- Lab 10 : Routing and switching
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Lab 10 – Dynamic routing: OSPF

Objective:

1. Configure OSPF in a broadcast environment with a single area (Area 0)
2. Understand and utilize priorities to influence DR and BDR election
3. Verify OSPF network connectivity and convergence
4. Analyze OSPF database and routing updates

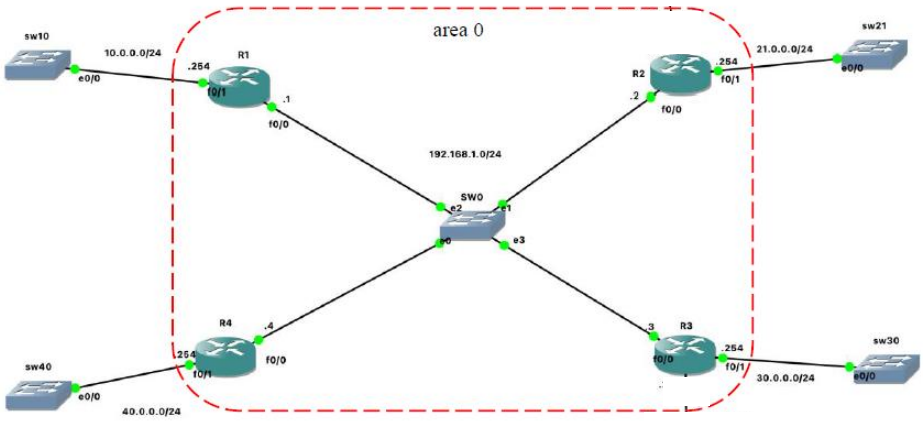
By the end of this lab, you will be able to:

- Configure an OSPF network in broadcast mode
- Control DR and BDR election using priority values
- Verify connectivity and observe OSPF neighbor relationships
- Troubleshoot OSPF convergence issues
- Understand LSA propagation in broadcast networks

Instructions:

1. The lab report must be submitted one week after the session in electronic format to Moodle platform
2. The lab must be done in class in groups of maximum 2 students.
3. Groups should remain the same for both reports and upcoming labs.

I. OSPF topology (use Router 1841 and use HWIC-4ESW for more fastethernet ports)



1. Verify Basic Connectivity

```
R1# ping 192.168.1.2
R1# ping 192.168.1.3
```

```
R1# ping 192.168.1.4
```

All pings should be successful before proceeding.

2. Configure OSPF on R1

```
R1(config)# router ospf 1
R1(config-router)# router-id 1.1.1.1
R1(config-router)# network 192.168.1.0 0.0.0.255 area 0
R1(config-router)# network 10.0.0.0 0.0.0.255 area 0
R1(config-router)# exit
```

3. Configure OSPF on R2

```
R2(config)# router ospf 1
R2(config-router)# router-id 2.2.2.2
R2(config-router)# network 192.168.1.0 0.0.0.255 area 0
R2(config-router)# network 10.0.1.0 0.0.0.255 area 0
R2(config-router)# exit
```

4. Configure OSPF on R3

```
R3(config)# router ospf 1
R3(config-router)# router-id 3.3.3.3
R3(config-router)# network 192.168.1.0 0.0.0.255 area 0
R3(config-router)# network 10.0.2.0 0.0.0.255 area 0
R3(config-router)# exit
```

5. Configure OSPF on R4

```
R4(config)# router ospf 1
R4(config-router)# router-id 4.4.4.4
R4(config-router)# network 192.168.1.0 0.0.0.255 area 0
R4(config-router)# network 10.0.3.0 0.0.0.255 area 0
R4(config-router)# exit
```

Note : OSPF Priority Configuration (DR/BDR Election)

Understanding DR/BDR Election: In broadcast networks, OSPF elects:

- **DR (Designated Router)**: Responsible for generating LSAs for the network
- **BDR (Backup Designated Router)**: Takes over if DR fails
- **DROther**: All other routers form adjacencies only with DR and BDR

Election Criteria (in order):

1. Highest OSPF priority (0-255, default is 1)
2. Priority 0 = never becomes DR/BDR
3. If priorities are equal, highest Router ID wins (NOT ip@)

6. Configure Priority on R1 (Future DR)

```
R1(config)# interface fastEthernet 0/0
R1(config-if)# ip ospf priority 100
R1(config-if)# exit
```

7. Configure Priority on R2 (Future BDR)

```
R2(config)# interface fastEthernet 0/0
R2(config-if)# ip ospf priority 50
R2(config-if)# exit
```

7. Configure Priority on R3

```
R3(config)# interface fastEthernet 0/0
R3(config-if)# ip ospf priority 10
R3(config-if)# exit
```

8. Configure Priority on R4

```
R4(config)# interface fastEthernet 0/0
R4(config-if)# ip ospf priority 1
R4(config-if)# exit
```

9. Force New DR/BDR Election

Since the election is non-preemptive, we need to reset OSPF:

Option 1: Clear OSPF process (preferred)

```
R1# clear ip ospf process
Reset ALL OSPF processes? [no]: yes

! Repeat on all routers
R2# clear ip ospf process
R3# clear ip ospf process
R4# clear ip ospf process
```

Option 2: Shutdown/No shutdown interfaces

```
R1(config)# interface fastEthernet 0/0
```

```
R1(config-if)# shutdown
R1(config-if)# no shutdown
```

10. Verify OSPF Neighbor Relationships

```
R1# show ip ospf neighbor
```

- Analyze the output in each router.
- Why are R3 and R4 in 2WAY state with each other but FULL with R1 and R2
- What would happen if R1 (DR) failed?

11. Verify OSPF Interface Details

```
R1# show ip ospf interface fastEthernet 0/0
```

Does this confirm the broadcast network type and neighbor relationships?

12. Examine OSPF Link-State Database

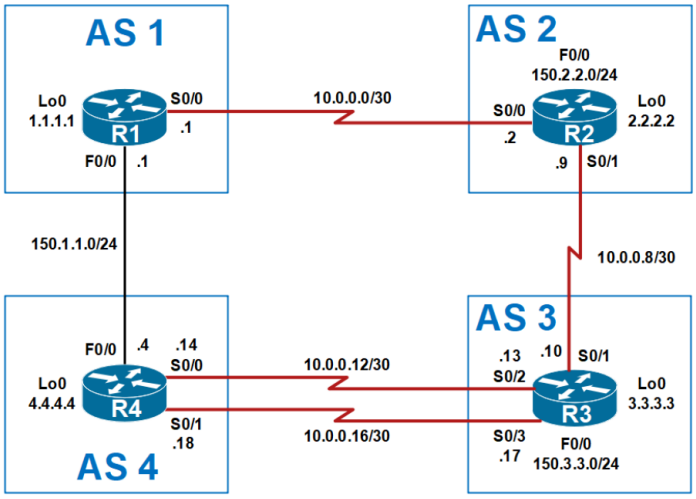
```
R1# show ip ospf database
```

Interpret the OSPF database results. What do you observe about the link types?
Notice the administrative distance and costs for each route. What do they indicate?

13. Test End-to-End Connectivity

From R1 to All Other Router Networks

II. BGP Routing Protocol Practice Labs (Homework)



R1 — AS 1

```
router bgp 1
 bgp log-neighbor-changes
 network 1.1.1.1 mask 255.255.255.255
 network 150.1.1.0 mask 255.255.255.0
 neighbor 10.0.0.2 remote-as 2
 neighbor 150.1.1.4 remote-as 4
```

R2 — AS 2

```
router bgp 2
 bgp log-neighbor-changes
 network 2.2.2.2 mask 255.255.255.255
 network 150.2.2.0 mask 255.255.255.0
 neighbor 10.0.0.1 remote-as 1
 neighbor 10.0.0.10 remote-as 3
```

R3 — AS 3

```
router bgp 3
 bgp log-neighbor-changes
 network 3.3.3.3 mask 255.255.255.255
 network 150.3.3.0 mask 255.255.255.0
 neighbor 10.0.0.9 remote-as 2
 neighbor 10.0.0.14 remote-as 4 ! neighbor over Link A
 neighbor 10.0.0.18 remote-as 4 ! neighbor over Link B
```

R4 — AS 4

```
router bgp 4
 bgp log-neighbor-changes
 network 4.4.4.4 mask 255.255.255.255
 network 150.1.1.0 mask 255.255.255.0
 neighbor 150.1.1.1 remote-as 1
 neighbor 10.0.0.13 remote-as 3 ! neighbor over Link A
 neighbor 10.0.0.17 remote-as 3 ! neighbor over Link B
```

VERIFICATION COMMANDS

Run these on each router:

1. `show ip bgp summary`
2. `show ip bgp`
3. `show ip route`

Expected:

- All neighbors should show Established
- You should see Loopback prefixes (1.1.1.1/32, 2.2.2.2/32, etc.) via eBGP
- All Routers should be able to communicate successfully