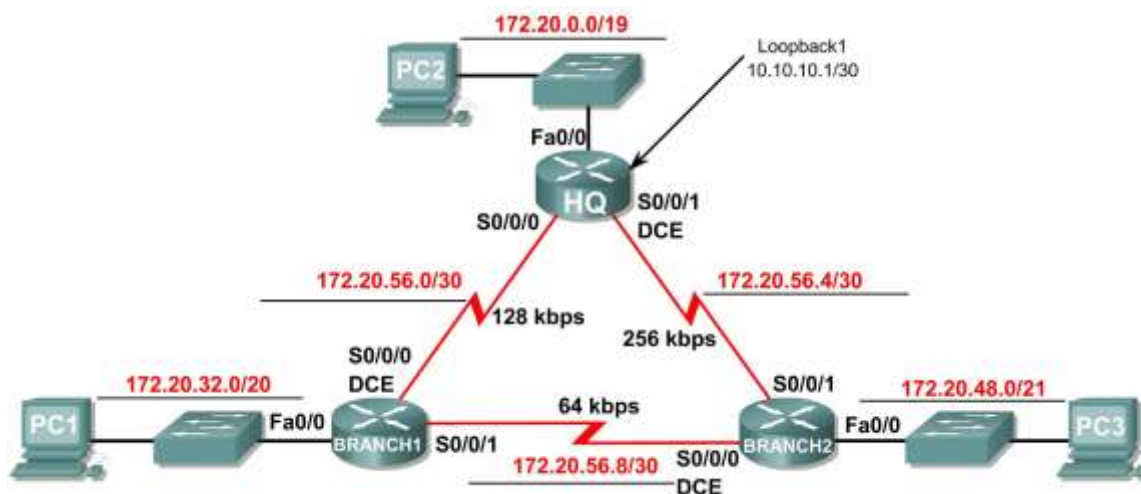# Lab 11.6.2: Challenge OSPF Configuration Lab (Instructor Version)

Topology Diagram

Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
HQ	Fa0/0	172.20.0.1	255.255.224.0	N/A
	S0/0/0	172.20.56.1	255.255.255.252	N/A
	S0/0/1	172.20.56.5	255.255.255.252	N/A
	Lo1	10.10.10.1	255.255.255.252	N/A
Branch1	Fa0/0	172.20.32.1	255.255.240.0	N/A
	S0/0/0	172.20.56.2	255.255.255.252	N/A
	S0/0/1	172.20.56.9	255.255.255.252	N/A
Branch2	Fa0/0	172.20.48.1	255.255.248.0	N/A
	S0/0/0	172.20.56.10	255.255.255.252	N/A
	S0/0/1	172.20.56.6	255.255.255.252	N/A
PC1	NIC	172.20.47.254	255.255.240.0	172.20.32.1
PC2	NIC	172.20.31.254	255.255.224.0	172.20.0.1
PC3	NIC	172.20.55.254	255.255.248.0	172.20.48.1

Learning Objectives

Upon completion of this lab, you will be able to:

- Create an efficient VLSM design given requirements
- Assign appropriate addresses to interfaces and document
- Cable a network according to the Topology Diagram
- Erase the startup configuration and reload a router to the default state
- Configure routers including OSPF
- Configure and propagate a static default route
- Verify OSPF operation
- Test and verify full connectivity
- Reflect upon and document the network implementation

Scenario

In this lab activity, you will be given a network address that must be subnetted using VLSM to complete the addressing of the network shown in the Topology Diagram. A combination OSPF routing and static routing will be required so that hosts on networks that are not directly connected will be able to communicate with each other. OSPF area ID of 0 and process ID of 1 will be used in all OSPF configurations.

Task 1: Subnet the Address Space.

Step 1: Examine the network requirements.

The addressing for the Network has the following requirements.

- The 172.20.0.0/16 network must be subnetted to provide addresses for the LANs and serial links.
    - The HQ LAN will require 8000 addresses
    - The Branch1 LAN will require 4000 addresses
    - The Branch2 LAN will require 2000 addresses
    - The links between the routers will require two addresses for each link
- The loopback address representing the link between the HQ router and the ISP will use the 10.10.10.0/30 network.

Step 2: Consider the following questions when creating your network design.

How many subnets need to be created from the 172.20.0.0/16 network? ___6____

How many total IP addresses are required from the 172.20.0.0/16 network? ___14006_____

What subnet mask will be used for the HQ LAN subnet? ___255.255.224.0 or /19_____

What is the maximum number of host addresses that could be used on this subnet?
___8190_____

What subnet mask will be used for the Branch1 LAN subnet? ___255.255.240.0 or /20_____

What is the maximum number of host addresses that could be used on this subnet?
___4094_____

What subnet mask will be used for the Branch2 LAN subnet? ___255.255.248.0 or /21_____

What is the maximum number of host addresses that could be used on this subnet?
___2046_____

What subnet mask will be used for the links between the three routers?
___255.255.255.252 or /30_____

What is the maximum number of host addresses that could be used on each of these subnets?
___2_____

Step 3: Assign subnetwork addresses to the Topology Diagram.

1. Assign subnet 0 of the 172.20.0.0/16 network to the HQ LAN subnet. What is the network address of this subnet? ___172.20.0.0/19_____

2. Assign subnet 1 of the 172.20.0.0/16 network to the Branch1 LAN subnet. What is the network address of this subnet? ___172.20.32.0/20_____

3. Assign subnet 2 of the 172.20.0.0/16 network to the Branch2 LAN subnet. What is the network address of this subnet? ___172.20.48.0/21_____

4. Assign subnet 3 of the 172.20.0.0/16 network to the link between the HQ and Branch1 routers. What is the network address of this subnet? ___172.20.56.0 /30_____

5. Assign subnet 4 of the 172.20.0.0/16 network to the link between the HQ and Branch2 routers. What is the network address of this subnet? ___172.20.56.4 /30_____

6. Assign subnet 5 of the 172.20.0.0/16 network to the link between the Branch1 and Branch2 routers. What is the network address of this subnet? ___172.20.56.8 /30_____

Task 2: Determine Interface Addresses.

Assign appropriate addresses to the device interfaces.

1. Assign the first valid host address in the 10.10.10.0/30 network to the Loopback 1 interface on the HQ router.

2. Assign the first valid IP address of the HQ LAN network to the LAN interface of the HQ router.

3. Assign the last valid IP address of the HQ LAN network to PC2.

4. Assign the first valid IP address of the Branch1 LAN network to the LAN interface of the Branch1 router.

5. Assign the last valid IP address of the Branch1 LAN network to PC1.

6. Assign the first valid IP address of the Branch2 LAN network to the LAN interface of the Branch2 router.

7. Assign the last valid IP address of the Branch2 LAN network to PC3.

8. Assign the first valid IP address of the HQ to Branch1 link network to the Serial 0/0/0 interface of the HQ router.

9. Assign the last valid IP address of the HQ to Branch1 link network to the Serial0/0/0 interface of the Branch router.

10. Assign the first valid IP address of the HQ to Branch2 link network to the Serial 0/0/1 interface of the HQ router.

11. Assign the last valid IP address of the HQ to Branch2 link network to the Serial0/0/1 interface of the Branch2 router.

12. Assign the first valid IP address of the Branch1 to Branch2 link network to the Serial 0/0/1 interface of the Branch1 router.

13. Assign the last valid IP address of the Branch1 to Branch2 link network to the Serial0/0/0 interface of the Branch2 router.

Document the addresses to be used in the table provided under the Topology Diagram.

Task 3: Prepare the Network.

Step 1: Cable a network that is similar to the one in the Topology Diagram.

You can use any current router in your lab as long as it has the required interfaces as shown in the topology.

Step 2: Clear any existing configurations on the routers.

Task 4: Perform Basic Router Configurations.

Perform basic configuration of the BRANCH, HQ, and ISP routers according to the following guidelines:

1. Configure the router hostname.

2. Disable DNS lookup.

3. Configure an EXEC mode password.

4. Configure a message-of-the-day banner.

5. Configure a password for console connections.

6. Configure a password for VTY connections.

7. Synchronize unsolicited messages and debug output with solicited output and prompts for the console and virtual terminal lines.

8. Configure an EXEC timeout of 15 minutes.

Task 5: Configure and Activate Serial and Ethernet Addresses.

Step 1: Configure the interfaces on the HQ, Branch1, and Branch2 routers with the IP addresses from the table provided under the Topology Diagram.

When you have finished, be sure to save the running configuration to the NVRAM of the router.

Step 2: Configure the Ethernet interfaces of PC1, PC2, and PC3 with the IP addresses from the table provided under the Topology Diagram.

Step 3: Configure the correct bandwidth for the serial interfaces on the Branch 1 router.

What commands are required to accomplish this?

_____configure terminal_____

_____interface serial0/0/0_____

_____bandwidth 128_____

_____interface serial 0/0/1_____

_____bandwidth 64_____

_____

Step 4: Configure the correct bandwidth for the serial interfaces on the Branch 2 router.

What commands are required to accomplish this?

_____configure terminal_____

_____interface serial0/0/0_____

_____bandwidth 64_____

_____interface serial 0/0/1_____

_____bandwidth 256_____

_____

Step 5: Configure the correct bandwidth for the serial interfaces on the HQ router.

What commands are required to accomplish this?

_____configure terminal_____

_____interface serial0/0/0_____

_____bandwidth 128_____

_____interface serial 0/0/1_____

_____bandwidth 256_____

_____

Task 6: Verify Connectivity to Next Hop Device.

You should NOT have connectivity between end devices yet. However, you can test connectivity between two routers and between and end device and its default gateway.

Step 1: Verify that the HQ, Branch1, and Branch2 routers can ping each of the neighboring routers across the WAN links.

Step 2: Verify that PC1, PC2, and PC3 can ping their respective default gateway.

Task 7: Configure OSPF Routing on the Branch1 Router.

Step 1: Consider the networks that need to be included in the OSPF updates that are sent out by the Branch1 router.

What directly connected networks are present in the Branch1 routing table?
_____ 172.20.32.0/20_____

_____ 172.20.56.0/30_____

_____172.20.56.8/30_____

What commands are required to enable OSPF and include the connected networks in the routing updates?
_____router ospf 1_____

_____network 172.20.32.0 0.0.15.255 area 0_____

_____network 172.20.56.0 0.0.0.3 area 0_____

_____network 172.20.56.8 0.0.0.3 area 0_____

_____

Are there any router interfaces that do not need to have OSPF updates sent out? _____Yes_____

What command is used to disable OSPF updates on these interfaces?

_____passive-interface FastEthernet0/0_____

Task 8: Configure OSPF and Static Routing on the HQ Router.

Step 1: Consider the type of static routing that is needed on HQ.

A static default route will need to be configured to send all packets with destination addresses that are not in the routing table to the loopback address representing the link between the HQ router and the ISP. What command is needed to accomplish this?

_____ip route 0.0.0.0 0.0.0.0 loopback1_____

What directly connected networks are present in the HQ routing table?

_____ 10.10.10.0/30_____

_____ 172.20.0.0/19_____

_____ 172.20.56.0/30_____

_____ 172.20.56.4/30_____

_____

Will the networks of the HQ LAN and the links between the Branch 1 and Branch2 routers need to have the subnet mask information included in the network statements? ___yes_____

What commands are required to enable OSPF and include the appropriate networks in the routing updates?

_____router ospf 1_____

_____network 172.20.0.0 0.0.31.255 area 0_____

_____network 172.20.56.0 0.0.0.3 area 0_____

_____network 172.20.56.4 0.0.0.3 area 0_____

_____

Are there any router interfaces that do not need to have OSPF updates sent out? _____Yes_____

What command is used to disable OSPF updates on these interfaces?

_____passive-interface FastEthernet0/0_____

_____passive-interface Loopback1_____

The HQ router needs to send the default route information to the Branch1 and Branch2 routers in the OSPF updates. What command is used to configure this?

_____ default-information originate_____

Task 9: Configure OSPF Routing on the Branch2 Router.

Step 1: Consider the networks that need to be included in the OSPF updates that are sent out by the Branch2 router.

What directly connected networks are present in the Branch2 routing table?
_____172.20.48.0/21_____

_____172.20.56.4/30_____

_____172.20.56.8/30_____

What commands are required to enable OSPF and include the connected networks in the routing updates?

_____router ospf 1_____

_____network 172.20.48.0 0.0.7.255 area 0_____

_____network 172.20.56.4 0.0.0.3 area 0_____

_____network 172.20.56.8 0.0.0.3 area 0_____

_____

Are there any router interfaces that do not need to have OSPF updates sent out? _____Yes____

What command is used to disable OSPF updates on these interfaces?

_____passive-interface FastEthernet0/0_____

Task 10: Verify the Configurations

Answer the following questions to verify that the network is operating as expected.

From PC1, is it possible to ping PC2? _____Yes_____

From PC1, is it possible to ping the PC3? _____Yes_____

The answer to the above questions should be 'yes'. If any of the above pings failed, check your physical connections and configurations. Refer to your basic troubleshooting techniques used in the [Chapter 1] labs.

What OSPF routes are present in the routing table of the Branch1 router?

_____172.20.0.0/19 [110/782] via 172.20.56.1_____

_____172.20.48.0/21 [110/1172] via 172.20.56.1_____

_____172.20.56.4/30 [110/1171] via 172.20.56.1_____

_____0.0.0.0/0 [110/1] via 172.20.56.1_____

_____

What is the gateway of last resort in the routing table of the Branch1 router?

_____172.20.56.1 to network 0.0.0.0_____

What OSPF routes are present in the routing table of the HQ router?

_____172.20.32.0/20 [110/782] via 172.20.56.2_____

_____172.20.48.0/21 [110/391] via 172.20.56.6_____

_____172.20.56.8/30 [110/1952] via 172.20.56.6_____

_____0.0.0.0/0 [110/1] via 172.20.56.1_____

_____

What is the gateway of last resort in the routing table of the HQ router?

_____0.0.0.0 to network 0.0.0.0_____

What OSPF routes are present in the routing table of the Branch2 router?

_____172.20.0.0/19 [110/391] via 172.20.56.5_____

_____172.20.32.0/20 [110/1172] via 172.20.56.5_____

_____172.20.56.0/30 [110/1171] via 172.20.56.5_____

_____0.0.0.0/0 [110/1] via 172.20.56.5_____

_____

What is the gateway of last resort in the routing table of the Branch2 router?

_____172.20.56.5 to network 0.0.0.0_____

Task 11: Reflection

On PC1, use the **tracert** command to examine the route that is used between PC1 and PC3.

What are the hops in the route to PC3?

_____172.20.32.1, the FastEthernet0/0 interface of the Branch 1 router._____

_____172.20.56.1, the Serial0/0/0 interface of the HQ router._____

_____172.20.56.6, the Serial0/0/1 interface of the Branch 2 router._____

_____172.20.55.254, the IP address of PC3._____

Is this the least number of hops that can be used to reach PC3? _____No_____

If the answer is no, why is a path with more than the minimum amount of hops used?

_____

_____

_____

_____

_____

_____

The serial connection between the Branch1 and HQ routers and the connection between the HQ and Branch 2 routers have a higher bandwidth that the link between the Branch 1 and Branch 2 routers. Routes with higher bandwidth values have a lower calculated cost. The route with the lowest cost is chosen as the route to the Branch 2 LAN.

Task 12: Documentation

On each router, capture the following command output to a text (.txt) file and save for future reference.

- **show running-config**
- **show ip route**
- **show ip interface brief**
- **show ip protocols**

If you need to review the procedures for capturing command output, refer to Lab 1.5.1

Task 13: Clean Up

Erase the configurations and reload the routers. Disconnect and store the cabling. For PC hosts that are normally connected to other networks (such as the school LAN or to the Internet), reconnect the appropriate cabling and restore the TCP/IP settings.