Assignment 1: Packet Tracer - Build a Switch and Router Network

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Introduction

In this report, I'll outline a hands-on lab activity focused on configuring a network of routers and switches. My task was to build and configure the network according to a provided diagram and addressing table. Throughout the lab, I applied practical Cisco IOS commands with minimal assistance.

I configured routers and switches to match specified addressing requirements and verified network connectivity. Additionally, I retrieved information from devices using IOS commands to answer questions about network equipment.

The lab utilized Cisco 4221 routers with Cisco IOS XE Release 16.9.4 and Catalyst 2960s switches with Cisco IOS Release 15.2(2). However, other devices and IOS versions may be used with slight variations in commands and output.

It was essential to erase startup configurations before starting the lab and configure the Switch Database Manager (SDM) template to support IPv6 address capabilities. I followed instructions to assign the dual-ipv4-and-ipv6 template as the default SDM template.

Overall, this lab provided valuable practical experience in network configuration and management, enhancing my understanding of networking concepts and skills in network administration.

Objectives

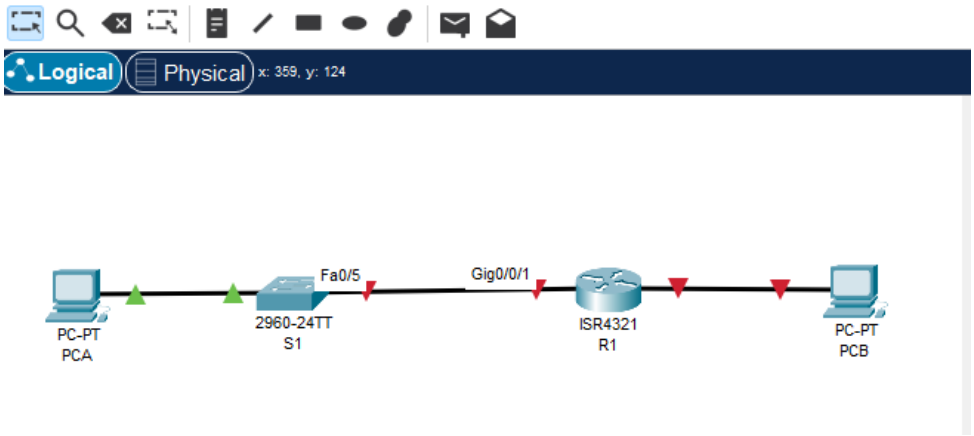
Part 1: Set Up the Topology and Initialize Devices

Part 2: Configure Devices and Verify Connectivity

Methodology

Part 1: Set Up Topology and Initialize Devices

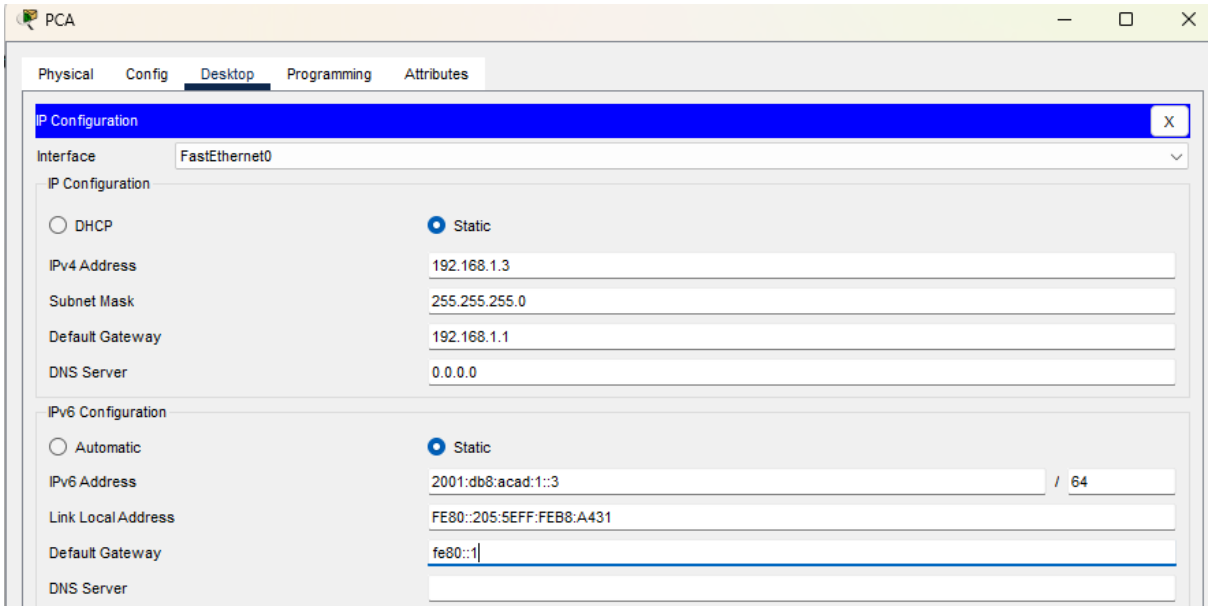
Step 1: Cable the network according to the provided topology diagram. Attach the devices as depicted and ensure all necessary cables are connected appropriately. Once connected, power on all devices to initialize the network.

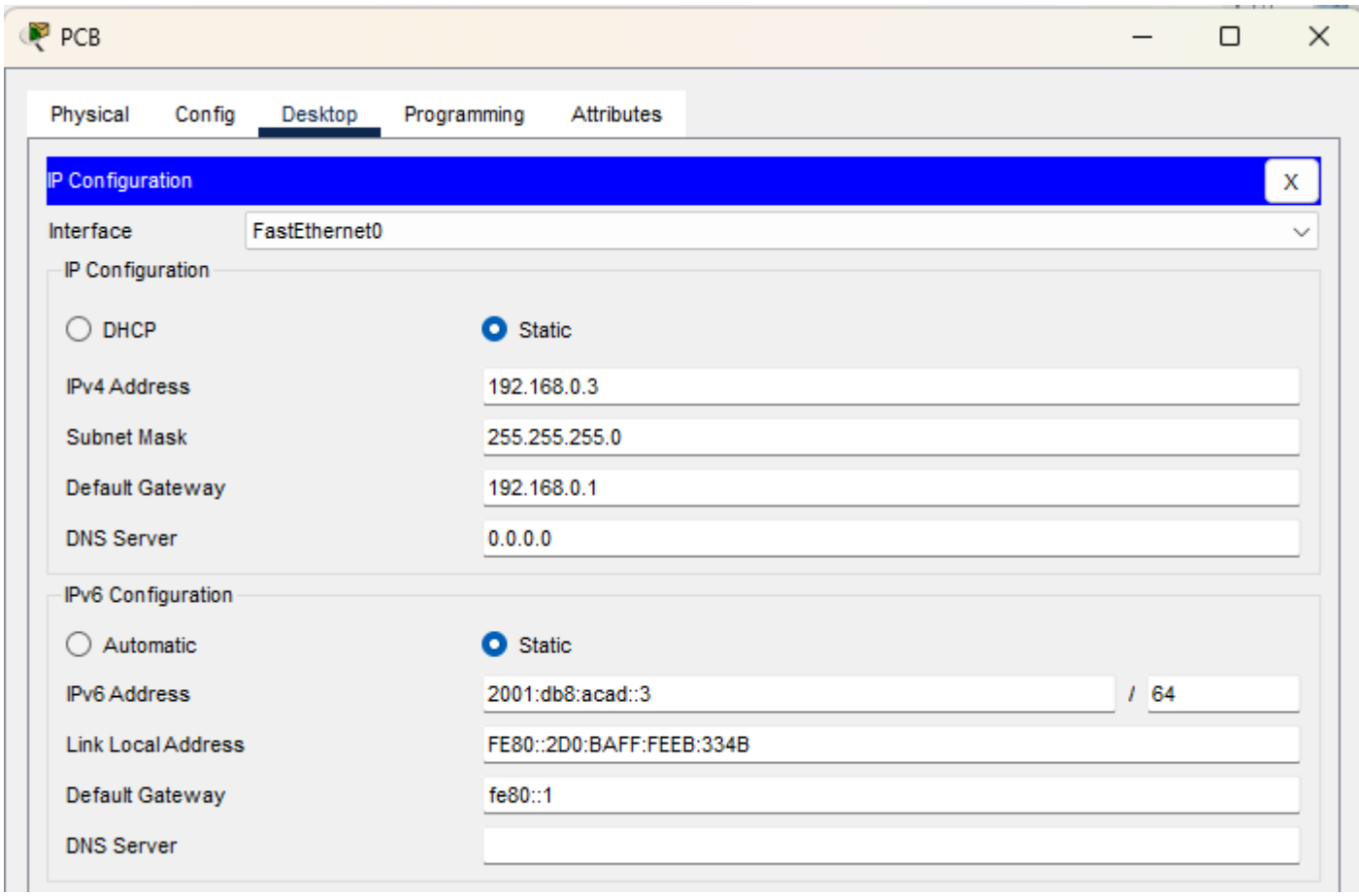


Part 2: Configure Devices and Verify Connectivity

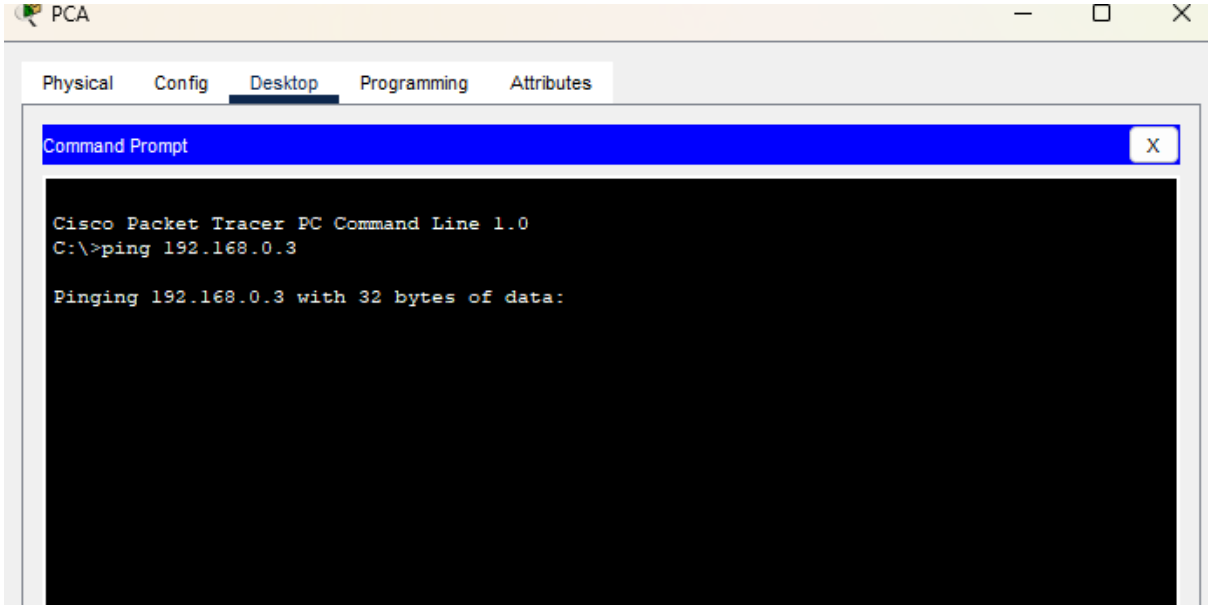
Step 1: Assign static IP information to the PC interfaces.

First, I configured the IP address, subnet mask, and default gateway settings on PC-A. Next, I repeated the same configuration steps for PC-B, ensuring both PCs have the correct network settings to enable proper communication within the network.





To verify network connectivity, I initiated a ping command from the command prompt on PC-A to PC-B. This test ensures that both PCs are properly configured and can communicate with each other over the network.



The pings aren't successful because the router interfaces (default gateways) have not been configured yet so Layer 3 traffic is not being routed between subnets.

Step 2: Configure the router.

To configure the router, I followed these steps:

1. **Enter Configuration Mode**: Accessed the router console and enabled privileged EXEC mode.
2. **Assign Device Name**: Named the router "R1".
3. **Disable DNS Lookup**: Prevented DNS translation of incorrect commands.

```
Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# hostname R1
R1(config)# no ip domain lookup
R1(config)# enable secret class
R1(config)# line console 0
R1(config-line)# password cisco
R1(config-line)# login
R1(config-line)# exit
R1(config)# vty 0 4
```

4. **Set Passwords**: Configured the encrypted privileged EXEC password "class" and the console and VTY passwords to "cisco".
5. **Encrypt Passwords**: Enabled encryption for plaintext passwords.

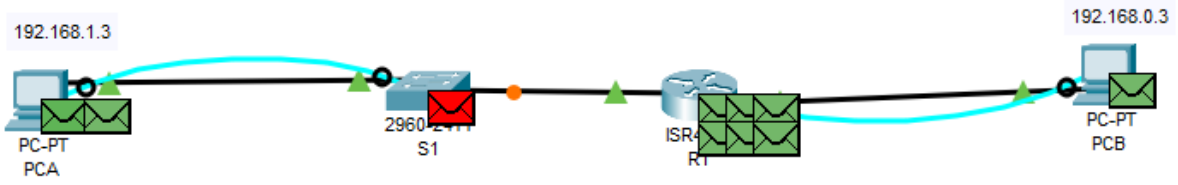
6. **Create MOTD Banner**: Added a banner warning unauthorized users.
7. **Configure Interfaces**: Assigned IP addresses and enabled both IPv4 and IPv6 on interfaces g0/0/0 and g0/0/1, and brought them up.
8. **Add Interface Descriptions**: Described each interface connection.
9. **Enable IPv6 Routing**: Enabled IPv6 unicast routing.
10. **Save Configuration**: Saved the running configuration to startup configuration.
11. **Set the Clock**: Set the router's clock to the current date and time.

```
R1(config)# line vty 0 4
R1(config-line)# password cisco
R1(config-line)# login
R1(config-line)# exit
R1(config)# service password-encryption
R1(config)# banner motd $ Authorized Users Only! $
R1(config)# interface g0/0/0
R1(config-if)# ip address 192.168.0.1 255.255.255.0
R1(config-if)# ipv6 address 2001:db8:acad::1/64
R1(config-if)# ipv6 address FE80::1 link-local
R1(config-if)# no shutdown

R1(config-if)# exit
R1(config)# interface g0/0/1
R1(config-if)# ip address 192.168.1.1 255.255.255.0
R1(config-if)# ipv6 address 2001:db8:acad:1::1/64
R1(config-if)# ipv6 address fe80::1 link-local
R1(config-if)# no shutdown

R1(config-if)# exit
R1(config)# interface g0/0/1
R1(config-if)# description Connected to F0/5 on S1
R1(config-if)# exit
R1(config)# interface g0/0/0
R1(config-if)# description Connected to Host PC-B
R1(config-if)# exit
R1(config)# ipv6 unicast-routing
R1(config)# exit
R1# copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
R1# clock set 15:30:00 27 Aug 2019
R1#
```

To verify network connectivity, I pinged PC-B from a command prompt window on PC-A.

Question: Were the pings successful? Explain.

Answer: Yes, the pings were successful. The router correctly routed the ping traffic across the two subnets, and the default settings for the 2960 switch automatically activated the interfaces connected to the devices, allowing seamless communication.



Step 3: Configure the Switch

In this step, I configured the switch by setting its hostname, configuring the VLAN 1 interface, and setting the default gateway.

1. I consoled into the switch and enabled privileged EXEC mode.
2. Entered configuration mode.
3. Assigned the device name "S1" to the switch.
4. Disabled DNS lookup to prevent incorrect command translation.

```
Press RETURN to get started!


%LINK-5-CHANGED: Interface FastEthernet0/6, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/6, changed state to up


Switch>en
Switch# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# hostname S1
S1(config)# no ip domain-lookup
S1(config)#
```

5. Configured and activated the VLAN 1 interface with the IP address 192.168.1.2 and brought it online.
6. Set the default gateway for the switch to 192.168.1.1.
7. Saved the running configuration to the startup configuration file to ensure the settings are retained after a reboot.

```
S1(config)# interface vlan 1
S1(config-if)# ip address 192.168.1.2 255.255.255.0
S1(config-if)# no shutdown

S1(config-if)# exit
S1(config)# ip default-gateway 192.168.1.1
S1(config)#
```

Step 4: Verify End-to-End Connectivity**

In this step, I performed connectivity tests to verify that communication is successful across the network.

a. I initiated a ping from PC-A to PC-B to ensure communication between the two PCs.

b. Next, I conducted a ping from switch S1 to PC-B to verify connectivity from the switch to PC-B.

All pings were successful, indicating that end-to-end connectivity has been established across the network.

Part 3: Display Device Information

In this section, I utilized show commands to gather essential interface and routing details from both the router and switch.

Step 1: Display Router Routing Table

a) To inspect the router's routing table and acquire insights into the network's routing configuration, I executed the "show ip route" command on the router.

```
R1# show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.0.0/24 is directly connected, GigabitEthernet0/0/0
L       192.168.0.1/32 is directly connected, GigabitEthernet0/0/0
     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/0/1
L       192.168.1.1/32 is directly connected, GigabitEthernet0/0/1

R1#
```

In the routing table, the "C" code designates a directly connected network, indicating that the router has an interface directly connected to the specified network. Additionally, the "L" code designates a local interface.

There are 2 route entries coded with a "C" in the routing table.

For the Cisco 4221 router used in this lab, the "C" coded routes are associated with the following interface types: G0/0/0 and G0/0/1

b) The "show ipv6 route" command on router R1 displays the IPv6 routing table, showing the routes that the router knows about for IPv6 networks. This command provides information about how IPv6 packets will be routed by the router

```
R1# show ipv6 route
IPv6 Routing Table - 5 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
C   2001:DB8:ACAD::/64 [0/0]
     via GigabitEthernet0/0/0, directly connected
L   2001:DB8:ACAD::1/128 [0/0]
     via GigabitEthernet0/0/0, receive
C   2001:DB8:ACAD:1::/64 [0/0]
     via GigabitEthernet0/0/1, directly connected
L   2001:DB8:ACAD:1::1/128 [0/0]
     via GigabitEthernet0/0/1, receive
L   FF00::/8 [0/0]
     via Null0, receive
R1#
```

Step 2: Display interface information on the router R1.

The "show ip interface g0/0/1" command displays detailed information about the GigabitEthernet0/0/1 interface on the router.

Running this command provides insight into the current configuration and status of the specified interface.

```
R1# show ip interface g0/0/1
GigabitEthernet0/0/1 is up, line protocol is up (connected)
  Internet address is 192.168.1.1/24
  Broadcast address is 255.255.255.255
  Address determined by setup command
  MTU is 1500 bytes
  Helper address is not set
  Directed broadcast forwarding is disabled
  Outgoing access list is not set
  Inbound  access list is not set
  Proxy ARP is enabled
  Security level is default
  Split horizon is enabled
  ICMP redirects are always sent
  ICMP unreachables are always sent
  ICMP mask replies are never sent
  IP fast switching is disabled
  IP fast switching on the same interface is disabled
  IP Flow switching is disabled
  IP Fast switching turbo vector
  IP multicast fast switching is disabled
  IP multicast distributed fast switching is disabled
  Router Discovery is disabled
  IP output packet accounting is disabled
  IP access violation accounting is disabled
  TCP/IP header compression is disabled
  RTP/IP header compression is disabled
  Probe proxy name replies are disabled
  Policy routing is disabled
  Network address translation is disabled
  BGP Policy Mapping is disabled
  Input features: MCI Check
  WCCP Redirect outbound is disabled
  WCCP Redirect inbound is disabled
  WCCP Redirect exclude is disabled
```

The operational status of the G0/0/1 interface is indicated as "up" for both the interface itself and the line protocol, implying that it is operational and connected.

```
R1# show ip interface g0/0/1
GigabitEthernet0/0/1 is up, line protocol is up (connected)
  Internet address is 192.168.1.1/24
```

The MAC address of the G0/0/1 interface is **0030.f267.ae02**

```
R1# show interface g0/0/1
GigabitEthernet0/0/1 is up, line protocol is up (connected)
  Hardware is Lance, address is 0030.f267.ae02 (bia 0030.f267.ae02)
```

The Internet address is displayed in the command as 192.168.1.1/24

```
R1# show ip interface g0/0/1
GigabitEthernet0/0/1 is up, line protocol is up (connected)
  Internet address is 192.168.1.1/24
  Broadcast address is 255.255.255.255
```

To display IPv6 information for interface G0/0/1, use the command: show ipv6 interface g0/0/1

```
R1# show ipv6 interface g0/0/1
GigabitEthernet0/0/1 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::1
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:DB8:ACAD:1::1, subnet is 2001:DB8:ACAD:1::/64
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::1:FF00:1
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds
  ND advertised reachable time is 0 (unspecified)
  ND advertised retransmit interval is 0 (unspecified)
  ND router advertisements are sent every 200 seconds
  ND router advertisements live for 1800 seconds
  ND advertised default router preference is Medium
  Hosts use stateless autoconfig for addresses.
R1#
```

Step 3: Display a summary list of the interfaces on the router and switch.

a) To display a brief overview of the IP interfaces configured on router R1, the command "show ip interface brief" is used.

```
R1# show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0/0   192.168.0.1     YES manual up                    up
GigabitEthernet0/0/1   192.168.1.1     YES manual up                    up
Vlan1                  unassigned      YES unset  administratively down down
R1#
```

b) To view a concise summary of the IPv6 interface configuration on router R1, the command "show ipv6 interface brief" is entered.

```
R1# show ipv6 interface brief
GigabitEthernet0/0/0       [up/up]
    FE80::1
    2001:DB8:ACAD::1
GigabitEthernet0/0/1       [up/up]
    FE80::1
    2001:DB8:ACAD:1::1
Vlan1                      [administratively down/down]
    unassigned
R1#
```

c) To display a brief summary of the IP interface configuration on switch S1, the command "show ip interface brief" is entered.

```
S1# show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/1        unassigned      YES manual down                  down
FastEthernet0/2        unassigned      YES manual down                  down
FastEthernet0/3        unassigned      YES manual down                  down
FastEthernet0/4        unassigned      YES manual down                  down
FastEthernet0/5        unassigned      YES manual up                    up
FastEthernet0/6        unassigned      YES manual up                    up
FastEthernet0/7        unassigned      YES manual down                  down
FastEthernet0/8        unassigned      YES manual down                  down
FastEthernet0/9        unassigned      YES manual down                  down
FastEthernet0/10       unassigned      YES manual down                  down
FastEthernet0/11       unassigned      YES manual down                  down
FastEthernet0/12       unassigned      YES manual down                  down
FastEthernet0/13       unassigned      YES manual down                  down
FastEthernet0/14       unassigned      YES manual down                  down
FastEthernet0/15       unassigned      YES manual down                  down
FastEthernet0/16       unassigned      YES manual down                  down
FastEthernet0/17       unassigned      YES manual down                  down
FastEthernet0/18       unassigned      YES manual down                  down
FastEthernet0/19       unassigned      YES manual down                  down
FastEthernet0/20       unassigned      YES manual down                  down
FastEthernet0/21       unassigned      YES manual down                  down
FastEthernet0/22       unassigned      YES manual down                  down
FastEthernet0/23       unassigned      YES manual down                  down
FastEthernet0/24       unassigned      YES manual down                  down
GigabitEthernet0/1     unassigned      YES manual down                  down
GigabitEthernet0/2     unassigned      YES manual down                  down
Vlan1                  192.168.1.2     YES manual up                    up
S1#
```

Reflection Questions

1. If the G0/0/1 interface showed that it was administratively down, what interface configuration command would you use to turn the interface up?

R1(config-if) # no shutdown

2. What would happen if you had incorrectly configured interface G0/0/1 on the router with an IP address of 192.168.1.2?

PC-A would not be able to ping PC-B. This is because PC-B is on a different network than PC-A which requires the default-gateway router to route these packets. PC-A is configured to use the IP address of 192.168.1.1 for the default-gateway router, but this address is not assigned to any device on the LAN. Any packets that need to be sent to the default-gateway for routing will never reach their destination.

Conclusion.

The lab exercise successfully demonstrated the configuration and verification of a basic network setup involving a router, a switch, and two PCs. By following the provided instructions, the devices were configured with appropriate IP addressing, default gateways, and other necessary settings. Connectivity between the PCs was established and verified through successful ping tests, indicating proper routing across subnets.

Additionally, the lab covered the use of various show commands to retrieve essential information from the router and switch, such as interface details and routing table entries. This hands-on practice helped reinforce the understanding of basic networking concepts and device configuration procedures.

Overall, the lab provided valuable experience in setting up and troubleshooting a small network environment, enhancing practical skills essential for networking professionals.