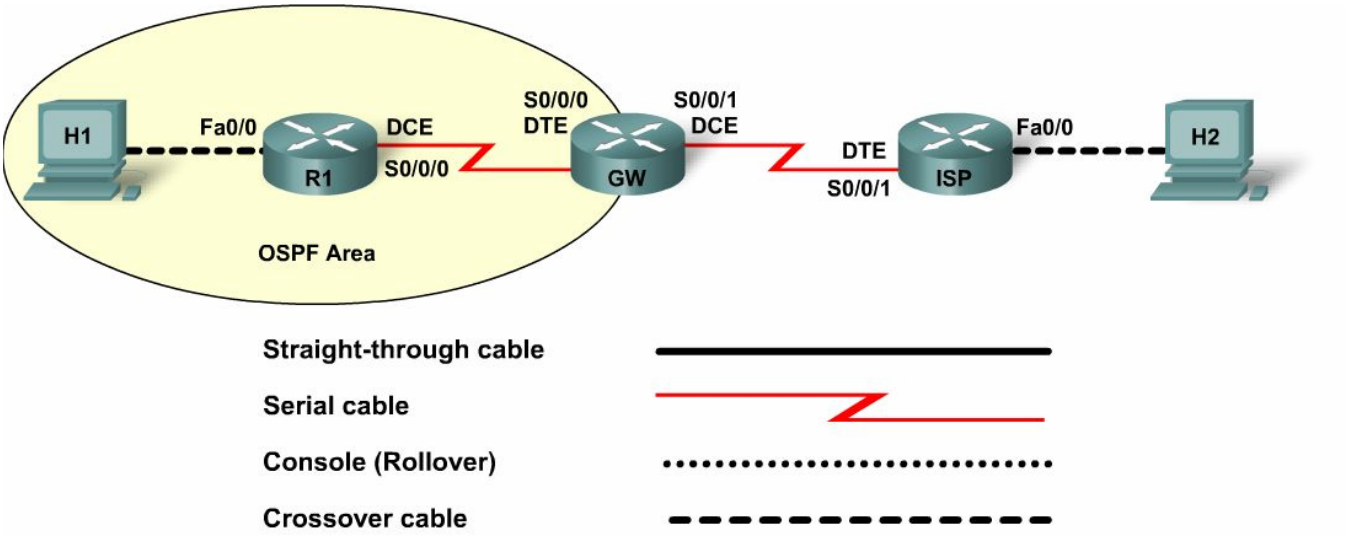
Lab 9.3.4 Troubleshooting OSPF Default Route Redistribution



Device	Host Name	Fast Ethernet 0/0 Interface IP Address	Serial 0/0/0 IP Address	Serial 0/0/1 IP Address	Enable Secret Password	Enable, VTY, and Console Password
Router 1	R1	192.168.1.1/24	192.168.5.1/30		class	cisco
Router 2	GW		192.168.5.2/30	172.16.1.1/30	class	cisco
Router 3	ISP	10.0.1.1/24		172.16.1.2/30	class	cisco
Host 1	H1	192.168.1.5/24 GW=192.168.1.1				
Host 2	H2	10.0.1.10/24 GW=10.0.1.1				

Objectives

- Set up network as shown in the topology diagram.
- Configure and verify single-area OSPF routing.
- Configure OSPF default route redistribution.
- Use IOS commands to troubleshoot and verify route redistribution.

Background / Preparation

Cable a network similar to the one shown in the topology diagram. Any router that meets the interface requirements displayed in the diagram may be used. For example, router series 800, 1600, 1700, 1800, 2500, 2600, 2800, or any combination can be used.

The information in this lab applies to the 1841 router. Other routers may be used; however, the command syntax given in the lab may vary. Depending on the router model, the interfaces may differ. For example, the interfaces may differ due to the router model. On some routers Serial 0 may be Serial 0/0 or Serial 0/0/0 and Ethernet 0 may be FastEthernet 0/0.

The following resources are required:

- Three Cisco routers, two with a serial connection and an Ethernet interface, and one with two serial interfaces
- Two Windows-based PCs with a terminal emulation program set up as a host
- At least one RJ-45-to-DB-9 connector console cable to configure the routers
- Two crossover Ethernet cables
- Two DTE/DCE serial cables

NOTE: Make sure that the routers and the switches have been erased and have no startup configurations. Instructions for erasing both switch and router are provided in the Lab Manual, located on Academy Connection in the Tools section.

NOTE: SDM Enabled Routers – If the startup-config is erased in an SDM enabled router, SDM will no longer come up by default when the router is restarted. It will be necessary to build a basic router configuration using IOS commands. The steps provided in this lab use IOS commands and do not require the use of SDM. If you wish to use SDM, refer to the instructions in the Lab Manual, located on the Academy Connection in the Tools section or contact your instructor if necessary.

Step 1: Connect the equipment

a. Cable the network as shown in the topology diagram.

b. Connect Host 1 to the console port of Router 1 using a console cable to perform configurations.

Step 2: Perform basic configuration on Router 1

Configure Router 1 with a hostname, assign IP addresses to interfaces, assign privileged passwords, and configure for secure console and Telnet access according to the addressing table and topology diagram. Configure OSPF to advertise networks between routers. Save the configuration. This router will serve as an internal router to the network.

Step 3: Perform basic configuration on Router 2

a. Perform basic configuration on Router 2 with a hostname, assign IP addresses to interfaces, assign privileged passwords, and configure for secure console and Telnet access according to the addressing table and topology diagram. Configure OSPF to advertise networks between routers 1 and 2. Save the configuration. This router will serve as the router connecting the network to the ISP.

b. On the GW router, issue the **show ip route** command. There should be one OSPF-advertised route (one 0 route) in the routing table. Troubleshoot configurations and/or cabling as necessary until the route appears.

Step 4: Perform basic configuration on Router 3

Perform basic configuration on Router 3 with a hostname, assign IP addresses to interfaces, assign privileged passwords, and configure for secure console and Telnet access according to the addressing table and topology diagram. OSPF will not be configured on this router. Save the configuration. This router will serve as the ISP side router.

Step 5: Configure the hosts with IP address, subnet mask, and default gateway

a. Configure Host 1 and Host 2 with the proper IP address, subnet mask, and default gateway.

   1) Host 1 should be assigned 192.168.1.5 /24 and the default gateway of 192.168.1.1.

   2) Host 2 should be assigned 10.0.1.10 /24 and the default gateway of 10.0.1.1.

b. Each host should be able to ping its default gateway. If the ping is not successful, troubleshoot as necessary. Check and verify that the workstation has been assigned a specific IP address and default gateway.

Step 6: Configure default routing

In this scenario, the devices will have the following functions:

- Router 1 (R1) will be an internal enterprise network router.
- Router 2 (GW) is to serve as the gateway router connecting the network to the ISP.
- Router 3 (ISP) represents the ISP side of the Internet connection.
- Host 1 represents an internal network host.
- Host 2 (or loopback interface) connected to Router 3 represents a resource on the Internet.

This enterprise network is single-homed, meaning that it only has one connection to the Internet. Therefore, there is no need to run a routing protocol between the enterprise network and the ISP. Static routing will be used here.

After a default route to the ISP has been created on the GW router, it is desired to redistribute that default route into the rest of the enterprise network rather than configuring default routes on all enterprise routers.

a. Create a static route on the ISP router to the enterprise network.

```
ISP(config)#ip route 192.168.1.0 255.255.255.0 172.16.1.1
```

b. Create a default route on the GW router to the ISP router.

```
GW(config)#ip route 0.0.0.0 0.0.0.0 172.16.1.2
```

c. Use the **show ip route** command on the GW router to observe the result from configuring the default route.

```
GW#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, su - IS-IS summary, 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 172.16.1.2 to network 0.0.0.0

     172.16.0.0/30 is subnetted, 1 subnets
```



```
C       172.16.1.0 is directly connected, Serial0/0/1
     192.168.5.0/30 is subnetted, 1 subnets
C       192.168.5.0 is directly connected, Serial0/0/0
O    192.168.1.0/24 [110/782] via 192.168.5.1, 00:13:39, Serial0/0/0
S*   0.0.0.0/0 [1/0] via 172.16.1.2
GW#
```

The output of the **show ip route** command should indicate that a gateway of last resort has been identified.

d. Test the functionality by pinging from the GW router to Host 2.

Was the ping successful? _____

e. Test the current overall connectivity by pinging from Host 1 to Host 2.

Was the ping successful? _____

Explain the results.

_____

f. The OSPF process does not automatically propagate the default route into the OSPF routing domain. Router R2 must be configured to redistribute the default route into the OSPF routing process. This can be done with the **redistribute static** command or with the **default-information originate** command. The **redistribute static** option must be considered carefully because, by default, it redistributes all static routes configured into the OSPF domain. This may or may not be desirable in a given scenario. In this scenario, use the **default-information originate** option.

```
GW(config-router)#default-information originate
```

g. Test the functionality by pinging from Host 1 to Host 2.

Was the ping successful? _____

h. Use the **show ip route** command on router R1 to observe the default route.

```
R1#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, su - IS-IS summary, 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 192.168.5.2 to network 0.0.0.0
     192.168.5.0/30 is subnetted, 1 subnets
C       192.168.5.0 is directly connected, Serial0/0/0
C    192.168.1.0/24 is directly connected, FastEthernet0/0
O*E2 0.0.0.0/0 [110/1] via 192.168.5.2, 00:02:56, Serial0/0/0
```

The output displays the default routing information. What type of OSPF route was generated on Router 1? _____

What type of OSPF router did Router 2 become? _____

Step 7: Troubleshooting default routing

Default routing is susceptible to many of the same issues that can cause problems with any OSPF route propagation. In this lab, some typical problems will be injected, and troubleshooting methods will be explored.

Router GW has been configured with a default route. Even though it is a default route, the same reachability rules apply that apply to any route.

a. Shut down the S0/0/1 interface on Router ISP and observe the routing table on Router R1.

```
R1#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, su - IS-IS summary, 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
     192.168.5.0/30 is subnetted, 1 subnets
C       192.168.5.0 is directly connected, Serial0/0/0
C    192.168.1.0/24 is directly connected, FastEthernet0/0
```

b. Observe that the default route is no longer present. Whenever a configuration like the one used in this lab is present and a default route is not appearing, first check whether other routers are also not receiving the default route. If multiple routers are not receiving the default route, go to the source of the default route – the GW router in this lab – and begin troubleshooting there. First, check the routing table on the GW router.

```
GW#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, su - IS-IS summary, 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
     192.168.5.0/30 is subnetted, 1 subnets
C       192.168.5.0 is directly connected, Serial0/0/0
O    192.168.1.0/24 [110/782] via 192.168.5.1, 00:23:27, Serial0/0/0
```

Because the default route does not appear in the routing table of the GW router, it cannot be advertised to other routers.

c. Troubleshooting becomes more difficult when the GW router is configured to always send the default routing information. Configure this option on the GW router now.

```
GW(config-router)#default-information originate always
```

d. Recheck the routing table on Router 1.

Is the default route present? _____

e. Attempt to ping from Host 1 to Host 2.

Was the ping successful? _____

In this case, using **tracert** from a host on the network would provide better information about how far the pings are going. From H1 use **tracert** to H2.

C:\>**tracert 10.0.1.10**

You should see that the trace gets to the GW router (192.168.5.2).

f. Display the routing table on router GW.

```
GW#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, su - IS-IS summary, 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
     192.168.5.0/30 is subnetted, 1 subnets
C       192.168.5.0 is directly connected, Serial0/0/0
O    192.168.1.0/24 [110/782] via 192.168.5.1, 00:59:29, Serial0/0/0
```

The oddity in this situation is that the default route does not appear on router GW but it is being advertised to router R1.

g. On router ISP, turn the S0/0/1 interface back up.

Other problems with default route advertisements are often due to typical OSPF communication issues. Next, you will inject some OSPF faults and observe the commands used to determine the faults.

h. On router GW, remove the current **network** statement and replace it with:

```
GW(config-router)#network 192.168.5.0 0.0.0.3 area 1
```

i. On R1, enter the **show ip ospf neighbor** command.

Do any neighbors appear? _____

If any neighbors appear, wait until the Dead Time drops to 00:00:00 and reissue the command.

j. Knowing that OSPF has been configured on both routers, enter the **debug ip ospf events** command on R1 and observe the output.

```
R1#debug ip ospf events
*Mar  1 02:14:44.807: OSPF: Send hello to 224.0.0.5 area 0 on
FastEthernet0/0 from 192.168.1.1
*Mar  1 02:14:46.963: OSPF: Send hello to 224.0.0.5 area 0 on
Serial0/0/0 from 192.168.5.1
*Mar  1 02:14:52.743: OSPF: Rcv pkt from 192.168.5.2, Serial0/0/0, area
0.0.0.0
      mismatch area 0.0.0.1 in the header
```

In the event output, OSPF hellos are being sent and received. The packet received from router GW indicates the mismatched area. This mismatched area prevents the neighbor relationship from forming.

k. Replace the **network** statement on router GW with the correct one. After a brief delay, a console message should appear indicating that the neighbor relationship was re-established.

l. Verify this neighbor relationship with the **show ip ospf neighbor** command.

m. On Router 1, remove the **network** statement for the 192.168.5.0 network.

The output of the **debug ip ospf events** command is still helpful in this situation. In this case, the hint is in what is *not* appearing versus what *is* appearing. Notice that there is never an indication of a hello being sent out the Serial 0/0/0 interface.

n. On Router 1, enter the **show ip ospf interface** command. The output will be similar to this:

```
R1#show ip ospf interface
FastEthernet0/0 is up, line protocol is up
  Internet Address 192.168.1.1/24, Area 0
  Process ID 1, Router ID 192.168.5.1, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 192.168.5.1, Interface address 192.168.1.1
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:05
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 0, maximum is 0
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
```

The Fa0/0 interface information appears in the output but not the S0/0/0 interface information. This absence of information indicates that the S0/0/0 interface has not been configured to participate in the OSPF process.

o. Place the **network** statement for the 192.168.5.0 network back into the OSPF routing process, and then shut down the S0/0/0 interface.

p. On Router 1, enter the **show ip ospf interface** command.

```
R1#show ip ospf interface
Serial0/0/0 is administratively down, line protocol is down
  Internet Address 192.168.5.1/30, Area 0
  Process ID 1, Router ID 192.168.5.1, Network Type POINT_TO_POINT,
Cost: 64
  Transmit Delay is 1 sec, State DOWN,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
FastEthernet0/0 is up, line protocol is up
  Internet Address 192.168.1.1/24, Area 0
  Process ID 1, Router ID 192.168.5.1, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 192.168.5.1, Interface address 192.168.1.1
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:08
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 0, maximum is 0
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
```

Even though the serial interface is shut down, it still appears in the command output. This means that the **show ip ospf interface** command is showing the *configured* interfaces, not just the *active* interfaces.

Step 8: Reflection

a. Can a default route be advertised by an OSPF router that does not have the next hop in its routing table?

_____

b. List three things that can cause OSPF default route propagation to fail?

_____

_____

_____

c. What type of OSPF router does a router that injects a default route into the OSPF process become?

_____

_____

d. What is an advantage and a disadvantage of using the **`default-information originate`** command over configuring default routes on all routers?

_____

_____

_____

_____