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Tutorials

How to configure Open Shortest Path First (OSPF) Protocol

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If you are not familiar with Open Shortest Path First (OSPF) Protocol click the following link to view an [introduction to Open Shortest Path First \(OSPF\) Protocol](#).

Open Shortest Path First (OSPF) Protocol Configuration

```
Router(config)# router ospf process_ID
```

```
Router(config-router)# network network_id wildcard_mask area area_#
```

Note:

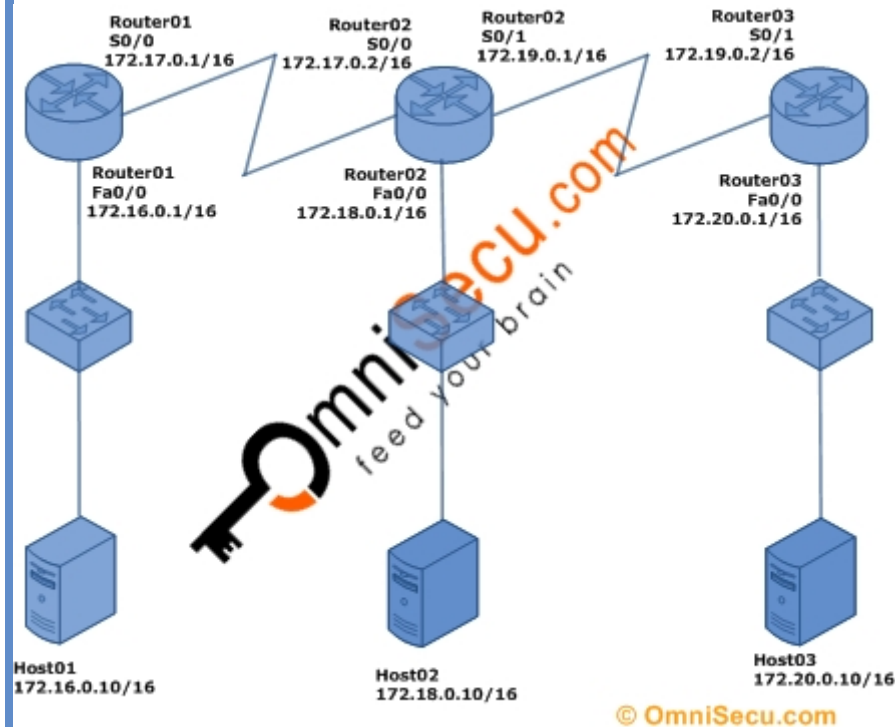
Process id: A value in the range 1–65,535 identifies the OSPF Process ID. OSPF Process ID is a unique number on this router that groups a series of OSPF configuration commands under a specific running process.

Wildcard Mask: The wildcard mask (wildcard_mask) given above is the inverse mask of the subnet mask. A 0 octet in the wildcard mask indicates that the corresponding octet in the network must match exactly. On the other hand, a 255 indicates that you don't care what the corresponding octet is in the network number. A network and wildcard mask combination of 192.168.10.0 0.0.0.0 would match 192.168.10.0 only, and nothing else.

Area Number: The area_# given above is the Area Number. Area Number can always be zero (0) for small networks, but for larger networks, the Area Number need to be properly planned as all routing updates must traverse Area 0.

Open Shortest Path First (OSPF) Protocol - Lab Practice

The following diagram shows our lab setup. We have three routers, three switches and three hosts connected as below. The host names, IP addresses and the interfaces of the routers are shown in diagram. The IP addresses of the hosts are also shown in the diagram.



If you are not familiar with a router console connection, click the following link to learn [how to connect the serial port of your computer to router console port](#).

Click the following link to learn [how to connect to the console port of the router if there is no serial port in your computer](#).

Click the following links to learn how to use [HyperTerminal terminal emulator](#) and [PuTTY terminal emulator](#) to configure router.

Hostname and IP address configuration in Router01

Connect to Router01 console and use the following IOS commands to configure host name as Router01.

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname Router01
Router01(config)#
```

Use the following IOS commands to open the fast ethernet interface Fa0/0 configuration mode on Router01 and configure IP address as 172.16.0.1/16.

```
Router01>enable
Router01#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router01(config)#interface fa0/0
Router01(config-if)#ip address 172.16.0.1 255.255.0.0
Router01(config-if)#no shutdown
```

Use the following IOS commands to open the serial interface S0/0 configuration mode on Router01 and configure IP address as 172.17.0.1/16. You have to **set a clock rate** also using the "clock rate" command on S0/0 interface, since this is the DCE side.

```
Router01>enable
Router01#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router01(config)#interface s0/0
Router01(config-if)#clock rate 64000
Router01(config-if)#ip address 172.17.0.1 255.255.0.0
Router01(config-if)#no shutdown
```

Do remember to run the "**copy running-config startup-config**" command from enable mode, if you want to save the changes you have made in the router.

Hostname and IP address configuration in Router02

Connect to Router02 console and use the following IOS commands to configure host name as Router02.

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname Router02
Router02(config)#
```

Use the following IOS commands to open the fast ethernet interface Fa0/0 configuration mode on Router02 and configure IP address as 172.18.0.1/16.

```
Router02>enable
Router02#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router02(config)#interface fa0/0
Router02(config-if)#ip address 172.18.0.1 255.255.0.0
Router02(config-if)#no shutdown
```

Use the following IOS commands to open the serial interface S0/0 configuration mode on Router02 and configure IP address as 172.17.0.2/16.

```
Router02>enable
Router02#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router02(config)#interface s0/0
Router02(config-if)#ip address 172.17.0.2 255.255.0.0
Router02(config-if)#no shutdown
```

Use the following IOS commands to open the serial interface S0/1 configuration mode on Router02 and configure IP address as 172.19.0.1/16. You have to **set a clock rate** also using the "clock rate" command on S0/1 interface, since this is the DCE side.

```
Router02>enable
Router02#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router02(config)#interface s0/1
Router02(config-if)#clock rate 64000
```

```
Router02(config-if)#ip address 172.19.0.1 255.255.0.0
Router02(config-if)#no shutdown
```

Do remember to run the "**copy running-config startup-config**" command from enable mode, if you want to save the changes you have made in the router.

Hostname and IP address configuration in Router03

Connect to Router03 console and use the following IOS commands to configure host name as Router03.

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname Router03
Router03(config)#
```

Use the following IOS commands to open the fast ethernet interface Fa0/0 configuration mode on Router03 and configure IP address as 172.20.0.1/16.

```
Router03>enable
Router03#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router03(config)#interface fa0/0
Router03(config-if)#ip address 172.20.0.1 255.255.0.0
Router03(config-if)#no shutdown
```

Use the following IOS commands to open the serial interface S0/1 configuration mode on Router03 and configure IP address as 172.19.0.2/16.

```
Router03>enable
Router03#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router03(config)#interface s0/1
Router03(config-if)#ip address 172.19.0.2 255.255.0.0
Router03(config-if)#no shutdown
```

Do remember to run the "**copy running-config startup-config**" command from enable mode, if you want to save the changes you have made in the router.

Open Shortest Path First (OSPF) Protocol configuration in Router01

Connect to Router01 console and use the following IOS commands to configure Open Shortest Path First (OSPF) Protocol in Router01. Please refer the beginning of this lesson to view the Open Shortest Path First (OSPF) Protocol configuration IOS commands.

Using the IOS "network" command, as shown below, we specify only the directly connected networks of this router.

```
Router01>enable
Router01#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router01(config)#router ospf 1
Router01(config-router)#network 172.16.0.0 0.0.255.255 area 0
```

```
Router01(config-router)#network 172.17.0.0 0.0.255.255 area 0
Router01(config-router)#exit
Router01(config)#exit
Router01#
```

Do remember to run the "**copy running-config startup-config**" command from enable mode, if you want to save the changes you have made in the router.

Open Shortest Path First (OSPF) Protocol configuration in Router02

Connect to Router02 console and use the following IOS commands to configure Open Shortest Path First (OSPF) Protocol in Router02. Please refer the beginning of this lesson to view the Open Shortest Path First (OSPF) Protocol configuration IOS commands.

Using the IOS "network" command, as shown below, we specify only the directly connected networks of this router.

```
Router02>
Router02>enable
Router02#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router02(config)#router ospf 1
Router02(config-router)#network 172.17.0.0 0.0.255.255 area 0
Router02(config-router)#network 172.18.0.0 0.0.255.255 area 0
Router02(config-router)#network 172.19.0.0 0.0.255.255 area 0
Router02(config-router)#exit
Router02(config)#exit
```

Do remember to run the "**copy running-config startup-config**" command from enable mode, if you want to save the changes you have made in the router.

Open Shortest Path First (OSPF) Protocol configuration in Router03

Connect to Router03 console and use the following IOS commands to configure Open Shortest Path First (OSPF) Protocol in Router03. Please refer the beginning of this lesson to view the Open Shortest Path First (OSPF) Protocol configuration IOS commands.

Using the IOS "network" command, as shown below, we specify only the directly connected networks of this router.

```
Router03>enable
Router03#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router03(config)#router ospf 1
Router03(config-router)#network 172.19.0.0 0.0.255.255 area 0
Router03(config-router)#network 172.20.0.0 0.0.255.255 area 0
Router03(config-router)#exit
Router03(config)#exit
Router03#
```

Do remember to run the "**copy running-config startup-config**" command from enable mode, if you want to save the changes you have made in

the router.

How to view the routing table in Router01

After the initial configuration and Open Shortest Path First (OSPF) Protocol configuration in all routers, we can use the "show ip route" to view the routing table in Router01, as shown below.

```
Router01>enable
Router01#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
C    172.16.0.0/16 is directly connected, FastEthernet0/0
C    172.17.0.0/16 is directly connected, Serial0/0
O    172.18.0.0/16 [110/65] via 172.17.0.2, 00:26:31,
Serial0/0
O    172.19.0.0/16 [110/128] via 172.17.0.2, 00:26:21,
Serial0/0
O    172.20.0.0/16 [110/129] via 172.17.0.2, 00:24:54,
Serial0/0
```

The "O" character at the beginning of a line in routing table shows that it is a route discovered by Open Shortest Path First (OSPF) Protocol and "C" character shows that it is a directly connected network.

How to view the routing table in Router02

After the initial configuration and Open Shortest Path First (OSPF) Protocol configuration in all routers, we can use the "show ip route" to view the routing table in Router02, as shown below.

```
Router02>enable
Router02#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
O    172.16.0.0/16 [110/65] via 172.17.0.1, 00:30:20,
Serial0/0
C    172.17.0.0/16 is directly connected, Serial0/0
C    172.18.0.0/16 is directly connected, FastEthernet0/0
C    172.19.0.0/16 is directly connected, Serial0/1
O    172.20.0.0/16 [110/65] via 172.19.0.2, 00:28:08,
Serial0/1
```

The "O" character at the beginning of a line in routing table shows that it is a route discovered by Open Shortest Path First (OSPF) Protocol and "C" character shows that it is a directly connected network.

How to view the routing table in Router03

After the initial configuration and Open Shortest Path First (OSPF) Protocol configuration in all routers, we can use the "show ip route" to view the routing table in Router03, as shown below.

```
Router03>enable
Router03#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
O        172.16.0.0/16 [110/129] via 172.19.0.1, 00:29:43,
Serial0/1
O        172.17.0.0/16 [110/128] via 172.19.0.1, 00:29:43,
Serial0/1
O        172.18.0.0/16 [110/65] via 172.19.0.1, 00:29:43,
Serial0/1
C        172.19.0.0/16 is directly connected, Serial0/1
C        172.20.0.0/16 is directly connected, FastEthernet0/0
```

The "O" character at the beginning of a line in routing table shows that it is a route discovered by Open Shortest Path First (OSPF) Protocol and "C" character shows that it is a directly connected network.

Verify the connectivity between networks using the ping command

To verify the Open Shortest Path First (OSPF) Protocol routes and the connectivity between networks, run the ping command from Host01 (IP address: 172.16.0.10/16) to Host03 (IP address: 172.20.0.10/16).

C:\>ping 172.20.0.10

Pinging 172.20.0.10 with 32 bytes of data:

Reply from 172.20.0.10: bytes=32 time=172ms TTL=125

Reply from 172.20.0.10: bytes=32 time=188ms TTL=125

Reply from 172.20.0.10: bytes=32 time=157ms TTL=125

Reply from 172.20.0.10: bytes=32 time=188ms TTL=125

Ping statistics for 172.20.0.10:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

Minimum = 157ms, Maximum = 188ms, Average = 176ms

The ping reply from Host03 (IP address: 172.20.0.10/16) shows that the Open Shortest Path First (OSPF) Protocol is configured well in three routers and there is network connectivity between different networks.



<< Introduction to Open Shortest Path First (OSPF) Protocol

What is OSPF Metric value Cost and OSPF default Cost Reference Bandwidth >>

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- How to configure Routing Information Protocol (RIP)
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