

COURSE: CLOUD AND NETWORK SECURITY

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**PACKET TRACER - BUILD A SWITCH AND ROUTER
NETWORK**

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INTRODUCTION

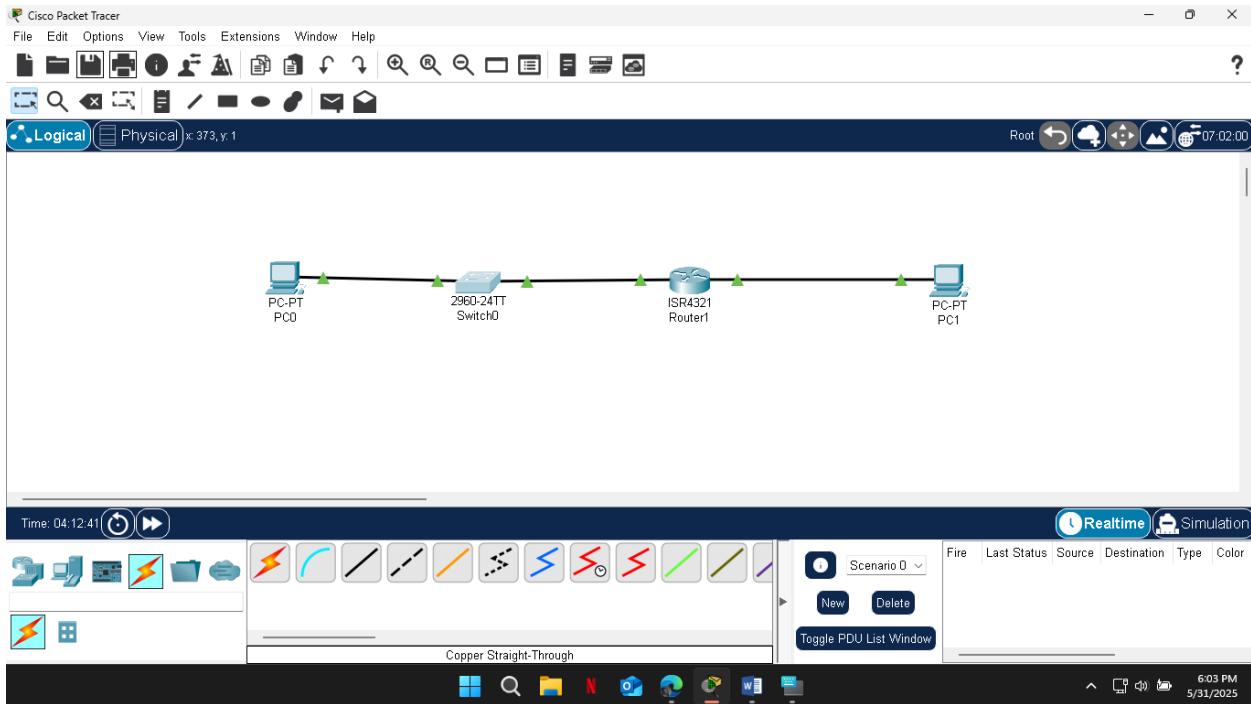
In this Packet Tracer assignment, the primary objective is to configure a router and its interfaces for both IPv4 and IPv6 communication. The setup involves assigning appropriate hostnames, securing access through password protection, enabling routing protocols, and ensuring interface connectivity across the network. By applying core Cisco IOS commands, we aim to simulate a functional, secure, and well-documented network infrastructure. This exercise enhances practical skills in router configuration, interface management, and troubleshooting—key competencies for any aspiring network professional.

PART 1: SET UP TOPOLOGY AND INITIALIZE DEVICES

Step 1: Cable the network as shown in the topology.

a. Attach the devices shown in the topology diagram, and cable, as necessary.

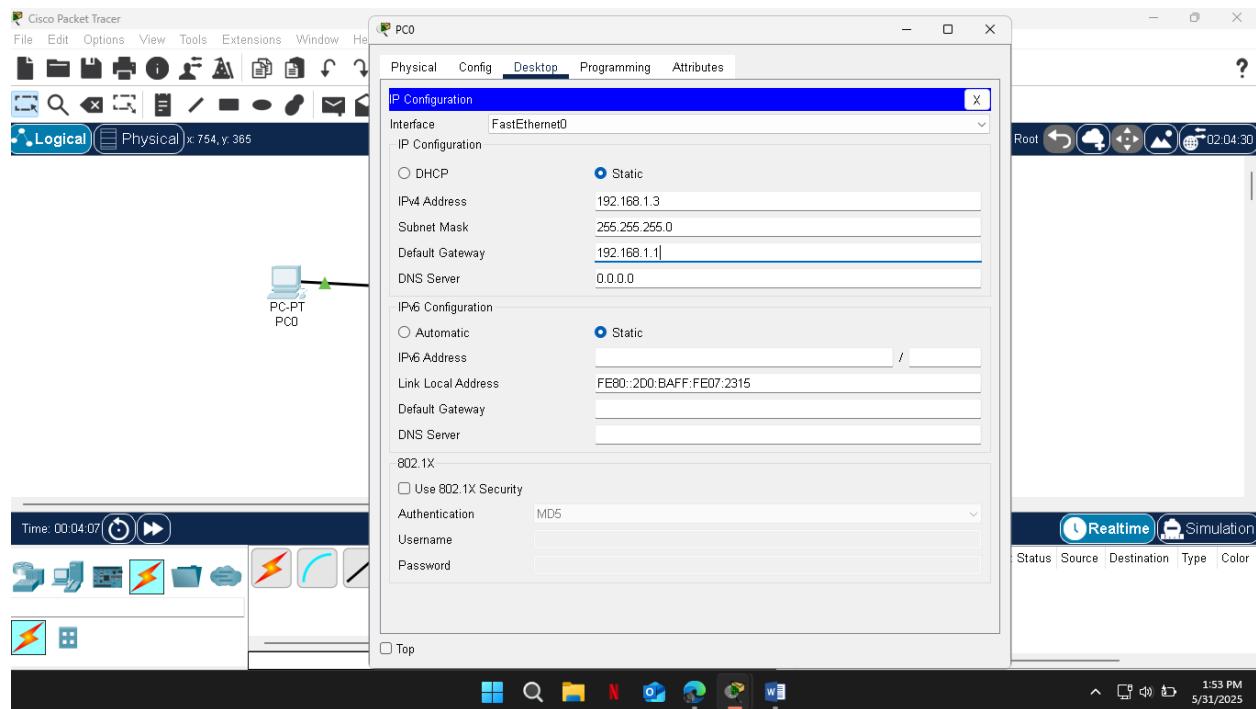
b. Power on all the devices in the topology.



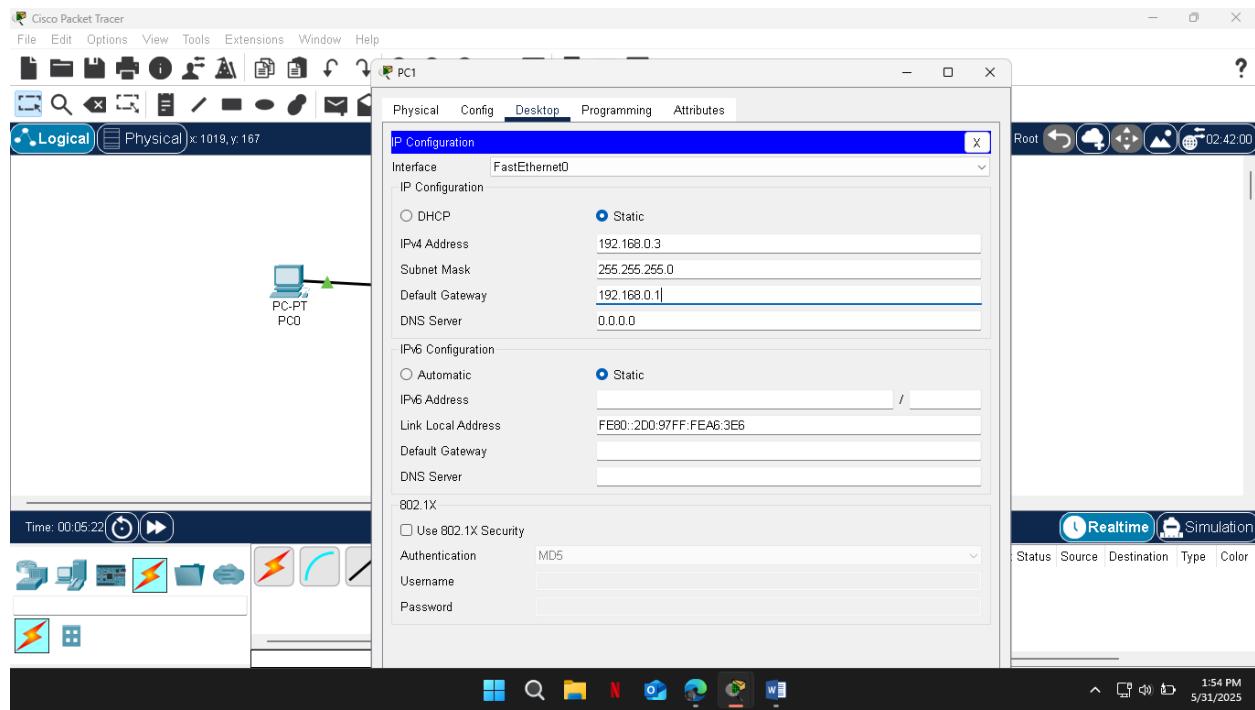
PART 2: CONFIGURE DEVICES AND VERIFY CONNECTIVITY

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

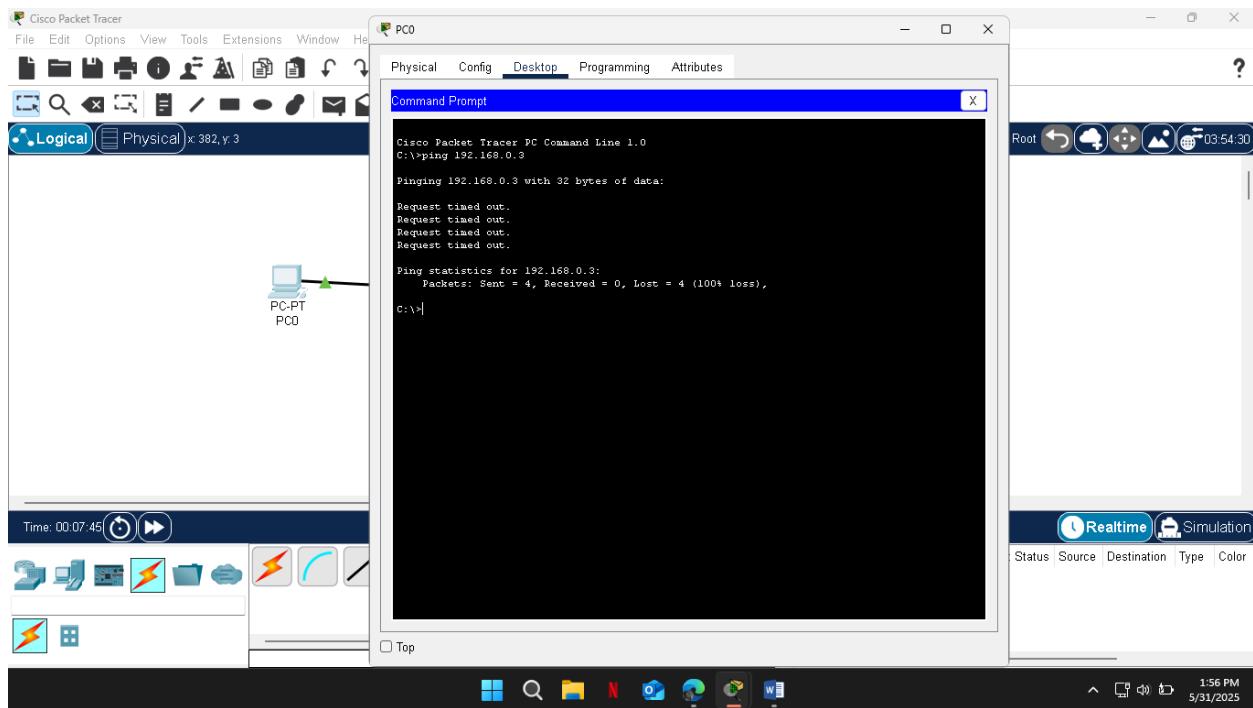
- Configure the IP address, subnet mask, and default gateway settings on PC-A.



- Configure the IP address, subnet mask, and default gateway settings on PC-B.



c. Ping PC-B from a command prompt window on PC-A.



Why were the pings not successful?

These are two distinct networks. Without a router or another Layer 3 device to interconnect them, communication between the two is not possible—similar to two isolated islands with no bridge linking them.

Step 2: Configure the router.

This initial configuration ensures the router is properly identified, secured, and optimized for basic administrative use:

1. Device Identification:

The router is assigned a hostname (R1) to provide a clear and unique identity within the network.

2. Command Input Optimization:

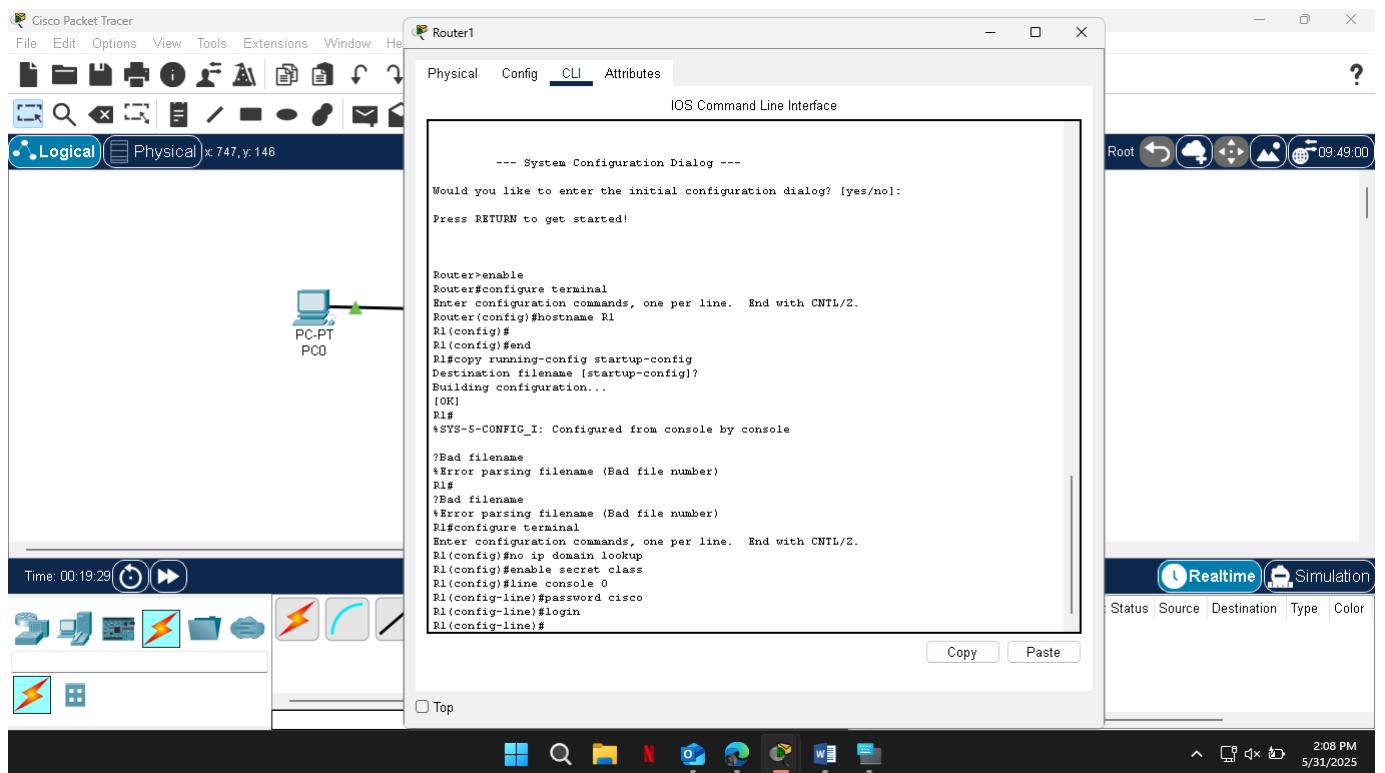
DNS lookup is disabled (no ip domain-lookup) to prevent delays caused by misentered commands being interpreted as hostnames.

3. Privilege Access Security:

An encrypted privileged EXEC mode password is configured using the enable secret command, enhancing access security.

4. Console Access Control:

A console line password is set with login enabled, ensuring that only authorized users can access the device through the console port.



The router configuration includes setting the VTY password to cisco and enabling login for remote access security. All plaintext passwords are encrypted to enhance device protection. A warning banner is created to notify users that unauthorized access is prohibited. Both router interfaces are configured and activated, with descriptive labels indicating their connected devices for easy identification. IPv6 routing is enabled using the ipv6 unicast-routing command to support modern networking protocols. The current running configuration is saved to the startup configuration to ensure persistence after reboot. Finally, the router's clock is set to maintain accurate system time.

```

Router1
Physical Config CLI Attributes
IOS Command Line Interface

R1>enable
Password:
R1#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#interface g0/0/0
^
* Invalid input detected at '^' marker.

R1(config)#interface g0/0/0
R1(config-if)#ip address 192.168.1.1 255.255.255.0
R1(config-if)#ipv6 address 2001:db8::1:1/64
R1(config-if)#ipv6 address fe80::1 link-local
* Invalid link-local address
R1(config-if)#ipv6 address fe80::1 link-local
R1(config-if)#exit
R1(config)#shutdown
R1(config)#exit
R1(config)#interface g0/0/1
R1(config-if)#description Connected to f0/5 on s1
R1(config-if)#exit
R1(config)#interface g/0/0
^
* Invalid input detected at '^' marker.

R1(config)#interface g0/0/0
R1(config-if)#description Connected to Host PC-B
R1(config-if)#exit
R1(config)#ip6 unicast-routing
R1(config)#exit
R1#
*SYS-5-CONFIG_I: Configured from console by console

R1#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
R1#clock set 15:30:00 27 Aug 2019
R1#

```

Copy Paste

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3:29 PM
5/31/2025

Ping PC-B from a command prompt window on PC-A.

```

PC0
Physical Config Desktop Programming Attributes
Command Prompt

Reply from 192.168.1.1: Destination host unreachable.

Ping statistics for 192.168.0.3:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:
Reply from 192.168.1.3: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.1.3:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>exit

C:\>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:
Reply from 192.168.1.3: bytes=32 time=3ms TTL=128
Reply from 192.168.1.3: bytes=32 time=3ms TTL=128
Reply from 192.168.1.3: bytes=32 time=14ms TTL=128
Reply from 192.168.1.3: bytes=32 time=14ms TTL=128

Ping statistics for 192.168.1.3:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 34ms, Average = 16ms
C:\>

```

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The ping test between the two devices was successful, indicating proper network connectivity. The successful ping replies demonstrate that the IP addressing, subnet masks, and routing are set up properly, allowing seamless communication across the network.

Step 3: Configure the switch.

The screenshot shows a Windows Command Line Interface window titled "IOS Command Line Interface". The title bar includes standard window controls (minimize, maximize, close) and the title text. The main area of the window displays the configuration commands entered on the switch. The configuration starts with enabling the terminal and setting the hostname to S1. It then configures VLAN 1 with an IP address of 192.168.1.2 and a subnet mask of 255.255.255.0. A default gateway of 192.168.1.1 is also set. The configuration concludes with a message indicating it was configured from the console. At the bottom of the window, there are "Copy" and "Paste" buttons. The taskbar at the bottom of the screen shows various open applications, and the system tray indicates the date and time as 5/31/2025 at 4:00 PM.

```
Press RETURN to get started!

*LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
*LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up

Switch>enable
Switch#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname S1
S1(config)#no ip domain-lookup
S1(config)#interface vlan 1
S1(config-if)#ip address 192.168.1.2
* Incomplete command.
S1(config-if)#ip address 192.168.1.2 255.255.255.0
S1(config-if)#no shutdown

S1(config-if)#
*LINK-5-CHANGED: Interface Vlan1, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up

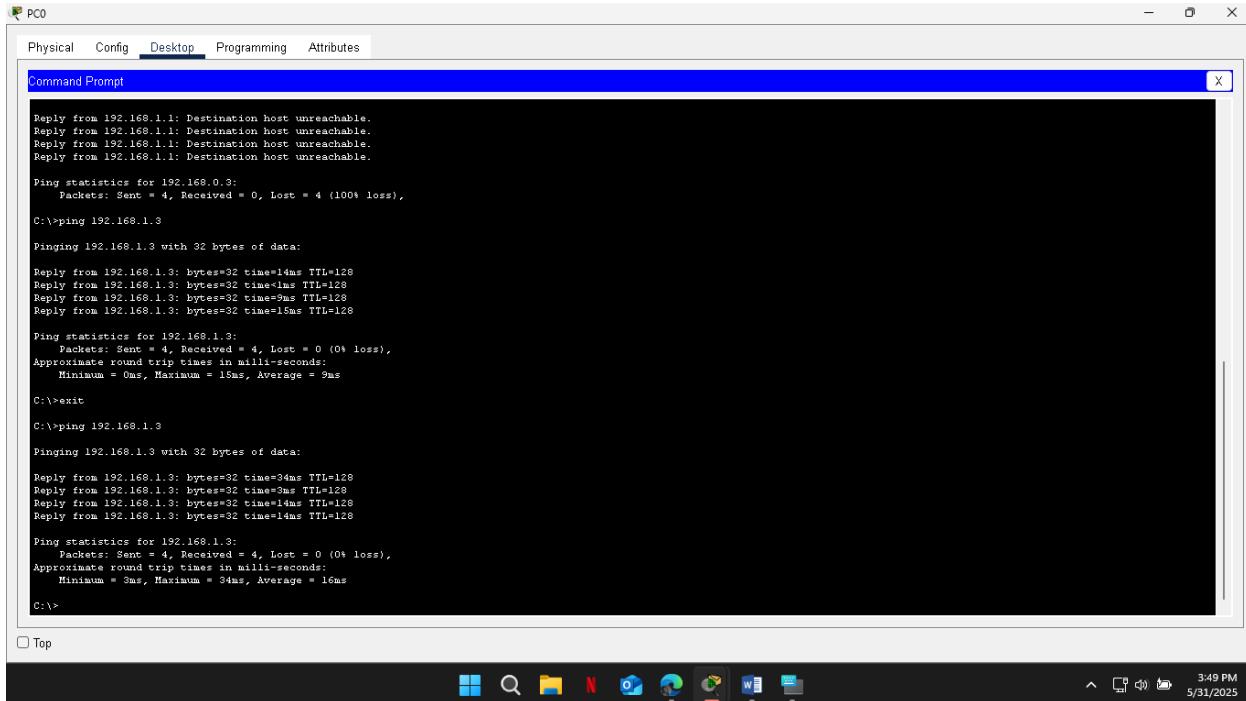
S1(config-if)#exit
S1(config)#ip default-gateway 192.168.1.1
^
* Invalid input detected at '^' marker.

S1(config)#ip default-gateway 192.168.1.1
S1(config)#exit
S1#
*SYS-5-CONFIG_I: Configured from console by console
```

We configured the switch by first enabling privileged EXEC mode and entering global configuration mode. The device was named S1 for easy identification. To prevent unnecessary delays, DNS lookup was disabled. The VLAN 1 interface was assigned the IP address 192.168.1.2 with the subnet mask 255.255.255.0 and activated to enable network communication. The default gateway was set to 192.168.1.1 to allow the switch to communicate beyond its local network.

Step 4: Verify connectivity end-to-end connectivity.

a. From PC-A, ping PC-B.



```
PC0
Physical Config Desktop Programming Attributes
Command Prompt
Reply from 192.168.1.1: Destination host unreachable.

Ping statistics for 192.168.0.3:
  Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time=14ms TTL=128
Reply from 192.168.1.3: bytes=32 time=1ms TTL=128
Reply from 192.168.1.3: bytes=32 time=9ms TTL=128
Reply from 192.168.1.3: bytes=32 time=15ms TTL=128

Ping statistics for 192.168.1.3:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 15ms, Average = 9ms

C:\>exit

C:\>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

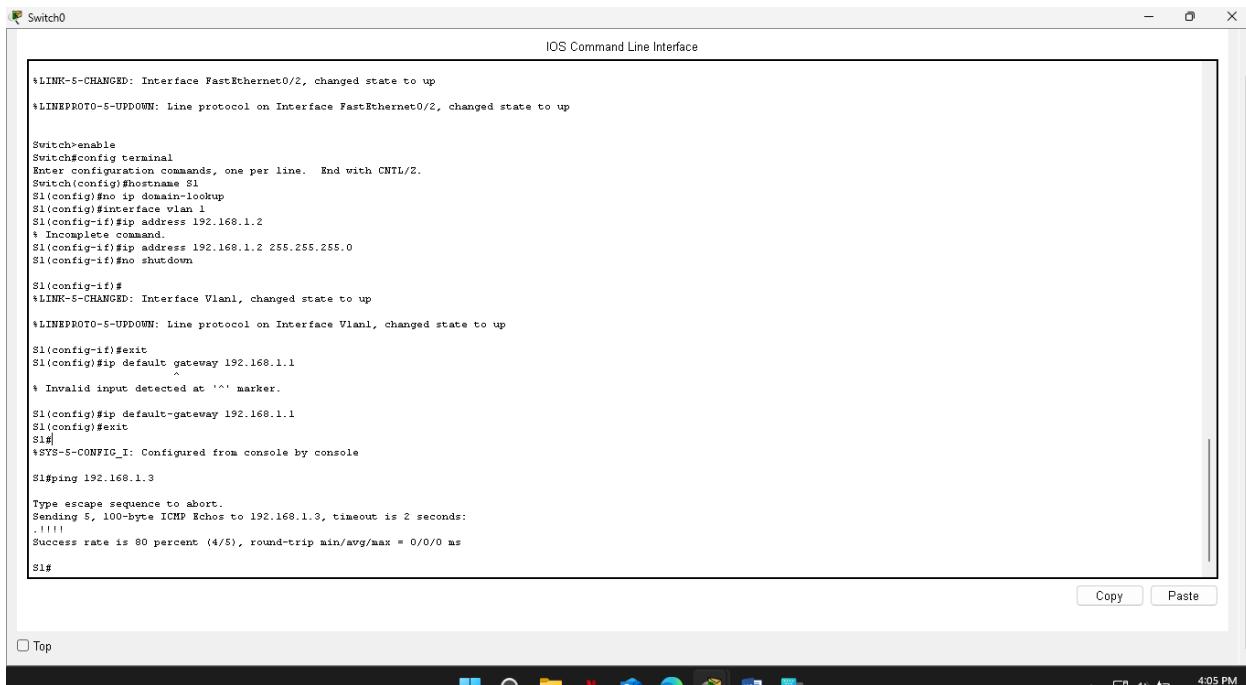
Reply from 192.168.1.3: bytes=32 time=34ms TTL=128
Reply from 192.168.1.3: bytes=32 time=3ms TTL=128
Reply from 192.168.1.3: bytes=32 time=14ms TTL=128
Reply from 192.168.1.3: bytes=32 time=14ms TTL=128

Ping statistics for 192.168.1.3:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 3ms, Maximum = 34ms, Average = 16ms

C:\>
```

PING FROM PC-A TO PC-B IS SUCCESSFUL

b. From S1, ping PC-B.



```
Switch0
IOS Command Line Interface
LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up
LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up

Switch>enable
Switch#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
switch(config)#hostname S1
S1(config)#ip domain-lookup
S1(config)#interface vlan 1
S1(config-if)#ip address 192.168.1.2 255.255.255.0
! Incomplete command.
S1(config-if)#ip address 192.168.1.2 255.255.255.0
S1(config-if)#no shutdown

S1(config-if)#*
LINK-5-CHANGED: Interface Vlan1, changed state to up
LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up

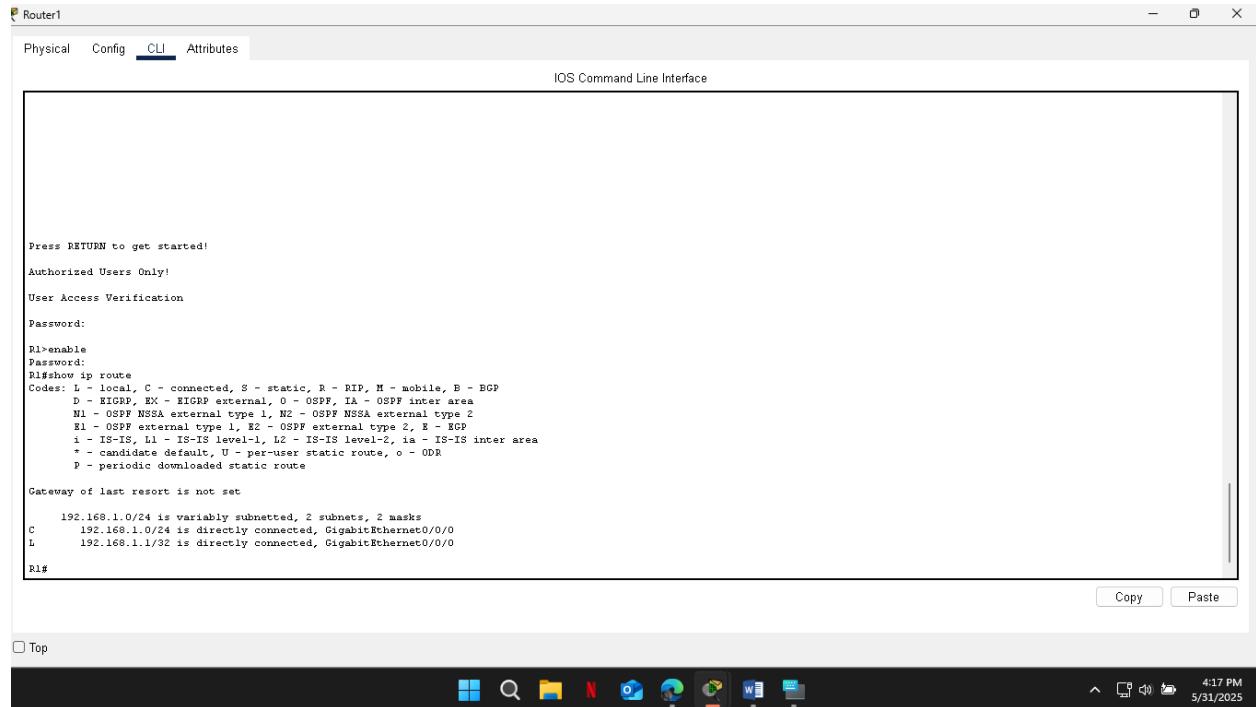
S1(config-if)#exit
S1(config)#default gateway 192.168.1.1
! Invalid input detected at `'' marker.
S1(config)#ip default-gateway 192.168.1.1
S1(config)#exit
S1]
SYS-5-CONFIG_I: Configured from console by console
S1#ping 192.168.1.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.3, timeout is 2 seconds:
!!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/0/0 ms
S1#
```

PING FROM S1 TO PC-B IS SUCCESSFUL.

PART 3: DISPLAY DEVICE INFORMATION

Step 1: Display the routing table on the router.



The screenshot shows a Windows Command Line Interface window titled "Router1". The tab bar at the top has "Physical", "Config", "CLI" (which is selected), and "Attributes". Below the tabs is the text "IOS Command Line Interface". The main area of the window displays the output of the "show ip route" command:

```
Press RETURN to get started!
Authorized Users Only!
User Access Verification
Password:
R1>enable
R1>password
R1>show ip route
Codes: L = local, C = static, S = 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

      192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.1.0/24 is directly connected, GigabitEthernet0/0/0
L        192.168.1.1/32 is directly connected, GigabitEthernet0/0/0
R1#
```

At the bottom right of the window are "Copy" and "Paste" buttons. The taskbar at the bottom of the screen shows various icons for Microsoft applications like File Explorer, Task View, and Edge. The system tray indicates the date and time as 4:17 PM, 5/31/2025.

What code is used in the routing table to indicate a directly connected network?

C is the code for directly connected networks.

How many route entries are coded with a C code in the routing table?

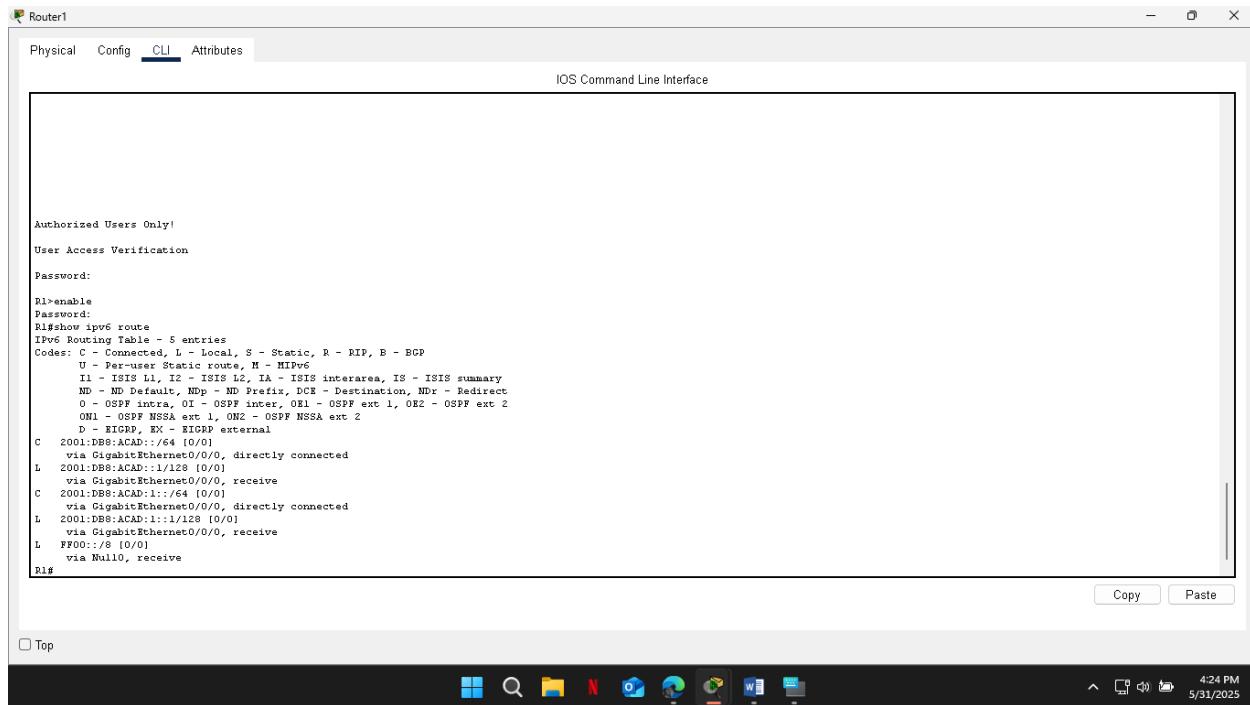
2: 192.168.0.1 and 192.168.1.1

What interface types are associated to the C coded routes?

C coded routes are tied to physical router interfaces you configured with IPs.

GigabitEthernet0/0/0 and GigabitEthernet0/0/1

Use the show ipv6 route command on router R1 to display the IPv6 routes.



The screenshot shows the Router1 CLI interface with the 'CLI' tab selected. The command 'show ipv6 route' is entered, and its output is displayed in a large text area. The output includes a legend for route codes (C, L, S, R, B) and detailed information about five routes. The routes are:

- 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 GigabitEthernet0/0/0, directly connected
- L 2001:DB8:ACAD:1::1/128 [0/0] via GigabitEthernet0/0/0, receive
- L FF00::/8 [0/0] via Null0, receive

The bottom right corner of the window shows the date and time: 4:24 PM, 5/31/2025.

The IPv6 routing table on router R1 contains five entries. Two of these are marked with a C, indicating they are directly connected networks: 2001:DB8:ACAD::/64 via interface GigabitEthernet0/0/0, and 2001:DB8:ACAD:1::/64 via GigabitEthernet0/0/1. Two additional entries are marked with an L, which means they are local addresses assigned to the router's own interfaces—2001:DB8:ACAD::1/128 and 2001:DB8:ACAD:1::1/128, associated with the same interfaces respectively. Lastly, the route FF00::/8 is a special multicast address received via the Null0 interface. These entries confirm that both interfaces are active and the router is properly configured for IPv6 communication.

Step 2: Display interface information on the router R1.

Use the show ip interface g0/0/1 to answer the following questions.

```
GigabitEthernet0/0/1 is up, line protocol is up (connected)
Internet protocol processing disabled

R1# 
R1(config) terminal
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#interface g0/0/1
R1(config-if)#ip address 192.168.0.1 255.255.255.0
R1(config-if)#exit
R1(config)#exit
R1#
*SYS-5-CONFIG_I: Configured from console by console

R1#show ip interface g0/0/1
GigabitEthernet0/0/1 is up, line protocol is up (connected)
  Internet address is 192.168.0.1/24
    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
--More--
```

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4:49 PM
5/31/2025

1. What is the operational status of the G0/0/1 interface?

The interface GigabitEthernet0/0/1 is **up**, and the line protocol is **up (connected)**. This means the physical connection is active and the data link layer is functioning correctly — the interface is fully operational and ready to transmit data.

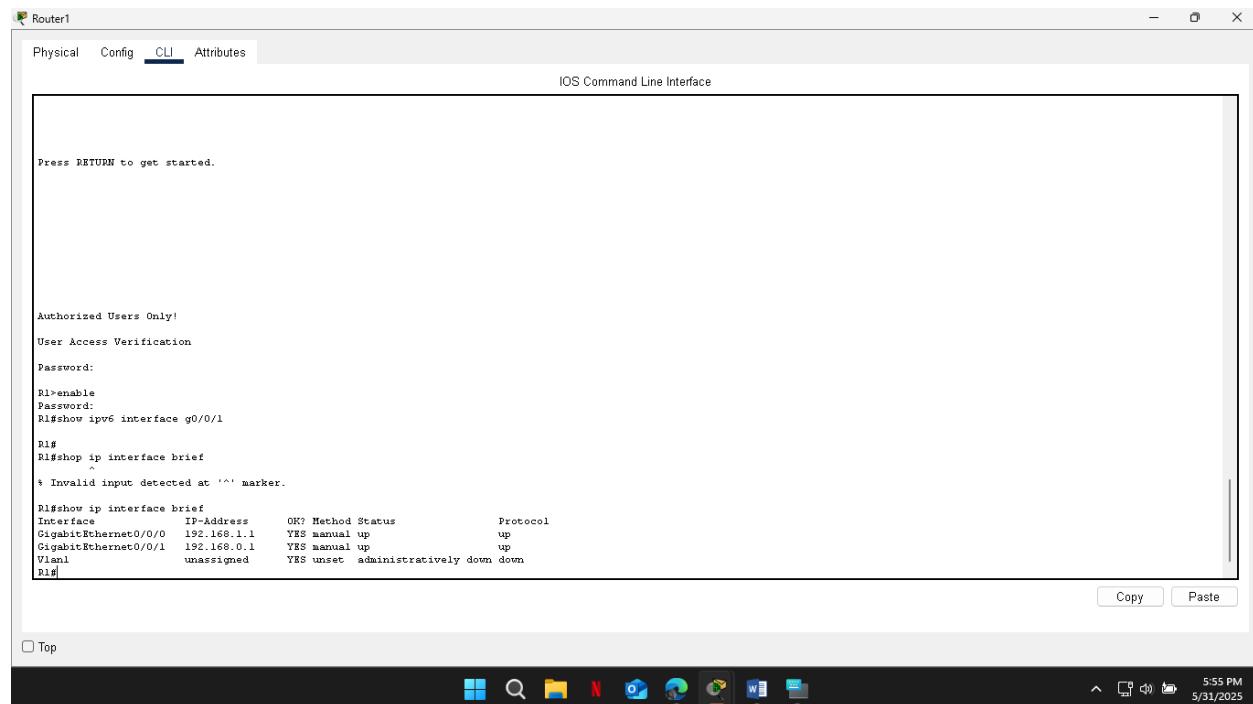
2. How is the Internet address displayed in this command?

The internet address is 192.168.0.1/24

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

Enter the show ip interface brief command on the router R1.

R1# show ip interface brief



The screenshot shows a Windows terminal window titled "Router1". The tab bar at the top has "Physical", "Config", "CLI" (which is selected), and "Attributes". Below the tabs is the text "IOS Command Line Interface". The main area of the window displays the following command-line session:

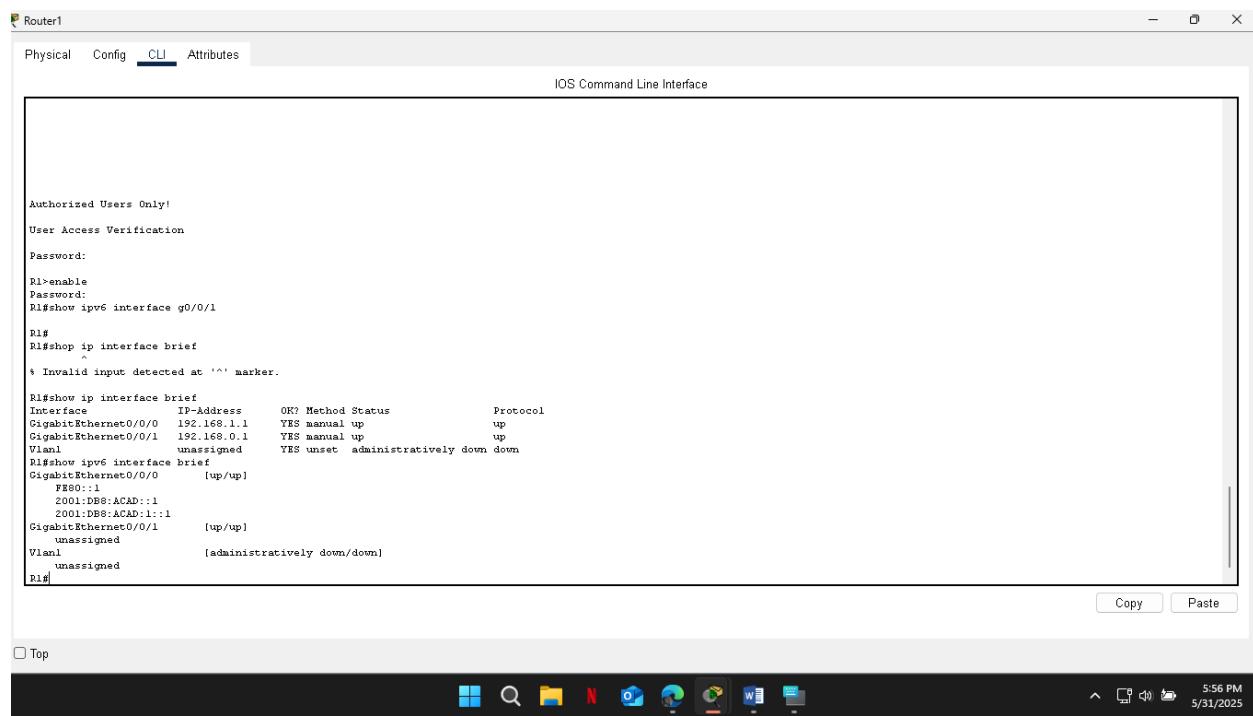
```
Press RETURN to get started.

Authorized Users Only!
User Access Verification
Password:
R1>enable
Password:
R1#show ipv6 interface g0/0/1
R1#
R1#show ip interface brief
^
* Invalid input detected at '^' marker.

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

At the bottom right of the window are "Copy" and "Paste" buttons. The taskbar at the bottom of the screen shows various icons for Microsoft applications like File Explorer, Edge, and Word, along with the system clock showing 5:55 PM and the date 5/31/2025.

To see the IPv6 interface information, enter the show ipv6 interface brief command on R1. R1# show ipv6 interface brief



The screenshot shows a Windows terminal window titled "Router1". The tab bar at the top has "Physical", "Config", "CLI" (selected), and "Attributes". Below the tabs is the text "IOS Command Line Interface". The main area of the window displays the following command-line session:

```
Press RETURN to get started.

Authorized Users Only!
User Access Verification
Password:
R1>enable
Password:
R1#show ipv6 interface g0/0/1
R1#
R1#show ip interface brief
^
* Invalid input detected at '^' marker.

R1#show ip interface brief
Interface          IP-Address      OK? Method Status       Protocol
GigabitEthernet0/0/0 192.168.1.1   YES manual up           up
GigabitEthernet0/0/1 192.168.0.1   YES manual up           up
Vlan1              unassigned     YES unset administratively down down
R1#show ipv6 interface brief
GigabitEthernet0/0/0 [up/up]
  FE80::1
  2001:DB8:ACAD:1:1
  2001:DB8:ACAD:1:1:1
GigabitEthernet0/0/1      [up/up]
  unassigned
Vlan1                  [administratively down/down]
R1#
```

At the bottom right of the window are "Copy" and "Paste" buttons. The taskbar at the bottom of the screen shows various icons for Microsoft applications like File Explorer, Edge, and Word, along with the system clock showing 5:56 PM and the date 5/31/2025.

Enter the show ip interface brief command on the switch S1.

Open configuration window S1# show ip interface brief

```
S1#enable
S1#show ip interface brief
Interface          IP-Address      OK? Method Status       Protocol
FastEthernet0/1    unassigned     YES manual up        up
FastEthernet0/2    unassigned     YES manual up        up
FastEthernet0/3    unassigned     YES manual down     down
FastEthernet0/4    unassigned     YES manual down     down
FastEthernet0/5    unassigned     YES manual down     down
FastEthernet0/6    unassigned     YES manual down     down
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
--More--
```

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?

You'd use the no shutdown command while in interface configuration mode.

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?

Network mismatch- The router's G0/0/1 interface would now belong to the 192.168.1.0/24 network instead of the intended 192.168.0.0/24.

Communication breakdown- PC-B (which is on 192.168.0.0/24) wouldn't be able to reach the router via G0/0/1, since they'd be on different networks and the router wouldn't be routing traffic correctly between them.

Ping fails- Connectivity tests like ping from PC-B to the router would fail, and routing between the two LANs would not function as intended.

CONCLUSION

Through this hands-on simulation, we successfully configured the router with both IPv4 and IPv6 addresses, enabled secure access via encrypted passwords, and ensured that all interfaces were operational and correctly addressed. The use of commands like `no shutdown`, `ipv6 unicast-routing`, and `copy running-config startup-config` demonstrated how to activate interfaces, enable IPv6 support, and save configurations for persistent networking. This assignment not only reinforced theoretical networking concepts but also developed confidence in navigating Cisco's command-line interface to manage real-world routing scenarios.