NETWORK PROTOCOLS AND SECURITY

23EC2210R 23EC2210A 23EC2210E

LAB MANUAL – 2024-25

STUDENT ID:

STUDENT NAME:

ACADEMIC YEAR: 2024-25

Lab 7: Configuration of ARP and Static Routing using Cisco network switch and verify the connectivity

Learning outcome:

- Understand the role of a router in a computer network and its importance in facilitating communication between different network segments.
- Gain familiarity with Huawei L3 network switches and their specific features and capabilities related to router functionality and static routing.

Configuring ARP (Address Resolution Protocol) and static routing on a Cisco network switch involves setting up the switch to handle ARP requests and responses, as well as defining static routes for network traffic. Below are the steps to configure ARP and static routing on a Cisco switch:

Step 1: Configure ARP on a Cisco Switch

ARP is generally automatically handled by Cisco switches and routers. However, you can configure static ARP entries if needed.

1. **Access the Switch**: Connect to your switch via the console port.
2. **Enter Privileged EXEC Mode**:

   Switch> enable
3. **Enter Global Configuration Mode**:

   Switch# configure terminal
4. **Add a Static ARP Entry**:

   Switch(config)# arp 192.168.1.10 00a0.c91b.b2b8 ARPA

Step 2: Configure Static Routing on a Cisco Switch

To configure static routing, you need to ensure that the switch has Layer 3 capabilities (i.e., it is a Layer 3 switch).

1. **Enable IP Routing** (if necessary):

   Switch(config)# ip routing
2. **Configure a Static Route**:

   Switch(config)# ip route <destination-network> <subnet-mask> <next-hop-ip>

   For example, to route traffic to the 192.168.2.0/24 network via the next-hop IP address 192.168.1.1:

   Switch(config)# ip route 192.168.2.0 255.255.255.0 192.168.1.1

Step 3: Verify Configuration

1. **Verify ARP Table**:

   Switch# show ip arp

2. **Verify Static Routes**:

   Switch# show ip route

Example Topology and Configuration

Assume you have a simple network topology with two VLANs, two Layer 3 switches, and a router.

Switch 1 Configuration

1. **Create VLANs and Assign IP Addresses**:

   Switch1(config)# vlan 10
   Switch1(config-vlan)# name Sales
   Switch1(config-vlan)# exit

   Switch1(config)# vlan 20
   Switch1(config-vlan)# name Engineering
   Switch1(config-vlan)# exit

   Switch1(config)# interface vlan 10
   Switch1(config-if)# ip address 192.168.10.1 255.255.255.0
   Switch1(config-if)# no shutdown

   Switch1(config)# interface vlan 20
   Switch1(config-if)# ip address 192.168.20.1 255.255.255.0
   Switch1(config-if)# no shutdown

2. **Enable IP Routing**:

   Switch1(config)# ip routing

3. **Configure Static Routes**:

   Switch1(config)# ip route 192.168.30.0 255.255.255.0 192.168.10.2

Switch 2 Configuration

1. **Create VLANs and Assign IP Addresses**:

   Switch2(config)# vlan 30
   Switch2(config-vlan)# name Management
   Switch2(config-vlan)# exit

   Switch2(config)# interface vlan 30
   Switch2(config-if)# ip address 192.168.30.1 255.255.255.0

Switch2(config-if)# no shutdown

2. **Enable IP Routing**:

   Switch2(config)# ip routing

3. **Configure Static Routes**:

   Switch2(config)# ip route 192.168.10.0 255.255.255.0 192.168.30.2

   Switch2(config)# ip route 192.168.20.0 255.255.255.0 192.168.30.2

Router Configuration (if needed)

1. **Assign IP Addresses to Interfaces**:

   Router(config)# interface gigabitEthernet 0/0

   Router(config-if)# ip address 192.168.10.2 255.255.255.0

   Router(config-if)# no shutdown

   Router(config)# interface gigabitEthernet 0/1

   Router(config-if)# ip address 192.168.30.2 255.255.255.0

   Router(config-if)# no shutdown

2. **Enable IP Routing (if not already enabled)**:

   Router(config)# ip routing

Testing and Verification

1. **Check ARP Entries**:

   Switch1# show ip arp

2. **Check Static Routes**:

   Switch1# show ip route

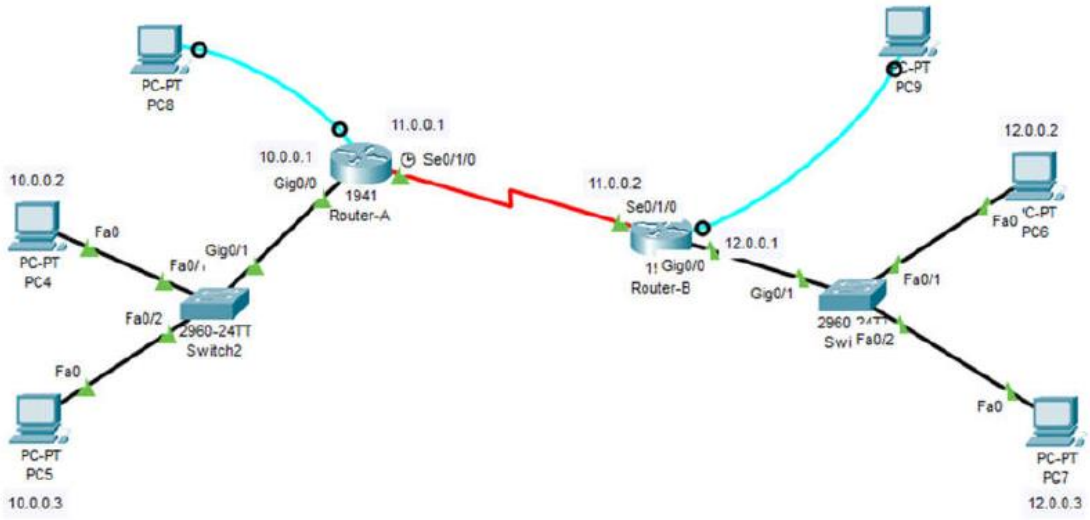
3. **Ping to Verify Connectivity**:

   Switch1# ping 192.168.30.1

Configuration of Static Routing

Addressing Table

Device	IP Address	Subnet Mask	Default Gateway
PC4	10.0.0.2	255.0.0.0	10.0.0.1
PC5	10.0.0.3	255.0.0.0	10.0.0.1
PC6	12.0.0.2	255.0.0.0	12.0.0.1
PC7	12.0.0.3	255.0.0.0	12.0.0.1
Router-A	**Interface: g0/0**	**IP Address: 10.0.0.1**	**Subnet Mask: 255.0.0.0**
	Interface: s0/1/0	**IP Address: 11.0.0.1**	**Subnet Mask: 255.0.0.0**
Router-B	**Interface: g0/0**	**IP Address: 12.0.0.1**	**Subnet Mask: 255.0.0.0**
	Interface: s0/1/0	**IP Address: 11.0.0.2**	**Subnet Mask: 255.0.0.0**



Router Configuration	
Router-A	**Router-B**
Router>en Router#config t Router(config)#int g0/0 Router(config-if)#ip address 10.0.0.1 255.0.0.0 Router(config-if)#no shut Router(config-if)#exit Router(config)#int s0/1/0 Router(config-if)#clock rate 64000 Router(config-if)#ip address 11.0.0.1 255.0.0.0 Router(config-if)#no shut Router(config-if)#exit Router(config)#ip route 12.0.0.0 255.0.0.0 11.0.0.2	Router>en Router#config t Router(config)#int g0/0 Router(config-if)#ip address 12.0.0.1 255.0.0.0 Router(config-if)#no shut Router(config-if)#exit Router(config)#int s0/1/0 Router(config-if)#ip address 11.0.0.2 255.0.0.0 Router(config-if)#no shut Router(config-if)#exit Router(config)#ip route 10.0.0.0 255.0.0.0 11.0.0.1

Conclusion

By following these steps, you can configure ARP and static routing on a Cisco switch, enabling communication between different VLANs and networks. This setup is essential for managing network traffic efficiently and ensuring proper connectivity in a multi-network environment.

Lab 8: Configuration of RIP and OSPF using Cisco network switch and verify the connectivity

Learning outcome:

- Understanding OSPF Basics and its role in dynamic routing protocols.
- Demonstrate an understanding of basic Cisco switch configuration, including accessing the command-line interface (CLI) and configuring interfaces.
- Identify and specify the OSPF router ID and Choose the OSPF network type (point-to-point, broadcast, etc.) and configure it accordingly.
- Understand the concept of hierarchical OSPF and area design**.**

Configuring OSPF (Open Shortest Path First) on a Cisco network switch involves several steps. Here's a basic guide to help you configure OSPF and verify connectivity on a Cisco switch:

Note: OSPF is typically configured on routers rather than switches. If you are working with a Layer 3 switch, you can configure OSPF on the switch. If you are using a Layer 2 switch, you would configure OSPF on a connected router.

1. Access Switch CLI:

- Access the command-line interface (CLI) of your Cisco switch using a console cable, Telnet, or SSH.

2. Enter Global Configuration Mode:

- Enter global configuration mode by typing:

  switch> enable switch# configure terminal

3. Configure OSPF:

- Enter OSPF configuration mode and specify an OSPF process ID (e.g., 1):

  switch(config)# router ospf 1

4. Assign Router ID:

- Assign a router ID to the switch. This can be done manually or left to the system to choose. For manual assignment:

  switch(config-router)# router-id <router_id>

5. Enable OSPF on Interfaces:

- Enable OSPF on the interfaces participating in OSPF. For each interface, use:

switch(config-router)# network <network_address> <wildcard_mask> area <area_id>

6. Verify OSPF Configuration:

- Verify OSPF configuration using the following commands:

  switch# show ip ospf switch# show ip ospf interface

7. Exit Configuration Mode:

- Exit OSPF configuration mode and return to global configuration mode:

  switch(config-router)# exit

8. Save Configuration:

- Save the configuration to ensure it persists after a reboot:

  switch# write memory

9. Verify Connectivity:

- Verify OSPF connectivity by checking OSPF neighbor relationships and routing tables. Use commands such as:

  switch# show ip ospf neighbor switch# show ip route

10. Test Connectivity:

- Test connectivity between devices in different OSPF areas to ensure that OSPF is routing traffic correctly.

11. Troubleshoot if Necessary:

- If there are issues with OSPF adjacency or routing, use troubleshooting commands like:

  switch# show ip ospf interface switch# show ip ospf database

12. Monitor OSPF:

- Continuously monitor OSPF using commands such as:

  switch# debug ip ospf events switch# debug ip ospf adj

13. Disable Debugging:

- Once troubleshooting is complete, disable debugging:

  switch# undebug all

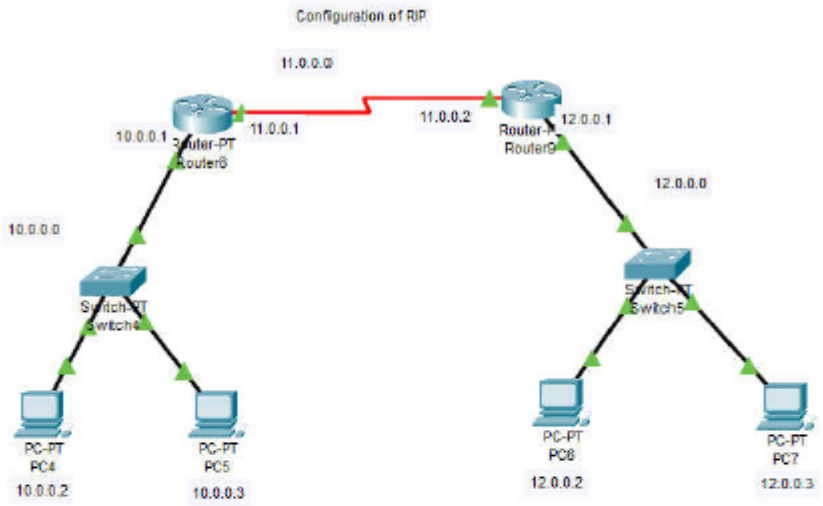
14. Save Final Configuration:

- Save the final configuration to ensure that it is persistent:

  switch# write memory

By following these steps, you can configure OSPF on a Cisco switch, verify the OSPF configuration, and ensure proper connectivity.

Configuration of RIP (Routing Information Protocol)



Configuration for PCs

PC4 IP Address: 10.0.0.2 Subnet Mask: 255.0.0.0 Default Gateway: 10.0.0.1	**PC5** IP Address: 10.0.0.3 Subnet Mask: 255.0.0.0 Default Gateway: 10.0.0.1
PC6 IP Address: 12.0.0.2 Subnet Mask: 255.0.0.0 Default Gateway: 12.0.0.1	**PC7** IP Address: 12.0.0.3 Subnet Mask: 255.0.0.0 Default Gateway: 12.0.0.1

Configuration for Routers

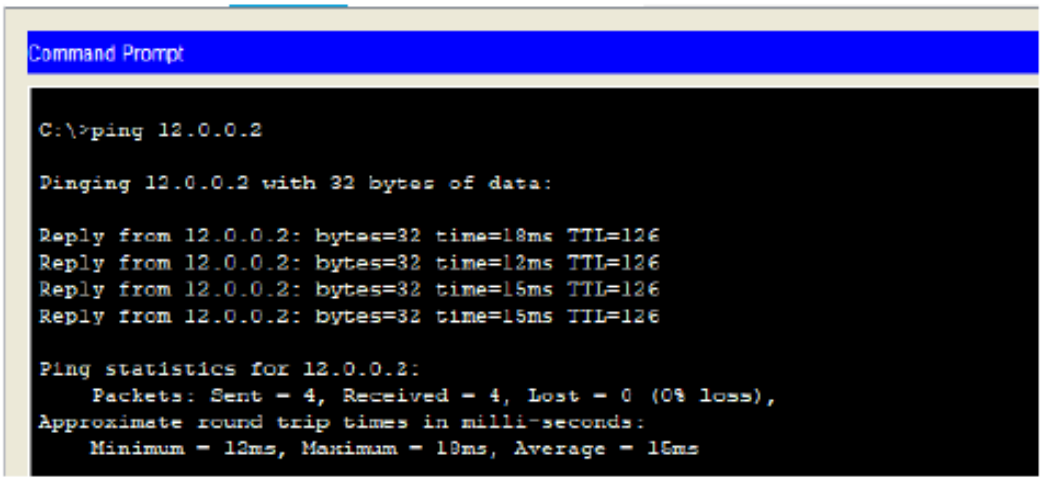
Fast Ethernet Port Configuration	
Router 8 Router>en Router#config t Router(config)# int f0/0 Router(config-if)# ip address 10.0.0.1 255.0.0.0 Router(config-if)# no shut	**Router 9** Router>en Router#config t Router(config)# int f0/0 Router(config-if)# ip address 12.0.0.1 255.0.0.0 Router(config-if)# no shut
Serial Port Configuration	
Router 8 Router#config t Router(config)# int s2/0 Router(config-if)# ip address 11.0.0.1 255.0.0.0 Router(config-if)# no shut	**Router 9** Router#config t Router(config)# int s2/0 Router(config-if)# ip address 11.0.0.2 255.0.0.0 Router(config-if)# no shut

RIP Configuration	
Router 8 Router#config t Router(config)# router rip Router(config-router)# network 10.0.0.0 Router(config-router)# network 11.0.0.0	**Router 9** Router#config t Router(config)# router rip Router(config-router)# network 11.0.0.0 Router(config-router)# network 12.0.0.0

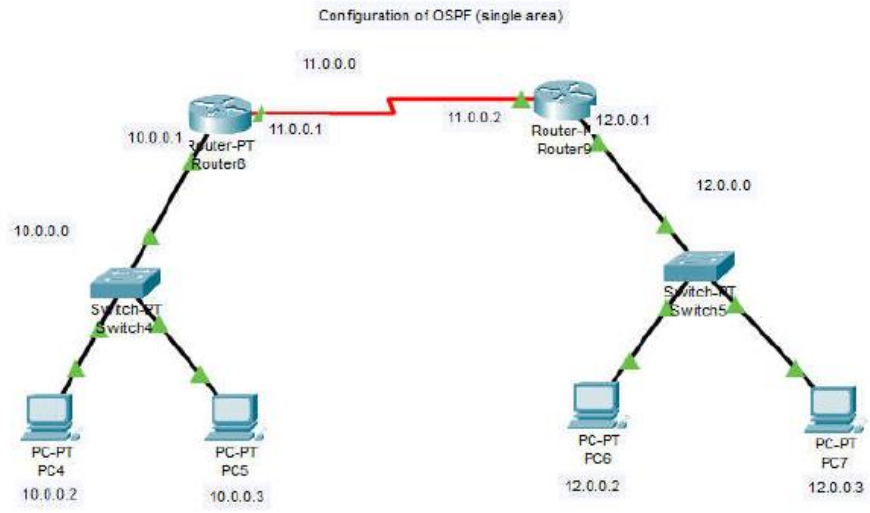
Output

To check whether the OSPF configuration is running properly lets go to the command prompt of PC4 and give the following command as below

C:\>ping 12.0.0.2 (pinging PC6)
The output is as follows



Configuration of OSPF (Open Shortest Path First Protocol)-Single Area



Configuration for PCs

PC4 IP Address: 10.0.0.2 Subnet Mask: 255.0.0.0 Default Gateway: 10.0.0.1	**PC5** IP Address: 10.0.0.3 Subnet Mask: 255.0.0.0 Default Gateway: 10.0.0.1
PC6 IP Address: 12.0.0.2 Subnet Mask: 255.0.0.0 Default Gateway: 12.0.0.1	**PC7** IP Address: 12.0.0.3 Subnet Mask: 255.0.0.0 Default Gateway: 12.0.0.1

Configuration for Routers

Fast Ethernet Port Configuration	
Router 8 Router>en Router#config t Router(config)# int f0/0 Router(config-if)# ip address 10.0.0.1 255.0.0.0 Router(config-if)# no shut	**Router 9** Router>en Router#config t Router(config)# int f0/0 Router(config-if)# ip address 12.0.0.1 255.0.0.0 Router(config-if)# no shut
Serial Port Configuration	
Router 8 Router#config t Router(config)# int s2/0 Router(config-if)# ip address 11.0.0.1 255.0.0.0 Router(config-if)# no shut	**Router 9** Router#config t Router(config)# int s2/0 Router(config-if)# ip address 11.0.0.2 255.0.0.0 Router(config-if)# no shut

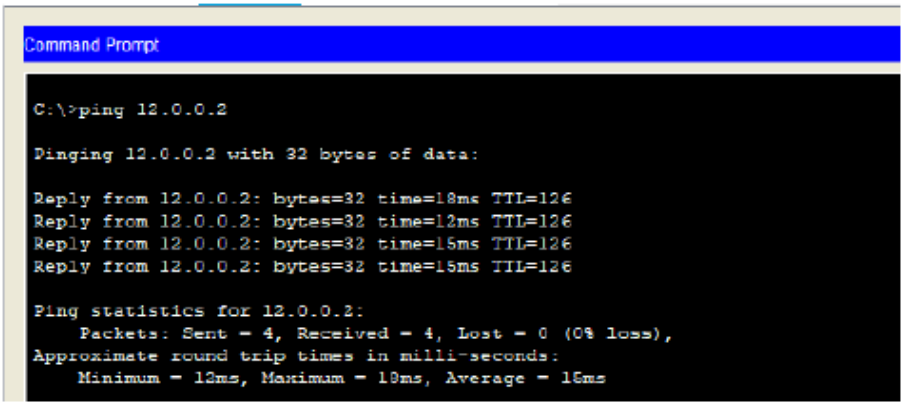
OSPF (Single Area) Configuration	
Router 8 Router#config t Router(config)# router ospf 1 Router(config-router)# network 10.0.0.0 0.255.255.255 area 0 Router(config-router)# network 11.0.0.0 0.255.255.255 area 0	**Router 9** Router#config t Router(config)# router ospf 1 Router(config-router)# network 11.0.0.0 0.255.255.255 area 0 Router(config-router)# network 12.0.0.0 0.255.255.255 area 0

Output

To check whether the OSPF configuration is running properly lets go to the command prompt of PC4 and give the following command as below

C:\>ping 12.0.0.2 (pinging PC6)

The output is as follows



Conclusion

By following these steps, we successfully configured RIP and OSPF on Cisco network switches using Cisco Packet Tracer. The process involved:

- Enabling and configuring RIP for simple, distance-vector routing in smaller networks.
- Enabling and configuring OSPF for efficient, link-state routing in larger and more complex networks.
- Verifying routing tables and neighbor relationships to ensure proper route advertisement and learning.

Configuring both RIP and OSPF enhances the network's ability to dynamically learn and advertise routes, improving overall network efficiency and reliability. RIP is straightforward and easy to configure, making it suitable for smaller networks with limited complexity. OSPF, on the other hand, provides more advanced features and scalability, making it ideal for larger enterprise networks. Understanding and implementing these routing protocols is crucial for network administrators to ensure optimal routing performance and network connectivity in various environments.