

Introduction to Building a Switch and Router Network Lab

This lab introduces to configuring basic network connectivity between devices using Cisco routers and switches. gain hands-on experience in setting up a network topology with a router and a switch, followed by configuring them to enable communication between attached PCs.

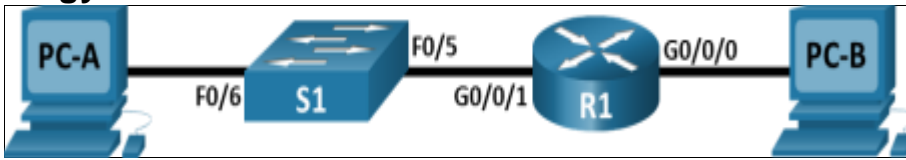
The lab walks through the process of:

- Cabling the network according to a provided diagram.
- Initializing and reloading the router and switch.
- Configuring static IP addresses for the router interfaces and the switch VLAN interface.
- Assigning passwords and enabling privileged access on the router.
- Implementing basic router configuration, including interface descriptions and enabling IPv6 routing.
- Verifying end-to-end connectivity using ping commands.
- Extracting information from the router and switch using various "show" commands to understand interface details and routing tables.

This lab serves as a practical introduction to essential network configuration tasks using Cisco IOS commands. It reinforces theoretical knowledge and equips with the ability to troubleshoot basic network connectivity issues.

Lab - Build a Switch and Router Network

Topology



Addressing Table

| Device | Interface | IP Address / Prefix | Default Gateway |
|--------|-----------|-----------------------|-----------------|
| R1 | G0/0/0 | 192.168.0.1 /24 | N/A |
| | | 2001:db8:acad::1/64 | |
| | | fe80::1 | |
| | G0/0/1 | 192.168.1.1 /24 | N/A |
| | | 200:db8:acad:1::1/64 | |
| | | fe80::1 | |
| S1 | VLAN 1 | 192.168.1.2 /24 | 192.168.1.1 |
| PC-A | NIC | 192.168.1.3 /24 | 192.168.1.1 |
| | | 2001:db8:acad:1::3/64 | fe80::1 |
| PC-B | NIC | 192.168.0.3 /24 | 192.168.0.1 |
| | | 2001:db8:acad::3/64 | fe80::1 |

Objectives

Part 1: Set Up the Topology and Initialize Devices

Part 2: Configure Devices and Verify Connectivity

Background / Scenario

© 2013 - 2020 Cisco and/or its affiliates. All rights reserved. Cisco Public Page 1 of 9 www.netacad.com

Lab - Build a Switch and Router Network

```
S1# show sdm prefer
```

Use the following commands to assign the **dual-ipv4-and-ipv6** template as the default SDM template. S1# **configure terminal**

```
S1(config)# sdm prefer dual-ipv4-and-ipv6 default
```

```
S1(config)# end
```

```
S1# reload
```

Required Resources

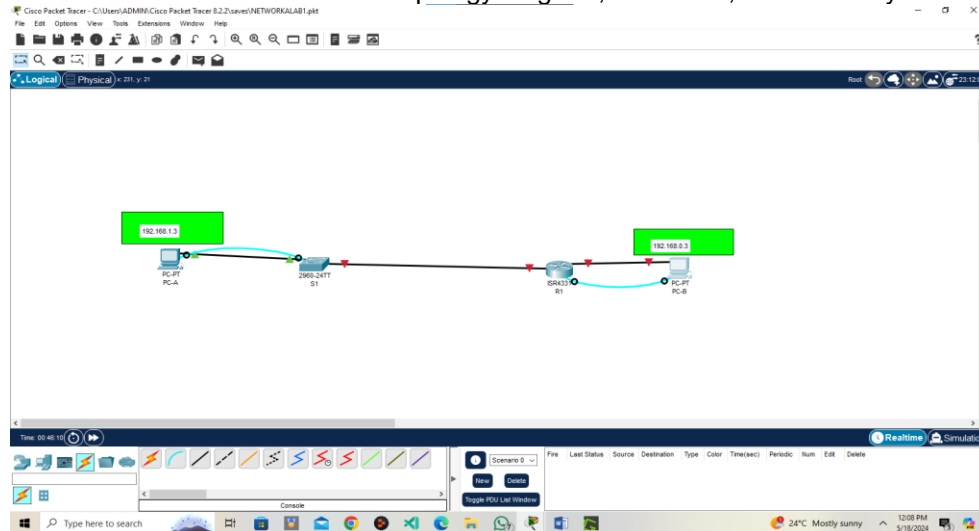
- 1 Router (Cisco 4221 with Cisco IOS XE Release 16.9.4 universal image or comparable)
- 1 Switch (Cisco 2960 with Cisco IOS Release 15.2(2) lanbasek9 image or comparable)
- 2 PCs (Windows with a terminal emulation program, such as Tera Term)
- Console cables to configure the Cisco IOS devices via the console ports
- Ethernet cables as shown in the topology

Instructions

Part 1: Set Up Topology and Initialize Devices

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

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



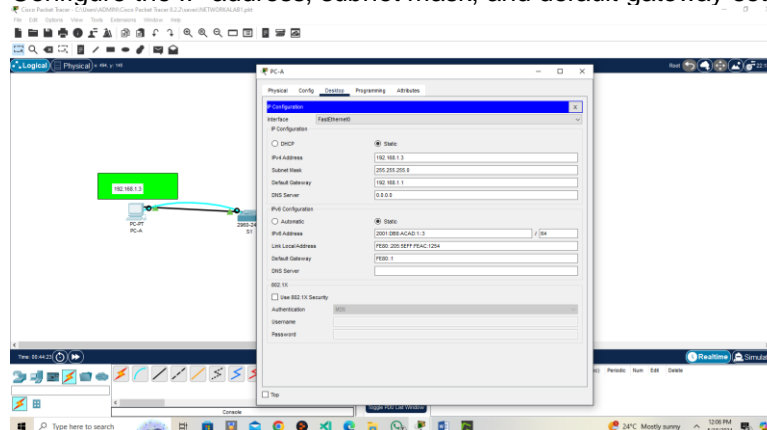
- Power on all the devices in the topology.

Step 2: Initialize and reload the router and switch.

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.



-

-
- The screenshot displays the Cisco Packet Tracer interface. In the background, a network diagram shows a green box labeled "192.168.1.3" connected to a device labeled "PC-PT PC-A". A switch labeled "S1" is also visible.
- In the foreground, the "PC-A" configuration window is open, showing the "Desktop" tab. The "Command Prompt" window is active, displaying the following commands and output:
- ```
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>ping 192.168.0.3

Pinging 192.168.0.3 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.0.3:
 Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>
```
- The bottom status bar indicates the time as 00:00:30 and includes icons for various tools and windows.

**Note:** If pings are not successful, the Windows Firewall may need to be turned off. Why were the pings not successful?

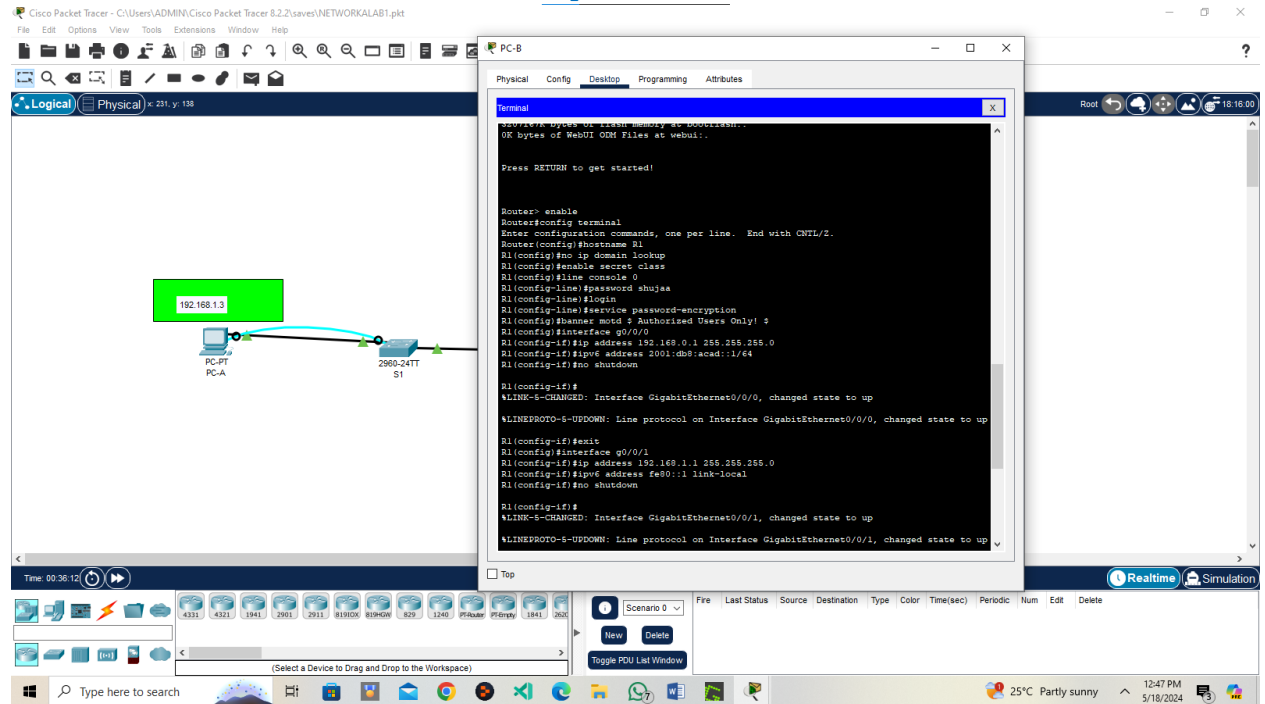
## Step 2: Configure the router.

- a. Console into the router and enable privileged EXEC mode.  
`Router> enable`
- b. Enter configuration mode.  
`Router# config terminal`
- c. Assign a device name to the router.  
`R1(config)# hostname R1`  
`R1(config)# no ip domain lookup`
- e. Assign **class** as the privileged EXEC encrypted password.  
`R1(config)# enable secret class`
- f. Assign **cisco** as the console password and enable login.  
`R1(config)# line console 0`  
`R1(config-line)# password cisco`  
`R1(config-line)# login`
- g. Assign **cisco** as the VTY password and enable login.  
`R1(config)# line vty 0 4`  
`R1(config-line)# password cisco`  
`R1(config-line)# login`
- h. Encrypt the plaintext passwords.  
`R1(config)# service password-encryption`
- i. Create a banner that warns anyone accessing the device that unauthorized access is prohibited.  
`R1(config)# banner motd $ Authorized Users Only! $`
- j. Configure and activate both interfaces on the router.  
`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`

## Lab - Build a Switch and Router Network

R1(config-if)# **no shutdown**

*Screenshot from instruction first up to this ;*



R1(config-if)# **exit**

- k. Configure an interface description for each interface indicating which device is connected to it. 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

```

l. To enable IPv6 routing, enter the command `ipv6 unicast-routing`.

```
R1(config) # ipv6 unicast-routing
```

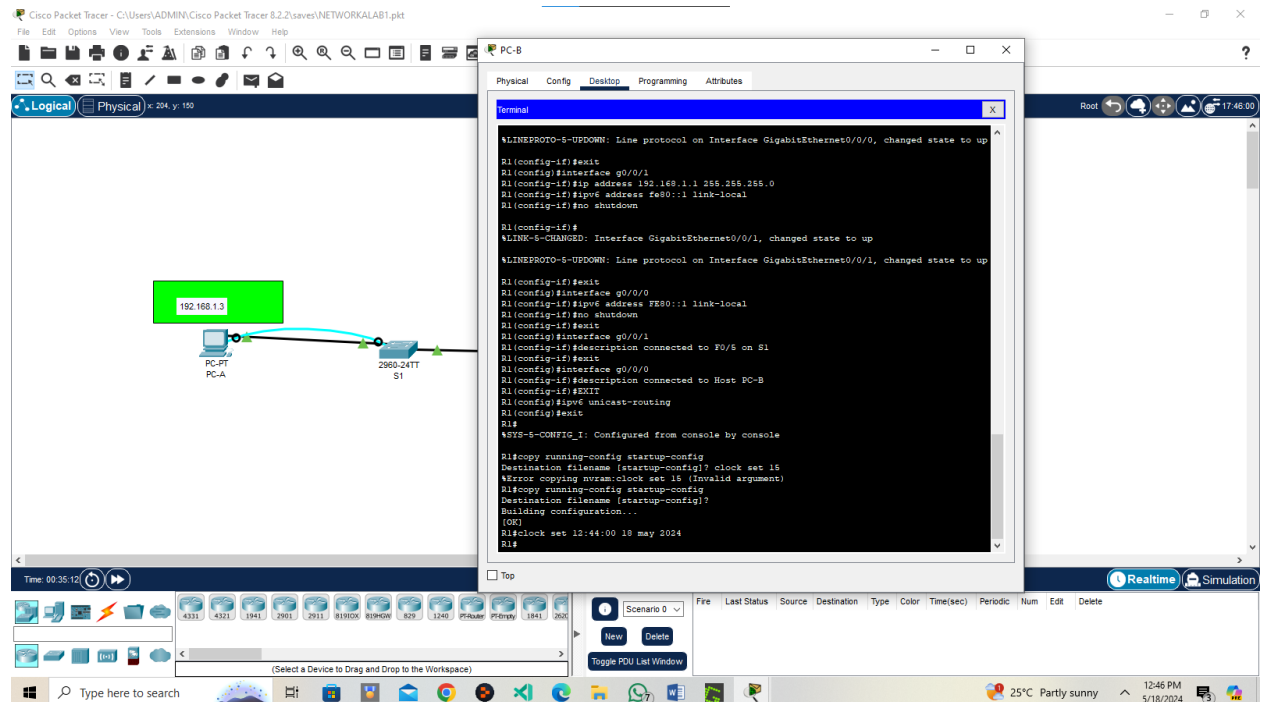
m. Save the running configuration to the startup configuration file.

```
R1(config) # exit
```

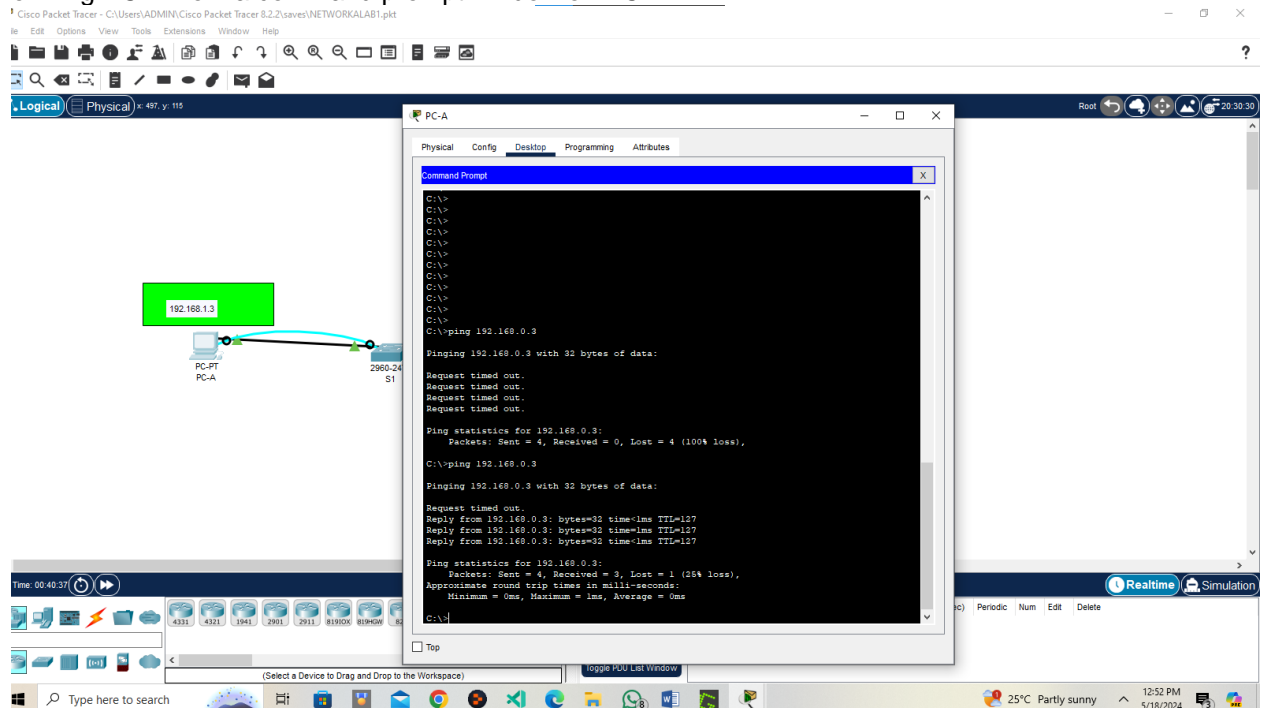
```
R1# copy running-config startup-config
```

n. Set the clock on the router.

```
R1# clock set 15:30:00 27 Aug 2019
```



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



**Note:** If pings are not successful, the Windows Firewall may need to be turned off.

Were the pings successful? Explain.

### Step 3: Configure the switch.

In this step, you will configure the hostname, the VLAN 1 interface and its default gateway.

a. Console into the switch and enable privileged EXEC mode.

```
Switch> enable
```

b. Enter configuration mode.

```
Switch# config terminal
```

c. Assign a device name to the switch.

```
Switch(config)# hostname S1
S1(config)# no ip domain-lookup
```

e. Configure and activate the VLAN interface on the switch S1.

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

### Lab - Build a Switch and Router Network

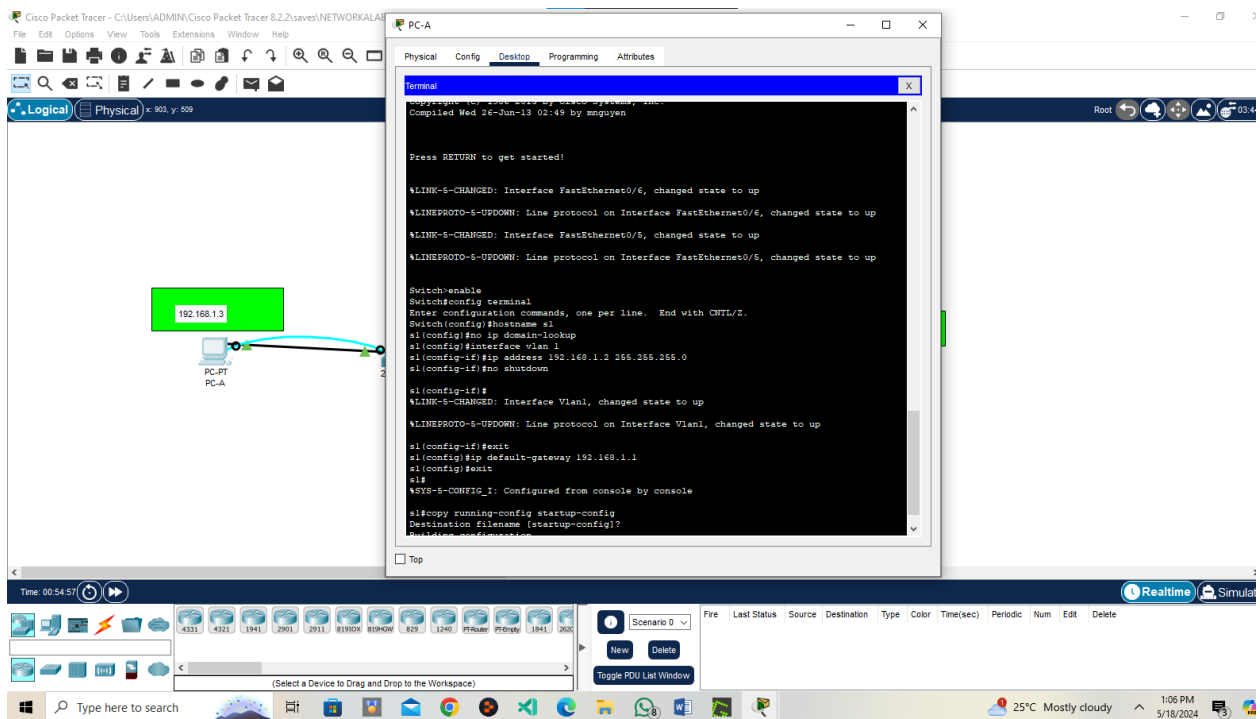
```
S1(config-if)# exit
```

f. Configure the default gateway for the switch S1.

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

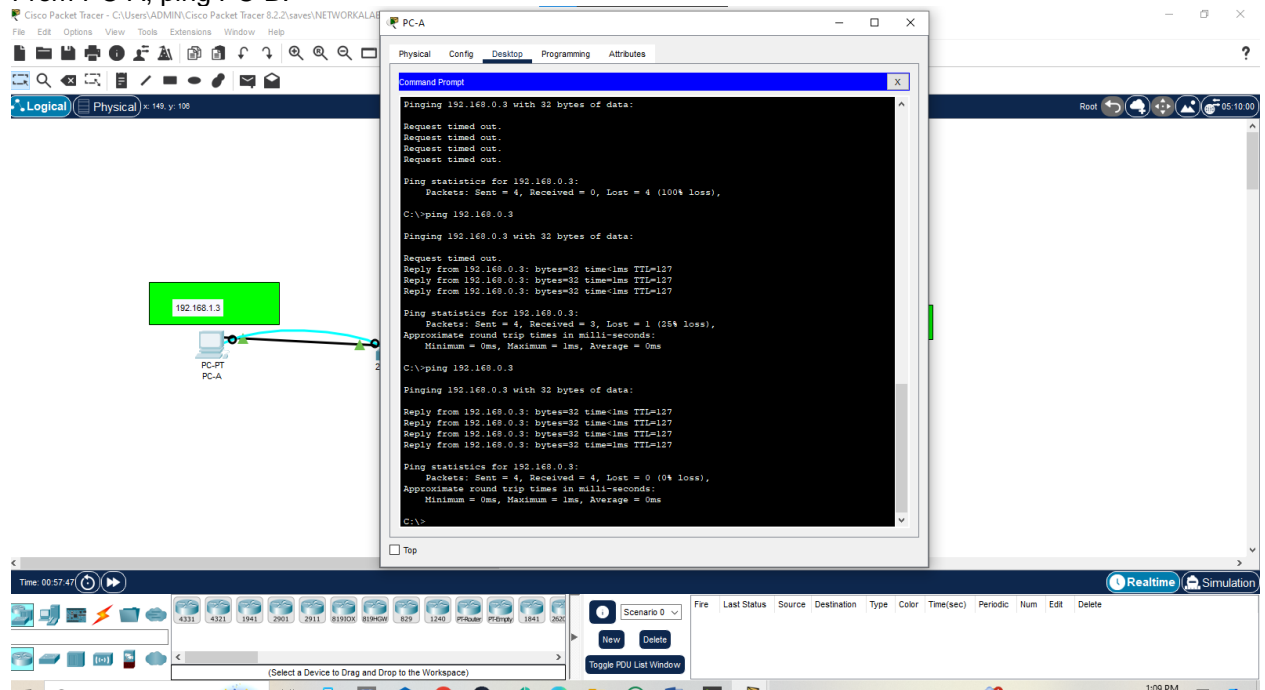
g. Save the running configuration to the startup configuration file.



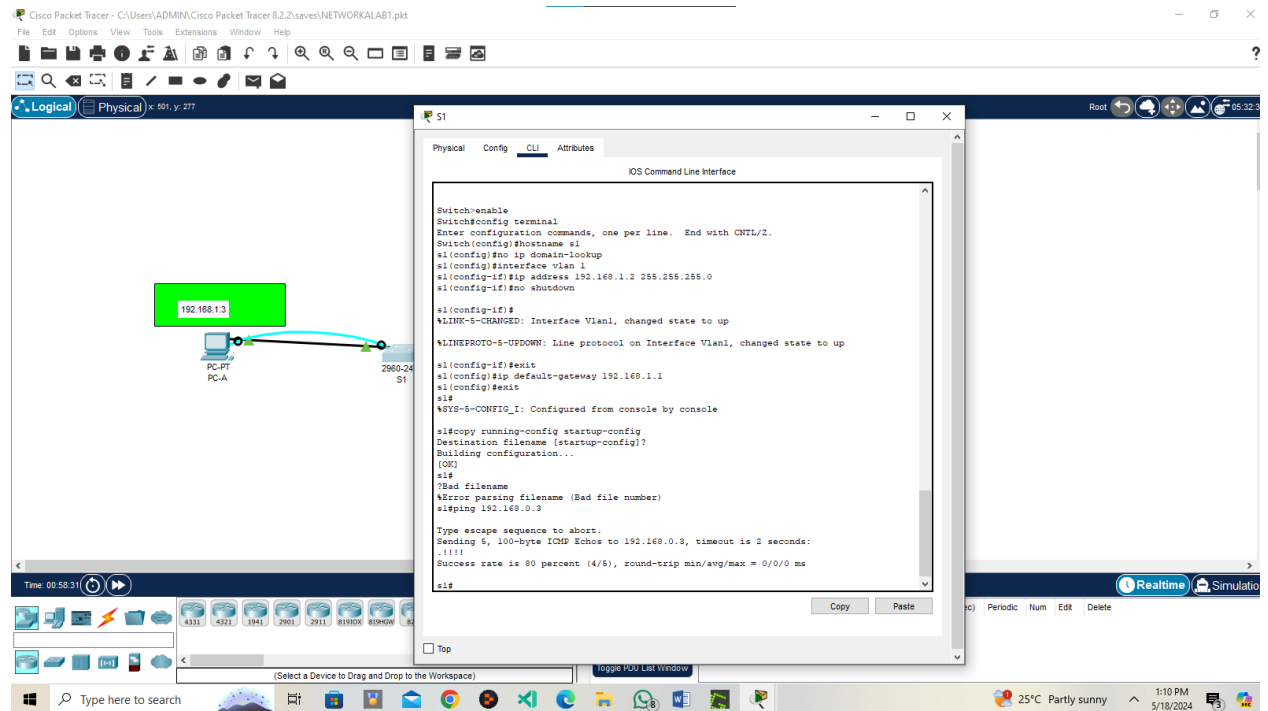


#### Step 4: Verify connectivity end-to-end connectivity.

- From PC-A, ping PC-B.



- From S1, ping PC-B.



All the pings should be successful.

## Part 3: Display Device Information

### Step 1: Display the routing table on the router.

a. Use the **show ip route** command on the router R1 to answer the following questions.

R1# **show ip route**

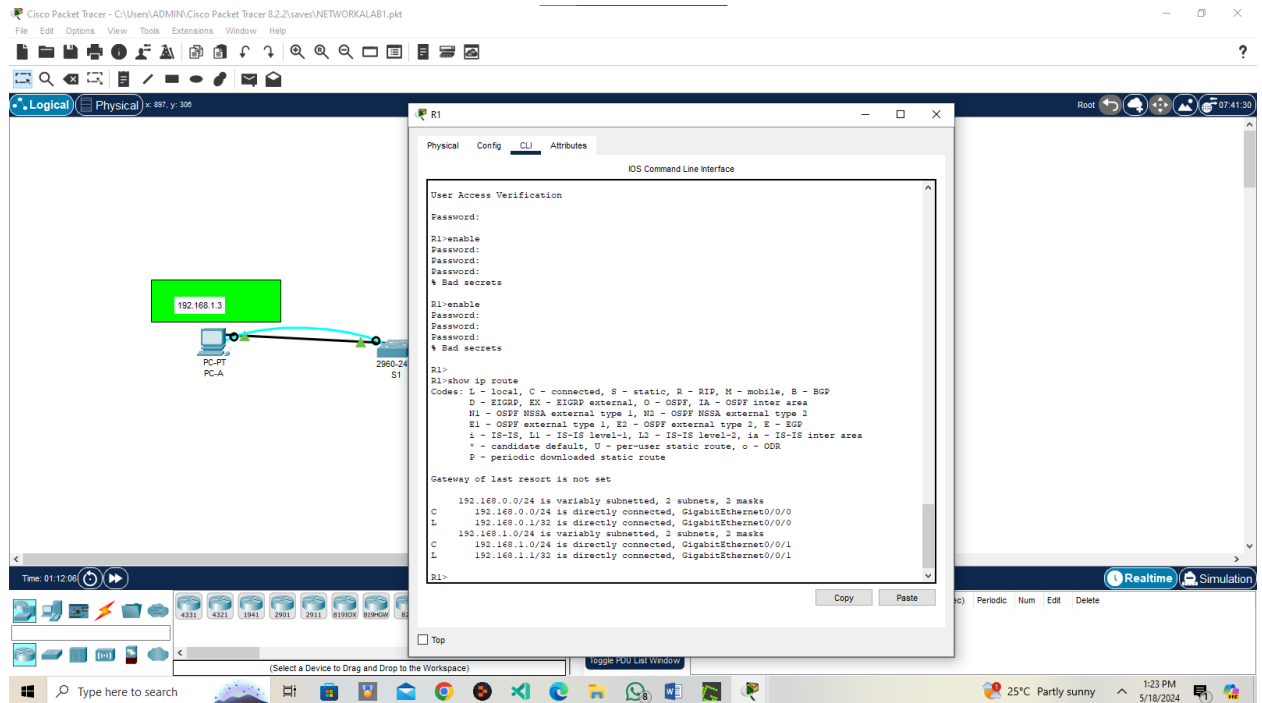
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP, D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP, + - replicated route, % - next hop override  
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



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

Code C

C 192.168.0.0/24 is directly connected, GigabitEthernet0/0/0

C 192.168.1.0/24 is directly connected, GigabitEthernet0/0/1

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

2 route entries one thru g0/0/0 and one thru g0/0/1

```
R1>
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

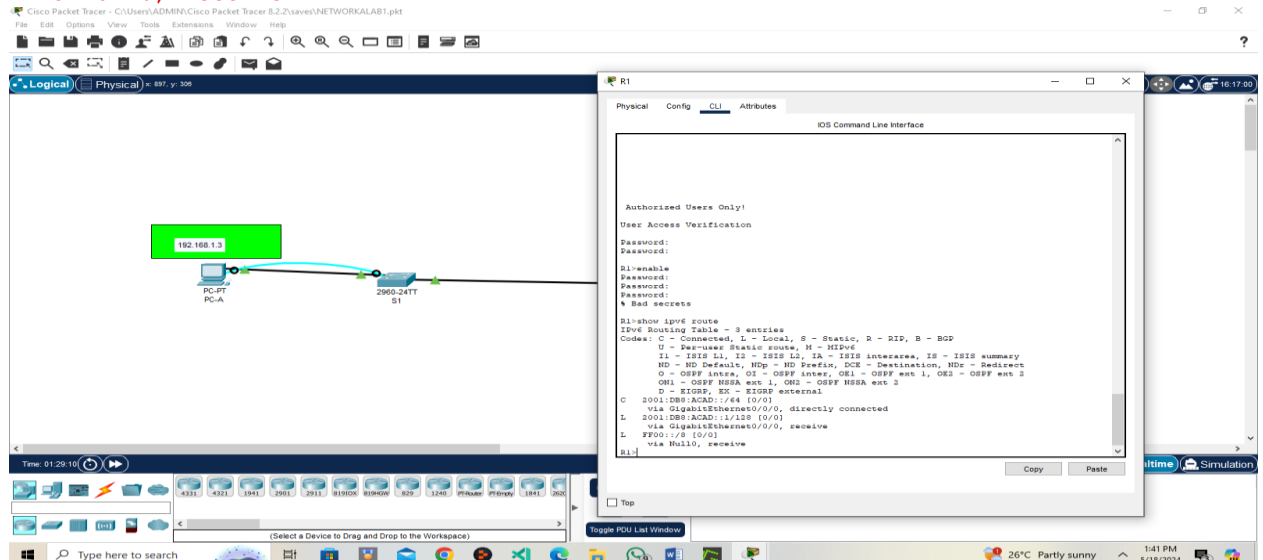
R1>
```

What interface types are associated to the C coded routes?

G0/0/0 and  
G0/0/1

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

```
R1# show ipv6 route
IPv6 Routing Table - default - 5 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user
Static route B - BGP, R - RIP, H - NHRP, I1 - ISIS L1
I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP EX
- EIGRP external, ND - ND Default, NDp - ND Prefix, DCE -
Destination NDr - Redirect, RL - RPL, O - OSPF Intra, OI - OSPF
Inter
OE1 - OSPF ext 1, OE2 - OSPF ext 2, ON1 - OSPF NSSA ext 1
ON2 - OSPF NSSA ext 2, la - LISP alt, lr - LISP site-
registrations ld - LISP dyn-eid, la - LISP away, le - LISP
extranet-policy a - Application
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
```



## Step 2: Display interface information on the router R1

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

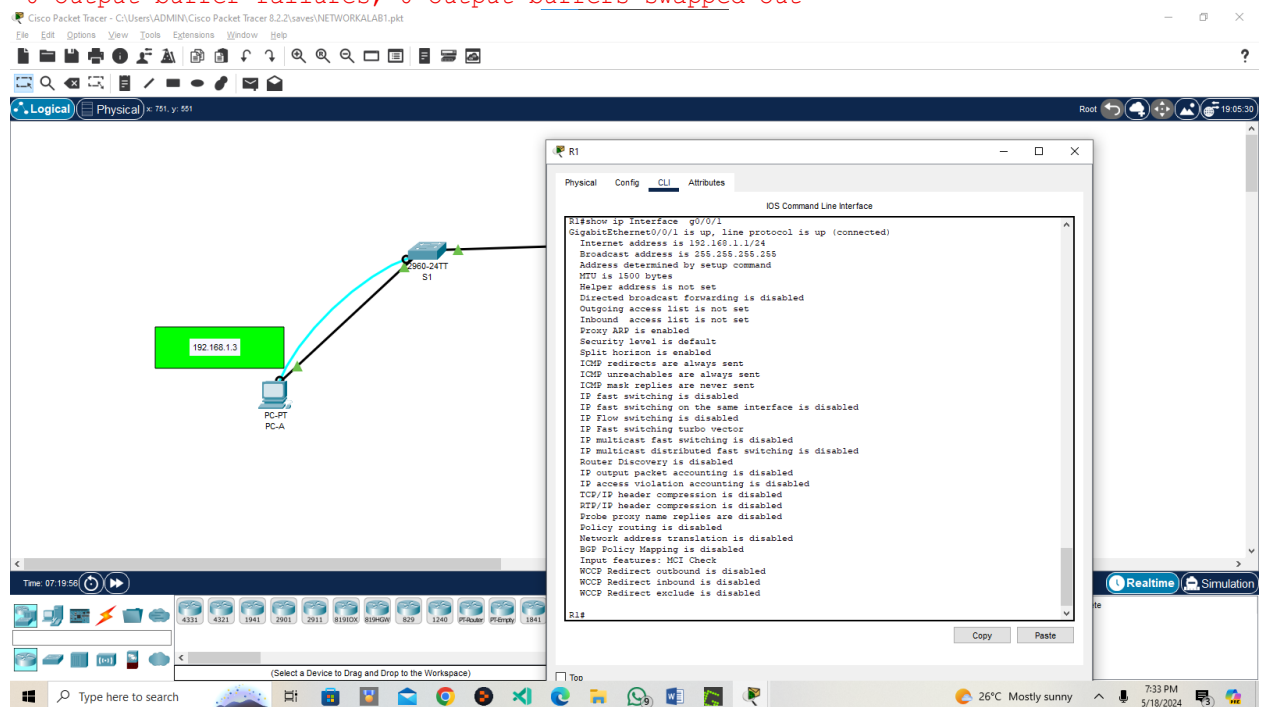
```
R1# show ip interfaces g0/0/1
GigabitEthernet0/0/1 is up, line protocol is up
Hardware is ISR4321-2x1GE, address is a0e0.af0d.e141 (bia
a0e0.af0d.e141) Description: Connectd to F0/5 on S1
Internet address is 192.168.1.1/24
MTU 1500 bytes, BW 100000 Kbit/sec, DLY 100 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
```

```
Keepalive not supported
Full Duplex, 100Mbps, link type is auto, media type is RJ45
output flow-control is off, input flow-control is off
ARP type: ARPA, ARP Timeout 04:00:00
```

```

Last input 00:00:00, output 00:00:19, output hang never
Last clearing of "show interface" counters never
Input queue: 0/375/0/0 (size/max/drops/flushes); Total output
drops: 0 Queueing strategy: fifo
Output queue: 0/40 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
4579 packets input, 637737 bytes, 0 no buffer
Received 1092 broadcasts (0 IP multicasts)
0 runs, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog, 2863 multicast, 0 pause input
700 packets output, 115187 bytes, 0 underruns
0 output errors, 0 collisions, 1 interface resets
0 unknown protocol drops
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier, 0 pause output
0 output buffer failures, 0 output buffers swapped out

```



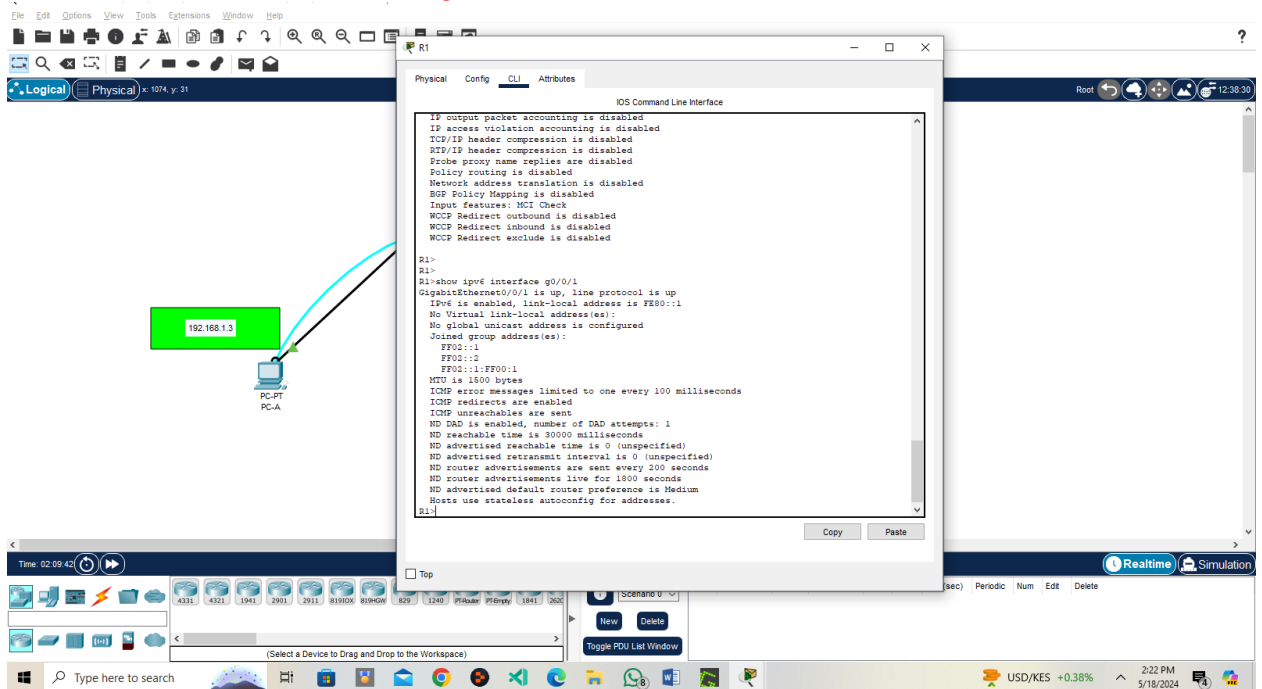
What is the operational status of the G0/0/1 interface?

What is the Media Access Control (MAC) address of the G0/1 interface?

How is the Internet address displayed in this command?

- b. For the IPv6 information, enter the **show ipv6 interface** command. **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):
Description: Connected to F0/5 on S1
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:FE00:1
MTU is 1500 bytes
ICMP error messages limited to one every 100 milliseconds
ICMP redirects are enabled
ICMP unreachable are sent
ND DAD is enabled, number of DAD attempts: 1
ND reachable time is 30000 milliseconds (using 30000)
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.
```



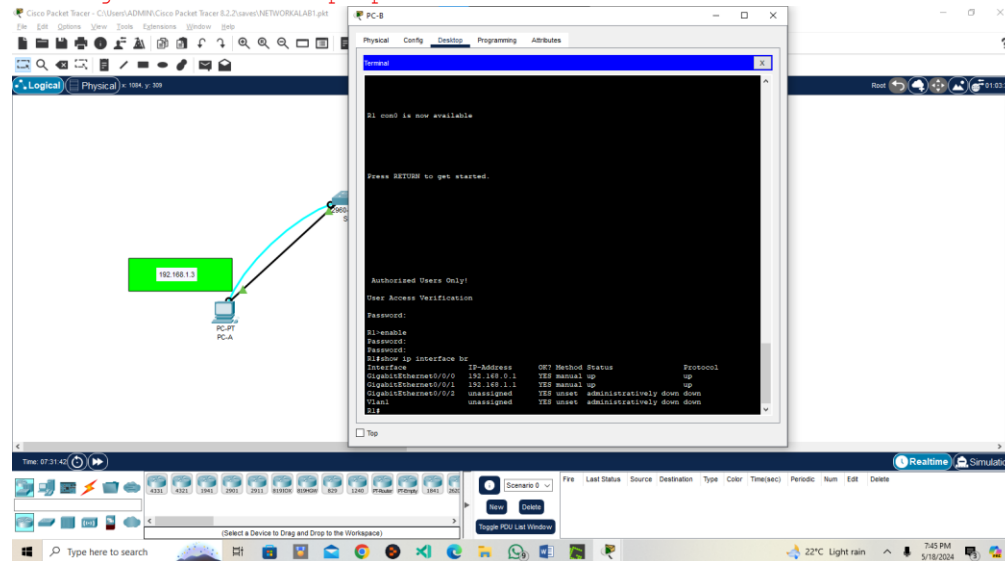
## Lab - Build a Switch and Router Network

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

- a. Enter the **show ip interface brief** command on the router R1.

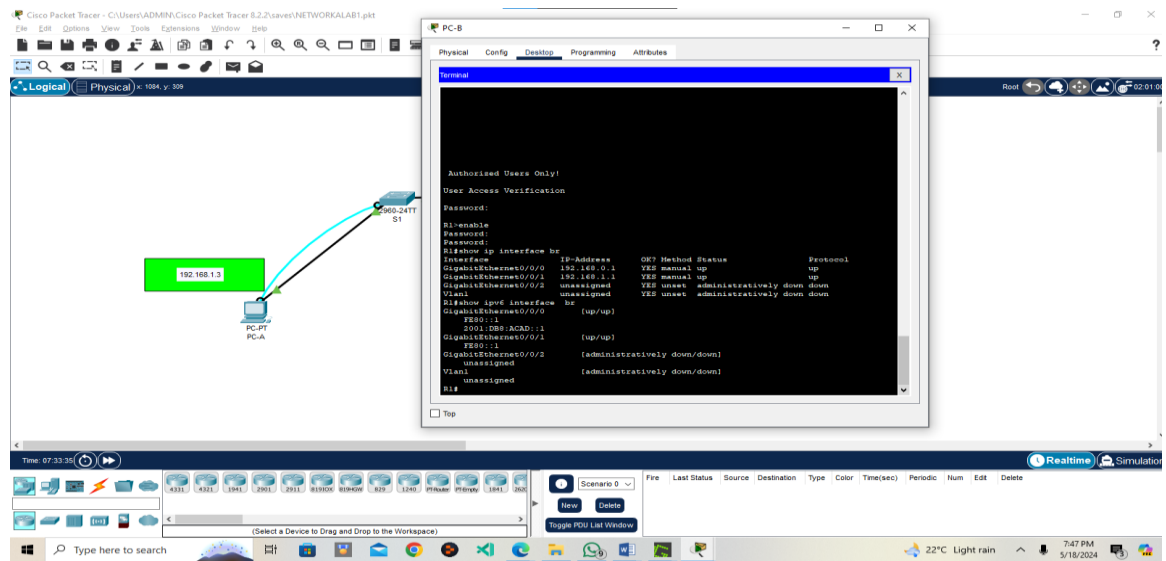
```
R1# show ip interface brief
```

```
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 Serial0/1/0 unassigned YES unset up up Serial0/1/1
unassigned YES unset up up.
```



- b. To see the IPv6 interface information, enter the **show ipv6 interface brief** command on R1. 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
Serial0/1/0 [up/up]
unassigned
Serial0/1/1 [up/up]
unassigned
GigabitEthernet0 [down/down]
Unassigned
```

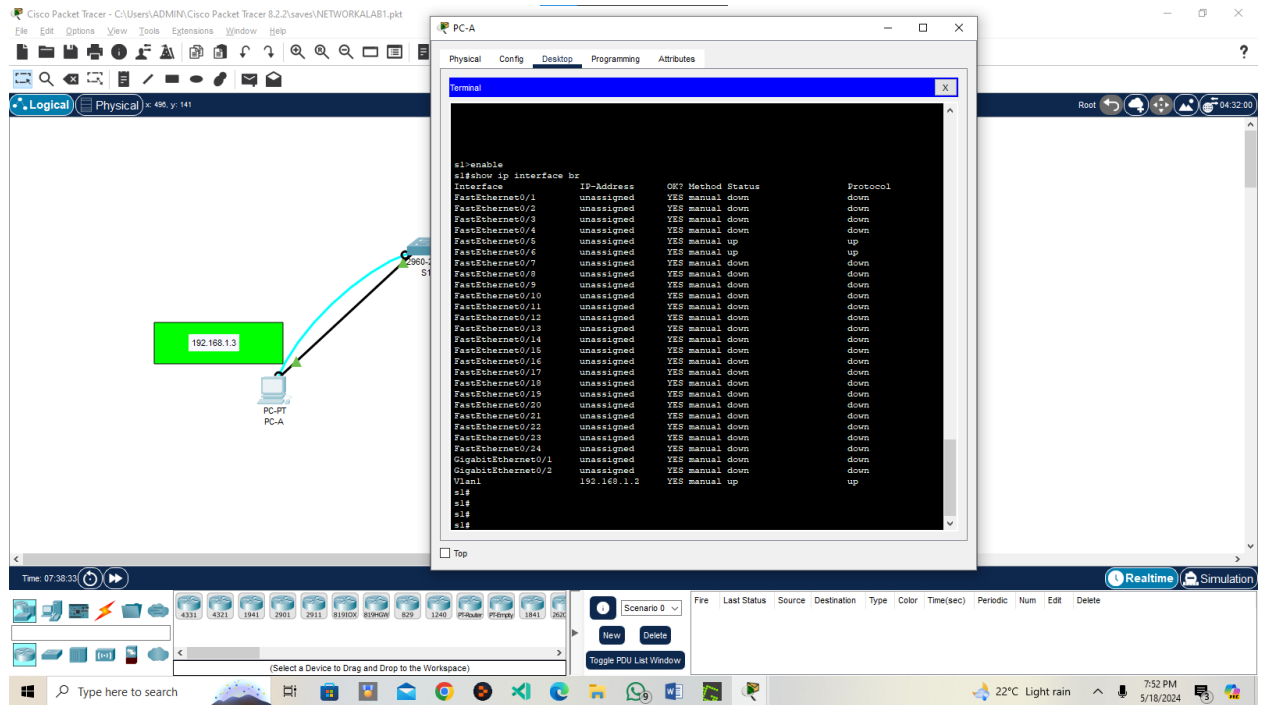


- c. Enter the **show ip interface brief** command on the switch S1.

S1# **show ip interface brief.**

```
Interface IP-Address OK? Method Status Protocol
Vlan1 192.168.1.2 YES manual up up
FastEthernet0/0 192.168.0.1 YES manual up up
FastEthernet0/0/1 192.168.1.1 YES manual up up
FastEthernet0/0/2 unassigned YES unset administratively down down
FastEthernet0/0/3 unassigned YES unset administratively down down
FastEthernet0/0/4 unassigned YES unset administratively down down
FastEthernet0/0/5 unassigned YES unset administratively down down
FastEthernet0/0/6 unassigned YES unset administratively down down
FastEthernet0/0/7 unassigned YES unset administratively down down
FastEthernet0/0/8 unassigned YES unset administratively down down
FastEthernet0/0/9 unassigned YES unset administratively down down
FastEthernet0/0/10 unassigned YES unset administratively down down
FastEthernet0/0/11 unassigned YES unset administratively down down
FastEthernet0/0/12 unassigned YES unset administratively down down
FastEthernet0/0/13 unassigned YES unset administratively down down
FastEthernet0/0/14 unassigned YES unset administratively down down
FastEthernet0/0/15 unassigned YES unset administratively down down
FastEthernet0/0/16 unassigned YES unset administratively down down
FastEthernet0/0/17 unassigned YES unset administratively down down
FastEthernet0/0/18 unassigned YES unset administratively down down
FastEthernet0/0/19 unassigned YES unset administratively down down
FastEthernet0/0/20 unassigned YES unset administratively down down
FastEthernet0/0/21 unassigned YES unset administratively down down
FastEthernet0/0/22 unassigned YES unset administratively down down
FastEthernet0/0/23 unassigned YES unset administratively down down
FastEthernet0/0/24 unassigned YES unset administratively down down
GigabitEthernet0/1 unassigned YES unset administratively down down
GigabitEthernet0/2 unassigned YES unset administratively down down
```





## Reflection Questions

1. If the G0/0/1 interface showed that it was administratively down, what inte

## Conclusion

By completing this lab, successfully built a basic network with a router and a switch, configured static IP addresses, and established connectivity between devices. also learned how to interpret "show" commands to retrieve valuable information about the network devices.

This lab provided a foundational understanding of network configuration. As progress in networking journey, encounter more advanced routing protocols, security configurations, and troubleshooting techniques to build and manage complex networks.