Configuration Labs

Part 1: Router Configuration

Lab 4: Configuring OSPF Routing—Solutions

Objective

The overall objective of this laboratory exercise is to gain experience with configuring Open Shortest Path First (OSPF) routing between two routers using the Cisco 640-802 Network Simulator. In this lab, you will gain an introductory understanding of the following:

- Configuring the computer's IP address
- Configuring the gateway address
- Configuring the IP addresses for the router interfaces
- Configuring OSPF routing
- Troubleshooting configuration problems

Topology

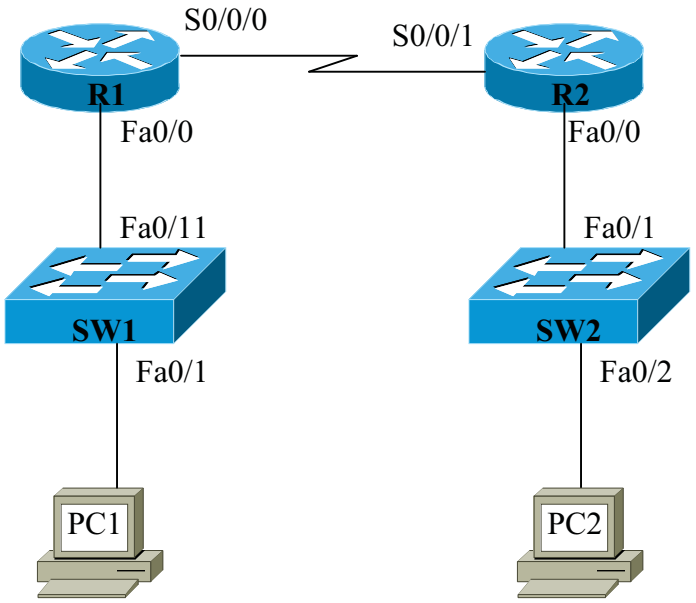

Figure 1 Network Topology for This Lab

Reference

The following simulator exercises provided with the CCNA 640-802 Network Simulator should be reviewed prior to starting this virtual laboratory exercise:

- OSPF Configuration I, II, and III
- OSPF Serial Configuration I–VI
- OSPF Router ID I, II
- OSPF Neighbors I–V

Key Concepts

The following concepts, terms, commands, and steps should have been mastered in this laboratory exercise:

- How to configure the IP address, subnet mask, and default gateway for the computers in your LAN.
- How the gateway address for your LAN router is configured.
- The steps for configuring the host name for your router.
- The steps for configuring the router interface's IP addresses and subnet masks.
- The commands for configuring OSPF routing from LAN-A to LAN-B.
- The two commands that can be used to verify that the routes are configured on the router.
- Using computers in your LAN to ping the computers in the adjacent LAN.
- Use the proper command to trace the route from a PC in LAN-A to the host in the connected LAN-B.
- Use the command to establish a Telnet connection to your router, and find out how to enable a Telnet connection to the router.
- The router command that displays the network routes stored in your router's routing table.
- The command used to save your router configuration to NVRAM.
- The command used to verify the routing protocol being used.
- The command that displays only the OSPF routes.
- The purpose of wildcard bits or inverse mask bits.

Reference Tables

Table 1 provides the IP addresses and masks of all necessary interfaces used to complete the lab.

Table 1 Computer IP Addresses, Subnet Masks, and Gateway Addresses for Lab 4

Computer/Interface - R1	IP Address	Subnet Mask	Gateway Address
PC1	172.20.15.8	255.255.255.224	172.20.15.1
R1-Fa0/0	172.20.15.1	255.255.255.224	—
R1-S0/0/0	10.10.1.1	255.255.255.252	—
Computer/Interface – R2	**IP Address**	**Subnet Mask**	**Gateway Address**
PC2	192.168.25.21	255.255.255.224	192.168.25.16
R2-Fa0/0	192.168.25.16	255.255.255.224	—
R2-S0/0/1	10.10.1.2	255.255.255.252	—

Detailed Lab Steps

Task 1

In this lab, you are configuring OSPF to the adjacent LAN for the network shown in Figure 1. You will be required to verify that computers in your LAN can ping the neighbor LAN. Note that a serial interface is being used to interconnect the LANs. You are configuring routing for both 172.20.15.0 and 192.168.25.0 networks. A subnet mask of 255.255.255.224 is being used. Use 56000 for the clock rate on the serial link (DCE interface). Use a subnet mask of 255.255.255.252 on the serial link connecting the two routers.

Step 1. Configure the gateway address for FastEthernet 0/0 and the serial s0/0/0 interfaces on Router R1. You also need to configure the IP address and the gateway address for PC-1. Use the IP address and subnet mask specified in Table 1. You will need to enable each interface and set the clock rate on the serial interface to 56000. List the router prompts and commands used to configure the interfaces.

```
R1# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)# interface fastEthernet 0/0
R1(config-if)# ip address 172.20.15.1 255.255.255.224
R1(config-if)# no shut
R1(config-if)#

R1# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)# interface serial 0/0/0
R1(config-if)# ip address 10.10.1.1 255.255.255.252
R1(config-if)# clock rate 56000
R1(config-if)# no shut
R1(config-if)#

C:\> ip address 172.20.15.8 255.255.255.224
C:\> gateway 172.20.15.1
```

Step 2. Configure the gateway address for FastEthernet 0/0 and the serial s0/0/1 interfaces on Router R2. Use the IP addresses and subnet masks specified in Table 1. Enable each interface and list the router prompts and commands used to configure the interfaces.

```
R2# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)# interface fastEthernet 0/0
R2(config-if)# ip address  192.168.25.16 255.255.255.224
R2(config-if)# no shut
R2(config-if)#

R2# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)# interface serial 0/0/1
R2(config-if)# ip address 10.10.1.2 255.255.255.252
R2(config-if)# no shut
R2(config-if)#
```

Step 3. Configure the host name for your routers. R1 should be renamed LAN-A, and R2 should be renamed LAN-B. List the router prompts and commands used to configure the router's host name.

```
R1# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)# hostname LAN-A
LAN-A(config)#

R2# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)# hostname LAN-B
LAN-B(config)#
```

Step 4. The proper commands to verify that the interfaces on the LAN-A and LAN-B routers have been properly configured. List the router prompts and commands used to configure the router's host name.

```
LAN-A# show ip interface brief
Interface          IP-Address     OK? METHOD   Status                  Protocol
FastEthernet0/0    172.20.15.1    YES manual   up                      up
FastEthernet0/1    unassigned     YES NVRAM    administratively down   down
Serial0/0/0        10.10.1.1      YES manual   up                      up
Serial0/0/1        unassigned     YES NVRAM    administratively down   down

LAN-B# show ip interface brief
Interface          IP-Address     OK? METHOD   Status                  Protocol
FastEthernet0/0    192.168.25.16  YES manual   up                      up
FastEthernet0/1    unassigned     YES NVRAM    administratively down   down
Serial0/0/0        unassigned     YES NVRAM    administratively down   down
Serial0/0/1        10.10.1.2      YES manual   up                      up
LAN-B#
```

Step 5. Configure OSPF routing between the LAN-A and LAN-B routers using a process ID of 100 and an area of 0. Use two commands to verify that the routes are configured. List the router prompts and commands used to configure the LAN-A and LAN-B routers.

```
LAN-A# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
LAN-A(config)# router ospf 100
LAN-A(config-router)# network 172.20.15.0 0.0.0.255 area 0
LAN-A(config-router)#

LAN-A# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
LAN-A(config)# router ospf 100
LAN-A(config-router)# network 10.10.1.0 0.0.0.255 area 0
LAN-A(config-router)#

LAN-B# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
LAN-B(config)# router ospf 100
LAN-B(config-router)# network 192.168.25.0 0.0.0.255 area 0
LAN-B(config-router)#

LAN-B# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
LAN-B(config)# router ospf 100
LAN-B(config-router)# network 10.10.1.0 0.0.0.255 area 0
LAN-B(config-router)#
```

Step 6. Use the proper commands to display the routing table for both the LAN-A and LAN-B routers. Are all the possible network routes displayed? List the router prompts and commands used to display the routes.

Yes, routing for the 10.10.1.0, 172.20.15.0, and 192.168.25.0 are available.

```
LAN-A# show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       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

     10.0.0.0/30 is subnetted, 1 subnets
C       10.10.1.0 is directly connected, Serial2/0
     172.20.0.0/27 is subnetted, 1 subnets
C       172.20.15.0 is directly connected, FastEthernet0/0
     192.168.25.0/27 is subnetted, 1 subnets
O       192.168.25.0 [110/782] via 10.10.1.2, 00:09:45, Serial2/0
LAN-A#
```

```
LAN-B# show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       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

     10.0.0.0/30 is subnetted, 1 subnets
C       10.10.1.0 is directly connected, Serial2/0
     172.20.0.0/27 is subnetted, 1 subnets
O       172.20.15.0 [110/782] via 10.10.1.1, 00:12:05, Serial2/0
     192.168.25.0/27 is subnetted, 1 subnets
C       192.168.25.0 is directly connected, FastEthernet0/0
LAN-B#
```

Step 7. Use the computers in each LAN to ping the computers in the adjacent LAN. List the commands used to ping the computer in the adjacent LAN.

LAN-A COMPUTER

```
PC> ping 192.168.25.16

Pinging 192.168.25.16 with 32 bytes of data:

Reply from 192.168.25.16: bytes=32 time=63ms TTL=254
Reply from 192.168.25.16: bytes=32 time=63ms TTL=254
Reply from 192.168.25.16: bytes=32 time=62ms TTL=254
Reply from 192.168.25.16: bytes=32 time=62ms TTL=254

Ping statistics for 192.168.25.16:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 62ms, Maximum = 63ms, Average = 62ms
```

LAN-B COMPUTER

```
PC> ping 172.20.15.1

Pinging 172.20.15.1 with 32 bytes of data:

Reply from 172.20.15.1: bytes=32 time=94ms TTL=254
Reply from 172.20.15.1: bytes=32 time=47ms TTL=254
Reply from 172.20.15.1: bytes=32 time=63ms TTL=254
Reply from 172.20.15.1: bytes=32 time=62ms TTL=254

Ping statistics for 172.20.15.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 47ms, Maximum = 94ms, Average = 66ms
```

Step 8. Use the proper command to trace the route from the PC in LAN-A to the PC in LAN-B. Your trace should pass through two routers. List the command used and record the trace information. How may hops did you record?

```
PC> tracert 192.168.25.21
Tracing route to 192.168.25.21 over a maximum of 30 hops:
  1    31 ms     32 ms     31 ms     172.20.15.1
  2    62 ms     63 ms     63 ms     10.10.1.2
  3    94 ms     94 ms     94 ms     192.168.25.21
Trace complete.
```

The trace passes through two router hops.

Step 9. Use the command to make a Telnet connection from the LAN-A router to the LAN-B router. Set the VTY password to ciscopress and enable remote login. Were you able to enter the privileged EXEC mode on the LAN-B router? Correct this problem if you can't enter the privileged EXEC mode on the LAN-B router. What did you have to do to correct the problem? List the commands used to establish the Telnet connection. What IP address did you use?

```
LAN-B(config)# line vty 0 4
LAN-B(config-line)# password ciscopress
LAN-B(config-line)# login
LAN-B(config-line)#

LAN-A# telnet 192.168.25.16
Trying 192.168.25.16 ...Open
User Access Verification
Password:
LAN-B>en
 % Error in authentication.
LAN-B>
```

Not able to enter the privileged EXEC mode. The enable secret needs to be set on the LAN-B router.

```
LAN-B(config)# enable secret ciscopress
```

Step 10. Use the command to save your router configuration to the startup configuration. What command did you use? Use the proper command to verify that the configuration has been saved to NVRAM. List the command prompts and the commands used.

```
LAN-B# copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
LAN-B#

LAN-A# copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
LAN-B#
```

This command is used to view the startup configuration:

```
LAN-B# show startup-config
```

Step 11. What is the command that is used to verify the routing protocol that is being used? List the command prompts and the commands used. Note that two commands can be used.

```
LAN-A# show ip protocols

Routing Protocol is "ospf 100"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 172.20.15.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    172.20.15.0 0.0.0.255 area 0
    192.168.25.0 0.0.0.255 area 0
    10.10.1.0 0.0.0.255 area 0
  Routing Information Sources:
    Gateway         Distance      Last Update
    10.10.1.2            110      00:10:30
  Distance: (default is 110)
```

The **show running-config** command can also be used. This displays the following regarding the routing protocol:

```
LAN-A# show running-config
!
!
router ospf 100
 log-adjacency-changes
 network 172.20.15.0 0.0.0.255 area 0
 network 192.168.25.0 0.0.0.255 area 0
 network 10.10.1.0 0.0.0.255 area 0
```

Task 2

Answer the following questions regarding the Cisco IOS:

1. The command prompt changes on a Cisco router to reflect the current state the router is in. Define what each command prompt listed below represents:

   a. Router>

   This is the prompt for the user EXEC mode.

   b. Router#

   This is the prompt for the privileged EXEC mode.

   c. Router(config)#

   This is the prompt for the global configuration mode.

d. Router(config-if)#

This prompt indicates that you are in interface configuration mode.

e. Router(config-router)#

This prompt indicates that you are in routing protocol configuration mode.

f. Router(config-line)#

This prompt indicates that you are in line configuration mode.

2. Cisco IOS provides support for many editing functions in terms of "hot keys." A few of the functions are listed below. Briefly describe these functions.

a. Delete

Erases one character to the right of the cursor.

b. Backspace

Erases one character to the left of the cursor.

c. Tab

Finishes a partially entered command.

d. Ctrl-Z

Returns to the privileged EXEC mode

Task 3: Configuration List

The following is a partial list of the items you might see when you issue the **show running-configuration [sh run]** command. Your task is to define each item and its purpose. You might need to go to the Cisco website (http://www.cisco.com) and look up what each of these commands means.

1. **ip cef**

Enables Cisco Express Forwarding (CEF).

2. **no ip domain lookup**

Disables the IP Domain Naming System.

3. **log-adjacency-changes**

Configures the router to send a syslog message when an OSPF neighbor goes up or down.

4. **control-plane**

Used to enter control plane configuration mode.

5. **scheduler allocate 20000 1000**

Used to guarantee CPU time for processes, [interrupt-time] [process-time], each expressed in microseconds.

6. **description <—->**

Used to enter a description for the interface.

Answer the following router questions:

1. What command is used to determine the version of the Cisco IOS?

   router# **show version**

2. What version of IOS is running on the LAN-A router?

   Version 12.4(7h)

3. What command is used to display the routing protocols configured on your router?

   router# **show ip protocols**

4. What information is displayed when the **show start** command is entered?

   This displays the startup configuration.

5. What router command is used to determine whether your serial interface is DTE or DCE?

   router# **show controllers serial 0/0/0**

6. What is the command for setting the clock rate on a router's DCE serial interface to 56000?

   router(config-if)# **clock rate 56000**

7. How long has it been since your router was last rebooted? Indicate how the system was restarted. Note: There is a Cisco command that provides this information. Cisco calls this the router uptime. The same command also specifies how the system was restarted.

   This information is displayed as the router uptime using the **router# show version** command. The system was started by "power-on."