



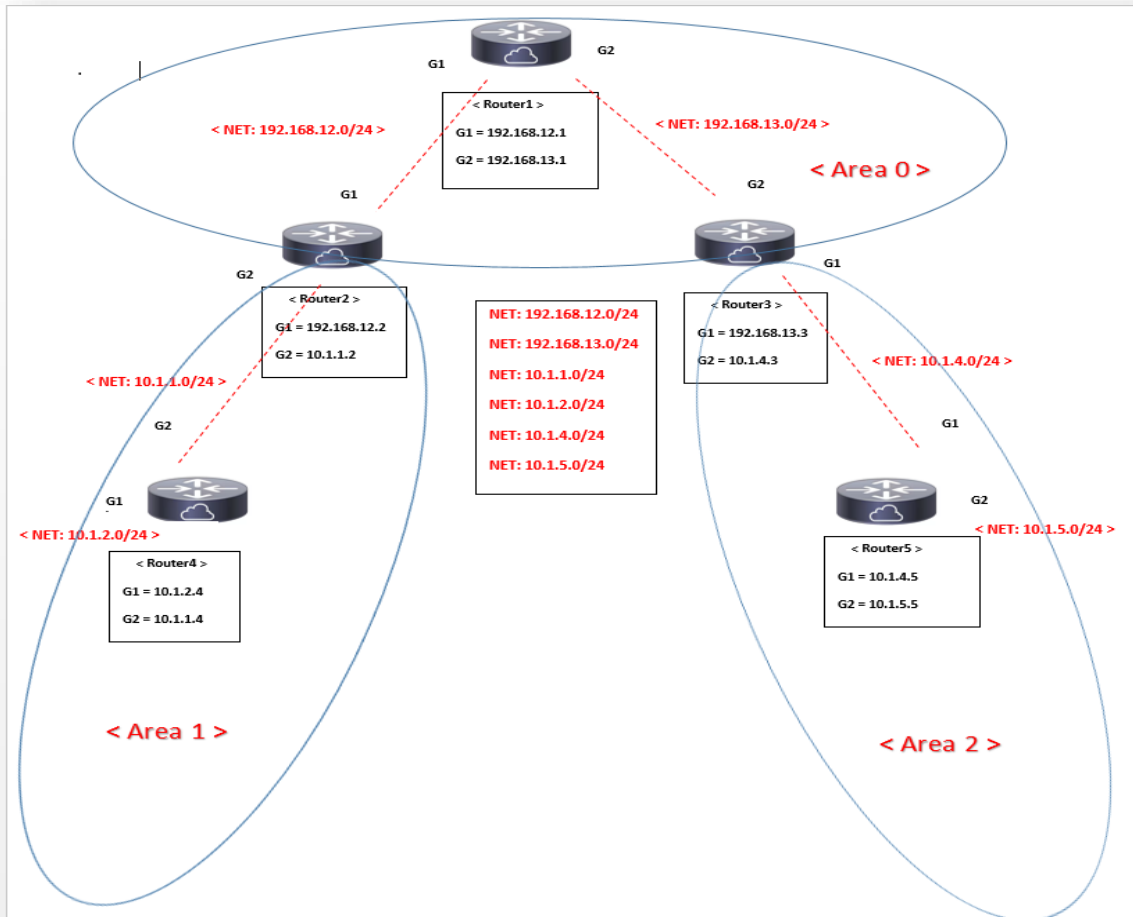
Cisco Multi Area OSPF Lab Introduction

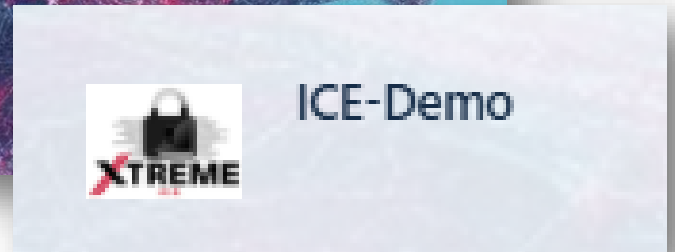
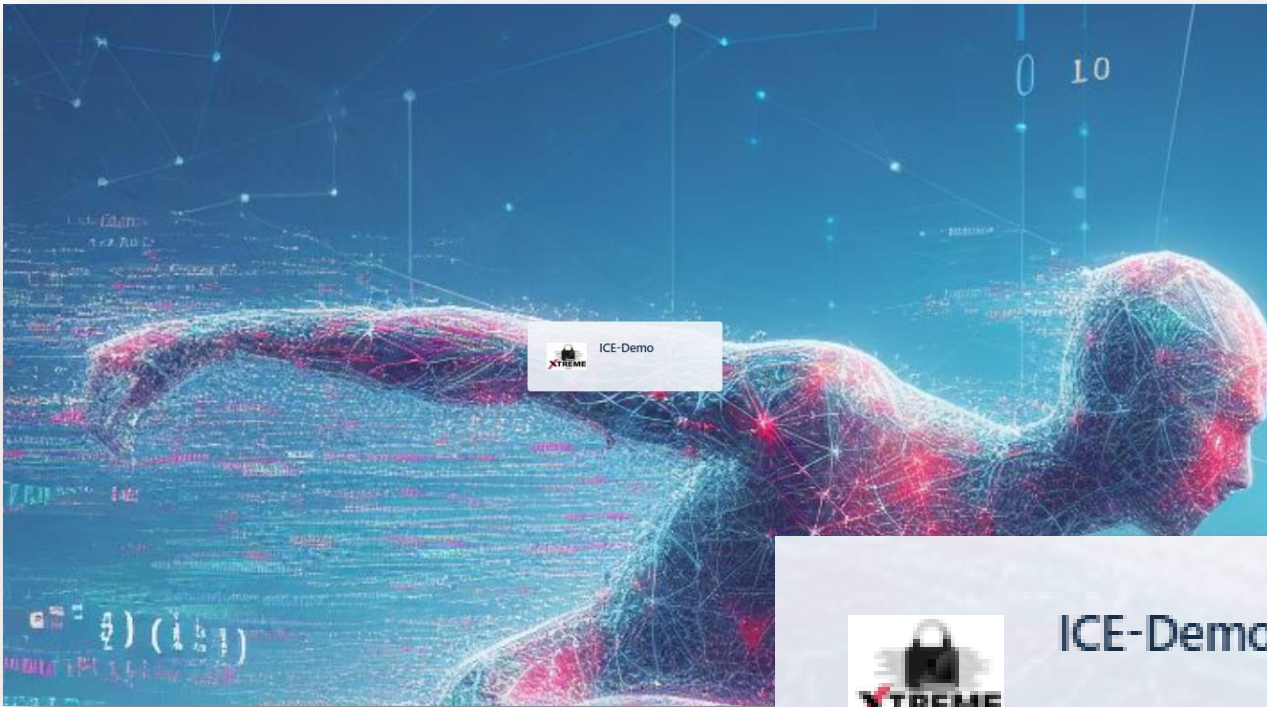
In this demonstration lab you will have access to a fully configured Cisco Multi-Area OSPF network infrastructure created with five Cisco Routers Systems. The instructions will provide the guidance to assist you to navigate the infrastructure in order the answer the questions at the end of each section. Each sections is organization by Router so you will have five sections – one per router with six questions in each section you will be required to answer. Each section will provide the necessary configuration perimeters for establish communications, verification commands and the expected output which will assist you in answering questions. In order to answer the questions will need to first access the OSPF network provided. The authentication for the workspace will be provided by an Administrator or Associate.

Network Overview

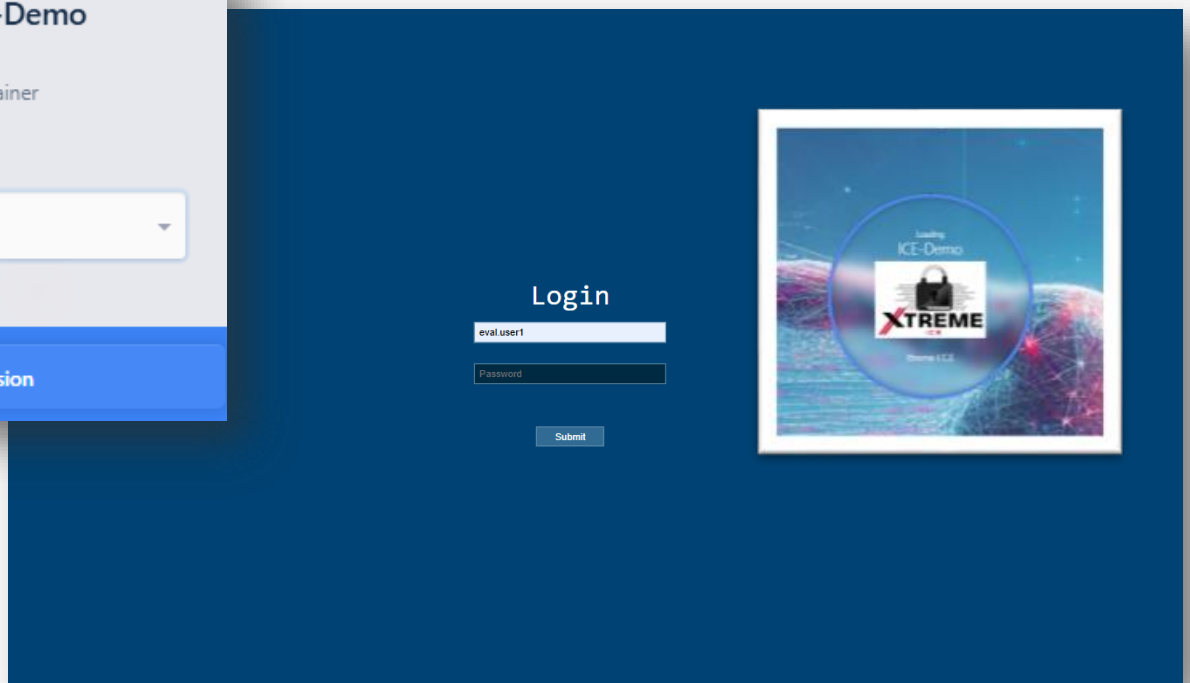
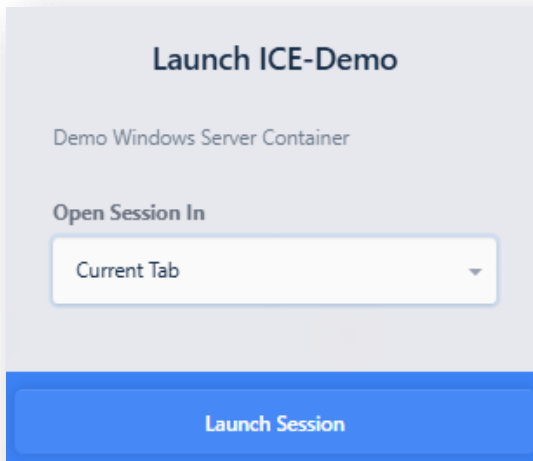
This lab demonstrates a **Multi-Area OSPF topology** using five Cisco CSR1000V routers. The configuration illustrates backbone and non-backbone OSPF areas, route exchange between areas, and verification of adjacency and routing tables.

Router	Interfaces	Networks Connected	OSPF Area(s)	Role
Router1	G0/1: 192.168.12.1 G0/2: 192.168.13.1 G0/4: 192.168.0.100	192.168.0.0/24, 192.168.12.0/24, 192.168.13.0/24	Area 0	Backbone Router
Router2	G0/1: 192.168.12.2 G0/2: 10.1.1.2	192.168.12.0/24, 10.1.1.0/24	Areas 0, 1	ABR (Area 0 ↔ Area 1)
Router3	G0/1: 10.1.4.3 G0/2: 192.168.13.3	192.168.13.0/24, 10.1.4.0/24	Areas 0, 2	ABR (Area 0 ↔ Area 2)
Router4	G0/1: 10.1.2.4 G0/2: 10.1.1.4	10.1.1.0/24, 10.1.2.0/24	Area 1	Internal Router
Router5	G0/1: 10.1.4.5 G0/2: 10.1.5.5	10.1.4.0/24, 10.1.5.0/24	Area 2	Internal Router





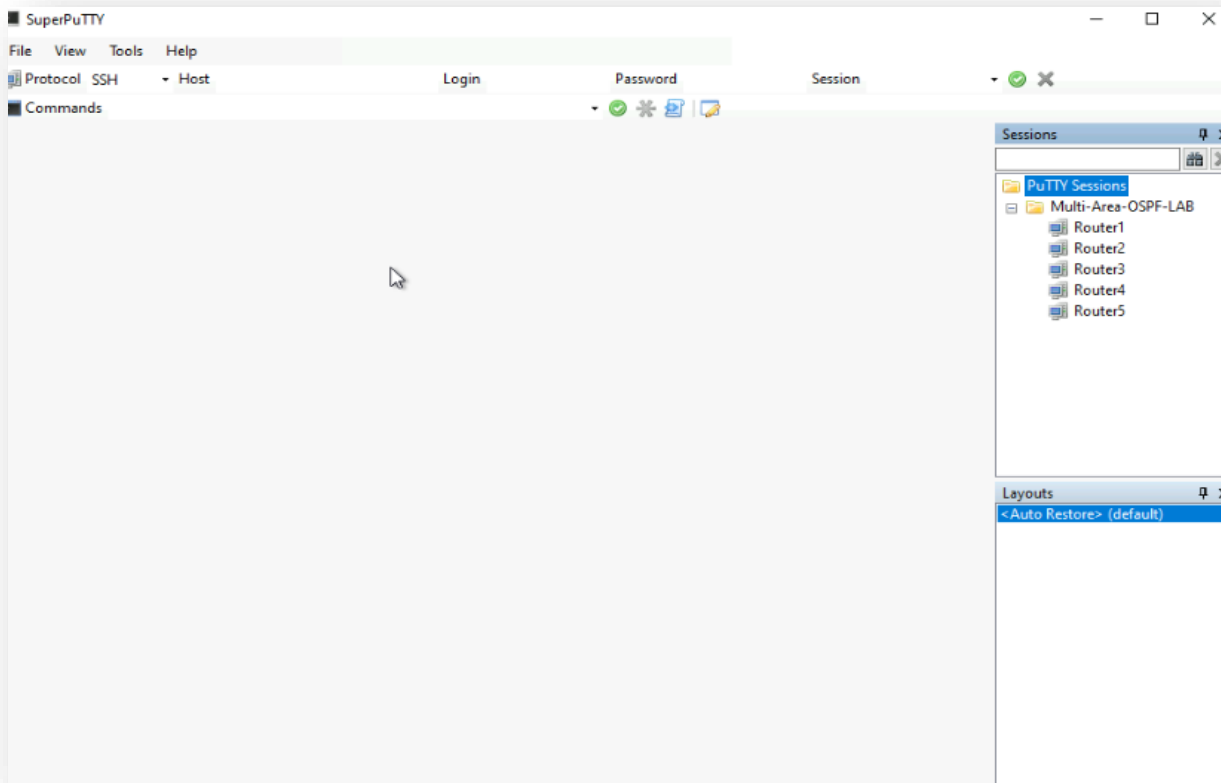
In the Xtreme Workspaces area you will see a Work Space Tile that Says ICE-Demo. Select the ICE-Demo Work Space to launch the Session.

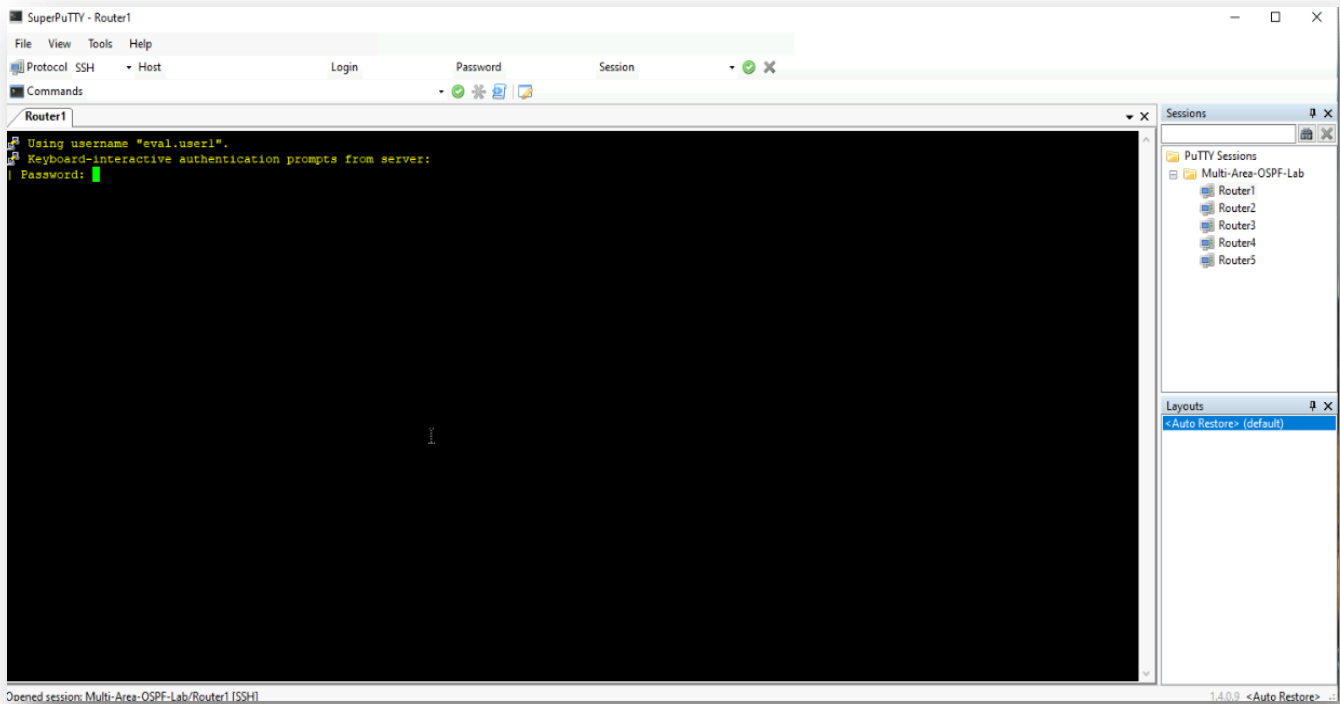


The launch session dialog will initiate. Select launch Session button and you should be taken to the workspace system to Authenticate.



Once authenticated to the system. Look for the either the Putty icon or the SuperPutty Icon. In the illustration the SuperPutty Icon is being shown. SuperPutty will look like the following:





SuperPutty will already be preconfigured with the necessary information to ssh into in the Routers in the topology. On the right hand side of the Superputty dialog in the Sessions section you will see a folder called Multi-Area-OSPF-LAB. If you expand that folder it will list all five Routers. Left mouse click the Router you wish to ssh into. The dialog should look like the illustration. SuperPutty will allow you to open multiple session simultaneously in individual tabs.


Note: The authentication Credentials will be provided by an Administrator or an Associate.

Router 1 – Backbone Router (Area 0)

Configuration Summary

```
bash

hostname Router1
interface GigabitEthernet1
 ip address 192.168.12.1 255.255.255.0
!
interface GigabitEthernet2
 ip address 192.168.13.1 255.255.255.0
!
router ospf 1
 redistribute static
 network 192.168.0.0 0.0.0.255 area 0
 network 192.168.12.0 0.0.0.255 area 0
 network 192.168.13.0 0.0.0.255 area 0
```


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✓ 1. Check OSPF Neighbors

Command:

```
arduino


Router1# show ip ospf neighbor
```

 Copy code

Expected Output:

```
nginx

Neighbor ID      Pri   State           Dead Time   Address        Interface
192.168.12.2    1     FULL/DR         00:00:34   192.168.12.2  GigabitEthernet1
192.168.13.3    1     FULL/DR         00:00:36   192.168.13.3  GigabitEthernet2
```


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✓ 2. Verify OSPF Interfaces

Command:

```
kotlin


Router1# show ip ospf interface brief
```

 Copy code

Expected Output:

```
swift


Interface      PID   Area           IP Address/Mask   Cost   State Nbrs F/C
Gi1             1     0              192.168.12.1/24   1     DR    1/1
Gi2             1     0              192.168.13.1/24   1     DR    1/1
```

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✓ 3. View OSPF Routes

Command:


arduino

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```
Router1# show ip route ospf
```

Expected Output:

nginx

 Copy code

```
O IA 10.1.1.0/24 [110/2] via 192.168.12.2, 00:00:12, GigabitEthernet1
O IA 10.1.2.0/24 [110/3] via 192.168.12.2, 00:00:12, GigabitEthernet1
O IA 10.1.4.0/24 [110/2] via 192.168.13.3, 00:00:10, GigabitEthernet2
O IA 10.1.5.0/24 [110/3] via 192.168.13.3, 00:00:10, GigabitEthernet2
```

Router 1 Questions

Instructions:

Answer the questions for each section.

Router (1)


1. How many OSPF neighbors does Router1 have, and on which interfaces?
2. What is the OSPF area ID assigned to each active interface?
3. What OSPF router ID is displayed in `show ip ospf neighbor`?
4. Are any OSPF routes marked as inter-area (O IA)? What does this mean?
5. Which router(s) are identified as DR or BDR on each segment?
6. What does the output of `show ip protocols` reveal about redistribution or default routing?

Router 2 – ABR (Area 0 and Area 1)

Configuration Summary

```
bash

hostname Router2
interface GigabitEthernet1
 ip address 192.168.12.2 255.255.255.0
!
interface GigabitEthernet2
 ip address 10.1.1.2 255.255.255.0
!
router ospf 1
 network 10.1.1.0 0.0.0.255 area 1
 network 192.168.12.0 0.0.0.255 area 0
```

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Verification Commands and Expected Output

✓ 1. OSPF Neighbors

```
arduino


Router2# show ip ospf neighbor
```

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Expected Output:

```
nginx


Neighbor ID      Pri   State           Dead Time   Address           Interface
192.168.12.1     1     FULL/BDR        00:00:34   192.168.12.1     GigabitEthernet1
10.1.1.4         1     FULL/DR         00:00:33   10.1.1.4         GigabitEthernet2
```

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✓ 2. OSPF Border Routers

```
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Router2# show ip ospf border-routers
```

 Copy code

Expected Output:


```
scss

OSPF Router with ID (192.168.12.2) (Process ID 1)
Known Area Border Router(s):
 192.168.12.1 (Router1) in Area 0
 10.1.1.4     (Router4) in Area 1
```

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✓ 3. Routing Table Verification


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```
Router2# show ip route ospf
```

Expected Output:

nginx

 Copy code

```
O IA 192.168.13.0/24 [110/2] via 192.168.12.1, 00:00:10, GigabitEthernet1
O IA 10.1.4.0/24      [110/3] via 192.168.12.1, 00:00:10, GigabitEthernet1
O IA 10.1.5.0/24      [110/4] via 192.168.12.1, 00:00:10, GigabitEthernet1
```

Router 2 Questions

Instructions:

Answer the questions for each section.


Router (2)

1. Which two routers appear as OSPF neighbors?
2. What is Router2's OSPF Router ID?
3. What evidence confirms that Router2 is an ABR?
4. What type of OSPF routes (O, O IA) are visible in the routing table?
5. If Router4 goes down, how would the neighbor table change?
6. What is the cost associated with interface GigabitEthernet1?

Router 3 – ABR (Area 0 and Area 2)

Configuration Summary

bash

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```
hostname Router3
interface GigabitEthernet1
 ip address 10.1.4.3 255.255.255.0
!
interface GigabitEthernet2
 ip address 192.168.13.3 255.255.255.0
!
router ospf 1
 network 10.1.4.0 0.0.0.255 area 2
 network 192.168.13.0 0.0.0.255 area 0
```

Verification Commands and Expected Output

1. Neighbor Table


arduino

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```
Router3# show ip ospf neighbor
```

Expected Output:


nginx

 Copy code

Neighbor ID	Pri	State	Dead Time	Address	Interface
192.168.13.1	1	FULL/BDR	00:00:33	192.168.13.1	GigabitEthernet2
10.1.4.5	1	FULL/DR	00:00:36	10.1.4.5	GigabitEthernet1

2. OSPF Interface Summary

kotlin

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```
Router3# show ip ospf interface brief
```

Expected Output:


swift

 Copy code

Interface	PID	Area	IP Address/Mask	Cost	State	Nbrs	F/C
Gi1	1	2	10.1.4.3/24	1	DR	1/1	
Gi2	1	0	192.168.13.3/24	1	DR	1/1	

✓ 3. Routing Table Verification


arduino

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```
Router3# show ip route ospf
```

Expected Output:

nginx

 Copy code

```
O IA 192.168.12.0/24 [110/2] via 192.168.13.1, 00:00:13, GigabitEthernet2
O IA 10.1.1.0/24     [110/3] via 192.168.13.1, 00:00:13, GigabitEthernet2
O IA 10.1.2.0/24     [110/4] via 192.168.13.1, 00:00:13, GigabitEthernet2
```

Router 3 Questions

Instructions:

Answer the questions for each section.

Router (3)


1. Which routers form adjacencies with Router3?
2. Which areas does Router3 participate in?
3. How many networks are being advertised by Router3?
4. What LSAs appear in the OSPF database?
5. Which networks are learned from Area 1, and how are they represented in the routing table?
6. What does the cost metric indicate about the 10.1.4.0/24 link?

Router 4 – Internal Router (Area 1)

Configuration Summary

```
bash


hostname Router4
interface GigabitEthernet1
 ip address 10.1.2.4 255.255.255.0
!
interface GigabitEthernet2
 ip address 10.1.1.4 255.255.255.0
!
router ospf 1
 network 10.1.1.0 0.0.0.255 area 1
 network 10.1.2.0 0.0.0.255 area 1
```

 Copy code

Verification Commands and Expected Output

✓ 1. Neighbor Table


```
arduino
```

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```
Router4# show ip ospf neighbor
```

Expected Output:

```
nginx
```

 Copy code

Neighbor ID	Pri	State	Dead Time	Address	Interface
10.1.1.2	1	FULL/BDR	00:00:37	10.1.1.2	GigabitEthernet2

✓ 2. OSPF Routing Table


```
arduino
```

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```
Router4# show ip route ospf
```

Expected Output:

```
nginx
```

 Copy code

```
O IA 192.168.12.0/24 [110/2] via 10.1.1.2, 00:00:10, GigabitEthernet2
O IA 192.168.13.0/24 [110/3] via 10.1.1.2, 00:00:10, GigabitEthernet2
O IA 10.1.4.0/24 [110/3] via 10.1.1.2, 00:00:10, GigabitEthernet2
O IA 10.1.5.0/24 [110/4] via 10.1.1.2, 00:00:10, GigabitEthernet2
```

Router 4 Questions

Instructions:

Answer the questions for each section.

Router (4)


1. Who is Router4's OSPF neighbor?
2. How many OSPF networks are being advertised by Router4?
3. What OSPF area does Router4 belong to?
4. Are there any O IA routes in its routing table?
5. Which router provides inter-area route updates to Router4?
6. What is the significance of Router4's OSPF state being "FULL"?

Router 5 – Internal Router (Area 2)

Configuration Summary

```
bash


hostname Router5
interface GigabitEthernet1
 ip address 10.1.4.5 255.255.255.0
!
interface GigabitEthernet2
 ip address 10.1.5.5 255.255.255.0
!
router ospf 1
 network 10.1.4.0 0.0.0.255 area 2
 network 10.1.5.0 0.0.0.255 area 2
```

 Copy code

Verification Commands and Expected Output

✓ 1. Neighbor Table

```
arduino
```

 Copy code

```
Router5# show ip ospf neighbor
```

Expected Output:

```
nginx
```

 Copy code

Neighbor	ID	Pri	State	Dead Time	Address	Interface
	10.1.4.3	1	FULL/BDR	00:00:36	10.1.4.3	GigabitEthernet1

✓ 2. OSPF Routes


```
arduino
```

 Copy code

```
Router5# show ip route ospf
```

Expected Output:

```
nginx
```

 Copy code

```
O IA 192.168.12.0/24 [110/3] via 10.1.4.3, 00:00:12, GigabitEthernet1
O IA 192.168.13.0/24 [110/2] via 10.1.4.3, 00:00:12, GigabitEthernet1
O IA 10.1.1.0/24 [110/3] via 10.1.4.3, 00:00:12, GigabitEthernet1
O IA 10.1.2.0/24 [110/4] via 10.1.4.3, 00:00:12, GigabitEthernet1
```

Router 5 Questions

Instructions:

Answer the questions for each section.

Router (5)

1. Who is Router5's OSPF neighbor, and what is their Router ID?
2. What type of routes (O, O IA) are visible in the routing table?
3. How does Router5 learn about Area 1 networks?
4. How many networks are reachable via OSPF?
5. What would happen if Router3's OSPF process stopped?
6. What evidence proves Router5 is not an ABR?