The purpose of this lab was to understand the routing protocol iBGP, and how it works with eBGP and other routing protocols. The previous lab was only to set up eBGP, which while looking complicated, is understandable. iBGP, however, seems to make no sense, especially when I first looked at the router topology. However, after configuring it, I think I get how it works, and why the topology must look like that. Because I am using so many routing protocols (OSPF, EIGRP, BGP, both internal and external), properly configuring the routers was complicated, but made a lot of sense when I successfully configured it.

First, some background on the lab. I already talked about OSPF and EIGRP, so I will only talk about BGP this time. **B**order **G**ateway **P**rotocol is an open standard routing protocol used in large networks and across the internet. While most routing protocols use layer 3, BGP uses layer 4. Protocols such as IS-IS, OSPF, and EIGRP use layer 3, but I couldn’t get a consistent answer for RIP. I got answers in layers 3, 4, and 7. Anyways, both eBGP and iBGP have their advantages over other routing protocols and each other, but they both have their disadvantages.

eBGP runs when two routers have a different autonomous system number. eBGP is used when linking several autonomous systems. BGP was made after the internet expanded enough that we need a new way to keep track of routes, that is also easily scalable. Therefore, BGP is used over OSPF—it is a more flexible and scalable protocol. People use eBGP instead of iBGP for these tasks because eBGP is a globally routable protocol, while iBGP isn’t. If you aren’t using a full mesh topology or transporting an iBGP message through a different routing protocol like OSPF, you can’t send iBGP routes to the internet. As I mentioned, BGP runs on layer 4 because BGP needs to be able to control the network layer (layer 3). BGP tries to pick the best route to get packets from to where they need to go, so it tells the network layer what route to use. Therefore, most routes on the internet use eBGP to communicate.

iBGP, however, behaves differently. iBGP runs when two routers connect with the same autonomous system number. While eBGP re-advertises routes to both internal and external BGP peers, iBGP only re-advertises routes to eBGP peers. Unlike basically any other routing protocol, iBGP isn't globally routable. If you try to show IP routes if you are outside the AS, then you won’t be able to see any of the iBGP routes. This is both an advantage and disadvantage. You may not want to have your routes seen but having multiple AS numbers in your network can be problematic. Therefore, iBGP should be set up with a full mesh topology. However, if you transport iBGP through a different routing protocol like OSPF, you can avoid using the full mesh topology.

In summary, I set up EIGRP on two different routers, and OSPF on the other three. I then used BGP to link the 7 routers together, with eBGP linking the two EIGRP routes, and iBGP linking the OSPF router in a way that I will explain in a second.

I already talked about setting up OSPF twice and setting up EIGRP. These are easy and configuring the two are basically the same. I will talk about BGP.

Setting up BGP is interesting because the protocol behaves differently to the other protocols. First you type:

router bgp <AS#>

I talked about what the AS is (autonomous system) already. When you are in the router configuration, you type:

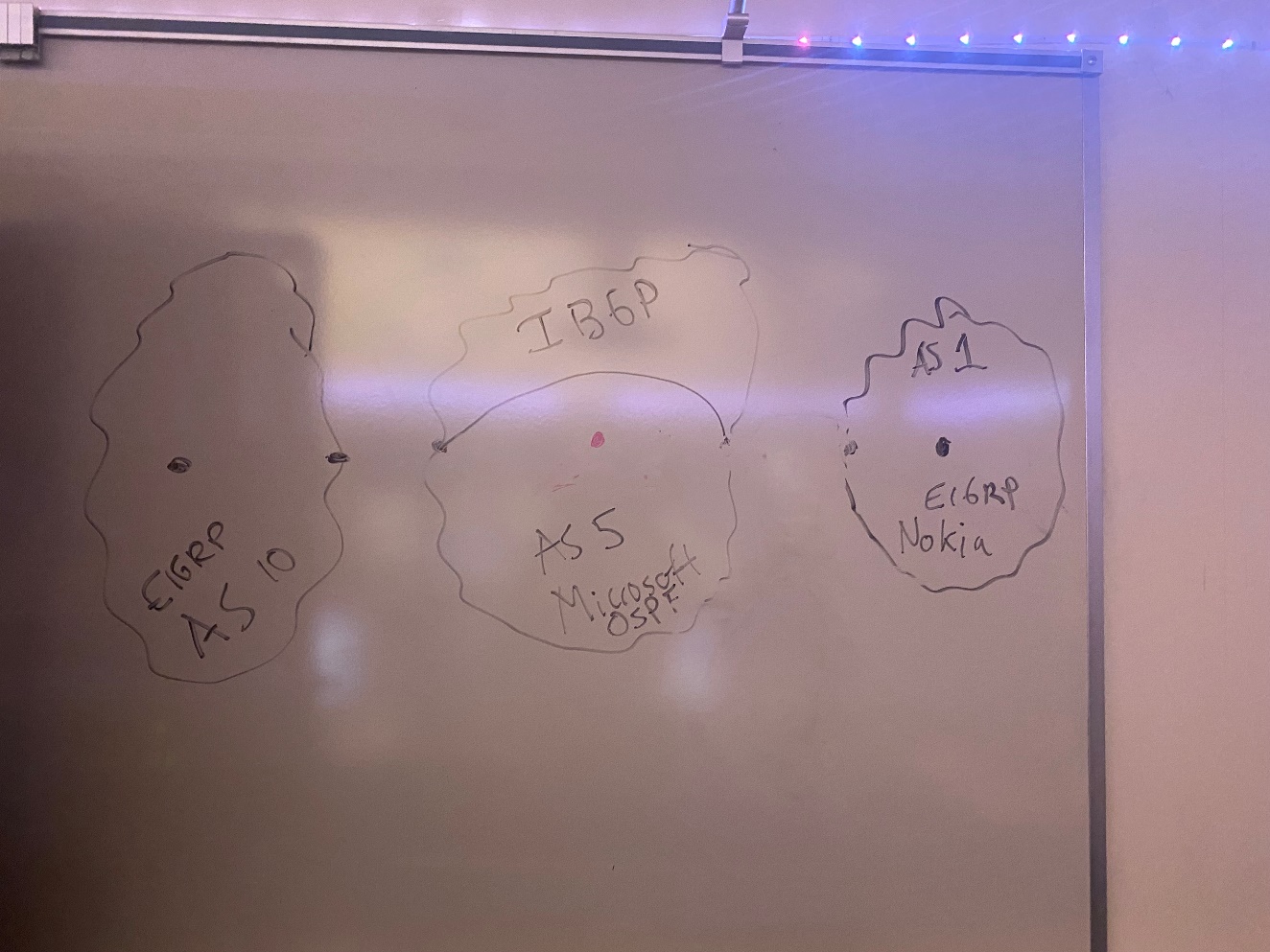
neighbor <IP> remote-as <AS>

From the last lab, I noticed I made a mistake, and I only realized it because of this lab. I claimed that you can only run BGP with two routers with different AS numbers. It turns out, you don’t need to use a different AS to get BGP running. You do need a different AS to get eBGP running, but with iBGP, you use the **same** AS. Just like in eBGP, you use the activate argument in the IPv6 address family, but not in IPv4. Redistributing is also the same, where you type:

redistribute <protocol> <ID>

Where the ID is local process ID in OSPF, and the local AS number in EIGRP or BGP. Again, use “redistribute connected” to let IPv6 redistribute directly connected routes because for whatever reason, they can’t do that normally. It's also generally a good habit to have your router redistribute its directly connected routes anyway, just for good measure.

Here is the topology that is conveniently laid out for me to use.



Now, this topology will need some explanation because it isn’t “complete”. First, the 3 autonomous systems are connected via eBGP, not mentioned here. Second, what is going on in the middle 3 routers with an arch connecting two routers together? You can only implement all iBGP in a full mesh topology. However, in the Microsoft OSPF, not every router is connected to every other router. Instead, the two edge routers are connected and the middle router is sort of acting like a bridge to connect the two routers together. This bridge uses OSPF instead of iBGP, that way the routers can still talk with each other, despite not being directly connected. Also, I know there are no other lines connecting the other routers, but you can infer how the routers should be connected (each one is connected to their neighbors).

Here are all the routers’ running configurations, IP and IPv6 routes, and pings.

Router 1:

R1#show run

Building configuration...

Current configuration : 1640 bytes

Last configuration change at 21:37:42 UTC Tue Nov 8 2022

version 15.5

service timestamps debug datetime msec

service timestamps log datetime msec

no platform punt-keepalive disable-kernel-core

hostname R1

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

no ip domain lookup

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

description Nokia

ip address 10.0.1.1 255.255.255.0

negotiation auto

ipv6 address FE80::1 link-local

ipv6 address 2001:1::1/64

ipv6 eigrp 1

interface GigabitEthernet0/0/1

description Nokia

ip address 10.0.0.1 255.255.255.0

negotiation auto

ipv6 address FE80::1 link-local

ipv6 address 2001::1/64

ipv6 eigrp 1

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 eigrp 1

network 10.0.0.0 0.0.1.255

passive-interface GigabitEthernet0/0/1

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router eigrp 1

passive-interface GigabitEthernet0/0/1

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, 10 subnets, 2 masks

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

L 10.0.0.1/32 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 EX 10.0.2.0/24 [170/3072] via 10.0.1.2, 01:38:43, GigabitEthernet0/0/0

D EX 10.0.3.0/24

[170/1707008] via 10.0.1.2, 01:37:30, GigabitEthernet0/0/0

D EX 10.0.4.0/24

[170/1707008] via 10.0.1.2, 01:36:49, GigabitEthernet0/0/0

D EX 10.0.5.0/24

[170/1707008] via 10.0.1.2, 01:36:49, GigabitEthernet0/0/0

D EX 10.0.6.0/24

[170/1707008] via 10.0.1.2, 01:36:49, GigabitEthernet0/0/0

D EX 10.0.7.0/24

[170/1707008] via 10.0.1.2, 01:14:16, GigabitEthernet0/0/0

R1#show ipv6 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

C 2001::/64 [0/0]

via GigabitEthernet0/0/1, directly connected

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

via GigabitEthernet0/0/1, receive

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

via GigabitEthernet0/0/0, directly connected

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

via GigabitEthernet0/0/0, receive

EX 2001:2::/64 [170/3072]

via FE80::2, GigabitEthernet0/0/0

EX 2001:3::/64 [170/1707008]

via FE80::2, GigabitEthernet0/0/0

EX 2001:4::/64 [170/1707008]

via FE80::2, GigabitEthernet0/0/0

EX 2001:5::/64 [170/1707008]

via FE80::2, GigabitEthernet0/0/0

EX 2001:6::/64 [170/1707008]

via FE80::2, GigabitEthernet0/0/0

EX 2001:7::/64 [170/1707008]

via FE80::2, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

R1#

Router 2:

R2#show run

Building configuration...

Current configuration : 2134 bytes

Last configuration change at 22:46:01 UTC Tue Nov 8 2022

version 15.5

service timestamps debug datetime msec

service timestamps log datetime msec

no platform punt-keepalive disable-kernel-core

hostname R2

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

no ip domain lookup

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

description Nokia

ip address 10.0.2.1 255.255.255.0

negotiation auto

ipv6 address FE80::1 link-local

ipv6 address 2001:2::1/64

interface GigabitEthernet0/0/1

description Nokia

ip address 10.0.1.2 255.255.255.0

negotiation auto

ipv6 address FE80::2 link-local

ipv6 address 2001:1::2/64

ipv6 eigrp 1

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 eigrp 1

network 10.0.1.0 0.0.0.255

redistribute bgp 1 metric 1500 1 255 255 10000

redistribute connected

router bgp 1

bgp log-neighbor-changes

neighbor 10.0.2.2 remote-as 5

neighbor 2001:2::2 remote-as 5

address-family ipv4

network 10.0.2.0 mask 255.255.255.0

redistribute connected

redistribute eigrp 1

neighbor 10.0.2.2 activate

no neighbor 2001:2::2 activate

exit-address-family

address-family ipv6

redistribute connected

redistribute eigrp 1

network 2001:2::/64

neighbor 2001:2::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 2.2.2.2

redistribute bgp 1 metric 1500 1 255 255 10000

redistribute connected

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, 10 subnets, 2 masks

D 10.0.0.0/24 [90/3072] via 10.0.1.1, 01:39:48, 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, 01:38:14

B 10.0.4.0/24 [20/2] via 10.0.2.2, 00:44:49

B 10.0.5.0/24 [20/0] via 10.0.2.2, 01:37:33

B 10.0.6.0/24 [20/0] via 10.0.2.2, 01:37:33

B 10.0.7.0/24 [20/0] via 10.0.2.2, 01:15:00

R2#show ipv6 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

D 2001::/64 [90/3072]

via FE80::1, GigabitEthernet0/0/1

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

via GigabitEthernet0/0/1, directly connected

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

via GigabitEthernet0/0/1, receive

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

via GigabitEthernet0/0/0, directly connected

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

via GigabitEthernet0/0/0, receive

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

via FE80::2, GigabitEthernet0/0/0

B 2001:4::/64 [20/2]

via FE80::2, GigabitEthernet0/0/0

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

via FE80::2, GigabitEthernet0/0/0

B 2001:6::/64 [20/0]

via FE80::2, GigabitEthernet0/0/0

B 2001:7::/64 [20/0]

via FE80::2, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

R2#

Router 3:

R3#show run

Building configuration...

Current configuration : 2266 bytes

Last configuration change at 22:39:45 UTC Tue Nov 8 2022

version 15.5

service timestamps debug datetime msec

service timestamps log datetime msec

no platform punt-keepalive disable-kernel-core

hostname R3

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

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 FDO214420G7

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

vlan 10,20

interface GigabitEthernet0/0/0

description Microsoft OSPF

ip address 10.0.3.1 255.255.255.0

ip ospf 5 area 0

negotiation auto

ipv6 address FE80::1 link-local

ipv6 address 2001:3::1/64

ipv6 ospf 5 area 0

interface GigabitEthernet0/0/1

description Microsoft OSPF

ip address 10.0.2.2 255.255.255.0

negotiation auto

ipv6 address FE80::2 link-local

ipv6 address 2001:2::2/64

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 5

redistribute bgp 5 subnets

redistribute connected

network 10.0.3.0 0.0.0.255 area 0

router bgp 5

bgp log-neighbor-changes

neighbor 10.0.2.1 remote-as 1

neighbor 10.0.4.2 remote-as 5

neighbor 2001:2::1 remote-as 1

neighbor 2001:4::2 remote-as 5

address-family ipv4

network 10.0.2.0 mask 255.255.255.0

redistribute connected

redistribute ospf 5

neighbor 10.0.2.1 activate

neighbor 10.0.4.2 activate

neighbor 2001:2::1 activate

neighbor 2001:4::2 activate

exit-address-family

address-family ipv6

redistribute connected

redistribute ospf 5

network 2001:2::/64

neighbor 2001:2::1 activate

neighbor 2001:4::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 ospf 5

router-id 3.3.3.3

redistribute bgp 5

redistribute connected

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, 10 subnets, 2 masks

B 10.0.0.0/24 [20/3072] via 10.0.2.1, 01:39:04

B 10.0.1.0/24 [20/0] via 10.0.2.1, 01:39:04

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, 01:39:05, GigabitEthernet0/0/0

O E2 10.0.5.0/24 [110/1] via 10.0.3.2, 01:39:05, GigabitEthernet0/0/0

O E2 10.0.6.0/24 [110/1] via 10.0.3.2, 01:38:24, GigabitEthernet0/0/0

O E2 10.0.7.0/24 [110/1] via 10.0.3.2, 01:15:50, GigabitEthernet0/0/0

R3#show ipv6 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

B 2001::/64 [20/3072]

via FE80::1, GigabitEthernet0/0/1

B 2001:1::/64 [20/0]

via FE80::1, GigabitEthernet0/0/1

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

via GigabitEthernet0/0/1, directly connected

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

via GigabitEthernet0/0/1, receive

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

via GigabitEthernet0/0/0, directly connected

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

via GigabitEthernet0/0/0, receive

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

via FE80::2, GigabitEthernet0/0/0

B 2001:5::/64 [200/0]

via 2001:4::2

OE2 2001:6::/64 [110/1]

via FE80::2, GigabitEthernet0/0/0

OE2 2001:7::/64 [110/1]

via FE80::2, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

R3#

Router 4:

R4#show run

Building configuration...

Current configuration : 1854 bytes

Last configuration change at 21:57:14 UTC Tue Nov 8 2022

version 15.5

service timestamps debug datetime msec

service timestamps log datetime msec

no platform punt-keepalive disable-kernel-core

hostname R4

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

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 FDO21442B21

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

vlan 10,20

interface GigabitEthernet0/0/0

description Microsoft OSPF

ip address 10.0.4.1 255.255.255.0

ip ospf 5 area 0

negotiation auto

ipv6 address FE80::1 link-local

ipv6 address 2001:4::1/64

ipv6 ospf 5 area 0

interface GigabitEthernet0/0/1

description Microsoft OSPF

ip address 10.0.3.2 255.255.255.0

ip ospf 5 area 0

negotiation auto

ipv6 address FE80::2 link-local

ipv6 address 2001:3::2/64

ipv6 ospf 5 area 0

interface Serial0/1/0

interface Serial0/1/1

interface GigabitEthernet0/2/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/2/1

no ip address

shutdown

negotiation auto

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

interface Vlan1

no ip address

shutdown

router ospf 5

network 10.0.3.0 0.0.0.255 area 0

network 10.0.4.0 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 5

router-id 4.4.4.4

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, 10 subnets, 2 masks

O E2 10.0.0.0/24 [110/1] via 10.0.3.1, 01:40:16, GigabitEthernet0/0/1

O E2 10.0.1.0/24 [110/1] via 10.0.3.1, 01:40:16, GigabitEthernet0/0/1

O E2 10.0.2.0/24 [110/1] via 10.0.3.1, 01:40:27, 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 10.0.5.0/24 [110/1] via 10.0.4.2, 01:40:17, GigabitEthernet0/0/0

O E2 10.0.6.0/24 [110/1] via 10.0.4.2, 01:39:35, GigabitEthernet0/0/0

O E2 10.0.7.0/24 [110/1] via 10.0.4.2, 01:17:02, GigabitEthernet0/0/0

R4#show ipv6 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 2001::/64 [110/1]

via FE80::1, GigabitEthernet0/0/1

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

via FE80::1, GigabitEthernet0/0/1

OE2 2001:2::/64 [110/20]

via FE80::1, GigabitEthernet0/0/1

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

via GigabitEthernet0/0/1, directly connected

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

via GigabitEthernet0/0/1, receive

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

via GigabitEthernet0/0/0, directly connected

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

via GigabitEthernet0/0/0, receive

OE2 2001:5::/64 [110/20]

via FE80::2, GigabitEthernet0/0/0

OE2 2001:6::/64 [110/1]

via FE80::2, GigabitEthernet0/0/0

OE2 2001:7::/64 [110/1]

via FE80::2, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

R4#

Router 5:

R5#show run

Building configuration...

Current configuration : 4647 bytes

Last configuration change at 23:23:34 UTC Tue Nov 8 2022

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname R5

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-mode

no ip domain lookup

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 170D3232 31313038 32313339

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 01009B6F 6C30682E 853AECEB 04A6916E 289E14A4 E6866063 0124A001

E8417B88 C3A4392F E11C2879 BE6D2C2D 6BC7B1F2 3EBA3051 93E01645 843CAEDF

DE5DAE94 618D7ACF A60B4386 85C4D3CA 6B0A2C4D F8F1C4EC C2AE4C80 9338BEF7

B7D8CC40 979C493C 2225C1FD D0BB57AA A24AFF43 B6F63AB3 D5D567F3 4CB6B559

82CAB2E2 25F28EE6 7C79E0A9 09FC44F2 8982C7AF FDA534BB BB4456B4 3F45D776

9F1A5E7D ECA2AE97 C7C8147D 07BDE306 12A6AD05 567FBAD7 2F380D20 294B85AE

B95B66E8 F6CF220D DC3509A5 D3DE7CC3 A3356878 97E098D2 7EB4CED2 E71D7419

F4594C68 8E16A715 AF7B494B 25A3BEFD 0ACBBA30 E3F6F8DC 2CBC5FCC 5FF7FA87

1399FF77 B50F0203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF

301F0603 551D2304 18301680 141E2C39 B14E001B 10C16E14 19D43A6C 2874662B

82301D06 03551D0E 04160414 1E2C39B1 4E001B10 C16E1419 D43A6C28 74662B82

300D0609 2A864886 F70D0101 05050003 82010100 60811175 7449719E 42063CBD

C03794B8 EA644D64 D51382FD DAC9D914 7EFCAC3E 3D795C65 7AFD1FC2 B4B90F2B

D8CD29DF 9D0FB2E2 8E935277 DBE880E8 79144B2C 87B7ED37 D0D4633C A0A855F2

D55982CB EB1E5464 D5F08CE1 040BF157 BD8F0A82 08331EBA 7F769D25 B51D7D12

9966B479 542F88A9 74945DAA 174BB5A6 50B1D256 7BF5EBCF AC70546A C714E0BE

34B12AFA 6BB54D6C 8FAF0633 73D09634 CEF5DDBF E4E70311 73D38B28 FF221B61

3BE2B9C5 E442B298 3B589900 E42E3E21 EE70D788 210D0632 5A347AAB F2C7C441

42F9EB06 1F230CF8 6312888D 71D30175 9A92F0DF 170665D5 AD0413A6 15748B21

59E15DBF 96640FC1 A18C924E D2FA0CD2 6EDF9340

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

description Microsoft OSPF

ip address 10.0.5.1 255.255.255.0

negotiation auto

ipv6 address FE80::1 link-local

ipv6 address 2001:5::1/64

interface GigabitEthernet0/0/1

description Microsoft OSPF

ip address 10.0.4.2 255.255.255.0

ip ospf 5 area 0

negotiation auto

ipv6 address FE80::2 link-local

ipv6 address 2001:4::2/64

ipv6 ospf 5 area 0

interface GigabitEthernet0/2/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/2/1

no ip address

shutdown

negotiation auto

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

router ospf 5

redistribute connected subnets

redistribute bgp 5 subnets

network 10.0.4.0 0.0.0.255 area 0

router bgp 5

bgp log-neighbor-changes

neighbor 10.0.3.1 remote-as 5

neighbor 10.0.5.2 remote-as 10

neighbor 2001:3::1 remote-as 5

neighbor 2001:5::2 remote-as 10

address-family ipv4

network 10.0.5.0 mask 255.255.255.0

redistribute connected

redistribute ospf 5

neighbor 10.0.3.1 activate

neighbor 10.0.5.2 activate

neighbor 2001:3::1 activate

neighbor 2001:5::2 activate

exit-address-family

address-family ipv6

redistribute connected

redistribute ospf 5

network 2001:5::/64

neighbor 2001:3::1 activate

neighbor 2001:5::2 activate

exit-address-family

ip forward-protocol nd

ip http server

ip http authentication local

ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router ospf 5

router-id 5.5.5.5

redistribute connected

redistribute bgp 5

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, 10 subnets, 2 masks

O E2 10.0.0.0/24 [110/1] via 10.0.4.1, 01:46:00, GigabitEthernet0/0/1

O E2 10.0.1.0/24 [110/1] via 10.0.4.1, 01:46:00, GigabitEthernet0/0/1

O E2 10.0.2.0/24 [110/20] via 10.0.4.1, 00:04:18, GigabitEthernet0/0/1

O 10.0.3.0/24 [110/2] via 10.0.4.1, 01:46:06, 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

C 10.0.5.0/24 is directly connected, GigabitEthernet0/0/0

L 10.0.5.1/32 is directly connected, GigabitEthernet0/0/0

B 10.0.6.0/24 [20/0] via 10.0.5.2, 01:45:19

B 10.0.7.0/24 [20/3072] via 10.0.5.2, 01:22:46

R5#show ipv6 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 2001::/64 [110/1]

via FE80::1, GigabitEthernet0/0/1

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

via FE80::1, GigabitEthernet0/0/1

OE2 2001:2::/64 [110/20]

via FE80::1, GigabitEthernet0/0/1

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

via FE80::1, GigabitEthernet0/0/1

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

via GigabitEthernet0/0/1, directly connected

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

via GigabitEthernet0/0/1, receive

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

via GigabitEthernet0/0/0, directly connected

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

via GigabitEthernet0/0/0, receive

B 2001:6::/64 [20/0]

via FE80::2, GigabitEthernet0/0/0

B 2001:7::/64 [20/3072]

via FE80::2, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

R5#

Router 6:

R6#show run

Building configuration...

Current configuration : 4416 bytes

Last configuration change at 22:25:40 UTC Tue Nov 8 2022

version 16.9

service timestamps debug datetime msec

service timestamps log datetime msec

platform qfp utilization monitor load 80

platform punt-keepalive disable-kernel-core

hostname R6

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

no ip domain lookup

login on-success log

subscriber templating

ipv6 unicast-routing

multilink bundle-name authenticated

crypto pki trustpoint TP-self-signed-4144679456

enrollment selfsigned

subject-name cn=IOS-Self-Signed-Certificate-4144679456

revocation-check none

rsakeypair TP-self-signed-4144679456

crypto pki certificate chain TP-self-signed-4144679456

certificate self-signed 01

30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030

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

69666963 6174652D 34313434 36373934 3536301E 170D3232 31313038 32313434

31375A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649

4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D34 31343436

37393435 36308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201

0A028201 0100A5BA B95CB8F0 C9E1FC1F F3F8A89F 28BF7601 6B39FD2C 190840B1

4F6BE97E 1F51A04C 663EDA13 0355E8CB 61056724 C82355B4 79A063A0 9B8222FA

5EFC427A 010D4F84 ABA2A2BE D46E37E0 D100C7FE 4B0F6FA2 3ECB51F9 6E0E8750

3989C77C 776AF869 C453FB59 C8798174 D2D53BB1 F187A2F2 7A3B525B 0157CE7C

AD4E383B 4B47BF53 392215CC 9C7740E4 7384373A BCEE8AC7 F20C51B7 2021D503

DCA7F9F4 CDA74854 72D295BB 9EEE9783 1A695454 6E865441 FA2F4D46 89B78220

0308CFDC 675AC999 AC40240A D2611749 B55091D0 CD931C55 90CA52BC F8C3FC06

2A942A6D 095BE954 36D5D7C5 4A304555 100BFD72 D143AB4F 9E27CE6A 0938E507

B3265338 2FE70203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF

301F0603 551D2304 18301680 14DF1A30 D9A44125 6A4D9644 BFC18220 3741F024

83301D06 03551D0E 04160414 DF1A30D9 A441256A 4D9644BF C1822037 41F02483

300D0609 2A864886 F70D0101 05050003 82010100 0BEE2F6B FCF7F4EF 6549C601

83DE7AE8 27393CC7 30FBE9DC 190F35E7 B3E66A05 E53FE709 D54BE56D 61121CB0

7B54225F 90EA9D8C 709ADA8B E9ABE52D EA34C43E 14DF2EDB BD82CD3E 5379A1A9

BE21FBFC F8D365A3 4F46145E 79C42F08 DBCEDEF5 8534B056 8D577CFF ED92BE80

6CF44381 73D2285B 7EC682EE C0165DB4 02DB69B7 211C94BC 4B0CCDAE 6DF89A51

CCD494A0 86CFEE62 18772F1E 10E628DA AA1F7868 47586C5E C1CD894B 938527A8

F6A23E0D 2B2EC92A DFE53A5D 9585E726 B67204C2 202E08DA 17DAC413 4AB1AA5A

2B15181D 2800CBD7 F4DB7083 ABEC747A A6A893E8 6C2F726C D4EF52F1 C4D843C3

B8C8393C 7ADCF791 0992C81F 604F80BC 1834A621

quit

license udi pid ISR4321/K9 sn FLM2408005M

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface GigabitEthernet0/0/0

ip address 10.0.6.1 255.255.255.0

negotiation auto

ipv6 address FE80::1 link-local

ipv6 address 2001:6::1/64

ipv6 eigrp 10

interface GigabitEthernet0/0/1

ip address 10.0.5.2 255.255.255.0

negotiation auto

ipv6 address FE80::2 link-local

ipv6 address 2001:5::2/64

interface GigabitEthernet0/2/0

negotiation auto

interface GigabitEthernet0/2/1

negotiation auto

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

router eigrp 10

network 10.0.6.0 0.0.0.255

redistribute bgp 10 metric 1500 1 255 255 10000

redistribute connected

router bgp 10

bgp log-neighbor-changes

neighbor 10.0.5.1 remote-as 5

neighbor 2001:5::1 remote-as 5

address-family ipv4

network 10.0.5.0 mask 255.255.255.0

redistribute connected

redistribute eigrp 10

neighbor 10.0.5.1 activate

neighbor 2001:5::1 activate

exit-address-family

address-family ipv6

redistribute connected

redistribute eigrp 10

network 2001:5::/64

neighbor 2001:5::1 activate

exit-address-family

ip forward-protocol nd

ip http server

ip http authentication local

ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router eigrp 10

eigrp router-id 6.6.6.6

redistribute bgp 10 metric 1500 1 255 255 10000

redistribute connected

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, 10 subnets, 2 masks

B 10.0.0.0/24 [20/0] via 10.0.5.1, 01:46:03

B 10.0.1.0/24 [20/0] via 10.0.5.1, 01:46:03

B 10.0.2.0/24 [20/0] via 10.0.5.1, 01:46:03

B 10.0.3.0/24 [20/2] via 10.0.5.1, 00:55:17

B 10.0.4.0/24 [20/0] via 10.0.5.1, 01:46:03

C 10.0.5.0/24 is directly connected, GigabitEthernet0/0/1

L 10.0.5.2/32 is directly connected, GigabitEthernet0/0/1

C 10.0.6.0/24 is directly connected, GigabitEthernet0/0/0

L 10.0.6.1/32 is directly connected, GigabitEthernet0/0/0

D 10.0.7.0/24 [90/3072] via 10.0.6.2, 01:22:53, GigabitEthernet0/0/0

R6#show ipv6 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

B 2001::/64 [20/0]

via FE80::1, GigabitEthernet0/0/1

B 2001:1::/64 [20/0]

via FE80::1, GigabitEthernet0/0/1

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

via FE80::1, GigabitEthernet0/0/1

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

via FE80::1, GigabitEthernet0/0/1

B 2001:4::/64 [20/0]

via FE80::1, GigabitEthernet0/0/1

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

via GigabitEthernet0/0/1, directly connected

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

via GigabitEthernet0/0/1, receive

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

via GigabitEthernet0/0/0, directly connected

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

via GigabitEthernet0/0/0, receive

D 2001:7::/64 [90/3072]

via FE80::2, GigabitEthernet0/0/0

L FF00::/8 [0/0]

via Null0, receive

R6#

Router 7:

R7#show run

Building configuration...

Current configuration : 1655 bytes

Last configuration change at 21:48:46 UTC Tue Nov 8 2022

version 15.5

service timestamps debug datetime msec

service timestamps log datetime msec

no platform punt-keepalive disable-kernel-core

hostname R7

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

no ip domain lookup

ipv6 unicast-routing

subscriber templating

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO214421BU

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface GigabitEthernet0/0/0

ip address 10.0.7.1 255.255.255.0

negotiation auto

ipv6 address FE80::1 link-local

ipv6 address 2001:7::1/64

ipv6 eigrp 10

interface GigabitEthernet0/0/1

ip address 10.0.6.2 255.255.255.0

negotiation auto

ipv6 address FE80::2 link-local

ipv6 address 2001:6::2/64

ipv6 eigrp 10

interface Serial0/1/0

interface Serial0/1/1

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 10

network 10.0.6.0 0.0.1.255

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 eigrp 10

passive-interface GigabitEthernet0/0/0

eigrp router-id 7.7.7.7

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

R7#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, 10 subnets, 2 masks

D EX 10.0.0.0/24

[170/1707008] via 10.0.6.1, 01:47:04, GigabitEthernet0/0/1

D EX 10.0.1.0/24

[170/1707008] via 10.0.6.1, 01:47:04, GigabitEthernet0/0/1

D EX 10.0.2.0/24

[170/1707008] via 10.0.6.1, 01:47:04, GigabitEthernet0/0/1

D EX 10.0.3.0/24

[170/1707008] via 10.0.6.1, 01:47:04, GigabitEthernet0/0/1

D EX 10.0.4.0/24

[170/1707008] via 10.0.6.1, 01:47:04, GigabitEthernet0/0/1

D EX 10.0.5.0/24 [170/3072] via 10.0.6.1, 01:47:59, GigabitEthernet0/0/1

C 10.0.6.0/24 is directly connected, GigabitEthernet0/0/1

L 10.0.6.2/32 is directly connected, GigabitEthernet0/0/1

C 10.0.7.0/24 is directly connected, GigabitEthernet0/0/0

L 10.0.7.1/32 is directly connected, GigabitEthernet0/0/0

R7#show ipv6 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

EX 2001::/64 [170/1707008]

via FE80::1, GigabitEthernet0/0/1

EX 2001:1::/64 [170/1707008]

via FE80::1, GigabitEthernet0/0/1

EX 2001:2::/64 [170/1707008]

via FE80::1, GigabitEthernet0/0/1

EX 2001:3::/64 [170/1707008]

via FE80::1, GigabitEthernet0/0/1

EX 2001:4::/64 [170/1707008]

via FE80::1, GigabitEthernet0/0/1

EX 2001:5::/64 [170/3072]

via FE80::1, GigabitEthernet0/0/1

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

via GigabitEthernet0/0/1, directly connected

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

via GigabitEthernet0/0/1, receive

C 2001:7::/64 [0/0]

via GigabitEthernet0/0/0, directly connected

L 2001:7::1/128 [0/0]

via GigabitEthernet0/0/0, receive

L FF00::/8 [0/0]

via Null0, receive

R7#

Pings and traceroutes:

C:\Users\user>ping 10.0.7.10

Pinging 10.0.7.10 with 32 bytes of data:

Reply from 10.0.7.10: bytes=32 time=1ms TTL=121

Reply from 10.0.7.10: bytes=32 time=1ms TTL=121

Reply from 10.0.7.10: bytes=32 time=1ms TTL=121

Reply from 10.0.7.10: bytes=32 time=1ms TTL=121

Ping statistics for 10.0.7.10:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\Users\user>tracert 10.0.7.10

Tracing route to 10.0.7.10 over a maximum of 30 hops

1 <1 ms <1 ms <1 ms 10.0.0.1

2 <1 ms <1 ms <1 ms 10.0.1.2

3 1 ms <1 ms <1 ms 10.0.2.2

4 <1 ms <1 ms <1 ms 10.0.3.2

5 1 ms <1 ms <1 ms 10.0.4.2

6 1 ms 1 ms 1 ms 10.0.5.2

7 <1 ms <1 ms <1 ms 10.0.6.2

8 1 ms 1 ms 1 ms 10.0.7.10

Trace complete.

C:\Users\user>ping 2001:7::727

Pinging 2001:7::727 with 32 bytes of data:

Reply from 2001:7::727: time=4ms

Reply from 2001:7::727: time=1ms

Reply from 2001:7::727: time=1ms

Reply from 2001:7::727: time=1ms

Ping statistics for 2001:7::727:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

Minimum = 1ms, Maximum = 4ms, Average = 1ms

C:\Users\user>tracert 2001:7::727

Tracing route to 2001:7::727 over a maximum of 30 hops

1 <1 ms <1 ms <1 ms 2001::1

2 <1 ms <1 ms <1 ms 2001:1::2

3 <1 ms <1 ms <1 ms 2001:2::2

4 1 ms 1 ms 2 ms 2001:3::2

5 1 ms <1 ms <1 ms 2001:4::2

6 1 ms 1 ms 1 ms 2001:5::2

7 1 ms 1 ms 1 ms 2001:6::2

8 1 ms 1 ms 1 ms 2001:7::727

Trace complete.

C:\Users\user>

While doing this lab, I ran into several problems. The first two were from the previous lab write-up. The first one is when I incorrectly claimed that BGP only works when the AS numbers are different. In reality, you can use the same AS numbers; it just uses iBGP instead of eBGP. The second mistake I made was when I claimed that BGP was a cisco-proprietary protocol. This never made it to the final draft, but when I first researched BGP, I somehow concluded that BGP was cisco-proprietary protocol, which would’ve been a catastrophic error, especially considering that the last lab was all about BGP. Thankfully, I caught my mistake, and fixed it. Now for the problems that I had during this lab. For starters, I assumed the middle 3 routers should all use iBGP, because I assumed that all devices had to use iBGP. However, iBGP with more than two routers requires a full mesh topology, so I had no idea how to link non-adjacent routers with iBGP. This made me stuck basically twiddling my thumbs for a few days until I was shown [this video](https://youtu.be/GrL1sG_RNCg), which showed me what the iBGP arch from the topology earlier meant. Once I figured that out, I misused the metric argument when redistributing EIGRP and BGP again until I remembered that the metric argument is supposed to go to “redistribute bgp” from EIGRP and not “redistribute eigrp” from BGP. Finally, in IPv6, I didn’t know that you had to use “neighbor <IPv6> remote-as" and “neighbor <IPv6> activate” in the IPv6 address family, so I was stuck there as well for another couple days. Finally, I forgot to redistribute directly connected routes in IPv6 again, so I had to fix that up. Once I did all of this, all IP and IPv6 routes were visible, and I could ping across all devices perfectly.

In conclusion, I set up 7 routers with various protocols, including OSPF, EIGRP, and BGP (both internal and external) and linked everything together. Even though I successfully set up all these routers so the PCs could talk to each other, I had to work out several problems, including learning how to get iBGP working when the routers aren’t directly connected, the metric argument, and forgetting how to use BGP’s IPv6 address family. Overall, I learned about how iBGP works and why you may want to use it over directly linking OSPF and EIGRP together. However, completing this lab still feels nothing short of miraculous and a stroke of luck, but I am happy to have figured it out regardless.