11. How to configure OSPF Routing Protocol and Connect Areas

OSPF-Open Short Path First, It is a Open Standard Routing Protocol

Link State Routing Protocol
Algorithm -Dijkistra, To find shortest path
Administrativ Distance-110
Metric- 10^8/Bandwidth
Incremental Update
Load Balancing Maximum 6 (Default 4)
It knows Network topology
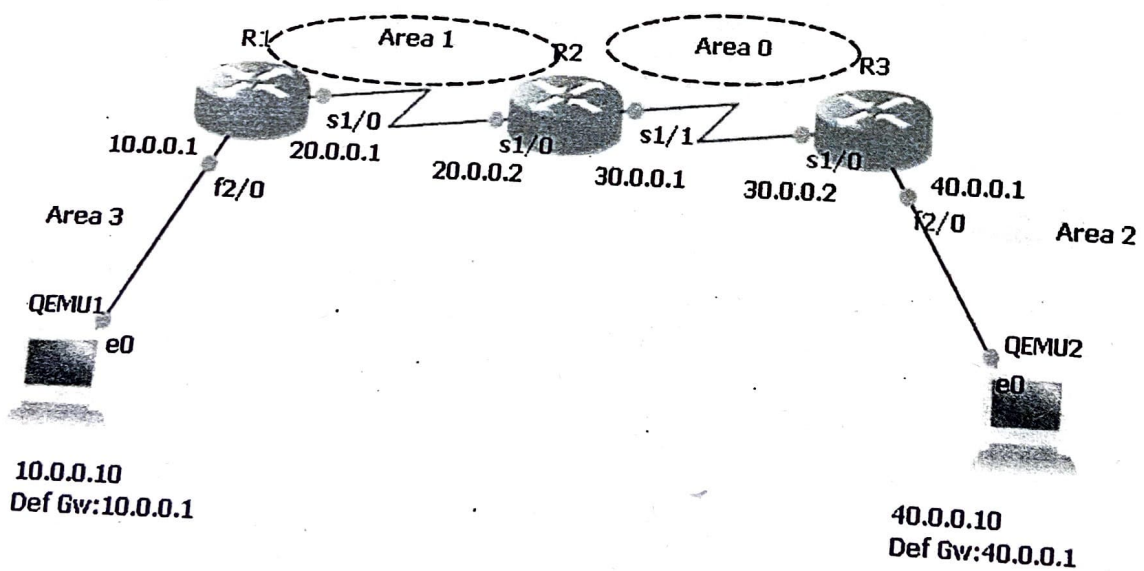Router ID-Initializes OSPF Process
Fast convergence

Timers
Hello-10
Dead-40
Wait-40
Retransmit-5

Step 1: Create topology like below i have given

Step 2: Cofigure ip addres to all interfaces

In Router R1,

1

```
R1(config)#interface fastethernet 2/0
R1(config-if)#ip address 10.0.0.1 255.0.0.0
R1(config-if)#no shutdown
R1(config-if)#exit

R1(config)#interface serial 1/0
R1(config-if)#ip address 20.0.0.1 255.0.0.0
R1(config-if)#encapsulation ppp
R1(config-if)#clock rate 64000
R1(config-if)#no shutdown
R1(config-if)#exit
```

In Router R2,

```
R2(config)#interface serial 1/0
R2(config-if)#ip address 20.0.0.2 255.0.0.0
R2(config-if)#encapsulation ppp
R2(config-if)#no shutdown
R2(config-if)#exit

R2(config)#interface serial 1/1
R2(config-if)#ip address 30.0.0.1 255.0.0.0
R2(config-if)#encapsulation ppp
R2(config-if)#clock rate 64000
R2(config-if)#no shutdown
R2(config-if)#exit
```

In Router R3,

```
R3(config)#
R3(config)#interface serial 1/0
R3(config-if)#ip address 30.0.0.2 255.0.0.0
R3(config-if)#encapsulation ppp
R3(config-if)#no shutdown
R3(config-if)#exit

R3(config)#
R3(config)#interface fastethernet 2/0
```

R3(config-if)#ip address 40.0.0.1 255.0.0.0
R3(config-if)#no shutdown
R3(config-if)#exit

Step 3:Now,Enable ip routing by configuring ospf routing protocol in all routers,

In Router R1,
R1(config)#router ospf 1
R1(config-router)#router-id 1.1.1.1
R1(config-router)#network 10.0.0.0 0.255.255.255 area 3
R1(config-router)#network 20.0.0.0 0.255.255.255 area 1
R1(config-router)#exit

In Router R2,
R2(config)#router ospf 1
R2(config-router)#router-id 2.2.2.2
R2(config-router)#network 20.0.0.0 0.255.255.255 area 1
R2(config-router)#network 30.0.0.0 0.255.255.255 area 0
R2(config-router)#exit

In Router R3,
R3(config)#router ospf 1
R3(config-router)#router-id 3.3.3.3
R3(config-router)#network 30.0.0.0 0.255.255.255 area 0
R3(config-router)#network 40.0.0.0 0.255.255.255 area 2
R3(config-router)#exit

You have to configure router id when we configure ospf.It is used to identify the router

Step 4:Now check routing table of R1,

Router#show ip route
Codes: 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, 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

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Gateway of last resort is not set

C   10.0.0.0/8 is directly connected, FastEthernet2/0
C   20.0.0.0/8 is directly connected, Serial1/0
O IA 40.0.0.0/8 [110/129] via 20.0.0.2, 00:04:23, Serial1/0
O IA 30.0.0.0/8 [110/128] via 20.0.0.2, 00:07:29, Serial1/0

Here,R2 knows Area 0.Network 20.0.0.0 connected to R2 from R1,So R1 learns networks through this network.

R3(config)#router ospf 1, Here, 1 is Process ID, it can be 1-65535.It initializes ospf process.

There must be one interface up to keep ospf process up. So its better to configure loopback address to routers. It is a virtual interface never goes down once we configured.

R1(config-if)#interface loopback 0
R1(config-if)#ip add 172.16.1.252 255.255.0.0
R1(config-if)#no shutdown

R2(config-if)#interface loopback 0
R2(config-if)#ip add 172.16.1.253 255.255.0.0
R2(config-if)#no shutdown

R3(config-if)#interface loopback 0
R3(config-if)#ip add 172.16.1.254 255.255.0.0
R3(config-if)#no shutdown

Step 5:Now ,Check Routing table of R3,

R3#show ip route
Codes: 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, 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

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Gateway of last resort is not set

O IA 20.0.0.0/8 [110/128] via 30.0.0.1, 00:18:58, Serial1/0
C   40.0.0.0/8 is directly connected, FastEthernet2/0
C   30.0.0.0/8 is directly connected, Serial1/0

Here,R3 doesn't know about the area 3 so we have to create virtual link between R1 and R2

Step 6:Create virtual link between R1,R2,by this we create a virtual link to connect area 3 to area 0.

In Router R1,
R1(config)#router ospf 1
R1(config-router)#area 1 virtual-link 2.2.2.2
R1(config-router)#
*Feb 10 10:29:23.767: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on OSPF_VL0 from LOADING to FULL, Loading Done

In Rotuer R2,
*Feb 10 10:28:59.543: %OSPF-4-ERRRCV: Received invalid packet: mismatch area ID, from backbone area must be virtual-link but not found from 20.0.0.1, Serial1/0a
*Feb 10 10:29:09.535: %OSPF-4-ERRRCV: Received invalid packet: mismatch area ID, from backbone area must be virtual-link but not found from 20.0.0.1, Serial1/0.1.1

R2(config-router)#
R2(config-router)#area 1 virtual-link 1.1.1.1
R2(config-router)#exit
R2(config)#

*Feb 10 10:29:19.667: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on OSPF_VL0 from LOADING to FULL, Loadi
ng Done

Step 7:R2 and R3 get updates about Area 3 .Now,Check routing table of R3,

R3#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
    D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

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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, 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

Gateway of last resort is not set

O IA 20.0.0.0/8 [110/128] via 30.0.0.1, 00:01:56, Serial1/0
C   40.0.0.0/8 is directly connected, FastEthernet2/0
O IA 10.0.0.0/8 [110/129] via 30.0.0.1, 00:01:56, Serial1/0
C   30.0.0.0/8 is directly connected, Serial1/0

Step 8:Check connectivity between host 10.0.0.10 to 40.0.0.10

```
QEMU (QEMU1)
tc@box:~$ sudo su
root@box:~# ifconfig eth0 10.0.0.10 netmask 255.0.0.0
root@box:~# ifconfig eth0 10.0.0.10 netmask 255.0.0.0 up
root@box:~# route add default gw 10.0.0.1
root@box:~#
root@box:~# ping 40.0.0.10
PING 40.0.0.10 (40.0.0.10): 56 data bytes
64 bytes from 40.0.0.10: seq=1 ttl=61 time=173.753 ms
64 bytes from 40.0.0.10: seq=2 ttl=61 time=64.793 ms
64 bytes from 40.0.0.10: seq=3 ttl=61 time=66.708 ms
64 bytes from 40.0.0.10: seq=4 ttl=61 time=60.829 ms
64 bytes from 40.0.0.10: seq=5 ttl=61 time=96.107 ms
^C
--- 40.0.0.10 ping statistics ---
6 packets transmitted, 5 packets received, 16% packet loss
round-trip min/avg/max = 60.829/92.438/173.753 ms
root@box:~# _
```