Multi Area OSPF

(Multi Area Open Shortest Path First)

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**Purpose** – The Purpose of this lab was to learn to use OSPF to gain full connectivity across multiple areas.

**Background Information on Lab Concepts** – OSPF is an interior gateway protocol, which was made for routing packets within one domain. OSPF was created in 1999. Areas are identified by 32-bit numbers.

**Lab Summary** – We connected PC1 to R1 to R2 using OSPF and assigned them to area 1. We then connected R2 to R3 which crosses over from area 1 to area 0. Then R3 is connected to R4 which is assigned to area 0. R4 is then connected to R5 which crosses over from area 0 to area 2. R5 then connects to R6 which then connects to PC2 using OSPF.

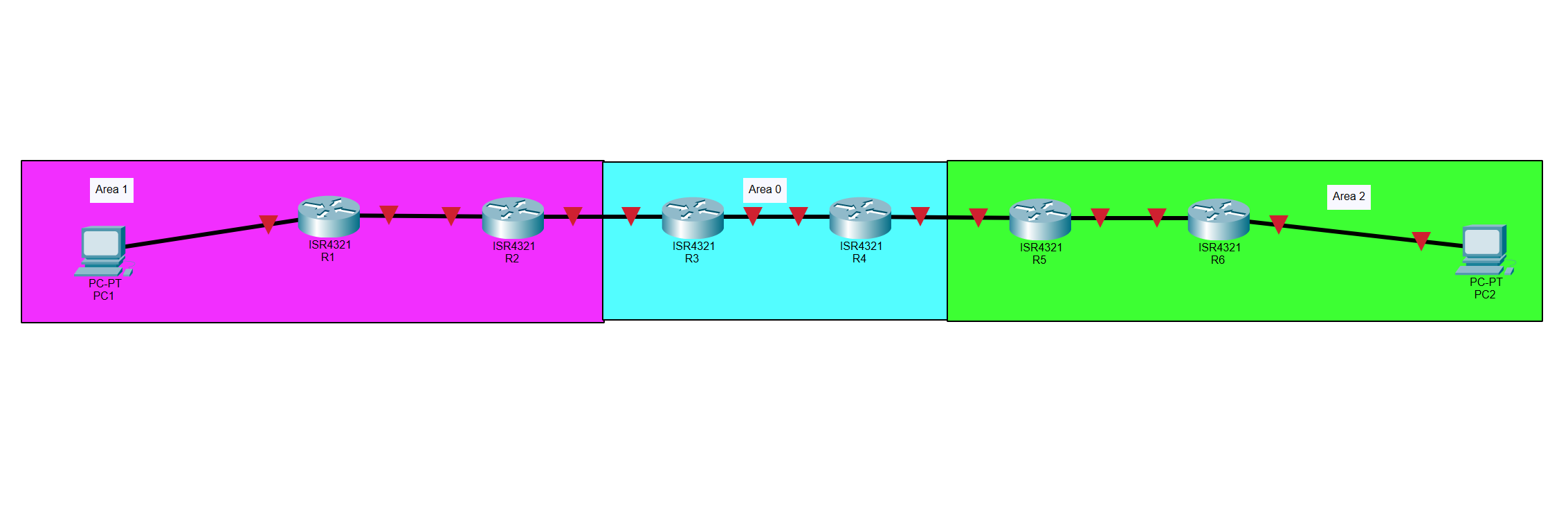
**Lab Commands** –

network #.#.#.# #.#.#.# area #

ipv6 ospf # area #

router ospf #

**Network Diagram With IP’s** -

**Configurations** -

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

ipv6 unicast-routing

subscriber templating

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO21482HZX

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface GigabitEthernet0/0/0

ip address 192.168.10.2 255.255.255.252

negotiation auto

ipv6 address FE80::7 link-local

ipv6 address 2001:DB8:0:1::1/64

ipv6 ospf 1 area 1

interface GigabitEthernet0/0/1

ip address 192.168.10.5 255.255.255.252

negotiation auto

ipv6 address FE80::1 link-local

ipv6 address 2001:DB8:0:7::1/64

ipv6 ospf 1 area 1

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

router-id 1.1.1.1

network 192.168.10.0 0.0.0.3 area 1

network 192.168.10.4 0.0.0.3 area 1

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router ospf 1

router-id 1.1.1.1

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

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

ipv6 unicast-routing

subscriber templating

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO21482DWJ

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface GigabitEthernet0/0/0

ip address 192.168.10.9 255.255.255.252

negotiation auto

ipv6 address FE80::8 link-local

ipv6 address 2001:DB8:0:2::1/64

ipv6 ospf 1 area 1

interface GigabitEthernet0/0/1

ip address 192.168.10.1 255.255.255.252

negotiation auto

ipv6 address FE80::2 link-local

ipv6 address 2001:DB8:0:8::1/64

ipv6 ospf 1 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 1

router-id 2.2.2.2

network 192.168.10.0 0.0.0.3 area 0

network 192.168.10.8 0.0.0.3 area 1

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router ospf 1

router-id 2.2.2.2

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

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

ipv6 unicast-routing

subscriber templating

vtp domain cisco

vtp mode transparent

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO214420HW

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface GigabitEthernet0/0/0

ip address 192.168.10.13 255.255.255.252

negotiation auto

ipv6 address FE80::9 link-local

ipv6 address 2001:DB8:0:3::1/64

ipv6 ospf 1 area 0

interface GigabitEthernet0/0/1

ip address 192.168.10.10 255.255.255.252

negotiation auto

ipv6 address FE80::3 link-local

ipv6 address 2001:DB8:0:9::1/64

ipv6 ospf 1 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 1

router-id 3.3.3.3

network 192.168.10.8 0.0.0.3 area 0

network 192.168.10.12 0.0.0.3 area 0

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router ospf 1

router-id 3.3.3.3

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

hostname R4

boot-start-marker

boot-end-marker

vrf definition Mgmt-intf

address-family ipv4

exit-address-family

address-family ipv6

exit-address-family

no aaa new-model

ipv6 unicast-routing

subscriber templating

vtp domain cisco

vtp mode transparent

multilink bundle-name authenticated

license udi pid ISR4321/K9 sn FDO214421D1

spanning-tree extend system-id

redundancy

mode none

vlan internal allocation policy ascending

interface GigabitEthernet0/0/0

ip address 192.168.10.14 255.255.255.252

negotiation auto

ipv6 address FE80::10 link-local

ipv6 address 2001:DB8:0:4::1/64

ipv6 ospf 1 area 0

interface GigabitEthernet0/0/1

ip address 192.168.10.17 255.255.255.252

negotiation auto

ipv6 address FE80::4 link-local

ipv6 address 2001:DB8:0:10::1/64

ipv6 ospf 1 area 2

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 1

router-id 4.4.4.4

network 192.168.10.12 0.0.0.3 area 0

network 192.168.10.16 0.0.0.3 area 2

ip forward-protocol nd

no ip http server

no ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router ospf 1

router-id 4.4.4.4

control-plane

line con 0

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

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

login on-success log

subscriber templating

vtp domain cisco

vtp mode transparent

ipv6 unicast-routing

multilink bundle-name authenticated

crypto pki trustpoint TP-self-signed-859896477

enrollment selfsigned

subject-name cn=IOS-Self-Signed-Certificate-859896477

revocation-check none

rsakeypair TP-self-signed-859896477

crypto pki certificate chain TP-self-signed-859896477

certificate self-signed 01

3082032E 30820216 A0030201 02020101 300D0609 2A864886 F70D0101 05050030

30312E30 2C060355 04031325 494F532D 53656C66 2D536967 6E65642D 43657274

69666963 6174652D 38353938 39363437 37301E17 0D323230 39313631 36313535

365A170D 33303031 30313030 30303030 5A303031 2E302C06 03550403 1325494F

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

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

82010100 9BB2265A 57F2E906 69FF86FC 08FB5CF5 EC8C4702 7AAA361B 8A03D21D

D9F797D5 84A29BA4 83D8E10B A90AFF54 89ACA438 3214EEA2 B11D20DA CAC61D1A

6E63BA0C 4D1754D9 B328B3EB 861C55B0 7A51DB43 76923A52 A051AEEB 97998FA0

9FBB1A2A F472BD8A D18F5A41 6483915F 33448A67 9FC0762E 13007677 AC1CD1A4

61097626 065C1876 8C31CE8A F747307C 069E2DB8 1E2D6424 C4672C97 7631D0F9

9F743C64 69FA00ED 84D7F31B C475C93C CBA7667B 7E0E0BFD 7C1813E5 DA27C2E0

3CA935FB 33C0B743 94043410 2E176EC8 033BDF8B E4718F06 1BEA8EE3 51C34F5C

6701144B 411BDE0A 9D1084E6 03F2A0EF 1C3BFAF8 72653BF5 2A43FE46 282CAEF6

1D22F8E7 02030100 01A35330 51300F06 03551D13 0101FF04 05300301 01FF301F

0603551D 23041830 168014EF E15E4F5C E54E1A60 7E879C2B 018686B9 7E064A30

1D060355 1D0E0416 0414EFE1 5E4F5CE5 4E1A607E 879C2B01 8686B97E 064A300D

06092A86 4886F70D 01010505 00038201 01005192 7EAA3669 BACE95EF E264EDA8

FCFE10E5 CCD3081F 5D057CB2 1A92DEE1 7EE28E5D C20FD969 A8F654A9 8FCC2ABB

19EA6551 1E63A5DC D259672B F8ABF37C 18FD77F0 60CFF52D F8889D07 3E796F50

6092D3F7 5222F39D 1444FF27 C28B1B64 57427496 1AAAB4B7 392C5462 245749F9

F58D9575 82DE8341 D0A925FA DB92632C 1F40393D 9E19BF77 73F8863C 388DD36E

A1D9A00A A7D47C4E 7589D065 FE3D617D 751D0A28 82F4381C 49131903 9892B862

160808C4 9916779B 1D1AF59C 650DCADD FAC87DBA 7787D1A0 59263AAB 25257377

453A74D6 6C43C0A3 F3BC3D99 1BACAF92 16A7D969 316D5A63 7C1A0231 11ED4A9B

7A584B10 2D1AA1E9 5B25B1B7 88445DC2 DF80

quit

license udi pid ISR4321/K9 sn FLM240608PJ

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface GigabitEthernet0/0/0

ip address 192.168.10.21 255.255.255.252

negotiation auto

ipv6 address FE80::11 link-local

ipv6 address 2001:DB8:0:5::1/64

ipv6 ospf 1 area 2

interface GigabitEthernet0/0/1

ip address 192.168.10.18 255.255.255.252

negotiation auto

ipv6 address FE80::5 link-local

ipv6 address 2001:DB8:0:11::1/64

ipv6 ospf 1 area 2

interface GigabitEthernet0/1/0

no ip address

negotiation auto

interface GigabitEthernet0/1/1

no ip address

shutdown

negotiation auto

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

router ospf 1

router-id 5.5.5.5

network 192.168.10.16 0.0.0.3 area 2

network 192.168.10.20 0.0.0.3 area 2

ip forward-protocol nd

ip http server

ip http authentication local

ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router ospf 1

router-id 5.5.5.5

control-plane

line con 0

transport input none

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

end

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

login on-success log

subscriber templating

ipv6 unicast-routing

multilink bundle-name authenticated

crypto pki trustpoint TP-self-signed-4288135047

enrollment selfsigned

subject-name cn=IOS-Self-Signed-Certificate-4288135047

revocation-check none

rsakeypair TP-self-signed-4288135047

crypto pki certificate chain TP-self-signed-4288135047

certificate self-signed 01

30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030

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

69666963 6174652D 34323838 31333530 3437301E 170D3232 30393136 31363139

32345A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649

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

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

0A028201 01008BEF 1BE20810 6E8E5A68 801D7E5E CF71051F 9BACEFBF 2005D276

0192D8AF CA0C4484 C296ED03 A6EC16AF C1910BCD E34BF862 755960A3 9E44E4B5

EA67556B 06C0F6E8 95F97D81 2227E484 8E35F2A0 CA274879 E1FBB742 6008C33E

21FDE6A1 FFE3AA8B 8E854EDB EFD3D226 BC1BA13E EDCE357A 24898D1C F1A17C9C

01321421 0EF3487A 4900E894 28A503A7 2B1E8141 9CE7654C 565DCF2F 777C9E36

B6A63A07 FED4217B 13A6F13B FEB971C1 94D2FAAF B287A343 6E4DEF4D 38B2743F

958DD645 FF3F3CB5 A141D3F2 0B02BDBB A97ED32F 6E012540 FD63C1E2 D5B72794

967AAA01 4C9FB862 0E24897A FFC42A86 3AD7757C 3A3859FB 4AD96870 C3EBE668

0E268CE5 030D0203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF

301F0603 551D2304 18301680 14157E80 981BB65C 0BDE93C3 468D5549 A4E34B52

B6301D06 03551D0E 04160414 157E8098 1BB65C0B DE93C346 8D5549A4 E34B52B6

300D0609 2A864886 F70D0101 05050003 82010100 4BAECD66 CEFC9A27 44C823DC

E1F8C050 8635270D 980E2464 786B7F8C D25049C9 0495F6D6 833D3DCE 30400DC1

73F4CB1A 898CDA94 936C0810 A4191244 D1F87D83 2D315522 90129DB7 CCA2E3B5

B2BFB02C F6F0640C BDA00604 F0807DAA 7647AC1E 2BA88DBC 5225C713 01FB4F31

C5DCF205 409F9CAF 147370F9 F6383D4C 1F5C5B3F 7EE9622F ABA9BAF0 7469C981

5EF3F67A 081DB437 C9668B04 A7E36F70 9CCACB13 1F76474B 38C3C041 27338326

B78252EF 116A9CBA B80E58B6 A435DDFF 07B6D964 60C28CBF 99EDA5B0 273A5247

2063331B 097F292F E296A073 D6FD5C1B 377427EF B8D71DEF 9A3B51C9 42AE3358

289CEB52 8AEB9635 C5F1A00B E787661F 35F7B582

quit

license udi pid ISR4321/K9 sn FLM2406090M

no license smart enable

diagnostic bootup level minimal

spanning-tree extend system-id

redundancy

mode none

interface GigabitEthernet0/0/0

ip address 192.168.10.22 255.255.255.252

negotiation auto

ipv6 address FE80::12 link-local

ipv6 address 2001:DB8:0:6::1/64

ipv6 ospf 1 area 2

interface GigabitEthernet0/0/1

ip address 192.168.10.25 255.255.255.252

negotiation auto

ipv6 address FE80::6 link-local

ipv6 address 2001:DB8:0:12::1/64

ipv6 ospf 1 area 0

interface GigabitEthernet0/1/0

no ip address

shutdown

negotiation auto

interface GigabitEthernet0/1/1

no ip address

shutdown

negotiation auto

interface GigabitEthernet0

vrf forwarding Mgmt-intf

no ip address

shutdown

negotiation auto

router ospf 1

router-id 6.6.6.6

network 192.168.10.20 0.0.0.3 area 2

network 192.168.10.24 0.0.0.3 area 0

ip forward-protocol nd

ip http server

ip http authentication local

ip http secure-server

ip tftp source-interface GigabitEthernet0

ipv6 router ospf 1

control-plane

line con 0

transport input none

stopbits 1

line aux 0

stopbits 1

line vty 0 4

login

End

**Problem** – The problems we had during this lab consisted of assigning the wrong areas to the wrong routers which caused us not to have full connectivity for most of the time we were doing the lab. We had this problem mainly in area 0, this consisted of R3 and R4. We solved this problem by guessing and checking really, because we were not sure which interfaces were supposed to be assigned to which router. Once we found out that the outgoing interface is the right one to assign to the connecting area, then all our problems were finally solved, and we got stamped off.

**Conclusion** – In conclusion we learned how to use multi-area OSPF on a six-router config. We learned how to troubleshoot this configuration and how to understand exactly how to move between different OSPF areas.