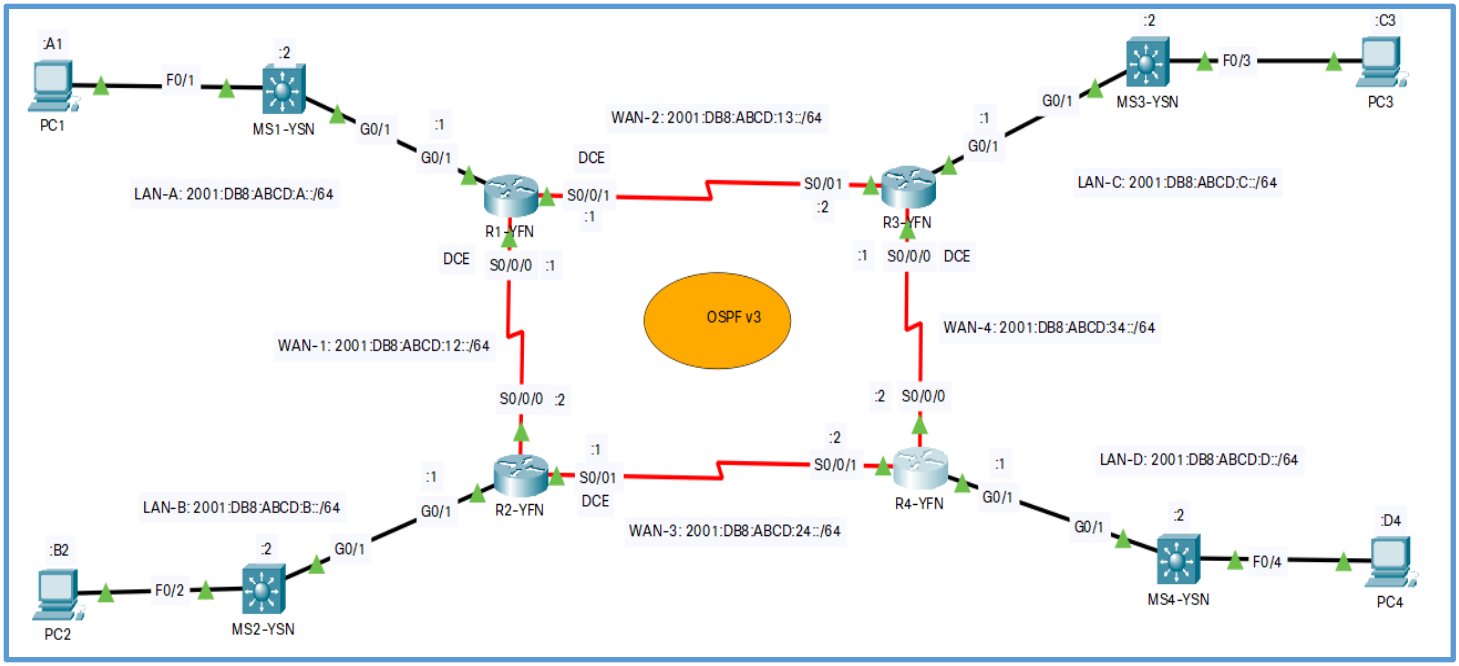
Lab objective:

Configure OSPFv3 Routing and Verification

Lab Activity – OSPFv3 Routing (Dynamic):

a. There are four LANs and four WANs in the topology below. Please simulate the following topology in any simulator, preferably Packet Tracer.

YFN → Your First Name YSN → Your Last/Family Name



Required Resources:

- Four Multilayer Switches (Cisco 3560 with Cisco IOS Release 15+ image)
- Four Routers (Cisco 1941 with Cisco IOS Release 15+ image)
- Four PCs (Windows with Terminal Emulation Program)
- Cables:

- Console cables to configure the Cisco IOS devices through the console port.
- Ethernet cables as shown in the topology.

Addressing Table:

Device	Interface	IP Address	Default Gateway
MS1-YSN	VLAN1	2001:DB8:ABCD:A::2/64 FE80::1 (Link Local)	2001:DB8:ABCD:A::1/64
MS2-YSN	VLAN1	2001:DB8:ABCD:B::2/64 FE80::2 (Link Local)	2001:DB8:ABCD:B::1/64
MS3-YSN	VLAN1	2001:DB8:ABCD:C::2/64 FE80::3 (Link Local)	2001:DB8:ABCD:C::1/64
MS4-YSN	VLAN1	2001:DB8:ABCD:D::2/64 FE80::4 (Link Local)	2001:DB8:ABCD:D::1/64
R1-YFN	G0/1	2001:DB8:ABCD:A::1/64 FE80::1 (Link Local)	N/A
	S0/0/0	2001:DB8:ABCD:12::1/64 FE80::1 (Link Local)	N/A
	S0/0/1	2001:DB8:ABCD:13::1/64 FE80::1 (Link Local)	N/A
R2-YFN	G0/1	2001:DB8:ABCD:B::1/64 FE80::2 (Link Local)	N/A
	S0/0/0	2001:DB8:ABCD:12::2/64 FE80::2 (Link Local)	N/A
	S0/0/1	2001:DB8:ABCD:24::1/64 FE80::2 (Link Local)	N/A
R3-YFN	G0/1	2001:DB8:ABCD:C::1/64 FE80::3 (Link Local)	N/A
	S0/0/0	2001:DB8:ABCD:34::1/64 FE80::3 (Link Local)	N/A
	S0/0/1	2001:DB8:ABCD:13::2/64 FE80::3 (Link Local)	N/A
R4-YFN	G0/1	2001:DB8:ABCD:D::1/64 FE80::4 (Link Local)	N/A
	S0/0/0	2001:DB8:ABCD:34::2/64	N/A

		FE80::4 (Link Local)	
	S0/0/1	2001:DB8:ABCD:24::2/64 FE80::4 (Link Local)	N/A
PC1	NIC	2001:DB8:ABCD:A::A1/64	FE80::1
PC2	NIC	2001:DB8:ABCD:B::B2/64	FE80::2
PC3	NIC	2001:DB8:ABCD:C::C3/64	FE80::3
PC4	NIC	2001:DB8:ABCD:D::D4/64	FE80::4

Lab Description:

b. In this lab, please build a LAN and WAN based simple network.
    - LAN-A with one switch and one host.
    - LAN-B with one switch and one host.
    - LAN-C with one switch and one host.
    - LAN-D with one switch and one host.
    - Four WANs (WAN-1, WAN-2, WAN-3, and WAN-4) with four routers.
c. You are also required to do the basic configuration on the following devices:
    - Switches: Hostnames, SVI, default gateway, DNS lookup (disable), and so on.
    - Routers: Hostnames, IP addressing, DNS lookup (disable), and so on.

Instructions:

Step 1: Set up the network topology.

- Simulate the topology by using all the devices mentioned above and then cable them all together:

Step 2: Configure and verify basic switch settings on all switches.

- Console into the switch and enter the global configuration mode:

Step 3: Configure and verify basic router settings on all routers.

- Console into the router and enter the global configuration mode:

Step 4: Configure all host devices.

Step 5: Verify connections.

a. Every router should be able to ping its directly connected neighbour router.
b. Every host device should be able to ping its switch SVI and default gateway.
c. Every switch should be able to ping its directly connected host device and default gateway.

Step 6: Configure OSPF routing on all routers so that all hosts can communicate with every host in all LANs and WANs. The below configuration is for R1-YFN.

Step 7: Verify the connectivity.
NOTE: All the above-mentioned pings must work, otherwise troubleshoot the network.

Step 8: OSPF Verification. Sample output is provided for all the steps below. Please submit similar output for each router while highlighting the important information in the output, as displayed below.

a. OSPF routing verification
   - Execute the following command on all routers and check that all eight routes (four LANs, four WANs) are available from the entire network on every router.
     - show ipv6 route.

Sample Output for Router R1

```
R1-Muhammad#show ipv6 route
IPv6 Routing Table - 12 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
U - Per-user Static route, M - MIPv6
I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect
O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
D - EIGRP, EX - EIGRP external

O 2001:DB8:ABCD:A::/64 [110/65]
via FE80::1, Serial0/0/0
C 2001:DB8:ABCD:B::/64 [0/0]
via GigabitEthernet0/1, directly connected
L 2001:DB8:ABCD:B::1/128 [0/0]
via GigabitEthernet0/1, receive
O 2001:DB8:ABCD:C::/64 [110/129]
via FE80::1, Serial0/0/0
via FE80::4, Serial0/0/1
O 2001:DB8:ABCD:D::/64 [110/65]
via FE80::4, Serial0/0/1
C 2001:DB8:ABCD:12::/64 [0/0]
via Serial0/0/0, directly connected
L 2001:DB8:ABCD:12::2/128 [0/0]
via Serial0/0/0, receive
O 2001:DB8:ABCD:13::/64 [110/128]
via FE80::1, Serial0/0/0
C 2001:DB8:ABCD:24::/64 [0/0]
via Serial0/0/1, directly connected
L 2001:DB8:ABCD:24::1/128 [0/0]
via Serial0/0/1, receive
O 2001:DB8:ABCD:34::/64 [110/128]
via FE80::4, Serial0/0/1
```

It can be clearly noticed from the above output that there are three directly connected routes and five OSPF routes, so this router R1-YFN can reach all eight networks (four LANs and four WANs) in the mentioned topology.

b. OSPF neighbour verification
   - Execute the following command on all routers to check and verify that all the routers have two neighbours each.
     - *show ipv6 ospf neighbor*

Sample Output for all Routers

R1-Muhammad#show ipv6 ospf neighbor

Neighbor ID	Pri	State	Dead Time	Interface ID	Interface
36.36.36.36	0	FULL/ -	00:00:38	4	Serial0/0/1
26.26.26.26	0	FULL/ -	00:00:37	3	Serial0/0/0

R2-Muhammad#show ipv6 ospf neighbor

Neighbor ID	Pri	State	Dead Time	Interface ID	Interface
46.46.46.46	0	FULL/ -	00:00:36	4	Serial0/0/1
16.16.16.16	0	FULL/ -	00:00:39	3	Serial0/0/0

R3-Muhammad#show ipv6 ospf neig

Neighbor ID	Pri	State	Dead Time	Interface ID	Interface
46.46.46.46	0	FULL/ -	00:00:38	3	Serial0/0/0
16.16.16.16	0	FULL/ -	00:00:35	4	Serial0/0/1

R4-Muhammad#show ipv6 ospf neighbor

Neighbor ID	Pri	State	Dead Time	Interface ID	Interface
36.36.36.36	0	FULL/ -	00:00:32	3	Serial0/0/0
26.26.26.26	0	FULL/ -	00:00:31	4	Serial0/0/1

c. OSPF process information verification
   - Execute the following command on all routers to check and verify the process ID list of interfaces taking part in OSPFv3 (IPv6).
     - *Show ipv6 protocols*

Sample Output for Router R3

```
R3-Muhammad#show ipv6 protocols
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "ospf 1"
Interfaces (Area 0)
GigabitEthernet0/1
Serial0/0/1
Serial0/0/0
Redistribution:
None
```

d. OSPFv3 interface verification
   - Execute the following command on all routers to check and verify interface status, its link local address, Process ID, and Router ID.
     - *show ipv6 ospf interfaces*

Sample Output for Router R2

```
R2-Muhammad#show ipv6 ospf interface
GigabitEthernet0/1 is up, line protocol is up
Link Local Address FE80::2, Interface ID 2
Area 0, Process ID 1, Instance ID 0, Router ID 26.26.26.26
Network Type BROADCAST, Cost: 1
Transmit Delay is 1 sec, State WAITING, Priority 1
No designated router on this network
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
No Hellos (Passive interface)
Index 1/1, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 1, maximum is 1
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 0, Adjacent neighbor count is 0
Suppress hello for 0 neighbor(s)
Serial0/0/0 is up, line protocol is up
Link Local Address FE80::2, Interface ID 3
Area 0, Process ID 1, Instance ID 0, Router ID 26.26.26.26
Network Type POINT-TO-POINT, Cost: 64
Transmit Delay is 1 sec, State POINT-TO-POINT,
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
Hello due in 00:00:04
Index 2/2, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 1, maximum is 1
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 1 , Adjacent neighbor count is 1
Adjacent with neighbor 16.16.16.16
Suppress hello for 0 neighbor(s)
Serial0/0/1 is up, line protocol is up
Link Local Address FE80::2, Interface ID 4
Area 0, Process ID 1, Instance ID 0, Router ID 26.26.26.26
Network Type POINT-TO-POINT, Cost: 64
Transmit Delay is 1 sec, State POINT-TO-POINT,
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
Hello due in 00:00:05
Index 3/3, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 1, maximum is 1
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 1 , Adjacent neighbor count is 1
Adjacent with neighbor 46.46.46.46
Suppress hello for 0 neighbor(s)
```