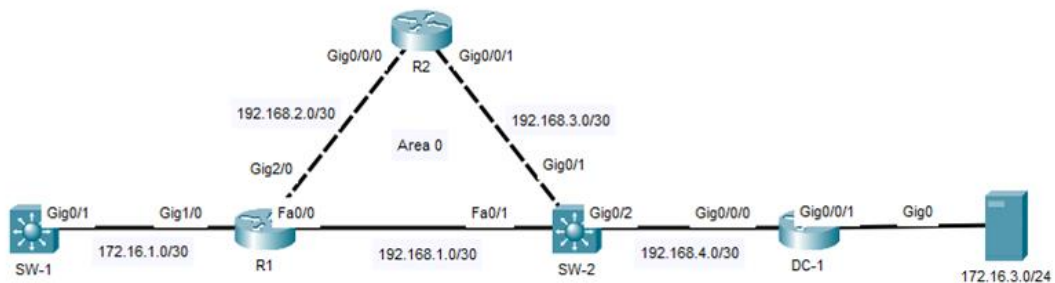


# OSPF Reference Bandwidth

## Lab Summary

Modify reference bandwidth on all routers within routing domain to distinguish faster speed links for best path selection.

**Figure 1** Lab Topology



## Lab Configuration

Start Packet Tracer File: **ospf reference bandwidth.pkt**

Click on *R1* router and select the *CLI* folder.

Step 1: Enter enable mode.

```
R1>enable
```

Step 2: Verify the preferred route in routing table to 172.16.3.0/24 (server) is currently via next hop 192.168.1.2 (SW-2) with slower FastEthernet link.

```
R1#show ip route
```

<output omitted>

```
O 172.16.3.0/24 [110/3] via 192.168.1.2, 00:01:44, FastEthernet0/0
```

Step 3: Verify forwarding path from R1 to 172.16.3.0/24 with traceroute (run twice).

```
R1#traceroute 172.16.3.1
```

Type escape sequence to abort.

Tracing the route to 172.16.3.1

1	192.168.1.2	0 msec	0 msec	0 msec
2	192.168.4.2	0 msec	0 msec	0 msec
3	172.16.3.1	1 msec	0 msec	1 msec

Step 4: Enter global configuration mode.

```
R1#configure terminal
```

Step 5: Configure OSPF reference bandwidth to 1000 Mbps on R1 router.

```
R1(config)#router ospf 1  
R1(config-router)#auto-cost reference-bandwidth 1000  
R1(config-router)#end  
R1#copy running-config startup-config
```

Click on *R2* router and select the *CLI* folder.

Step 6: Enter global configuration mode.

```
R2>enable  
R2#configure terminal
```

Step 7: Configure OSPF reference bandwidth to 1000 Mbps on R2 router.

```
R2(config)#router ospf 1  
R2(config-router)#auto-cost reference-bandwidth 1000  
R2(config-router)#end  
R2#copy running-config startup-config
```

Click on *DC-1* router and select the *CLI* folder.

Step 8: Enter global configuration mode.

```
DC-1>enable  
DC-1#configure terminal
```

Step 9: Configure OSPF reference bandwidth to 1000 Mbps on DC-1 router.

```
DC-1(config)#router ospf 1  
DC-1(config-router)#auto-cost reference-bandwidth 1000  
DC-1(config-router)#end  
DC-1#copy running-config startup-config
```

Click on *SW-1* router and select the *CLI* folder.

Step 10: Enter global configuration mode.

```
SW-1>enable  
SW-1#configure terminal
```

Step 11: Configure OSPF reference bandwidth to 1000 Mbps on SW-1.

```
SW-1(config)#router ospf 1  
SW-1(config-router)#auto-cost reference-bandwidth 1000  
SW-1(config-router)#end  
SW-1#copy running-config startup-config
```

Click on SW-2 and select the *CLI* folder.

Step 12: Enter global configuration mode.

```
SW-2>enable  
SW-2#configure terminal
```

Step 13: Configure OSPF reference bandwidth to 1000 Mbps on SW-2.

```
SW-2(config)#router ospf 1  
SW-2(config-router)#auto-cost reference-bandwidth 1000  
SW-2(config-router)#end  
SW-2#copy running-config startup-config
```

Step 14: Reset all OSPF neighbor adjacencies to recalculate path costs. Reload all network devices if Packer Tracer does not reset all neighbors.

```
SW-2#clear ip ospf process  
Reset ALL OSPF processes? [no]: yes
```

```
SW-1#clear ip ospf process  
Reset ALL OSPF processes? [no]: yes
```

Step 15: Verify the preferred route in the routing table to 172.16.3.0/24 (server) is now via R2 (192.168.2.2). The forwarding path is now via all Gigabit links instead of FastEthernet link to SW-2.

```
R1#show ip route  
<output omitted>  
O 172.16.3.0/24 [110/4] via 192.168.2.2, 00:34:22, GigabitEthernet2/0
```

Step 16: Verify the new forwarding path from R1 to 172.16.3.0/24 with traceroute.

```
R1#traceroute 172.16.3.1  
Type escape sequence to abort.  
Tracing the route to 172.16.3.1
```

1	192.168.2.2	0 msec	0 msec	0 msec
2	192.168.3.2	0 msec	0 msec	0 msec
3	192.168.4.2	0 msec	0 msec	0 msec
4	172.16.3.1	0 msec	1 msec	0 msec

Step 17: Shutdown R1 interface Gi2/0 to install higher cost route in routing table.

```
R1(config)#interface Gi2/0
R1(config-if)#shut
```

Step 18: Verify there is a higher OSPF path cost metric (12) to 172.16.3.1 when the preferred route is not available.

```
R1#show ip route
<output omitted>
O 172.16.3.0/24 [110/12] via 192.168.1.2, 00:00:05, FastEthernet0/0
```

Step 19: Verify the OSPF cost metric calculation on R1 interface Fa0/0 is 10.

```
R1#show ip ospf interface Fa0/0
<output omitted>
FastEthernet0/0 is up, line protocol is up
Internet address is 192.168.1.1/30, Area 0
Process ID 1, Router ID 192.168.2.1, Network Type BROADCAST, Cost: 10
Transmit Delay is 1 sec, State BDR, Priority 1
Designated Router (ID) 192.168.4.1, Interface address 192.168.1.2
Backup Designated Router (ID) 192.168.2.1, Interface address 192.168.1.1
```

## Lab Notes

OSPF reference bandwidth is an alternate method to cost method for influencing best path selection. The difference is that reference bandwidth must be applied to all routers within an OSPF routing domain. SPF algorithm will recalculate all links for the routing domain to provide best path selection. OSPF cost command is per interface only and should be removed when upgrading to a faster interface.

## Metric Calculation

Each routing protocol has a unique method for calculating route metric. OSPF calculates cost metric based on interface bandwidth. The default cost of an OSPF enabled Ethernet interface = 1 unless bandwidth is less than 100 Mbps.

$$\text{cost} = \text{reference bandwidth (Mbps)} / \text{interface bandwidth (Mbps)}$$

The lowest cost assignable to a link is 1 even though calculation could arrive at a lower number. The reference bandwidth of OSPF is configurable to account for faster interfaces that start at Gigabit (1000 Mbps) or faster speed today. The reference bandwidth is a global configuration command that must match for all routers in the same OSPF routing domain.

OSPF reference bandwidth in this lab was modified from 100 Mbps to 1000 Mbps, That recalculates cost metric on all egress interfaces. OSPF route metric is the sum of all egress interface costs from source to destination.

$$\text{cost} = 1000 \text{ Mbps} / 1000 \text{ Mbps} = 1 \text{ (GigabitEthernet)}$$
$$\text{cost} = 1000 \text{ Mbps} / 100 \text{ Mbps} = 10 \text{ (FastEthernet)}$$