

Border Gateway Protocol

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# Purpose

The purpose of this lab was to figure out how to setup and configure BGP to enable IP routing between 2 different autonomous systems

# Background Information

Border Gateway Protocol, or BGP is the protocol underlying the global routing system of the internet. BGP creates network stability by guaranteeing routers can adapt to route failures. Each router maintains a routing table controlling how packets are directed. BGP only sends updated routing information when something changes, and only sends the changed information.

# Lab Summary

For this lab we had to setup 6 cisco ISR 4321’s into 2 different autonomous systems, one for OSPF and one for EIGRP then use BGP to redistribute route to the other AS.

# Lab Commands

This lab required the use of a lot of new commands. These commands were:

Router (config)# ipv6 unicast-routing

* This command enables ipv6 routing and needs to be run on all our routers.

Border-router (config)# router bgp 1

* This command starts bgp on our border router with an autonomous system id of 1.

Border-router (config-router)# neighbor 10.0.2.2 activate

* Routers running BGP do not automatically become neighbors, so we need to pass this command to make them become neighbors

Border-router (config-router)# address-family ipv4

* This command will put us into IPv4 config

Border-router (config-router-af)# redistribute eigrp 1

* This command will redistribute all IPv4 EIGRP routes that our router knows about

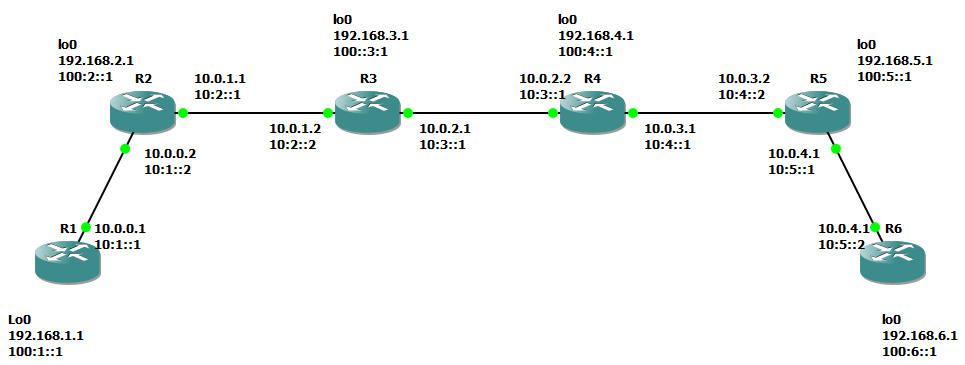
Border-router (config)# router eigrp 1

* This command will get us into EIGRP config

Border-router (config-router)# redistribute bgp 1 metric 10000 100 255 240

* This command will redistribute all BGP routes into our EIGRP autonomous system

# Network Diagram



# Configurations

#### R1

R1#show run

Building configuration...

Current configuration : 1743 bytes

!

! Last configuration change at 17:11:38 UTC Fri Dec 3 2021

!

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 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

R2

R2#show run

Building configuration...

Current configuration : 1820 bytes

!

! Last configuration change at 17:17:38 UTC Fri Dec 3 2021

!

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 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

R3

R3#show run

Building configuration...

Current configuration : 2173 bytes

!

! Last configuration change at 17:28:24 UTC Fri Dec 3 2021

!

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

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

R4

R4#show run

Building configuration...

Current configuration : 2172 bytes

!

! Last configuration change at 17:12:53 UTC Fri Dec 3 2021

!

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

!

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

R5

R5#show run

Building configuration...

Current configuration : 1739 bytes

!

! Last configuration change at 17:12:29 UTC Fri Dec 3 2021

!

version 15.5

service timestamps debug datetime msec

service timestamps log datetime msec

no 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-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

R6

R6#show run

Building configuration...

Current configuration : 1592 bytes

!

! Last configuration change at 17:09:34 UTC Fri Dec 3 2021

!

version 15.5

service timestamps debug datetime msec

service timestamps log datetime msec

no 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

!

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

In this lab the only real problem that we had were a few overlapping IPv6 addresses. This was fixed by adding a 0 to the first 4 digits of the loopback interfaces address.

# Conclusion

In conclusion, we

