

Course: CYB204 (Cisco Technologies – CCNA)

Lab 8: Configure OSPFv3 Routing and Verification

Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Student ID: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Section: \_\_\_\_\_\_\_\_

**Lab Activity – OSPFv3 Routing (Dynamic):**

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

Diagram

Description automatically generated 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  FE80::4 (Link Local) | N/A |
| 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:

1. 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.
2. 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:
  + Turn on the devices.
  + Connect the switch with the default gateway.
  + Connect the PCs and server with their respective switch.
  + Make sure all the lights between switches, PCs, laptops and server are green.

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

* Console into the switch and enter the global configuration mode:
  + Assign the switch with a host name according to the addressing table.
  + Disable unwanted DNS lookup.
  + Enable IPv6 configuration on switch: Perform the following commands on global configuration mode.
    - *sdm prefer dual-ipv4-and-ipv6 default*
    - *exit*
    - *copy running-config startup-config*
    - *reload*
  + Configure a login MOTD banner to warn about illegal access.
  + Assign the encrypted password cisco to privilege exec mode (#)
  + Protect the physical and virtual lines from having console access using the password trios and configure ***logging synchronous*** for the console line.
  + Configure the domain name as trios.com (both the hostname and domain name are required for the encryption keys to be generated)
  + Configure username, to access SSH client access, as Admin and password as cisco123
  + Generate the encryption keys (1024) for securing the session.
  + Enable SSH version 2.
  + Allow switch to be accessed remotely using only SSH.
  + Encrypt all current and future passwords by enabling the required service.
  + Configure and activate SVI according to the addressing table.
    - *interface vlan 1*
    - *ipv6 address 2001:DB8:ABCD:A::2/64*
    - *ipv6 address fe80::1 link-local*
    - *no shut*
    - *exit*
  + Configure default gateway according to the addressing table.
    - ipv6 route ::/0 2001:DB8:ABCD:A::1
    - exit
  + Save the configuration.

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

* Console into the router and enter the global configuration mode:
  + Assign the routers with host names according to the addressing table.
  + Disable unwanted DNS lookup.
  + Enable IPv6 configuration (***ipv6 unicast-routing***).
  + Configure a login MOTD banner to warn about illegal access.
  + Assign the encrypted password cisco to privilege exec mode (#)
  + Protect the physical and virtual lines from having console access using the password trios and configure ***logging synchronous*** for the console line.
  + Configure domain name as trios.com (both the hostname and domain name are required for the encryption keys to be generated)
  + Configure username, to access SSH client access, as Admin and password as cisco123
  + Generate the encryption keys (1024 bits) for securing the session.
  + Enable SSH version 2.
  + Allow router to be accessed remotely using only SSH.
  + Encrypt all current and future passwords by enabling the required service.
  + Configure and activate all the interfaces according to the addressing table.
    - *interface g0/1*
    - *ipv6 address 2001:DB8:ABCD:A::1/64*
    - *ipv6 address FE80::1 link-local*
    - *no shut*
    - *exit*

Note: (continue to similarly configure the other interfaces)

* + Set the clock rate for serial (DCE) interface at 128000.
  + Provide appropriate description on all the active interfaces.
  + Save the configuration.

Step 4: Configure all host devices.

1. Click to explore PC1.
2. Select IP configuration under Desktop tab.
3. Enter the IPv6 address, subnet mask, and default gateway from the addressing table above.
4. Repeat the above steps from a to c for all host devices.

Step 5: Verify connections.

1. Every router should be able to ping its directly connected neighbour router.
2. Every host device should be able to ping its switch SVI and default gateway.
3. 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.

1. Enter into OSPF routing configuration mode.
   * *ipv6 router ospf 1* (1 is the local process id)
2. Configure the router ID
   * *router-id 16.16.16.16* (For R1-YFN)
   * *exit*

(Note: 26.26.26.26 for R2-YFN, 36.36.36.36 for R3-YFN, 46.46.46.46 for R4-YFN)

1. Configure to OSPFv3 on all routers.
   * *interface g0/1*
   * *ipv6 ospf 1 area 0*
   * *interface s0/0/0*
   * *ipv6 ospf 1 area 0*
   * *interface s0/0/1*
   * *ipv6 ospf 1 area 0*
2. Disable routing updates towards LANs using passive interface command.
3. Save the configuration.
4. Repeat the above steps from a to e for every router while changing router-id and interfaces in regard to the relevant router.

Step 7: Verify the connectivity.

* Using the command line at PC1, ping the IP address of:
  + PC2, PC3, and PC4
* Using the switch MS1-YSN, ping the IP address of:
  + S0/0/0 interface of router R3-YFN
  + S0/1/1 interface of router R4-YFN
  + G0/1 interfaces of R1-YFN, R2-YFN, R3-YFN, and R4-YFN
* Using the router R4-YFN, ping the SVI of MS1-YSN, MS2-YSN, MS3-YSN, and MS4-YSN
* Using the command line at PC4, ping the IP address of:
  + PC1
  + SVI of MS1-YSN, MS2-YSN, and MS3-YSN
  + G0/1 of R1-YFN
  + S0/0/0 of R2-YFN

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.

1. 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.

1. 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

**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

**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

1. 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

1. 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)