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|  | | | | Weizhen Chen |  | | | |
|  | | | | —CCNP—Jeffery Mason &Michael Hansen |  | | | |
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Purpose

The objective of the lab was to use 5 routers to configure an OSPF system for all the routers. During this prosses of creating the OSPF it allowed us to review this IP routing and allowed us to better understand and familiarize ourselves with how to configure networks physically.

Background information

OSPF is an open-standard, classless routing protocol. It uses SPF (Dijkstra’s Shortest Path First) algorithm to determine the best path to each network. OSPF first needs to have a database for the structure of the network; this is called link-state routing protocol. With the learned information the Link state routing protocols would make an informed routing decision. OSPF routers exchange Hellos with each neighbor to learn the Router ID (RID) and cost of their neighbors. the information of the Neighbors is kept in adjacency database. The router then constructs the appropriate Link State Advertisements (LSA), which includes the Router IDs and cost of each neighbor that is shared among the routing domains. Each router would run the SPF (Dijkstra’s Shortest Path First) algorithm to determine the best end-to-end path to each network. It then submits these paths for inclusion in the routing able or forwarding database.

Lab summary

Before we started to configure the lab equipment, we first opened a notepad to create a topology with the OSPF configuration for the routers. Also, during the process, we created the correct IP address and subnet masks for the router interfaces and networks. Next, we connected the 5 routers with a copper cross-over cable through the gigabit ethernet and connected the routers to the computer with the console cable. In the configuration we would first enter user exec mode through the enable command and then enter global configuration mode through the config terminal command. In the global configuration mode, we would give the correct Ipv4 address according to the topology for the gigabit ethernet interfaces. After that We then applied a different Ip address for the loopback on each of the 5 routers. Finally, we would then enter OSPFv2 router config mode with the router ospf command with the process-id of 1. When in OSPFv2 mode we would use the network command with the Ip address of all the interfaces and loopback along with the wildcard mask and area id to notify the other IP addresses of the interfaces directly connected to the router in OSPF. To show that OSPFv2 was working we used the show run command to show the configuration we did, used the show ip ospf neighbor command to show the connected routers that use OSPF, show ip ospf to show the OSPF routing processes, show ip ospf interface to display interface information, show ip ospf border-routers to display internal OSPF routing entries and finally pinging between routers to show that OSPF is working.

Lab commands

**router ospf [*process-id*]**: Allows router to enter OSPFv2 router config. mode, used for IPv4.

**network [ip address] [*wildcard mask*] area [area-id]**: Advertises the IP addresses of the interfaces directly connected to the router in OSPF.

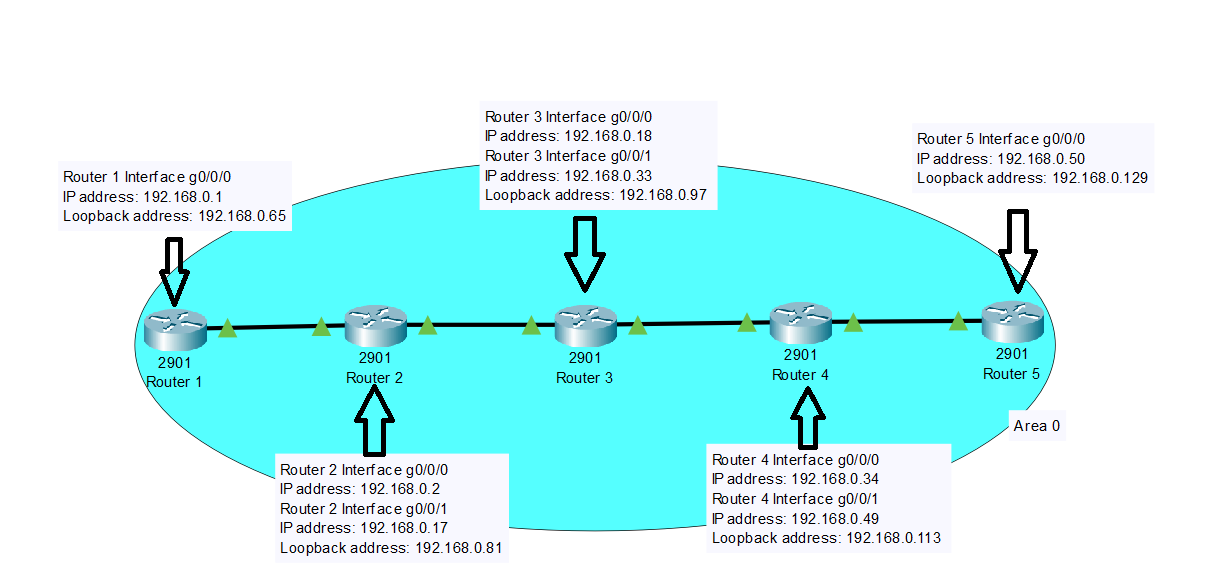
**show ip ospf neighbor**: Allows one to see the router’s neighbor(s) that use OSPF, used for IPv4.

**show ip ospf [*process-id*]**: To display genral information about OSPF routing processes, use the show ip ospf command in user EXEC or privileged EXEC mode

**show ip [*ospf]* interface**: To display interface information related to OSPF, use the show ip ospf interface command in user EXEC or privileged EXEC mode

**show ip ospf border-routers**: To display the internal OSPF routing table entries to an ABR and ASBR, use the show ip ospf border-routers command in privileged EXEC mode.

Network diagram



Configurations

**Router 1:**

**-R1#show run**

Building configuration...

Current configuration : 1850 bytes

Last configuration change at 17:51:00 UTC Thu Sep 9 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

subscriber templating

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO21482DXE

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface Loopback0

ip address 192.168.0.65 255.255.255.240

interface GigabitEthernet0/0/0

ip address 192.168.0.1 255.255.255.240

negotiation auto

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 ospf 1

network 192.168.0.0 0.0.0.15 area 0

network 192.168.0.16 0.0.0.15 area 0

network 192.168.0.32 0.0.0.15 area 0

network 192.168.0.48 0.0.0.15 area 0

network 192.168.0.64 0.0.0.15 area 0

network 192.168.0.80 0.0.0.15 area 0

network 192.168.0.96 0.0.0.15 area 0

network 192.168.0.112 0.0.0.15 area 0

network 192.168.0.128 0.0.0.15 area 0

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

**-R1#show ip ospf neighbor**

Neighbor ID Pri State Dead Time Address Interface

192.168.0.81 1 FULL/DR 00:00:35 192.168.0.2 GigabitEthernet0/0/0

**-R1#show ip ospf**

Routing Process "ospf 1" with ID 192.168.0.65

Start time: 00:10:16.387, Time elapsed: 00:26:13.307

Supports only single TOS(TOS0) routes

Supports opaque LSA

Supports Link-local Signaling (LLS)

Supports area transit capability

Supports NSSA (compatible with RFC 3101)

Supports Database Exchange Summary List Optimization (RFC 5243)

Event-log enabled, Maximum number of events: 1000, Mode: cyclic

Router is not originating router-LSAs with maximum metric

Initial SPF schedule delay 5000 msecs

Minimum hold time between two consecutive SPFs 10000 msecs

Maximum wait time between two consecutive SPFs 10000 msecs

Incremental-SPF disabled

Minimum LSA interval 5 secs

Minimum LSA arrival 1000 msecs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300

Number of external LSA 0. Checksum Sum 0x000000

Number of opaque AS LSA 0. Checksum Sum 0x000000

Number of DCbitless external and opaque AS LSA 0

Number of DoNotAge external and opaque AS LSA 0

Number of areas in this router is 1. 1 normal 0 stub 0 nssa

Number of areas transit capable is 0

External flood list length 0

IETF NSF helper support enabled

Cisco NSF helper support enabled

Reference bandwidth unit is 100 mbps

Area BACKBONE(0)

Number of interfaces in this area is 2 (1 loopback)

Area has no authentication

SPF algorithm last executed 00:05:36.244 ago

SPF algorithm executed 1 times

Area ranges are

Number of LSA 9. Checksum Sum 0x03B402

Number of opaque link LSA 0. Checksum Sum 0x000000

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

**-R1#show ip ospf interface**

Loopback0 is up, line protocol is up

Internet Address 192.168.0.65/28, Area 0, Attached via Network Statement

Process ID 1, Router ID 192.168.0.65, Network Type LOOPBACK, Cost: 1

Topology-MTID Cost Disabled Shutdown Topology Name

0 1 no no Base

Loopback interface is treated as a stub Host

GigabitEthernet0/0/0 is up, line protocol is up

Internet Address 192.168.0.1/28, Area 0, Attached via Network Statement

Process ID 1, Router ID 192.168.0.65, Network Type BROADCAST, Cost: 1

Topology-MTID Cost Disabled Shutdown Topology Name

0 1 no no Base

Transmit Delay is 1 sec, State BDR, Priority 1

Designated Router (ID) 192.168.0.81, Interface address 192.168.0.2

Backup Designated router (ID) 192.168.0.65, Interface address 192.168.0.1

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

oob-resync timeout 40

Hello due in 00:00:02

Supports Link-local Signaling (LLS)

Cisco NSF helper support enabled

IETF NSF helper support enabled

Index 1/1/1, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 1, maximum is 1

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 192.168.0.81 (Designated Router)

Suppress hello for 0 neighbor(s)

**-R1#show ip ospf border-routers**

OSPF Router with ID (192.168.0.65) (Process ID 1)

Base Topology (MTID 0)

Internal Router Routing Table

Codes: i - Intra-area route, I - Inter-area route

**-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

192.168.0.0/24 is variably subnetted, 11 subnets, 2 masks

C 192.168.0.0/28 is directly connected, GigabitEthernet0/0/0

L 192.168.0.1/32 is directly connected, GigabitEthernet0/0/0

O 192.168.0.16/28

[110/2] via 192.168.0.2, 00:09:14, GigabitEthernet0/0/0

O 192.168.0.32/28

[110/3] via 192.168.0.2, 00:09:14, GigabitEthernet0/0/0

O 192.168.0.48/28

[110/4] via 192.168.0.2, 00:09:14, GigabitEthernet0/0/0

C 192.168.0.64/28 is directly connected, Loopback0

L 192.168.0.65/32 is directly connected, Loopback0

O 192.168.0.81/32

[110/2] via 192.168.0.2, 00:09:14, GigabitEthernet0/0/0

O 192.168.0.97/32

[110/3] via 192.168.0.2, 00:09:14, GigabitEthernet0/0/0

O 192.168.0.113/32

[110/4] via 192.168.0.2, 00:09:14, GigabitEthernet0/0/0

O 192.168.0.129/32

[110/5] via 192.168.0.2, 00:09:14, GigabitEthernet0/0/0

**-R1#ping 192.168.0.65**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.65, timeout is 2 seconds:

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

**-R1#ping 192.168.0.81**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.81, timeout is 2 seconds:

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

**-R1#ping 192.168.0.97**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.97, timeout is 2 seconds:

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms

**-R1#ping 192.168.0.113**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.113, timeout is 2 seconds:

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

**-R1#ping 192.168.0.129**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.129, timeout is 2 seconds:

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

**Router 2:**

**-R2#show run**

Building configuration...

Current configuration : 1866 bytes

Last configuration change at 17:38:14 UTC Thu Sep 9 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

subscriber templating

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO21500G1N

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface Loopback0

ip address 192.168.0.81 255.255.255.240

interface GigabitEthernet0/0/0

ip address 192.168.0.2 255.255.255.240

negotiation auto

interface GigabitEthernet0/0/1

ip address 192.168.0.17 255.255.255.240

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 ospf 1

network 192.168.0.0 0.0.0.15 area 0

network 192.168.0.16 0.0.0.15 area 0

network 192.168.0.32 0.0.0.15 area 0

network 192.168.0.48 0.0.0.15 area 0

network 192.168.0.64 0.0.0.15 area 0

network 192.168.0.80 0.0.0.15 area 0

network 192.168.0.96 0.0.0.15 area 0

network 192.168.0.112 0.0.0.15 area 0

network 192.168.0.128 0.0.0.15 area 0

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

**-R2#show ip ospf neighbor**

Neighbor ID Pri State Dead Time Address Interface

192.168.0.97 1 FULL/DR 00:00:37 192.168.0.18 GigabitEthernet0/0/1

192.168.0.65 1 FULL/BDR 00:00:38 192.168.0.1 GigabitEthernet0/0/0

**-R2#show ip ospf**

Routing Process "ospf 1" with ID 192.168.0.81

Start time: 00:18:55.769, Time elapsed: 00:31:43.284

Supports only single TOS(TOS0) routes

Supports opaque LSA

Supports Link-local Signaling (LLS)

Supports area transit capability

Supports NSSA (compatible with RFC 3101)

Supports Database Exchange Summary List Optimization (RFC 5243)

Event-log enabled, Maximum number of events: 1000, Mode: cyclic

Router is not originating router-LSAs with maximum metric

Initial SPF schedule delay 5000 msecs

Minimum hold time between two consecutive SPFs 10000 msecs

Maximum wait time between two consecutive SPFs 10000 msecs

Incremental-SPF disabled

Minimum LSA interval 5 secs

Minimum LSA arrival 1000 msecs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300

Number of external LSA 0. Checksum Sum 0x000000

Number of opaque AS LSA 0. Checksum Sum 0x000000

Number of DCbitless external and opaque AS LSA 0

Number of DoNotAge external and opaque AS LSA 0

Number of areas in this router is 1. 1 normal 0 stub 0 nssa

Number of areas transit capable is 0

External flood list length 0

IETF NSF helper support enabled

Cisco NSF helper support enabled

Reference bandwidth unit is 100 mbps

Area BACKBONE(0)

Number of interfaces in this area is 3 (1 loopback)

Area has no authentication

SPF algorithm last executed 00:21:15.328 ago

SPF algorithm executed 16 times

Area ranges are

Number of LSA 9. Checksum Sum 0x03B402

Number of opaque link LSA 0. Checksum Sum 0x000000

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

**-R2#show ip ospf interface**

Loopback0 is up, line protocol is up

Internet Address 192.168.0.81/28, Area 0, Attached via Network Statement

Process ID 1, Router ID 192.168.0.81, Network Type LOOPBACK, Cost: 1

Topology-MTID Cost Disabled Shutdown Topology Name

0 1 no no Base

Loopback interface is treated as a stub Host

GigabitEthernet0/0/1 is up, line protocol is up

Internet Address 192.168.0.17/28, Area 0, Attached via Network Statement

Process ID 1, Router ID 192.168.0.81, Network Type BROADCAST, Cost: 1

Topology-MTID Cost Disabled Shutdown Topology Name

0 1 no no Base

Transmit Delay is 1 sec, State BDR, Priority 1

Designated Router (ID) 192.168.0.97, Interface address 192.168.0.18

Backup Designated router (ID) 192.168.0.81, Interface address 192.168.0.17

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

oob-resync timeout 40

Hello due in 00:00:06

Supports Link-local Signaling (LLS)

Cisco NSF helper support enabled

IETF NSF helper support enabled

Index 1/2/2, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 1, maximum is 1

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 192.168.0.97 (Designated Router)

Suppress hello for 0 neighbor(s)

GigabitEthernet0/0/0 is up, line protocol is up

Internet Address 192.168.0.2/28, Area 0, Attached via Network Statement

Process ID 1, Router ID 192.168.0.81, Network Type BROADCAST, Cost: 1

Topology-MTID Cost Disabled Shutdown Topology Name

0 1 no no Base

Transmit Delay is 1 sec, State DR, Priority 1

Designated Router (ID) 192.168.0.81, Interface address 192.168.0.2

Backup Designated router (ID) 192.168.0.65, Interface address 192.168.0.1

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

oob-resync timeout 40

Hello due in 00:00:00

Supports Link-local Signaling (LLS)

Cisco NSF helper support enabled

IETF NSF helper support enabled

Index 1/1/1, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 0, maximum is 2

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 192.168.0.65 (Backup Designated Router)

Suppress hello for 0 neighbor(s)

**-R2#show ip ospf border-routers**

OSPF Router with ID (192.168.0.81) (Process ID 1)

Base Topology (MTID 0)

Internal Router Routing Table

Codes: i - Intra-area route, I - Inter-area route

**-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

192.168.0.0/24 is variably subnetted, 12 subnets, 2 masks

C 192.168.0.0/28 is directly connected, GigabitEthernet0/0/0

L 192.168.0.2/32 is directly connected, GigabitEthernet0/0/0

C 192.168.0.16/28 is directly connected, GigabitEthernet0/0/1

L 192.168.0.17/32 is directly connected, GigabitEthernet0/0/1

O 192.168.0.32/28

[110/2] via 192.168.0.18, 00:30:07, GigabitEthernet0/0/1

O 192.168.0.48/28

[110/3] via 192.168.0.18, 00:29:25, GigabitEthernet0/0/1

O 192.168.0.65/32

[110/2] via 192.168.0.1, 00:23:30, GigabitEthernet0/0/0

C 192.168.0.80/28 is directly connected, Loopback0

L 192.168.0.81/32 is directly connected, Loopback0

O 192.168.0.97/32

[110/2] via 192.168.0.18, 00:24:24, GigabitEthernet0/0/1

O 192.168.0.113/32

[110/3] via 192.168.0.18, 00:24:11, GigabitEthernet0/0/1

O 192.168.0.129/32

[110/4] via 192.168.0.18, 00:23:58, GigabitEthernet0/0/1

**-R2#ping 192.168.0.65**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.65, timeout is 2 seconds:

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

**-R2#ping 192.168.0.81**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.81, timeout is 2 seconds:

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

**-R2#ping 192.168.0.97**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.97, timeout is 2 seconds:

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

**-R2#ping 192.168.0.113**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.113, timeout is 2 seconds:

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

**-R2#ping 192.168.0.129**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.129, timeout is 2 seconds:

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

**Router 3:**

**-R3#show run**

Building configuration...

Current configuration : 1715 bytes

Last configuration change at 17:46:53 UTC Thu Sep 9 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

subscriber templating

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO21441WDF

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface Loopback0

ip address 192.168.0.97 255.255.255.240

interface GigabitEthernet0/0/0

ip address 192.168.0.18 255.255.255.240

negotiation auto

interface GigabitEthernet0/0/1

ip address 192.168.0.33 255.255.255.240

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 ospf 1

network 192.168.0.0 0.0.0.15 area 0

network 192.168.0.16 0.0.0.15 area 0

network 192.168.0.32 0.0.0.15 area 0

network 192.168.0.48 0.0.0.15 area 0

network 192.168.0.64 0.0.0.15 area 0

network 192.168.0.80 0.0.0.15 area 0

network 192.168.0.96 0.0.0.15 area 0

network 192.168.0.112 0.0.0.15 area 0

network 192.168.0.128 0.0.0.15 area 0

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

**-R3#show ip ospf neighbor**

Neighbor ID Pri State Dead Time Address Interface

192.168.0.113 1 FULL/DR 00:00:30 192.168.0.34 GigabitEthernet0/0/1

192.168.0.81 1 FULL/BDR 00:00:39 192.168.0.17 GigabitEthernet0/0/0

**-R3#show ip ospf**

Routing Process "ospf 1" with ID 192.168.0.97

Start time: 00:18:58.990, Time elapsed: 00:37:38.181

Supports only single TOS(TOS0) routes

Supports opaque LSA

Supports Link-local Signaling (LLS)

Supports area transit capability

Supports NSSA (compatible with RFC 3101)

Supports Database Exchange Summary List Optimization (RFC 5243)

Event-log enabled, Maximum number of events: 1000, Mode: cyclic

Router is not originating router-LSAs with maximum metric

Initial SPF schedule delay 5000 msecs

Minimum hold time between two consecutive SPFs 10000 msecs

Maximum wait time between two consecutive SPFs 10000 msecs

Incremental-SPF disabled

Minimum LSA interval 5 secs

Minimum LSA arrival 1000 msecs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300

Number of external LSA 0. Checksum Sum 0x000000

Number of opaque AS LSA 0. Checksum Sum 0x000000

Number of DCbitless external and opaque AS LSA 0

Number of DoNotAge external and opaque AS LSA 0

Number of areas in this router is 1. 1 normal 0 stub 0 nssa

Number of areas transit capable is 0

External flood list length 0

IETF NSF helper support enabled

Cisco NSF helper support enabled

Reference bandwidth unit is 100 mbps

Area BACKBONE(0)

Number of interfaces in this area is 3 (1 loopback)

Area has no authentication

SPF algorithm last executed 00:28:40.980 ago

SPF algorithm executed 14 times

Area ranges are

Number of LSA 9. Checksum Sum 0x03AC06

Number of opaque link LSA 0. Checksum Sum 0x000000

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

**-R3#show ip ospf interface**

Loopback0 is up, line protocol is up

Internet Address 192.168.0.97/28, Area 0, Attached via Network Statement

Process ID 1, Router ID 192.168.0.97, Network Type LOOPBACK, Cost: 1

Topology-MTID Cost Disabled Shutdown Topology Name

0 1 no no Base

Loopback interface is treated as a stub Host

GigabitEthernet0/0/1 is up, line protocol is up

Internet Address 192.168.0.33/28, Area 0, Attached via Network Statement

Process ID 1, Router ID 192.168.0.97, Network Type BROADCAST, Cost: 1

Topology-MTID Cost Disabled Shutdown Topology Name

0 1 no no Base

Transmit Delay is 1 sec, State BDR, Priority 1

Designated Router (ID) 192.168.0.113, Interface address 192.168.0.34

Backup Designated router (ID) 192.168.0.97, Interface address 192.168.0.33

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

oob-resync timeout 40

Hello due in 00:00:03

Supports Link-local Signaling (LLS)

Cisco NSF helper support enabled

IETF NSF helper support enabled

Index 1/2/2, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 1, maximum is 1

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 192.168.0.113 (Designated Router)

Suppress hello for 0 neighbor(s)

GigabitEthernet0/0/0 is up, line protocol is up

Internet Address 192.168.0.18/28, Area 0, Attached via Network Statement

Process ID 1, Router ID 192.168.0.97, Network Type BROADCAST, Cost: 1

Topology-MTID Cost Disabled Shutdown Topology Name

0 1 no no Base

Transmit Delay is 1 sec, State DR, Priority 1

Designated Router (ID) 192.168.0.97, Interface address 192.168.0.18

Backup Designated router (ID) 192.168.0.81, Interface address 192.168.0.17

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

oob-resync timeout 40

Hello due in 00:00:01

Supports Link-local Signaling (LLS)

Cisco NSF helper support enabled

IETF NSF helper support enabled

Index 1/1/1, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 1, maximum is 3

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 192.168.0.81 (Backup Designated Router)

Suppress hello for 0 neighbor(s)

**-R3#show ip ospf border-routers**

OSPF Router with ID (192.168.0.97) (Process ID 1)

Base Topology (MTID 0)

Internal Router Routing Table

Codes: i - Intra-area route, I - Inter-area route

**-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

192.168.0.0/24 is variably subnetted, 12 subnets, 2 masks

O 192.168.0.0/28

[110/2] via 192.168.0.17, 00:38:31, GigabitEthernet0/0/0

C 192.168.0.16/28 is directly connected, GigabitEthernet0/0/0

L 192.168.0.18/32 is directly connected, GigabitEthernet0/0/0

C 192.168.0.32/28 is directly connected, GigabitEthernet0/0/1

L 192.168.0.33/32 is directly connected, GigabitEthernet0/0/1

O 192.168.0.48/28

[110/2] via 192.168.0.34, 00:36:50, GigabitEthernet0/0/1

O 192.168.0.65/32

[110/3] via 192.168.0.17, 00:30:55, GigabitEthernet0/0/0

O 192.168.0.81/32

[110/2] via 192.168.0.17, 00:31:08, GigabitEthernet0/0/0

C 192.168.0.96/28 is directly connected, Loopback0

L 192.168.0.97/32 is directly connected, Loopback0

O 192.168.0.113/32

[110/2] via 192.168.0.34, 00:31:36, GigabitEthernet0/0/1

O 192.168.0.129/32

[110/3] via 192.168.0.34, 00:31:23, GigabitEthernet0/0/1

**-R3#ping 192.168.0.65**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.65, timeout is 2 seconds:

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

**-R3#ping 192.168.0.81**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.81, timeout is 2 seconds:

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

**-R3#ping 192.168.0.97**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.97, timeout is 2 seconds:

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

**-R3#ping 192.168.0.113**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.113, timeout is 2 seconds:

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

**-R3#ping 192.168.0.129**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.129, timeout is 2 seconds:

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

**Router 4:**

**-R4#show run**

Building configuration...

Current configuration : 1716 bytes

Last configuration change at 17:40:03 UTC Thu Sep 9 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

subscriber templating

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO215009QY

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface Loopback0

ip address 192.168.0.113 255.255.255.240

interface GigabitEthernet0/0/0

ip address 192.168.0.34 255.255.255.240

negotiation auto

interface GigabitEthernet0/0/1

ip address 192.168.0.49 255.255.255.240

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 ospf 1

network 192.168.0.0 0.0.0.15 area 0

network 192.168.0.16 0.0.0.15 area 0

network 192.168.0.32 0.0.0.15 area 0

network 192.168.0.48 0.0.0.15 area 0

network 192.168.0.64 0.0.0.15 area 0

network 192.168.0.80 0.0.0.15 area 0

network 192.168.0.96 0.0.0.15 area 0

network 192.168.0.112 0.0.0.15 area 0

network 192.168.0.128 0.0.0.15 area 0

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

**-R4#show ip ospf neighbor**

Neighbor ID Pri State Dead Time Address Interface

192.168.0.129 1 FULL/DR 00:00:32 192.168.0.50 GigabitEthernet0/0/1

192.168.0.97 1 FULL/BDR 00:00:34 192.168.0.33 GigabitEthernet0/0/0

**-R4#show ip ospf**

Routing Process "ospf 1" with ID 192.168.0.113

Start time: 00:18:55.086, Time elapsed: 00:43:19.564

Supports only single TOS(TOS0) routes

Supports opaque LSA

Supports Link-local Signaling (LLS)

Supports area transit capability

Supports NSSA (compatible with RFC 3101)

Supports Database Exchange Summary List Optimization (RFC 5243)

Event-log enabled, Maximum number of events: 1000, Mode: cyclic

Router is not originating router-LSAs with maximum metric

Initial SPF schedule delay 5000 msecs

Minimum hold time between two consecutive SPFs 10000 msecs

Maximum wait time between two consecutive SPFs 10000 msecs

Incremental-SPF disabled

Minimum LSA interval 5 secs

Minimum LSA arrival 1000 msecs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300

Number of external LSA 0. Checksum Sum 0x000000

Number of opaque AS LSA 0. Checksum Sum 0x000000

Number of DCbitless external and opaque AS LSA 0

Number of DoNotAge external and opaque AS LSA 0

Number of areas in this router is 1. 1 normal 0 stub 0 nssa

Number of areas transit capable is 0

External flood list length 0

IETF NSF helper support enabled

Cisco NSF helper support enabled

Reference bandwidth unit is 100 mbps

Area BACKBONE(0)

Number of interfaces in this area is 3 (1 loopback)

Area has no authentication

SPF algorithm last executed 00:35:21.707 ago

SPF algorithm executed 11 times

Area ranges are

Number of LSA 9. Checksum Sum 0x03A20B

Number of opaque link LSA 0. Checksum Sum 0x000000

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

**-R4#show ip ospf interface**

Loopback0 is up, line protocol is up

Internet Address 192.168.0.113/28, Area 0, Attached via Network Statement

Process ID 1, Router ID 192.168.0.113, Network Type LOOPBACK, Cost: 1

Topology-MTID Cost Disabled Shutdown Topology Name

0 1 no no Base

Loopback interface is treated as a stub Host

GigabitEthernet0/0/1 is up, line protocol is up

Internet Address 192.168.0.49/28, Area 0, Attached via Network Statement

Process ID 1, Router ID 192.168.0.113, Network Type BROADCAST, Cost: 1

Topology-MTID Cost Disabled Shutdown Topology Name

0 1 no no Base

Transmit Delay is 1 sec, State BDR, Priority 1

Designated Router (ID) 192.168.0.129, Interface address 192.168.0.50

Backup Designated router (ID) 192.168.0.113, Interface address 192.168.0.49

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

oob-resync timeout 40

Hello due in 00:00:06

Supports Link-local Signaling (LLS)

Cisco NSF helper support enabled

IETF NSF helper support enabled

Index 1/2/2, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 1, maximum is 1

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 192.168.0.129 (Designated Router)

Suppress hello for 0 neighbor(s)

GigabitEthernet0/0/0 is up, line protocol is up

Internet Address 192.168.0.34/28, Area 0, Attached via Network Statement

Process ID 1, Router ID 192.168.0.113, Network Type BROADCAST, Cost: 1

Topology-MTID Cost Disabled Shutdown Topology Name

0 1 no no Base

Transmit Delay is 1 sec, State DR, Priority 1

Designated Router (ID) 192.168.0.113, Interface address 192.168.0.34

Backup Designated router (ID) 192.168.0.97, Interface address 192.168.0.33

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

oob-resync timeout 40

Hello due in 00:00:06

Supports Link-local Signaling (LLS)

Cisco NSF helper support enabled

IETF NSF helper support enabled

Index 1/1/1, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 0, maximum is 2

Last flood scan time is 0 msec, maximum is 1 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 192.168.0.97 (Backup Designated Router)

Suppress hello for 0 neighbor(s)

**-R4#show ip ospf border-routers**

OSPF Router with ID (192.168.0.113) (Process ID 1)

Base Topology (MTID 0)

Internal Router Routing Table

Codes: i - Intra-area route, I - Inter-area route

**-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

192.168.0.0/24 is variably subnetted, 12 subnets, 2 masks

O 192.168.0.0/28

[110/3] via 192.168.0.33, 00:44:10, GigabitEthernet0/0/0

O 192.168.0.16/28

[110/2] via 192.168.0.33, 00:44:10, GigabitEthernet0/0/0

C 192.168.0.32/28 is directly connected, GigabitEthernet0/0/0

L 192.168.0.34/32 is directly connected, GigabitEthernet0/0/0

C 192.168.0.48/28 is directly connected, GigabitEthernet0/0/1

L 192.168.0.49/32 is directly connected, GigabitEthernet0/0/1

O 192.168.0.65/32

[110/4] via 192.168.0.33, 00:37:31, GigabitEthernet0/0/0

O 192.168.0.81/32

[110/3] via 192.168.0.33, 00:37:44, GigabitEthernet0/0/0

O 192.168.0.97/32

[110/2] via 192.168.0.33, 00:38:25, GigabitEthernet0/0/0

C 192.168.0.112/28 is directly connected, Loopback0

L 192.168.0.113/32 is directly connected, Loopback0

O 192.168.0.129/32

[110/2] via 192.168.0.50, 00:37:59, GigabitEthernet0/0/1

**-R4#ping 192.168.0.65**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.65, timeout is 2 seconds:

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

**-R4#ping 192.168.0.81**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.81, timeout is 2 seconds:

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

**-R4#ping 192.168.0.97**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.97, timeout is 2 seconds:

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

**-R4#ping 192.168.0.113**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.113, timeout is 2 seconds:

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

**-R4#ping 192.168.0.129**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.129, timeout is 2 seconds:

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

**Router 5:**

**-R5#show run**

Building configuration...

Current configuration : 1700 bytes

Last configuration change at 17:46:56 UTC Thu Sep 9 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

subscriber templating

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO214420HM

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface Loopback0

ip address 192.168.0.129 255.255.255.240

interface GigabitEthernet0/0/0

ip address 192.168.0.50 255.255.255.240

negotiation auto

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

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

interface Vlan1

no ip address

shutdown

router ospf 1

network 192.168.0.0 0.0.0.15 area 0

network 192.168.0.16 0.0.0.15 area 0

network 192.168.0.32 0.0.0.15 area 0

network 192.168.0.48 0.0.0.15 area 0

network 192.168.0.64 0.0.0.15 area 0

network 192.168.0.80 0.0.0.15 area 0

network 192.168.0.96 0.0.0.15 area 0

network 192.168.0.112 0.0.0.15 area 0

network 192.168.0.128 0.0.0.15 area 0

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

**-R5#show ip ospf neighbor**

Neighbor ID Pri State Dead Time Address Interface

192.168.0.113 1 FULL/BDR 00:00:36 192.168.0.49 GigabitEthernet0/0/0

**-R5#show ip ospf**

Routing Process "ospf 1" with ID 192.168.0.129

Start time: 00:18:39.892, Time elapsed: 00:48:23.760

Supports only single TOS(TOS0) routes

Supports opaque LSA

Supports Link-local Signaling (LLS)

Supports area transit capability

Supports NSSA (compatible with RFC 3101)

Supports Database Exchange Summary List Optimization (RFC 5243)

Event-log enabled, Maximum number of events: 1000, Mode: cyclic

Router is not originating router-LSAs with maximum metric

Initial SPF schedule delay 5000 msecs

Minimum hold time between two consecutive SPFs 10000 msecs

Maximum wait time between two consecutive SPFs 10000 msecs

Incremental-SPF disabled

Minimum LSA interval 5 secs

Minimum LSA arrival 1000 msecs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

EXCHANGE/LOADING adjacency limit: initial 300, process maximum 300

Number of external LSA 0. Checksum Sum 0x000000

Number of opaque AS LSA 0. Checksum Sum 0x000000

Number of DCbitless external and opaque AS LSA 0

Number of DoNotAge external and opaque AS LSA 0

Number of areas in this router is 1. 1 normal 0 stub 0 nssa

Number of areas transit capable is 0

External flood list length 0

IETF NSF helper support enabled

Cisco NSF helper support enabled

Reference bandwidth unit is 100 mbps

Area BACKBONE(0)

Number of interfaces in this area is 2 (1 loopback)

Area has no authentication

SPF algorithm last executed 00:41:07.593 ago

SPF algorithm executed 9 times

Area ranges are

Number of LSA 9. Checksum Sum 0x03A20B

Number of opaque link LSA 0. Checksum Sum 0x000000

Number of DCbitless LSA 0

Number of indication LSA 0

Number of DoNotAge LSA 0

Flood list length 0

**-R5#show ip ospf interface**

Loopback0 is up, line protocol is up

Internet Address 192.168.0.129/28, Area 0, Attached via Network Statement

Process ID 1, Router ID 192.168.0.129, Network Type LOOPBACK, Cost: 1

Topology-MTID Cost Disabled Shutdown Topology Name

0 1 no no Base

Loopback interface is treated as a stub Host

GigabitEthernet0/0/0 is up, line protocol is up

Internet Address 192.168.0.50/28, Area 0, Attached via Network Statement

Process ID 1, Router ID 192.168.0.129, Network Type BROADCAST, Cost: 1

Topology-MTID Cost Disabled Shutdown Topology Name

0 1 no no Base

Transmit Delay is 1 sec, State DR, Priority 1

Designated Router (ID) 192.168.0.129, Interface address 192.168.0.50

Backup Designated router (ID) 192.168.0.113, Interface address 192.168.0.49

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5

oob-resync timeout 40

Hello due in 00:00:06

Supports Link-local Signaling (LLS)

Cisco NSF helper support enabled

IETF NSF helper support enabled

Index 1/1/1, flood queue length 0

Next 0x0(0)/0x0(0)/0x0(0)

Last flood scan length is 0, maximum is 3

Last flood scan time is 0 msec, maximum is 0 msec

Neighbor Count is 1, Adjacent neighbor count is 1

Adjacent with neighbor 192.168.0.113 (Backup Designated Router)

Suppress hello for 0 neighbor(s)

**-R5#show ip ospf border-routers**

OSPF Router with ID (192.168.0.129) (Process ID 1)

Base Topology (MTID 0)

Internal Router Routing Table

Codes: i - Intra-area route, I - Inter-area route

**-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

192.168.0.0/24 is variably subnetted, 11 subnets, 2 masks

O 192.168.0.0/28

[110/4] via 192.168.0.49, 00:48:56, GigabitEthernet0/0/0

O 192.168.0.16/28

[110/3] via 192.168.0.49, 00:48:56, GigabitEthernet0/0/0

O 192.168.0.32/28

[110/2] via 192.168.0.49, 00:48:56, GigabitEthernet0/0/0

C 192.168.0.48/28 is directly connected, GigabitEthernet0/0/0

L 192.168.0.50/32 is directly connected, GigabitEthernet0/0/0

O 192.168.0.65/32

[110/5] via 192.168.0.49, 00:43:01, GigabitEthernet0/0/0

O 192.168.0.81/32

[110/4] via 192.168.0.49, 00:43:14, GigabitEthernet0/0/0

O 192.168.0.97/32

[110/3] via 192.168.0.49, 00:43:55, GigabitEthernet0/0/0

O 192.168.0.113/32

[110/2] via 192.168.0.49, 00:43:42, GigabitEthernet0/0/0

C 192.168.0.128/28 is directly connected, Loopback0

L 192.168.0.129/32 is directly connected, Loopback0

**-R5#ping 192.168.0.65**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.65, timeout is 2 seconds:

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

**-R5#ping 192.168.0.81**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.81, timeout is 2 seconds:

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

**-R5#ping 192.168.0.97**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.97, timeout is 2 seconds:

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

**-R5#ping 192.168.0.113**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.113, timeout is 2 seconds:

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms

**-R5#ping 192.168.0.129**

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.0.129, timeout is 2 seconds:

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

Problems

We have not encountered any major problems while configuring the OSPF lab. But we did encounter some small mistakes during the lab, one such instance was not correctly connecting the console cables to correct router from the computer and connecting the wrong gigabit ethernet on the routers. This was an easy fix as we just needed to look under the table to check the color of the console cable connected to the desktop currently in use, patch board for computers referenced cable colors. Another problem was we forgot to subnet wildcard mask correctly after we changed the address, this was also an easy fix as we just needed to replace the wrong mask with the correct one.

Conclusion

The objective of the lab was to be able to configure an OSPF system for all the 5 routers. During this prosses of creating the OSPF it allowed us to review this IP routing and allowed us to better understand and familiarize ourselves with how to configure networks physically. During the lab we encountered some small troubles that we learned from, but We were able to config the OSPF system correctly by the end. This lab was straight forward, and I was able to formalize with the physical configuration of the routers by the end of the lab.