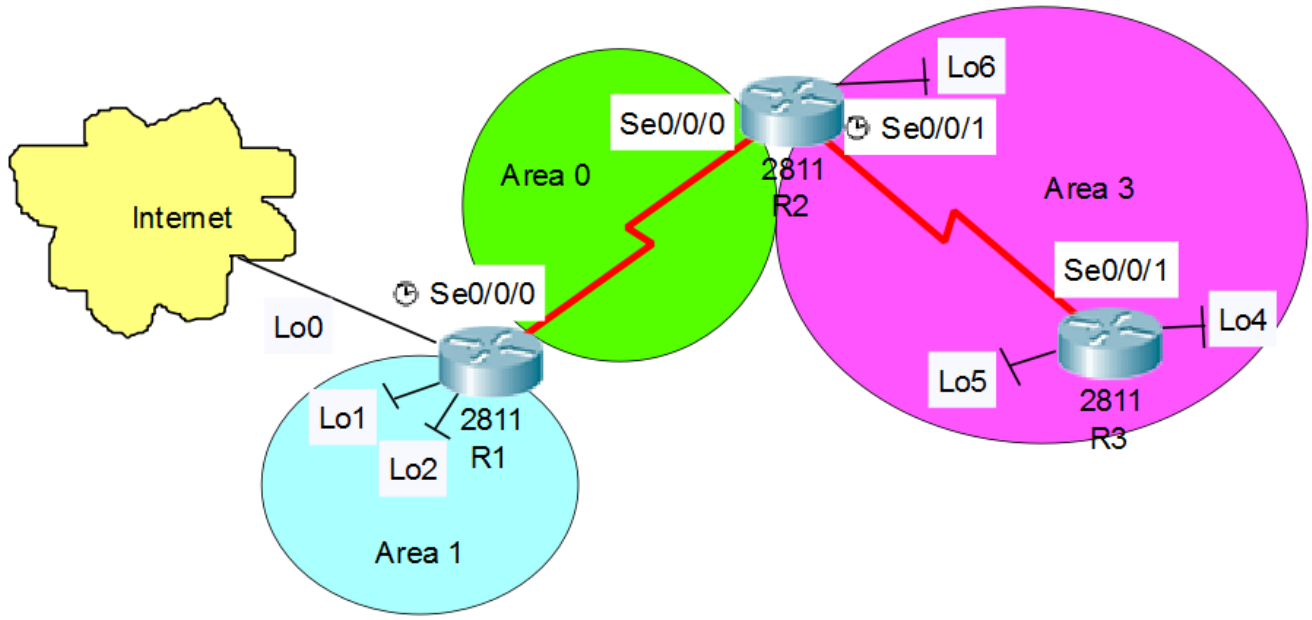
Multiarea OSPFv2

Topology



Addressing Table

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

Required Resources

- 3 Routers
- Console cables

- Serial cables as shown in the topology

Part 1: Build the Network and Configure Basic Device Settings

In Part 1, you will set up the network topology and configure basic settings on the routers.

Step 1: Cable the network as shown in the topology.

Step 2: Initialize and reload the routers as necessary.

Step 3: Configure basic settings for each router.

a. Disable DNS lookup.

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

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

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

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

f. Configure an MOTD banner to warn users that unauthorized access is prohibited.

g. Configure **the IP addresses** listed in the Addressing Table for all interfaces. DCE interfaces should be configured with a **clock rate of 128000**. Bandwidth should be set to **128 Kb/s** on all serial interfaces.

h. Copy the running configuration to the startup configuration.

Step 4: 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 Multiarea OSPFv2 Network

In Part 2, you will configure a multiarea OSPFv2 network with process ID of 1. All LAN loopback interfaces should be passive, and all serial interfaces should be configured with MD5 authentication using **RSLAB123** as the key.

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.

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

b. 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
```

c. Set all LAN loopback interfaces, Lo1 and Lo2, as passive.

d. Create a default route to the Internet using exit interface Lo0.

Note: You may see the "%Default route without gateway, if not a point-to-point interface, may impact performance" message. This is normal behavior if using a Loopback interface to simulate a default route.

e. Configure OSPF to propagate the routes throughout the OSPF areas.

Step 3: Configure OSPF on R2.

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

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

_____

_____

_____

c. Set all LAN loopback interfaces as passive.

Step 4: Configure OSPF on R3.

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

b. Add the networks for R3 to OSPF. Write the commands used in the space below.

_____

_____

_____

c. Set all LAN loopback interfaces as passive.

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

a. 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
<output omitted>
  It is an area border and autonomous system boundary router
 Redistributing External Routes from,
  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
R2# show ip protocols
<output omitted>
  It is an area border router
  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
    192.168.12.0 0.0.0.3 area 0
    192.168.23.0 0.0.0.3 area 3
<output omitted>
R3# show ip protocols
<output omitted>
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.4.0 0.0.0.255 area 3
    192.168.5.0 0.0.0.255 area 3
    192.168.23.0 0.0.0.3 area 3
<output omitted>
```

What is the OSPF router type for each router?

R1: _____

R2: _____

R3: _____

b. Issue the **show ip ospf neighbor** command to verify that OSPF adjacencies have been established between routers.

```
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
```

c. Issue the **show ip ospf interface brief** command to display a summary of interface route costs.

```
R1# show ip ospf interface brief
Interface    PID   Area            IP Address/Mask    Cost  State Nbrs F/C
Se0/0/0      1     0               192.168.12.1/30    781   P2P   1/1
Lo1          1     1               192.168.1.1/24     1     LOOP  0/0
Lo2          1     1               192.168.2.1/24     1     LOOP  0/0

R2# show ip ospf interface brief
Interface    PID   Area            IP Address/Mask    Cost  State Nbrs F/C
Se0/0/0      1     0               192.168.12.2/30    781   P2P   1/1
Lo6          1     3               192.168.6.1/24     1     LOOP  0/0
Se0/0/1      1     3               192.168.23.1/30    781   P2P   1/1
```

```
R3# show ip ospf interface brief
Interface    PID   Area            IP Address/Mask    Cost  State Nbrs F/C
Lo4          1     3               192.168.4.1/24     1     LOOP  0/0
Lo5          1     3               192.168.5.1/24     1     LOOP  0/0
Se0/0/1      1     3               192.168.23.2/30    781   P2P   1/1
```

Step 6: Configure MD5 authentication on all serial interfaces.

Configure OSPF MD5 authentication at the interface level with an authentication key of **RSLAB123**.

```
R1(config)# int s0/0/0
R1(config-if)# ip ospf message-digest-key 1 md5 RSLAB123
R1(config-if)# ip ospf authentication message-digest
```

Why is it a good idea to verify that OSPF is functioning correctly before configuring OSPF authentication?

_____

Step 7: Verify OSPF adjacencies have been re-established.

Issue the **show ip ospf neighbor** command again to verify that adjacencies have been re-established after MD5 authentication was implemented. Troubleshoot any issues found before moving on to Part 3.

Part 3: Configure Interarea Summary Routes

OSPF does not perform automatic summarization. Interarea summarization must be manually configured on ABRs. In Part 3, you will apply interarea summary routes on the ABRs. Using **show** commands, you will be able to observe how summarization affects the routing table and LSDBs.

Step 1: Display the OSPF routing tables on all routers.

a. Issue the **show ip route ospf** command on R1. OSPF routes that originate from a different area have a descriptor (O IA) indicating that these are interarea routes.

```
R1# show ip route ospf
<output omitted>
Gateway of last resort is 0.0.0.0 to network 0.0.0.0

      192.168.4.0/32 is subnetted, 1 subnets
O IA     192.168.4.1 [110/1563] via 192.168.12.2, 00:23:49, Serial0/0/0
      192.168.5.0/32 is subnetted, 1 subnets
O IA     192.168.5.1 [110/1563] via 192.168.12.2, 00:23:49, Serial0/0/0
      192.168.23.0/30 is subnetted, 1 subnets
O IA     192.168.6.1 [110/782] via 192.168.12.2, 00:02:01, Serial0/0/0
      192.168.23.0/30 is subnetted, 1 subnets
O IA     192.168.23.0 [110/1562] via 192.168.12.2, 00:23:49, Serial0/0/0
```

b. Repeat the **show ip route ospf** command for R2 and R3. Record the OSPF interarea routes for each router.

R2:

_____

_____

_____

R3:

_____

_____

_____

Step 2: Display the LSDB on all routers.

a. Issue the **show ip ospf database** command on R1. A router maintains a separate LSDB for every area that it is a member.

```
R1# show ip ospf database
```

b. Repeat the **show ip ospf database** command for R2 and R3. Record the Link IDs for the Summary Net Link States for each area.

R2:

_____

_____

R3:

_____

_____

Step 3: Configure the interarea summary routes.

a. Calculate the summary route for the networks in area 1.

b. Configure the summary route for area 1 on R1.

```
R1(config)# router ospf 1
R1(config-router)# area 1 range 192.168.0.0 255.255.252.0
```

c. Calculate the summary route for the networks in area 3. Record your results.

_____

d. Configure the summary route for area 3 on R2. Write the commands you used in the space below.

_____

_____

Step 4: Re-display the OSPF routing tables on all routers.

Issue the **show ip route ospf** command on each router. Record the results for the summary and interarea routes.

R1:

_____

_____

R2:

_____

_____

R3:

_____

_____

Step 5: Display the LSDB on all routers.

Issue the **show ip ospf database** command again on each router. Record the Link IDs for the Summary Net Link States for each area.

R1:

_____

_____

R2:

_____

_____

R3:

_____

_____

What type of LSA is injected into the backbone by the ABR when interarea summarization is enabled?

_____

Step 6: Verify end-to-end connectivity.

Verify that all networks can be reached from each router. If any issues exist, troubleshoot until they have been resolved.