TCOM 515
IP Routing
Lab Exercise 3

OSPF Routing

Name:
Lab Day:
Router Name:
Team Members:

Objective: The purpose of this lab is to become familiar with routers and their configuration parameters. You will physically set-up the equipment, configure the routers; learn the configuration of OSPF in single and multiple areas.

In this lab, you will execute the following tasks:

1. Make physical connectivity between devices
2. Login to the terminal server via telnet
3. Configure the router and its interfaces
4. Configure OSPF
5. Turn up one additional link
6. Move two existing links to the new area

References:

How to use Cisco CLI
Cisco Command Line Overview
Configuring Interfaces
Configuring OSPF

Equipment Used:

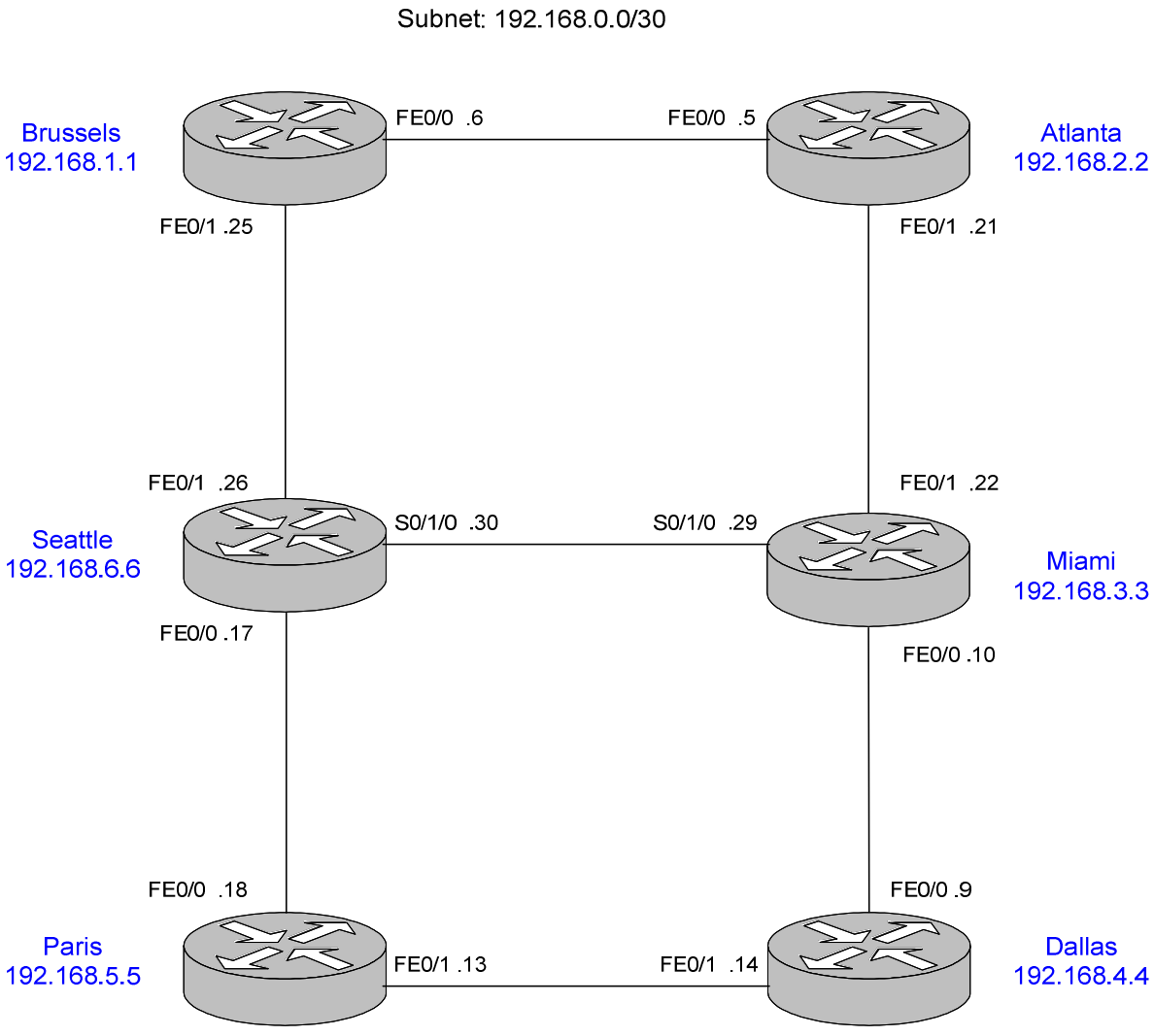
- Cisco router 2511 (terminal server)
- Six 2811 Cisco ISRs
- PC workstations for management

Detailed Lab Steps

1. Make physical connectivity between devices

The first objective of this lab is to create the physical topology required. The physical connectivity is shown below in Figure 1 – Lab 3 Physical Connectivity. Each router will have a FastEthernet connection to two other routers.

Figure 1 Lab 3 Physical Connectivity



2. Login to the router

You must connect to your assigned router through the terminal server.

From SDTConnector, choose corresponding router from the list. Login using the following info,

- User: *student*
- Password: *nocnoc*

Now once you are on the appropriate router, type the following commands:

- *"enable"*
- *"nocnoc"* If prompted for password
- *"erase start"*
- *"reload"*

When the router reloads you will get the autoinstall menu, type "no" or "ctrl-c" to cancel the autoinstall program. Now you will see a prompt that look like this:

router>

Now enter the following commands:

- *"enable"*
- *"conf t"*
- *"hostname <your router's name>"*
- *"no ip domain lookup"*
- *"line console 0"*
- *"logging synchronous"*

3. Configure the router and its interfaces

Now that you have configured a few basic global parameters, you will configure the physical interfaces for your base topology.

The table below lists the IP addresses for the various router interfaces as they were identified in Figure 1. Identify your interface from the table below:

Router Name	Loopback0	FastEthernet Interface 0/0 and mask	FastEthernet Interface 0/1 and mask
Brussels	192.168.1.1/32	192.168.0.6/30	192.168.0.25/30
Atlanta	192.168.2.2/32	192.168.0.5/30	192.168.0.21/30
Miami	192.168.3.3/32	192.168.0.10/30	192.168.0.22/30
Dallas	192.168.4.4/32	192.168.0.9/30	192.168.0.14/30
Paris	192.168.5.5/32	192.168.0.18/30	192.168.0.13/30
Seattle	192.168.6.6/32	192.168.0.17/30	192.168.0.26/30

To enter configuration mode again,

- Type "*config terminal* "

To enter the interface configuration mode from the global configuration mode,

- Type *"interface <your FastEthernet interface> "*

Now type your FastEthernet description.

- Type *"description Link to <Other Router Name> <Network Address> "*

Now you will assign the IP addresses to your interfaces.

- Type *"ip address <address number from chart> 255.255.255.252 "*

Note that the 255.255.255.252 is the dotted decimal equivalent of the network mask listed a /30 in the chart.

To bring the interface up,

- Type *"no shut "*

Repeat the last 4 commands for your other Fast Ethernet interface.

Now you will configure your loopback interface, which is logical rather than physical like the FastEthernet interfaces above.

- Type *"interface loop 0 "*

Now you will assign the IP addresses to your loopback0 interface.

- Type *"ip address <address number from chart> 255.255.255.255 "*

To bring the interface up,

- Type *"no shut "*

Exit the interface configuration mode and the global configuration mode by typing either "ctrl-z" or "end".

The teams on Seattle and Miami have one last interface to configure but not turn up.

Seattle S0/1/0	Miami S0/1/0
192.168.0.30/30	192.168.0.29/30

Type “show ip interface brief”

3.1 Are each the interfaces you configured up that should be? Which ones?

- Now type “show ip route”

3.2 What does your route table look like, how many entries, what kind of entries?

4. Configure OSPF

Now you will turn OSPF on your router. In global configuration mode:

- *"router ospf 1"*
- *"network <FastEthernet1 network address> 255.255.255.252 area 0"*
- *"network <FastEthernet2 network address> 255.255.255.252 area 0*
- *"network <loopback network address> 255.255.255.255 area 0"*

Do not turn up OSPF on the link between Miami and Seattle!

Here is an example configuration from the Atlanta router,
router ospf 1
network 192.168.0.4 255.255.255.252 area 0
network 192.168.0.20 255.255.255.252 area 0
network 192.168.2.2 255.255.255.255 area 0

Use the following show commands and their outputs to answer the questions.

- *"show IP route"*
- *"show IP route summary"*
- *"show IP protocols"*
- *"show IP OSPF"*
- *"show IP OSPF neighbor"*
- *"show IP OSPF database"*

Make sure all OSPF is configured before answering the following questions.

4.1 How many entries are now visible in the IP route table? How has it changed? Include output of route table.
4.2 Take one OSPF route entry from the IP route table and decipher each part of it.
4.3 Who are your OSPF neighbors?
4.4 How many LSAs do you have in your LS database? What kinds of LSAs are in your LS database?
4.5 How does your LS database compare to your neighbors' database?

Now if you are on Paris, Seattle or Brussels, traceroute to Miami's loopback. If you are on Dallas, Miami or Atlanta, traceroute to Seattle's loopback.

- Type "traceroute X.X.X.X"

4.6 What is the total cost to your destination?
4.7 What is/are your best path(s)? Explain why this path was taken.

Stop here and wait for all the groups to complete section 4.

5. Turn up one additional link

Seattle and Miami should now turn up their third link on interface S0/1/0.

All teams should monitor the route table output (show IP route) to see how long it takes for the router to learn the new network.

Use the following show commands and their outputs to answer the questions.

- *"show IP route"*
- *"show IP route summary"*
- *"show IP protocols"*
- *"show IP OSPF"*
- *"show IP OSPF neighbor"*
- *"show IP OSPF database"*

5.1 How has the IP routing table changed from section 4?
5.2 How has the LS database changed from section 4?
5.3 Comparing the network convergence time with RIP, what are some reasons why OSPF converges faster?

Now if you are on Paris, Seattle or Brussels, traceroute to Miami's loopback. If you are on Dallas, Miami or Atlanta, traceroute to Seattle's loopback.

5.4 What is the path to your destination? How has this changed from section 4?

Stop here and wait for all the groups to complete section 5.

6. Move two existing links to new areas

Brussels and Atlanta need to remove the 192.168.0.4/30 networks from Area 0 and add it to Area 1, Dallas and Paris need to remove 192.168.0.12/30 network from Area 0 and add it to Area 2. Area 1 will become a stub area.

Brussels and Atlanta

- *"router ospf 1"*
- *"no network 192.168.0.4 255.255.255.252 area 0"*
- *"network 192.168.0.4 255.255.255.252 area 1"*
- *"area 1 stub"*

Dallas and Paris

- *"router ospf 1"*
- *"no network 192.168.0.12 255.255.255.252 area 0"*
- *"network 192.168.0.12 255.255.255.252 area 2"*

Use the following show commands and their outputs to answer the questions.

- *"show IP route"*
- *"show IP route summary"*
- *"show IP protocols"*
- *"show IP OSPF"*
- *"show IP OSPF neighbor"*
- *"show IP OSPF database"*
- *"show IP OSPF <process ID> <area ID> database"*

6.1 How has the IP routing table changed from section 5?
6.2 How has your LS database changed from section 5?
6.3 What types of new areas have been formed in the network?

Now if you are on Paris, Seattle or Brussels, traceroute to Miami's loopback. If you are on Dallas, Miami or Atlanta, traceroute to Seattle's loopback.

6.4 What is the path to your destination? How has this changed from section 5?

Stop here and wait for all the groups to complete section 6.

7. Power down the router and undo all cabling.

Lab Questions: Answer these questions in addition to all questions contained within the lab itself. 2-3 sentence answers should suffice.

1. *What was the most important piece of knowledge you took away from this lab?*
2. *What new command did you find most useful and why?*
3. *Identify at least one problem you experienced in this lab. How did you figure out the problem? How did you resolve it?*

***Lab Diagram**: You are required to include a diagram as the whole network looked at the end of Section 6. Label areas, area types, router names, router types (ABR, ASBR, Internal, Backbone), and LSA types (1-5, assume there were type 4 and 5 in the lab) within each area, this diagram can be computer generated or hand drawn. Use of different colors is encouraged.*