Packet Tracer - OSPF Multiarea Exploration - Physical Mode - Part 2

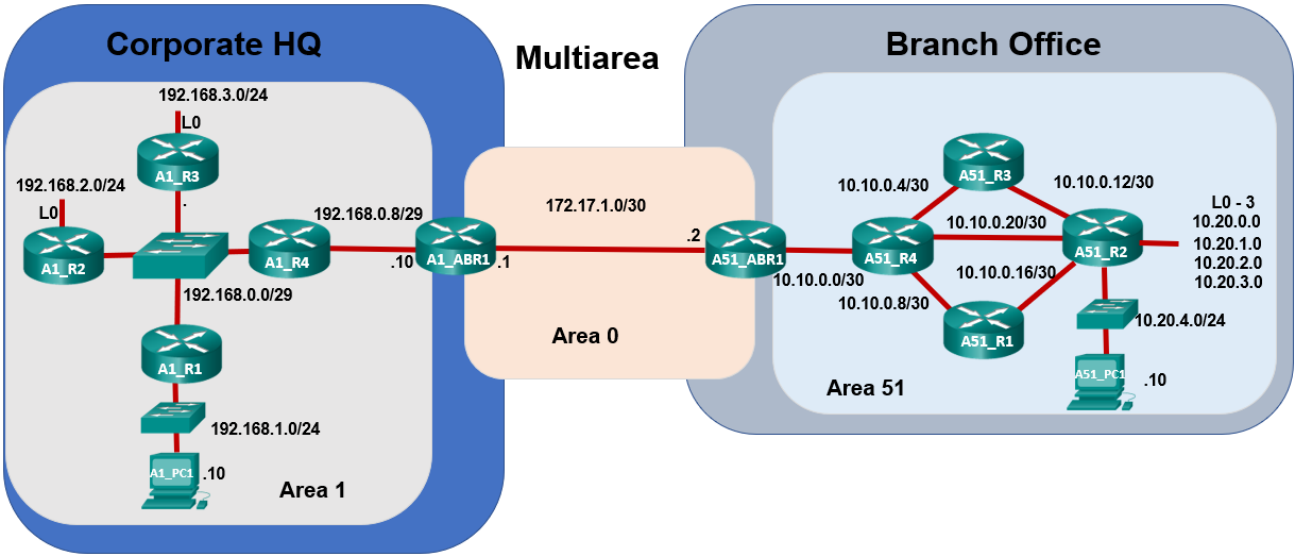
Objectives

Part 1: Evaluate Network Operation of Single-Area OSPF

Part 2: Evaluate Network Operation of Multiarea OSPF

Part 3: Configure a New Area and Attach to Area 0 Through the Internet

Topology



Background / Scenario

Part 1: The Beginning

Casual Recording Company, based in Sao Paulo, Brazil, provides self-serve, mini-recording studios around the city so that anyone can rent a timeslot and record their songs by themselves. CRC began with a single-area OSPF network located in one building. This idea was very popular and consequently the business has grown, causing the company to expand into a branch office in a second building at the far end of the city. They continued to use single-area OSPF. You will evaluate the impact of the expanded network.

Part 2: Business is Booming

The IT department in CRC decided to migrate to a multiarea OSPF network. You will evaluate the impact and benefits derived from the change to determine if it was a good decision or not.

Part 3: CRC Expansion Continues

CRC has continued to grow and will open a new branch office in Montevideo, Uruguay. You will configure the Area Border Router for the new area and physically connect the branch office network to the corporate headquarters network through the internet.

Instructions

Part 2: Evaluate Multiarea OSPF Network Operation

In this part, CRC has migrated their single-area OSPF to multiarea OSPF.

Step 1: Explore OSPF Area 1 devices in the Corporate HQ and Branch Office.

a. Click the **city icon** for **Sao Paulo**, and then click **Corporate HQ**. Click the **rack icon** that represents the **Sao Paulo HQ Wiring Closet**.

b. Click **A1_ABR1**, and then select the **CLI** tab.

c. The terminal should show that G0/0 and G1/0 are up and that two adjacencies have been established, as shown below. If not, wait for the OSPF loading process to complete.

```
<output omitted>
Press RETURN to get started!


%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0, changed state to
up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to
up
23:00:40: %OSPF-5-ADJCHG: Process 1, Nbr 172.17.1.2 on GigabitEthernet0/0 from LOADING
to FULL, Loading Done
23:00:45: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.0.9 on GigabitEthernet1/0 from
LOADING to FULL, Loading Done


A1_ABR1>
```

d. Execute the **show ip route** command. Notice that the routing table on router A1_ABR1 is shorter than it was on router B1_R5 in the single-area OPSF example in Part 1.

How are the networks from Area 51 displayed in the routing table of A1_ABR1?

e. Execute the **show ip ospf** command on router A1_ABR1.

Which areas are displayed on router A1_ABR1?

Record the number of times that the SPF algorithm has been executed in each area.

f. Keep the console window for A1_ABR1 open and select **router A1_R2**. Execute the **show ip route** and **show ip ospf** commands, and then compare the output with the output on A1_ABR1. Similar networks should be displayed and the number of SPF algorithm executions should be similar.

Record the number of SPF algorithm executions.

Step 2: Explore the impact of changes in Area 51.

a. Keep the console windows open for both routers **A1_ABR1** and **A1_R2**.

b. On the blue tool bar at the top, click the **Back level** button twice to return to the **Sao Paulo** city view. You can also use the shortcut keys **Alt+Left** arrow key.

c. Click **Branch Office**, and then the **rack icon** that represents the **Sao Paulo Branch Office Wiring Closet**.

d. Click **A51_R4**, and then select the **CLI** tab.

e. The terminal should show that all four Gigabit Ethernet interfaces are up and that four adjacencies have been established.

```
<output omitted>
Press RETURN to get started!


%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet4/0, changed state to
up
%LINK-5-CHANGED: Interface GigabitEthernet1/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0, changed state to
up
%LINK-5-CHANGED: Interface GigabitEthernet2/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet2/0, changed state to
up
%LINK-5-CHANGED: Interface GigabitEthernet3/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet3/0, changed state to
up
23:00:40: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on GigabitEthernet1/0 from LOADING to
FULL, Loading Done
23:00:40: %OSPF-5-ADJCHG: Process 1, Nbr 172.17.1.2 on GigabitEthernet4/0 from LOADING
to FULL, Loading Done
23:00:40: %OSPF-5-ADJCHG: Process 1, Nbr 3.3.3.3 on GigabitEthernet3/0 from LOADING to
FULL, Loading Done
23:00:45: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on GigabitEthernet2/0 from LOADING to
FULL, Loading Done


A51_R4>
```

f. Execute the **show ip route** command. Compare the output of A51_R4 to the output of A1_ABR1 and A1_R2. Notice that other than a few connected or local routes, the same networks are displayed.

   Record the number of IA routes displayed.

g. Execute the **show ip ospf** command.

   Record the number of SPF calculations.

h. Keep the console window for A51_R4 open. Click **A51_R2**. On the **Physical** tab, turn the power off to simulate a power failure.

i. Return to the console window for **A51_R4**. You should see a console message that the adjacency with A51_R2 is down.

```
%LINK-3-UPDOWN: Interface GigabitEthernet2/0, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet2/0, changed state to
down
23:30:33: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on GigabitEthernet2/0 from FULL to
DOWN, Neighbor Down: Interface down or detached
```

j. Re-issue the **show ip route** and **show ip ospf** commands.

   Have the SPF algorithm executions increased?

   Record the number of SPF algorithm executions.

What networks are missing from the A51_R4 routing table?

k. Navigate to A1_R2 and issue the **show ip route** and **show ip ospf** commands again.

Is the summary route for Area 51 still in the routing table?

Has the value for the SPF algorithm executions increased from Step 1g?

Will a **ping** or a **tracert** between A1_PC1 (192.168.1.10) and A51_PC1 (10.20.4.10) be successful?

Note: The area 51 border router, A51_ABR1 has summarized the 10.0.0.0/8 networks and is advertising the summary route to all the other areas. Topology changes in area 51, such as power failures, interface disconnects, or OSPF network changes, will cause SPF recalculations on all routers within area 51 but will NOT cause SPF recalculations in area 1.

Step 3: Summarize the Area 1 routes to be sent to Area 51.

a. Select router **A51_R4** and execute the **show ip route.**

Compare the output of A51_R4 to the output of A1_R4. You should notice that all of the 192.168.0.0 networks from area 1 are showing inside the routing table.

If a cleaning crew accidentally removed the cable on A1_R1 (192.168.1.0/24), how will the routers in area 51 be affected?

What could be done to avoid the area 51 recalculations?

b. Navigate to **A1_ABR1**. Using the CLI tab, enter the following commands to implement OSPF summarization for the 192.168.0.0 network in area 1:

```
A1_ABR1(config)# router ospf 1
A1_ABR1(config-router)# area 1 range 192.168.0.0 255.255.0.0
A1_ABR1(config-router)# end
```

Note: Summarizing OSPF routes is beyond the scope of this course and the CCNA exam.

c. Return to the screen of **A51_R4** and execute a **show ip route** command.

How is the routing table output different following the summarization?

Note: Multiarea OSPF provides the benefit of summarization between areas. The summarization helps to reduce the size of routing tables and reduces the frequency of LSA flooding throughout the entire system. With summarization, a change in one area will cause all routers within that area to execute SPF. Routing tables and SPF recalculations for routers in other areas will not be affected. Connectivity to the downed network(s) still poses an issue.

You have completed **Part 2: Evaluate Multiarea OSPF Network Operation**.

To continue to **Part 3: Configure a New Area and Attach to Area 0 Through the Internet**, close this Packet Tracer file. Return to the online course and open the **Multiarea OSPF Exploration - Physical Mode (Part3)** Packet Tracer file.