10.1.1.6, 00:35:28, GigabitEthernet0/0/0

D EX 10.1.1.20/30

[170/282112] via 10.1.1.6, 00:35:28, 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 10.1.1.6, 00:53:00, GigabitEthernet0/0/0

D 192.168.3.0/24 [90/131072] via 10.1.1.6, 00:51:31, GigabitEthernet0/0/0

D EX 192.168.4.0/24 [170/282112] via 10.1.1.6, 00:35:28, GigabitEthernet0/0/0

192.168.5.0/32 is subnetted, 1 subnets

D EX 192.168.5.1 [170/282112] via 10.1.1.6, 00:35:28, GigabitEthernet0/0/0

192.168.6.0/32 is subnetted, 1 subnets

D EX 192.168.6.1 [170/282112] via 10.1.1.6, 00:35:28, GigabitEthernet0/0/0

R1#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 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::2, GigabitEthernet0/0/0

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

via FE80::2, GigabitEthernet0/0/0

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

via FE80::2, GigabitEthernet0/0/0

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

via FE80::2, GigabitEthernet0/0/0

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

via GigabitEthernet0/0/0, directly connected

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

via GigabitEthernet0/0/0, receive

D 2001:DB8:ACAD:3::/64 [90/3072]

via FE80::2, GigabitEthernet0/0/0

D 2001:DB8:ACAD:4::/64 [90/3328]

via FE80::2, GigabitEthernet0/0/0

EX 2001:DB8:ACAD:5::/64 [170/282112]

via FE80::2, GigabitEthernet0/0/0

EX 2001:DB8:ACAD:6::/64 [170/282112]

via FE80::2, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

# R2:

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 FDO21482DWJ

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 10

interface GigabitEthernet0/0/0

ip address 10.1.1.9 255.255.255.252

negotiation auto

ipv6 address FE80::1 link-local

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

ipv6 eigrp 10

interface GigabitEthernet0/0/1

ip address 10.1.1.6 255.255.255.252

negotiation auto

ipv6 address FE80::2 link-local

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

ipv6 eigrp 10

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 eigrp 10

network 10.1.1.4 0.0.0.3

network 10.1.1.8 0.0.0.3

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 10

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 10.1.1.4/30 is directly connected, GigabitEthernet0/0/1

L 10.1.1.6/32 is directly connected, GigabitEthernet0/0/1

C 10.1.1.8/30 is directly connected, GigabitEthernet0/0/0

L 10.1.1.9/32 is directly connected, GigabitEthernet0/0/0

D 10.1.1.12/30 [90/3072] via 10.1.1.10, 00:43:24, GigabitEthernet0/0/0

D EX 10.1.1.16/30

[170/281856] via 10.1.1.10, 00:36:53, GigabitEthernet0/0/0

D EX 10.1.1.20/30

[170/281856] via 10.1.1.10, 00:36:53, GigabitEthernet0/0/0

D 192.168.1.0/24 [90/130816] via 10.1.1.5, 00:54:27, 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 10.1.1.10, 00:52:55, GigabitEthernet0/0/0

D EX 192.168.4.0/24

[170/281856] via 10.1.1.10, 00:36:53, GigabitEthernet0/0/0

192.168.5.0/32 is subnetted, 1 subnets

D EX 192.168.5.1

[170/281856] via 10.1.1.10, 00:36:53, GigabitEthernet0/0/0

192.168.6.0/32 is subnetted, 1 subnets

D EX 192.168.6.1

[170/281856] via 10.1.1.10, 00:36:53, GigabitEthernet0/0/0

R2#show ipv6 route

IPv6 Routing Table - default - 14 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 100:1::/64 [90/130816]

via FE80::267E:12FF:FE4D:F6E0, 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::2, GigabitEthernet0/0/0

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

via FE80::2, GigabitEthernet0/0/0

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

via FE80::2, GigabitEthernet0/0/0

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

via GigabitEthernet0/0/1, directly connected

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

via GigabitEthernet0/0/1, receive

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

via GigabitEthernet0/0/0, directly connected

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

via GigabitEthernet0/0/0, receive

D 2001:DB8:ACAD:4::/64 [90/3072]

via FE80::2, GigabitEthernet0/0/0

EX 2001:DB8:ACAD:5::/64 [170/281856]

via FE80::2, GigabitEthernet0/0/0

EX 2001:DB8:ACAD:6::/64 [170/281856]

via FE80::2, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

# R3:

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

vtp domain cisco

vtp mode transparent

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO214420HW

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 10

interface GigabitEthernet0/0/0

ip address 10.1.1.13 255.255.255.252

negotiation auto

ipv6 address FE80::1 link-local

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

ipv6 eigrp 10

interface GigabitEthernet0/0/1

ip address 10.1.1.10 255.255.255.252

negotiation auto

ipv6 address FE80::2 link-local

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

ipv6 eigrp 10

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 eigrp 10

network 10.1.1.8 0.0.0.3

network 10.1.1.12 0.0.0.3

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 10.1.1.14 remote-as 2

neighbor 2001:DB8:ACAD:4::2 remote-as 2

address-family ipv4

redistribute eigrp 10

neighbor 10.1.1.14 activate

no neighbor 2001:DB8:ACAD:4::2 activate

exit-address-family

address-family ipv6

redistribute eigrp 10

network 2001:DB8:ACAD:3::/64

network 2001:DB8:ACAD:4::/64

neighbor 2001:DB8:ACAD:4::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 10

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 10.1.1.4/30 [90/3072] via 10.1.1.9, 00:54:51, GigabitEthernet0/0/1

C 10.1.1.8/30 is directly connected, GigabitEthernet0/0/1

L 10.1.1.10/32 is directly connected, GigabitEthernet0/0/1

C 10.1.1.12/30 is directly connected, GigabitEthernet0/0/0

L 10.1.1.13/32 is directly connected, GigabitEthernet0/0/0

B 10.1.1.16/30 [20/0] via 10.1.1.14, 00:38:43

B 10.1.1.20/30 [20/2] via 10.1.1.14, 00:38:43

D 192.168.1.0/24 [90/131072] via 10.1.1.9, 00:54:51, GigabitEthernet0/0/1

D 192.168.2.0/24 [90/130816] via 10.1.1.9, 00:54:51, 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 10.1.1.14, 00:38:43

192.168.5.0/32 is subnetted, 1 subnets

B 192.168.5.1 [20/2] via 10.1.1.14, 00:38:43

192.168.6.0/32 is subnetted, 1 subnets

B 192.168.6.1 [20/3] via 10.1.1.14, 00:38:43

R3#show ipv6 route

IPv6 Routing Table - default - 14 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 100:1::/64 [90/131072]

via FE80::1, GigabitEthernet0/0/1

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

via FE80::1, 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::2, GigabitEthernet0/0/0

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

via FE80::2, GigabitEthernet0/0/0

D 2001:DB8:ACAD:2::/64 [90/3072]

via FE80::1, GigabitEthernet0/0/1

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

via GigabitEthernet0/0/1, directly connected

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

B 2001:DB8:ACAD:5::/64 [20/0]

via FE80::2, GigabitEthernet0/0/0

B 2001:DB8:ACAD:6::/64 [20/2]

via FE80::2, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

# R4:

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

vtp domain cisco

vtp mode transparent

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO214421D1

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 10 area 0

interface GigabitEthernet0/0/0

ip address 10.1.1.17 255.255.255.252

negotiation auto

ipv6 address FE80::1 link-local

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

ipv6 ospf 10 area 0

interface GigabitEthernet0/0/1

ip address 10.1.1.14 255.255.255.252

negotiation auto

ipv6 address FE80::2 link-local

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

ipv6 ospf 10 area 0

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 ospf 10

router-id 4.4.4.4

redistribute bgp 2 subnets

network 10.1.1.16 0.0.0.3 area 0

network 192.168.4.0 0.0.0.255 area 0

router bgp 2

bgp router-id 4.4.4.4

bgp log-neighbor-changes

neighbor 10.1.1.13 remote-as 1

neighbor 2001:DB8:ACAD:4::1 remote-as 1

address-family ipv4

redistribute ospf 10

neighbor 10.1.1.13 activate

no neighbor 2001:DB8:ACAD:4::1 activate

exit-address-family

address-family ipv6

redistribute ospf 10

network 2001:DB8:ACAD:4::/64

network 2001:DB8:ACAD:5::/64

neighbor 2001:DB8:ACAD:4::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 10

redistribute bgp 2 metric 10000

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 10.1.1.4/30 [20/3072] via 10.1.1.13, 00:40:30

B 10.1.1.8/30 [20/0] via 10.1.1.13, 00:40:30

C 10.1.1.12/30 is directly connected, GigabitEthernet0/0/1

L 10.1.1.14/32 is directly connected, GigabitEthernet0/0/1

C 10.1.1.16/30 is directly connected, GigabitEthernet0/0/0

L 10.1.1.17/32 is directly connected, GigabitEthernet0/0/0

O 10.1.1.20/30 [110/2] via 10.1.1.18, 00:46:18, GigabitEthernet0/0/0

B 192.168.1.0/24 [20/131072] via 10.1.1.13, 00:40:30

B 192.168.2.0/24 [20/130816] via 10.1.1.13, 00:40:30

B 192.168.3.0/24 [20/0] via 10.1.1.13, 00:40:30

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 10.1.1.18, 00:46:18, GigabitEthernet0/0/0

192.168.6.0/32 is subnetted, 1 subnets

O 192.168.6.1 [110/3] via 10.1.1.18, 00:46:18, GigabitEthernet0/0/0

R4#show ipv6 route

IPv6 Routing Table - default - 14 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 100:1::/64 [20/131072]

via FE80::1, GigabitEthernet0/0/1

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

via FE80::1, 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::2, GigabitEthernet0/0/0

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

via FE80::2, GigabitEthernet0/0/0

B 2001:DB8:ACAD:2::/64 [20/3072]

via FE80::1, GigabitEthernet0/0/1

B 2001:DB8:ACAD:3::/64 [20/0]

via FE80::1, GigabitEthernet0/0/1

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

via GigabitEthernet0/0/1, directly connected

L 2001:DB8:ACAD:4::2/128 [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::1/128 [0/0]

via GigabitEthernet0/0/0, receive

O 2001:DB8:ACAD:6::/64 [110/2]

via FE80::2, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

# R5:

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

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 0D323231 30303631 34343534

395A170D 33303031 30313030 30303030 5A303031 2E302C06 03550403 1325494F

532D5365 6C662D53 69676E65 642D4365 72746966 69636174 652D3835 39383936

34373730 82012230 0D06092A 864886F7 0D010101 05000382 010F0030 82010A02

82010100 A5175846 74B11444 12F2F0DC F295AF42 253AD245 E02813A9 36EE28E3

F6F3C068 9B1EC0E5 B49377D0 909831EF D86FD497 00432910 1029CBF4 B874EBDD

2FB4F8B5 27F7332D 4D1C9221 21500517 8D63CB52 4C81E16D 7D506349 93E57A68

FDDE0608 3EECD188 F6080A96 DEAA77F3 994C8DF7 3C4AA447 530239A3 A79C373A

2CF7E593 F7935E33 217C33A6 07E8194F 90B93821 03BA9643 4B3D70CE C9663213

BE570EEF C7488BEA E1E2E0D4 955F8FC5 E5537833 7CCE5F2E 34A3E17D F35CD1BE

897A902D 22FAB0AF 786DCC10 E6D52CFA 979CB189 754B0D81 9DBD720B 2C9AB1BF

023595FA 7B7F4B9D 65BC1C6C 3879AF97 51BB2F1B D1160B49 86E08FA6 C8DFC5D9

D8CE2D89 02030100 01A35330 51300F06 03551D13 0101FF04 05300301 01FF301F

0603551D 23041830 168014F8 3232D9F6 DB1985BD 67BBB315 563673A2 7A93A330

1D060355 1D0E0416 0414F832 32D9F6DB 1985BD67 BBB31556 3673A27A 93A3300D

06092A86 4886F70D 01010505 00038201 01007726 0E0A36B2 BA96CFE8 713083C9

921910C8 4C11281A 0ED704A2 4EF66B06 B8C02DA5 E378ED0C 1BD94A38 C210221B

FD62F829 C74D326E F1F0B7B7 109ED8C6 F0357A90 85E2A567 659916D3 0FD38591

B3A7C108 0E218F31 8A9200B7 17D85056 ABCAFB37 AA3CAB74 AD4EAC09 54D8004F

3F31C79F 401C82B3 8F4C780E B402204B 1D805A68 AB43E2D9 CB98DFB6 560BD8A2

1A32EBB5 3F4580D7 5B15D21D C2DB683B 4D7D8BD7 1D01DFBD A3E181AC 2C1DB533

0095DC9F C2067875 15360717 020C424E BE8F2819 8C7A3F20 87E7B97D D91D391C

CD819F82 109A1C59 4F040D39 F36A9138 40E3655E 8E0AF129 FB98F2EF 7CAB07A4

D0B7CD31 B3F1F76C 425D8F8C 82125693 AE5B

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 Loopback0

ip address 192.168.5.1 255.255.255.0

ipv6 address 100:5::1/64

ipv6 ospf 10 area 0

interface GigabitEthernet0/0/0

ip address 10.1.1.21 255.255.255.252

negotiation auto

ipv6 address FE80::1 link-local

ipv6 address 2001:DB8:ACAD:6::1/64

ipv6 ospf 10 area 0

interface GigabitEthernet0/0/1

ip address 10.1.1.18 255.255.255.252

negotiation auto

ipv6 address FE80::2 link-local

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

ipv6 ospf 10 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 10

router-id 5.5.5.5

network 10.1.1.16 0.0.0.3 area 0

network 10.1.1.20 0.0.0.3 area 0

network 192.168.5.0 0.0.0.255 area 0

ip forward-protocol nd

no ip http server

ip http authentication local

no ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router ospf 10

control-plane

line con 0

transport input none

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 10.1.1.4/30 [110/1] via 10.1.1.17, 00:42:05, GigabitEthernet0/0/1

O E2 10.1.1.8/30 [110/1] via 10.1.1.17, 00:42:05, GigabitEthernet0/0/1

C 10.1.1.16/30 is directly connected, GigabitEthernet0/0/1

L 10.1.1.18/32 is directly connected, GigabitEthernet0/0/1

C 10.1.1.20/30 is directly connected, GigabitEthernet0/0/0

L 10.1.1.21/32 is directly connected, GigabitEthernet0/0/0

O E2 192.168.1.0/24 [110/1] via 10.1.1.17, 00:42:05, GigabitEthernet0/0/1

O E2 192.168.2.0/24 [110/1] via 10.1.1.17, 00:42:05, GigabitEthernet0/0/1

O E2 192.168.3.0/24 [110/1] via 10.1.1.17, 00:42:05, GigabitEthernet0/0/1

192.168.4.0/32 is subnetted, 1 subnets

O 192.168.4.1 [110/2] via 10.1.1.17, 00:48:00, 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 10.1.1.22, 00:52:25, GigabitEthernet0/0/0

R5#show ipv6 route

IPv6 Routing Table - default - 14 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 100:1::/64 [110/10000]

via FE80::1, GigabitEthernet0/0/1

OE2 100:2::/64 [110/10000]

via FE80::1, GigabitEthernet0/0/1

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

via FE80::1, 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::2, GigabitEthernet0/0/0

OE2 2001:DB8:ACAD:2::/64 [110/10000]

via FE80::1, GigabitEthernet0/0/1

OE2 2001:DB8:ACAD:3::/64 [110/10000]

via FE80::1, GigabitEthernet0/0/1

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

via FE80::1, GigabitEthernet0/0/1

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

via GigabitEthernet0/0/1, directly connected

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

via GigabitEthernet0/0/1, receive

C 2001:DB8:ACAD:6::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 2001:DB8:ACAD:6::1/128 [0/0]

via GigabitEthernet0/0/0, receive

L FF00::/8 [0/0]

via Null0, receive

# R6:

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

login on-success log

subscriber templating

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 170D3232 31303036 31343437

30305A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649

4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D34 32383831

33353034 37308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201

0A028201 0100CD23 659B6AB4 BDD5BDAA F626A7E7 10263918 670E1E29 8717BF6E

6AC33796 18D8D16E 1A0CB228 7D7CA607 38F6C6B9 438B009E B3FA7F25 1169F70B

E190A686 01C54E51 1142FF60 5AB745F7 4A947375 24FEBE3D 134F96C4 CE3A5DD2

2820F06F E62E8248 1C2AE7C3 86011CA5 71CB2694 C7B7039F 3AB1700E C9EA5719

3D710E77 2005CC5A E37B0B62 F2A6766B 6DE7BA4C C0907BEB D660AA5C 5131105B

4C07C2A8 60F20002 9535B3D5 7177340B 19CB08CB 9AEAB553 D9899E14 8E3F8F2C

F545CF2A 9F5DFF18 A98ACC7F FE5A5099 497B5ABE 08740A6D 52532063 C3B23D51

43452AC0 905086F0 8F214E69 B530C1E6 7D5B2618 6564DCB7 BAC38AFE 6191E3C6

3FF46CF5 28290203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF

301F0603 551D2304 18301680 14B7E3A5 FE139E11 57E04B5E F608F69E 04A96A6D

F9301D06 03551D0E 04160414 B7E3A5FE 139E1157 E04B5EF6 08F69E04 A96A6DF9

300D0609 2A864886 F70D0101 05050003 82010100 C89D1B1E BCA90F64 13FBC0D7

72E073E3 24D571D0 76A35D00 FB05BCEC 17BEB0DA CCD15782 CAE83718 0DC662E9

0DC585E7 42790464 2946BF16 F0FBFECB 64F1C143 A9CE544A 1FF93685 17C20C85

FA1B7587 32EE0260 16477786 7AD48799 26CB65CA 61EB43E2 96E39E6B 730252DB

55B27E43 A560ACBC A23B634E B523B1C2 5C993EB3 208BA041 ABC93623 9EA5DAE4

C2D591C1 9771B560 CC49549D 8ED8DF5A C60FE877 44352E45 36281E50 F7D11B41

75CC6168 3B5C7A2B 97BAA972 B7AC3D0A 46D365CE 78DAA929 BFA1B991 1EAF0849

623C8EA5 7C2DA847 761D48DF 9AB3D7E4 124D8C8B E9CACEBA 1AA830B3 89712908

964C53C1 F2297B2B 59C6E451 0B3CCE0D EEBB4E6C

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 Loopback0

ip address 192.168.6.1 255.255.255.0

ipv6 address 100:6::1/64

ipv6 ospf 10 area 0

interface GigabitEthernet0/0/0

no ip address

negotiation auto

interface GigabitEthernet0/0/1

ip address 10.1.1.22 255.255.255.252

negotiation auto

ipv6 address FE80::2 link-local

ipv6 address 2001:DB8:ACAD:6::2/64

ipv6 ospf 10 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 10

router-id 6.6.6.6

network 10.1.1.20 0.0.0.3 area 0

network 192.168.6.0 0.0.0.255 area 0

ip forward-protocol nd

no ip http server

ip http authentication local

no ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router ospf 10

router-id 6.6.6.6

control-plane

line con 0

transport input none

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 10.1.1.4/30 [110/1] via 10.1.1.21, 00:43:21, GigabitEthernet0/0/1

O E2 10.1.1.8/30 [110/1] via 10.1.1.21, 00:43:21, GigabitEthernet0/0/1

O 10.1.1.16/30 [110/2] via 10.1.1.21, 00:49:57, GigabitEthernet0/0/1

C 10.1.1.20/30 is directly connected, GigabitEthernet0/0/1

L 10.1.1.22/32 is directly connected, GigabitEthernet0/0/1

O E2 192.168.1.0/24 [110/1] via 10.1.1.21, 00:43:21, GigabitEthernet0/0/1

O E2 192.168.2.0/24 [110/1] via 10.1.1.21, 00:43:21, GigabitEthernet0/0/1

O E2 192.168.3.0/24 [110/1] via 10.1.1.21, 00:43:21, GigabitEthernet0/0/1

192.168.4.0/32 is subnetted, 1 subnets

O 192.168.4.1 [110/3] via 10.1.1.21, 00:49:17, GigabitEthernet0/0/1

192.168.5.0/32 is subnetted, 1 subnets

O 192.168.5.1 [110/2] via 10.1.1.21, 00:53:42, 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 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

OE2 100:1::/64 [110/10000]

via FE80::1, GigabitEthernet0/0/1

OE2 100:2::/64 [110/10000]

via FE80::1, GigabitEthernet0/0/1

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

via FE80::1, GigabitEthernet0/0/1

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

via FE80::1, GigabitEthernet0/0/1

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

via Loopback0, directly connected

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

via Loopback0, receive

OE2 2001:DB8:ACAD:2::/64 [110/10000]

via FE80::1, GigabitEthernet0/0/1

OE2 2001:DB8:ACAD:3::/64 [110/10000]

via FE80::1, GigabitEthernet0/0/1

O 2001:DB8:ACAD:4::/64 [110/3]

via FE80::1, GigabitEthernet0/0/1

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

via FE80::1, GigabitEthernet0/0/1

C 2001:DB8:ACAD:6::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

L 2001:DB8:ACAD:6::2/128 [0/0]

via GigabitEthernet0/0/1, receive

L FF00::/8 [0/0]

via Null0, receive

# Problems:

We had trouble getting the three different networks to talk to each other. You could ping within the OSPF network and within the EIGRP but not ping across the three. We figured out that we did not do all the redistribute commands we needed to. Within BGP we learned about the address-family command which is where we needed to put our redistribute statements for IPv4 and IPv6. Once we did that BGP was able to successfully distribute all the routes and were now able to ping across the network.

Conclusion:

In conclusion we were able to successfully configure OSPF, EIGRP, and BGP for IPv4 and Ipv6. The three different protocols were able to communicate with each other and share routes. This allows for a ping from one side of a network all the way through to the other.