Configuring Multi-area OSPFv2 *v1.1a*

Introduction

OSPF uses areas to simplify administration and optimize traffic and resource utilization. To make OSPF more efficient and scalable, OSPF supports hierarchical routing. An OSPF area is a group of routers that share the same link-state information in their link-state databases (LSDBs). All routers in the same area have the same topology table and don't know about routers in the other areas. When a large OSPF area is divided into smaller areas, it is called multi-area OSPF. Multi-area OSPF is useful in larger network deployments to reduce processing and memory overhead.

Objective(s)

In this lab the student will:

- Configure Basic Device Settings
- Configure a Multi-area OSPFv2 Network

Equipment/Supplies Needed

If working in a physical environment:

- 3 Routers (Cisco 1941 with Cisco IOS Release 15.2(4) M3 universal image or comparable)
- Console cables to configure the Cisco IOS devices via the console ports
- Ethernet and serial cables as shown in the topology

If working online:

- Your Computer workstation
- Cisco Packet Tracer (online)
- Configuring Multi-area OSPFv2.PKA file

Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	Lo0	209.165.200.225	255.255.255.252	N/A
	Lo1	192.168.1.1	255.255.255.0	N/A
	Lo2	192.168.2.1	255.255.255.0	N/A
	S0/0/0 (DCE)	192.168.12.1	255.255.255.252	N/A
R2	Lo6	192.168.6.1	255.255.255.0	N/A
	S0/0/0	192.168.12.2	255.255.255.252	N/A
	S0/0/1 (DCE)	192.168.23.1	255.255.255.252	N/A
R3	Lo4	192.168.4.1	255.255.255.0	N/A
	Lo5	192.168.5.1	255.255.255.0	N/A
	S0/0/1	192.168.23.2	255.255.255.252	N/A

Topology
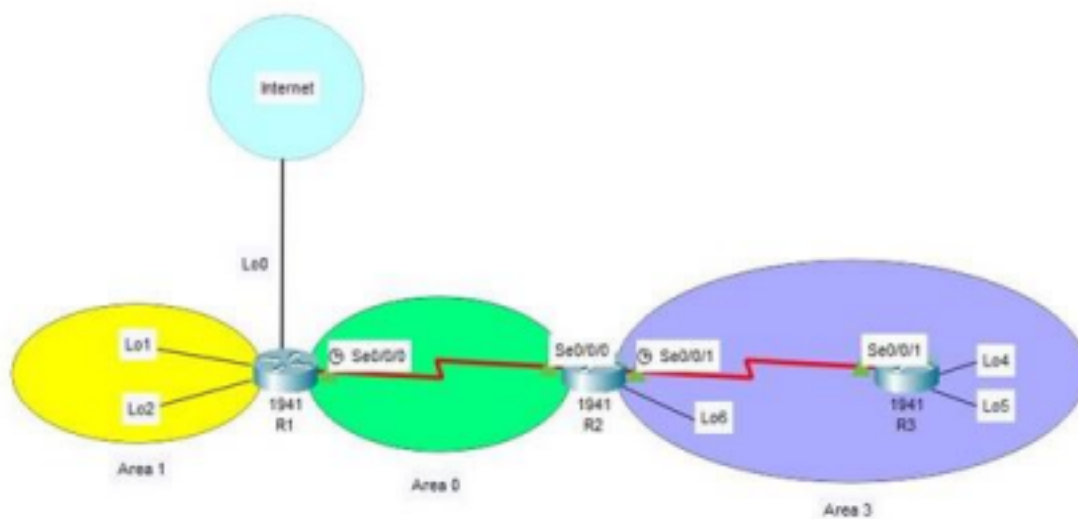
Perform the steps in this lab in the order they are presented to you. Answer all questions and record the requested information in a file.

Part 1: Configure Basic Device Settings

Step 1: Configure basic settings for *each router*.

a. Disable DNS lookup.

b. Configure device name, as shown in the topology.

c. Assign **cyber** as the privileged EXEC password.

d. Assign **security** as the console and vty passwords.

e. Configure **logging synchronous** for the console line.

f. Configure a MOTD banner to warn users that **"Unauthorized access is prohibited"**.

g. Configure the IP addresses listed in the Addressing Table for *all interfaces* including *all loopback interfaces* (Virtual Interfaces) for *each router*.

Note: Loopback Interfaces - You can specify a software-only interface called a loopback interface to emulate a physical interface. Loopback interfaces are supported on all platforms. A loopback interface is a virtual interface on a Cisco router that remains up (active) until you disable it with the **shutdown** command. Unlike subinterfaces, loopback interfaces are independent of the state of any physical interfaces.

R1#(config) **Interface loopback 0**

R1#(config-if) **ip address 209.165.200.225 255.255.255.252**

Note: DCE interfaces should be configured with a clock rate of 128000.

R1#(config) **Interface s0/0/0**

R1#(config-if) **clock rate 128000**

     i. Copy the running configuration to the startup configuration.

 Step 2: Verify Layer 3 connectivity.

Use the **show ip interface brief** command to verify that the IP addressing is correct and that the interfaces are active. Verify that each router can ping their neighbor's serial interface.

Part 2: Configure a Multi-area OSPFv2 Network

In Part 2, you will configure a multi-area OSPFv2 network with a process ID of 1. All LAN loopback interfaces should be passive.

Step 1: Identify the OSPF router types in the topology.

Identify the Backbone router(s):

Identify the Autonomous System Boundary Router(s)

(ASBR): Identify the Area Border Router(s) (ABR):

Identify the Internal router(s):

Step 2: Configure OSPF on R1

    1. Configure a router ID of **1.1.1.1** with OSPF process ID of 1.

    2. Add the networks for R1 to OSPF.

        R1(config-router)# **network 192.168.1.0 0.0.0.255 area 1**

        R1(config-router)# **network 192.168.2.0 0.0.0.255 area 1**

        R1(config-router)# **network 192.168.12.0 0.0.0.3 area 0**

3. Set LAN loopback interfaces, Lo1 and Lo2 as passive.

4. Create a default route to the internet using the exit interface Lo0

Note: You may see the message.

"%Default route without gateway, if not a point-to-point interface, may impact performance"

This is normal behavior if using a Loopback interface to simulate a default route.

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5. Configure OSPF *to propagate the routes throughout the OSPF areas*, including the static route.

Step 3: Configure OSPF on R2.

1. Configure a router ID of **2.2.2.2** with OSPF process ID of 1

2. Add networks for R2 to OSPF. Add the networks to the correct area. Write the commands used in the space below.

3. Set all LAN loopback interfaces as passive.

Step 4: Configure OSPF on R3

1. Configure a router ID of **3.3.3.3** with OSPF process ID of 1

2. Add networks for R3 to OSPF. Add the networks to the correct area. Write the commands used in the space below.

3. Set all LAN loopback interfaces as passive.

Step 5: Verify that OSPF settings are correct and adjacencies have been established between routers.

1. Issue the **show ip protocols** command to verify OSPF settings on each router.

Use this command to identify the OSPF router types and to determine the networks assigned to each area.

R1# **show ip protocols**

Routing Protocol is "ospf 1"

Outgoing update filter list for all interfaces is not set

Incoming update filter list for all interfaces is not set

Router ID 1.1.1.1

Number of areas in this router is 2. 2 normal 0 stub 0

nssa Maximum path: 4

Routing for Networks:

192.168.1.0 0.0.0.255 area 1

192.168.2.0 0.0.0.255 area 1

192.168.12.0 0.0.0.3 area 0

Passive Interface(s):

Loopback1

Loopback2

Routing Information Sources:

Gateway Distance Last Update

1.1.1.1 110 00:03:20

2.2.2.2 110 00:03:20

Distance: (default is 110)

R2# **show ip protocols**

Routing Protocol is "ospf 1"

Outgoing update filter list for all interfaces is not set

Incoming update filter list for all interfaces is not

set Router ID 2.2.2.2

Number of areas in this router is 2. 2 normal 0 stub 0

nssa Maximum path: 4

Routing for Networks:

192.168.6.0 0.0.0.255 area 3

192.168.23.0 0.0.0.3 area 3

192.168.12.0 0.0.0.3 area 0

Passive Interface(s):

Loopback6

Routing Information Sources:

Gateway Distance Last Update

1.1.1.1 110 00:04:08

2.2.2.2 110 00:04:08

3.3.3.3 110 00:02:39

Distance: (default is 110)

R3# **show ip protocols**

Routing Protocol is "ospf 1"

Outgoing update filter list for all interfaces is not set

Incoming update filter list for all interfaces is not

set Router ID 3.3.3.3

Number of areas in this router is 1. 1 normal 0 stub 0

nssa Maximum path: 4

Routing for Networks:

192.168.23.0 0.0.0.3 area 3

192.168.4.0 0.0.0.255 area 3

192.168.5.0 0.0.0.255 area 3

Passive Interface(s):

Loopback4

Loopback5

Routing Information Sources:

Gateway Distance Last Update

2.2.2.2 110 00:11:28

3.3.3.3 110 00:00:20

Distance: (default is 110)

What is the OSPF router type for each router?

R1: _____

R2: _____

R3: _____

1. Issue the **show ip ospf neighbor** command to verify that OSPF adjacencies have been established between all routers. If neighbor adjacencies between all routers is not established. Troubleshoot the network and fix any connectivity issues discovered.

R1# **show ip ospf neighbor**

Neighbor ID Pri State Dead Time Address Interface 2.2.2.2 0 FULL/ - 00:00:34

192.168.12.2 Serial0/0/0

R2# **show ip ospf neighbor**

Neighbor ID Pri State Dead Time Address Interface 1.1.1.1 0 FULL/ - 00:00:36

192.168.12.1 Serial0/0/0 3.3.3.3 0 FULL/ - 00:00:36 192.168.23.2 Serial0/0/1

R3# **show ip ospf neighbor**

Neighbor ID Pri State Dead Time Address Interface 2.2.2.2 0 FULL- 00:00:38

192.168.23.1 Serial0/0/1

Reflection

What are three advantages for designing a network with multi-area OSPF over having one large OSPF area?

1.

2.

3.

Submit Your Work:

Submit all text files, screenshots, or answers to questions to your instructor Using the most appropriate method below.

Packet Tracer:

Submit Packet Tracer file as well as your text file with your findings and notes.

Rubric

Checklist/Single Point Mastery

Concerns Working Towards Proficiency	Criteria Standards for This Competency	Accomplished Evidence of Mastering Competency
	Criteria #1: Basic router and switch configs configs (30 pts)	Configure basic router configs needed for all 3 routers.(30 pts) Each router (10 pts)
	Criteria #2: Configure OSPF protocol needed on all 3 routers for connectivity between networks (40 pts)	Configure EIGRP protocol needed on all 3 routers for connectivity between networks. (40 pts) Each router (13.3pts)
	Criteria #4: Test connectivity between all remote networks using ping. (15 pts)	Test connectivity between all remote networks using ping. (15 pts) 3 Ping test (5 pts) a piece.
	Criteria #5: Submit instructions document with lab questions completed. (15 pts)	Criteria #5: Submit instructions document with lab questions completed. (15 pts) 3 questions (5 pts) a piece