EC-4060 COMPUTER AND DATA NETWORKS ASSIGNMENT - 1

PRIYADHARSHANI N.

2020 / E / 120

GROUP C3

SEMESTETR – 4

17 MAY 2023

SELF - LEARING ASSIGNMENT

Q: The University has recently built the IT Centre and department building. These building will house discussion rooms, department office, lecture halls, lectures room, laboratories meeting room and computer labs.
Eeach Building dimensions (2 story building): Length: 70 meeters, Width: 30 meeters, Height: each floor 4 meeters.
You are requested to design a computer network to these buildings of the University with optimum use of network IP addresses. Available IP address range is 10.20.0.0/16
You should submit a report with the following details:
- Network diagram (subnets and VLANs – provide IP addresses for each of them)
- Write the steps on how to configure Routers and switeches.
- WiFi Acdess points configruation details

- Computers available at staff room can't be accessed from the network Engineering lab, department office, department meeting room, lecture halls, computer labs, Computer Vision and Machine Learning Lab, Microprocessor Lab, Technical Officers Rooms and the IT Centre (for security reason).
- Computers available at the department office can't be accessed from the staff room, network Engineering lab, department office, department meeting room, lecture halls, computer labs, Computer Vision and Machine Learning Lab, Microprocessor Lab, Technical Officers Rooms and the IT Centre.

Requirement
- Printer available at the depratment office can only be accessed by the depratment staffs.
- Printer available at the IT Centre printing room can only be accessed by the IT Centre staffs.
- Each network node can only be accessed by the administator, not others.

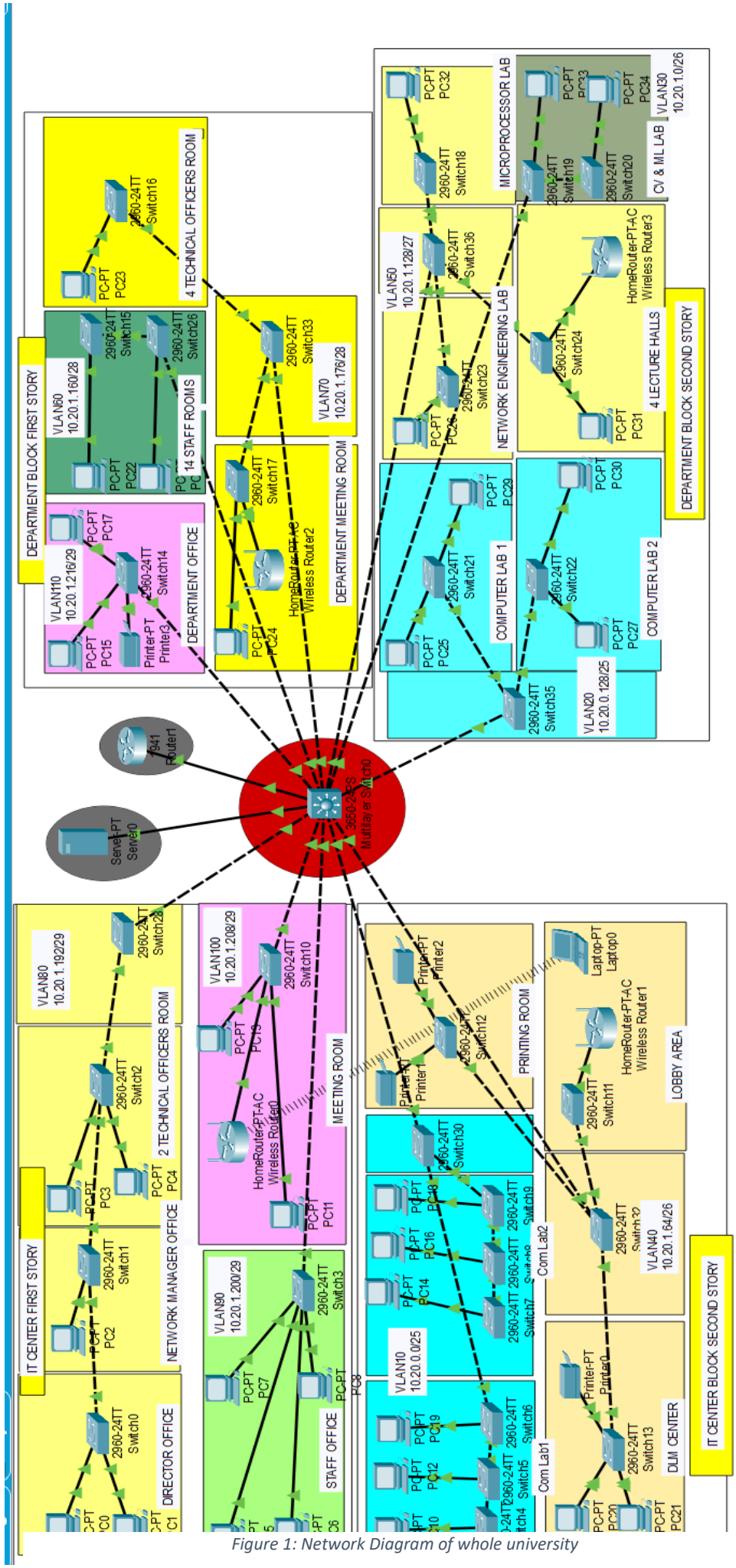

Figure 1: Network Diagram of whole university

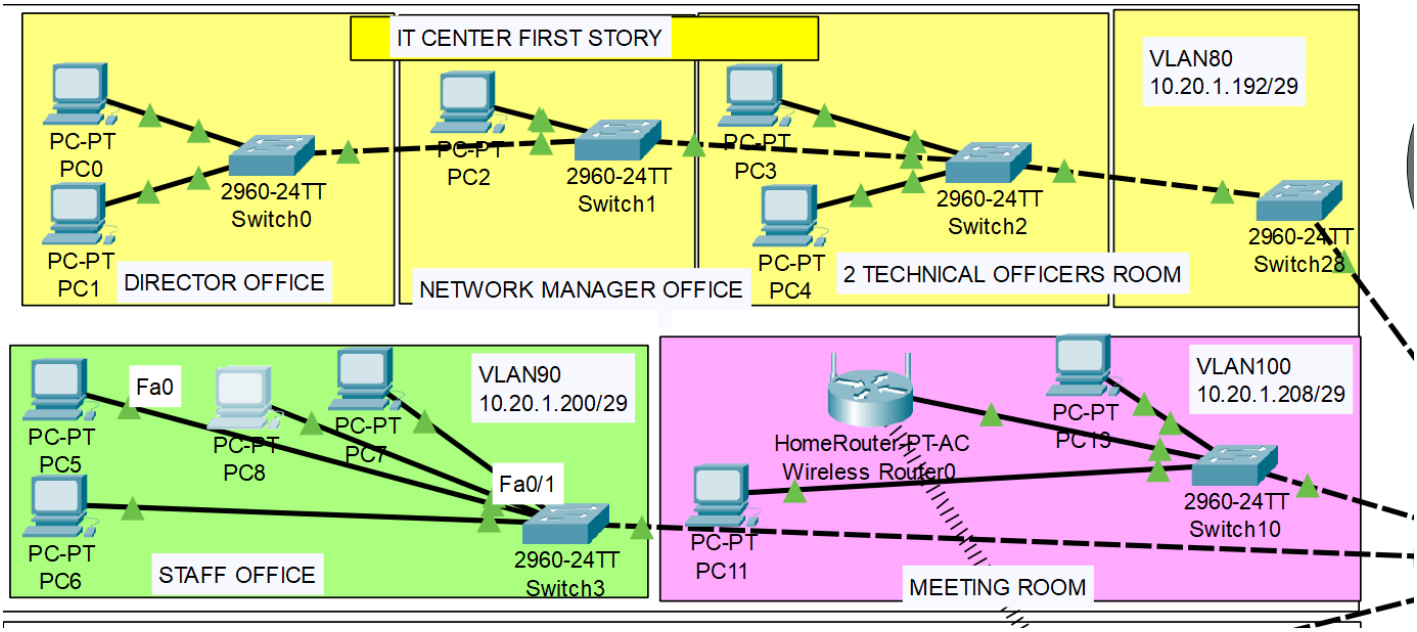

Figure 2: Data Network diagram of FirstStory of IT Center Block

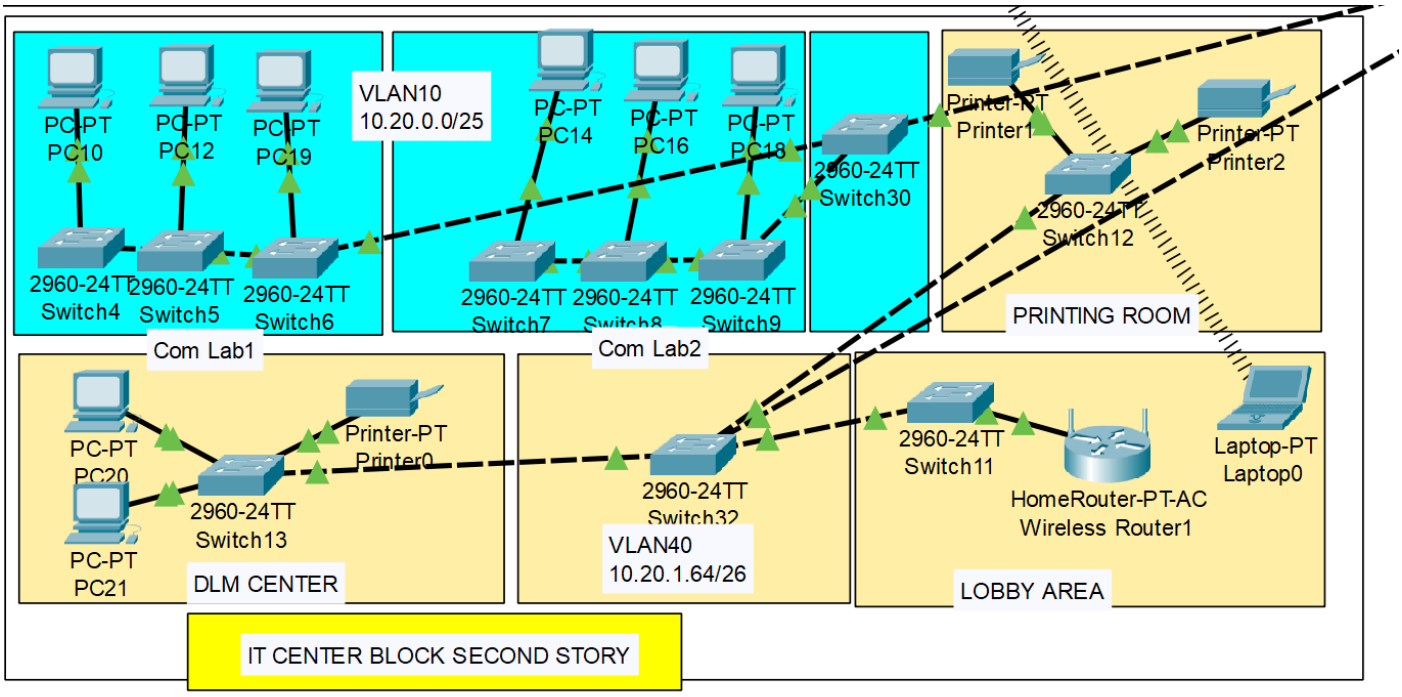

Figure 3: Data Network diagram of Second Story of IT Center Block

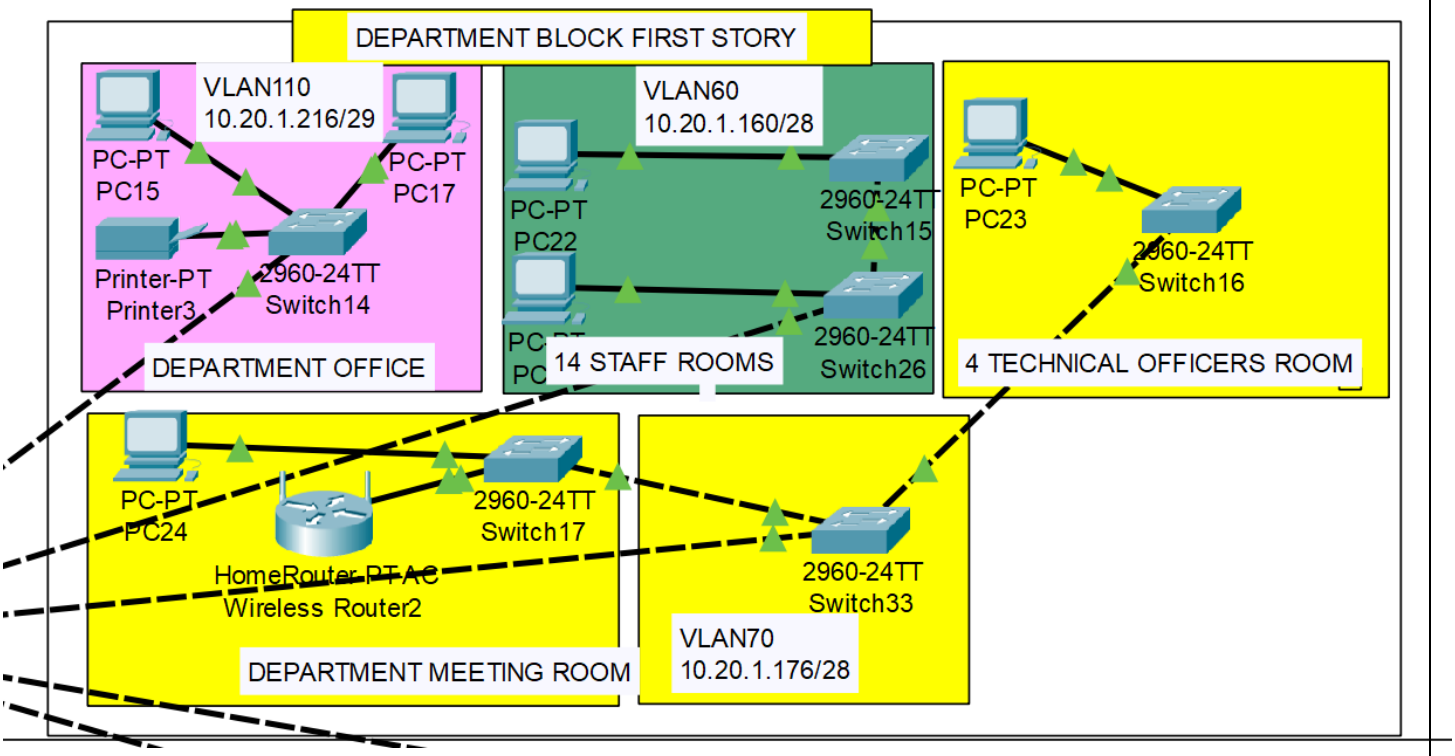

Figure 4: Data Network diagram of First tStory of Department Block

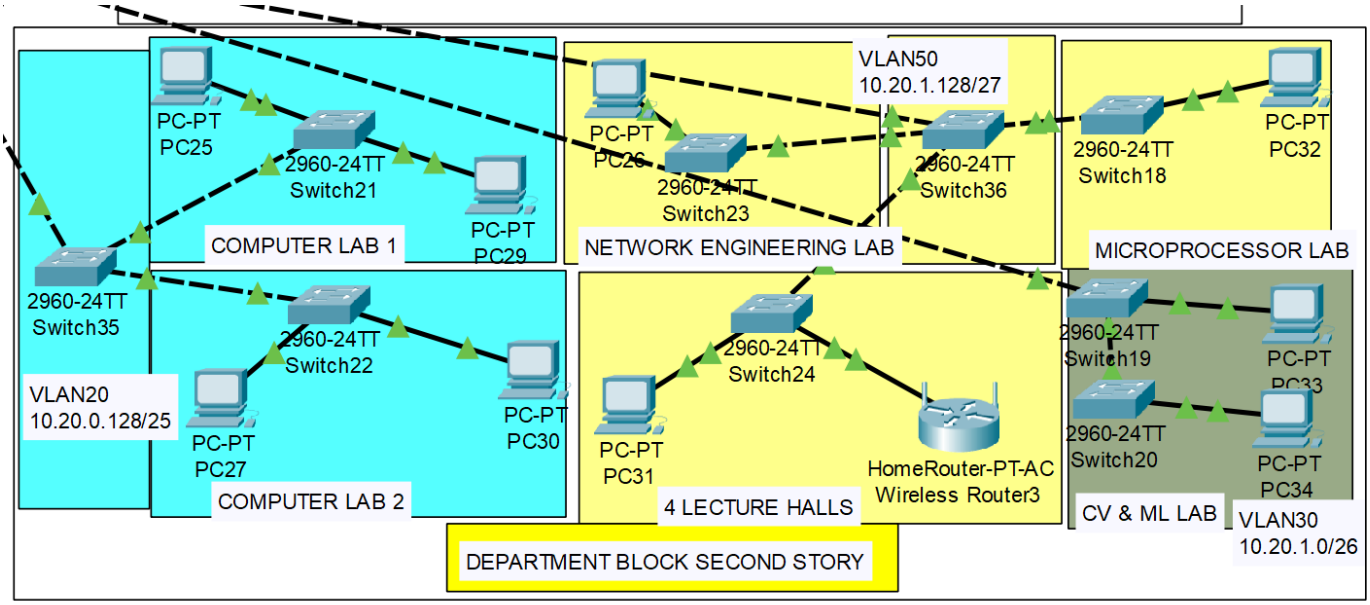

Figure 5: : Data Network diagram of Second Story of Department Block

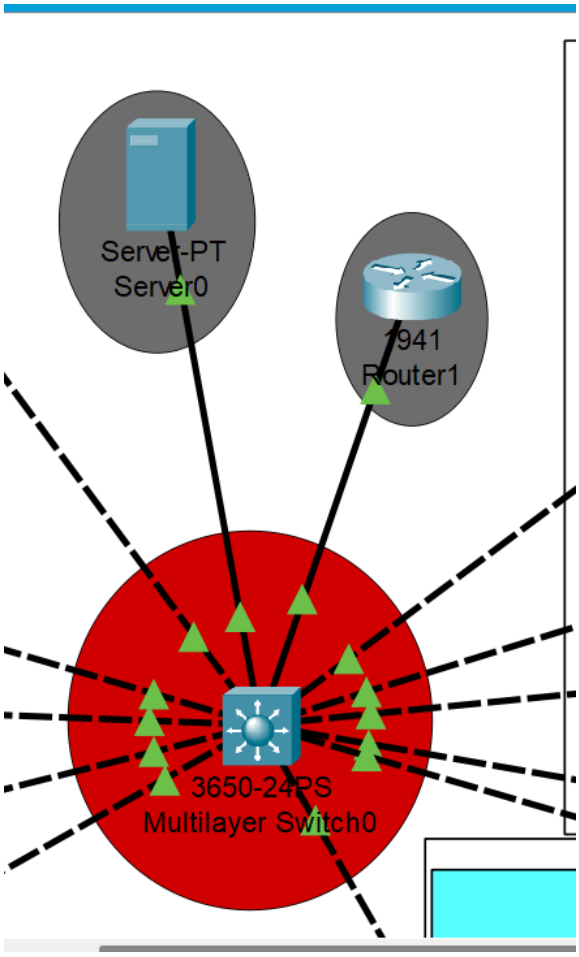

Figure 6: Main inter-connections

IT CENTRE BLOCK & DEPARTMENT BLOCK

Figure 7: Data Summary

Place IT Center Block	No of pc	Place Department Block	No of pc
Director office	2	**4 Lecture halls**	1
Network manager room	1	**14 staff rooms**	1
2 technical officer	2	**4 technical officers room**	1
Staff office	5	**Department meeting room**	2
Meeting room	2	**Computer lab 1**	50
Computer lab 1	60	**Computer lab 2**	50
Computer lab 2	60	**Network engineering lab**	10
Digital learning and media center	30	**Microprocessor lab**	12
Printers	3	**Computer vision and machine learning lab**	50
Wi-fi coverage	2	**Department office**	2
		Printers	1

- ✓ To restrict the address of staff room and department office, it should be consider as separate VLANs.

Block Name	VLAN No	VLAN Id	Required Size	Allocated Size	Ip Address Assignable Range	Subnet Mask	CIDR Notation	Broadcast Address
Com Lab 1, Com Lab 2	10	10.20.0.0/25	120	128	10.20.0.1-10.20.0.126	255.255.255.128	/25	10.20.0.127
Computer Lab 1, Computer Lab 2	20	10.20.0.128/25	100	128	10.20.0.129-10.20.0.254	255.255.255.128	/25	10.20.0.255
CV & ML Lab	30	10.20.1.0/26	50	64	10.20.1.1-10.20.1.62	255.255.255.192	/26	10.20.1.63
Printing Room, DLM Center, Lobby Area	40	10.20.1.64/26	34	64	10.20.1.65-10.20.1.126	255.255.255.192	/26	10.20.1.127
Network Engineering Lab, Microprocessor Lab, 4 Lecture Halls	50	10.20.1.128/27	30	32	10.20.1.129-10.20.1.158	255.255.255.224	/27	10.20.1.159
14 Staff Rooms	60	10.20.1.160/28	14	16	10.20.1.161-10.20.1.174	255.255.255.240	/28	10.20.1.175
4 Technical Officers Room, Department Meeting Room	70	10.20.1.176/28	7	16	10.20.1.177-10.20.1.190	255.255.255.240	/28	10.20.1.191
Director Office, Network Manager Room, 2 Technical Officers Room	80	10.20.1.192/29	5	8	10.20.1.193-10.20.1.198	255.255.255.248	/29	10.20.1.199
Staff Office	90	10.20.1.200/29	5	8	10.20.1.201-10.20.1.206	255.255.255.248	/29	10.20.1.207
Meeting Room	100	10.20.1.208/29	3	8	10.20.1.209-10.20.1.214	255.255.255.248	/29	10.20.1.215
Department Office	110	10.20.1.216/29	3	8	10.20.1.217-10.20.1.222	255.255.255.248	/29	10.20.1.223

Figure 8: IP Address Distribution Table

- ✓ VLAN name given as (Block10, Block20, ……., Block110)

Table 1: Sample for a VLAN

Consider VLAN 50	
VLAN ID	10.20.1.128/27
Network Address	10.20.1.128
Broadcast Address	10.20.1.159
Usable range	10.20.1.129 – 10.20.1.158
CIDR Notation	/27
Total number of hosts	32
Total number of usable hosts	30

✓ **TURN ON THE LAYER 3 SWITCH (Put the AC Power Supply)**
Place all the equipment then supply the power

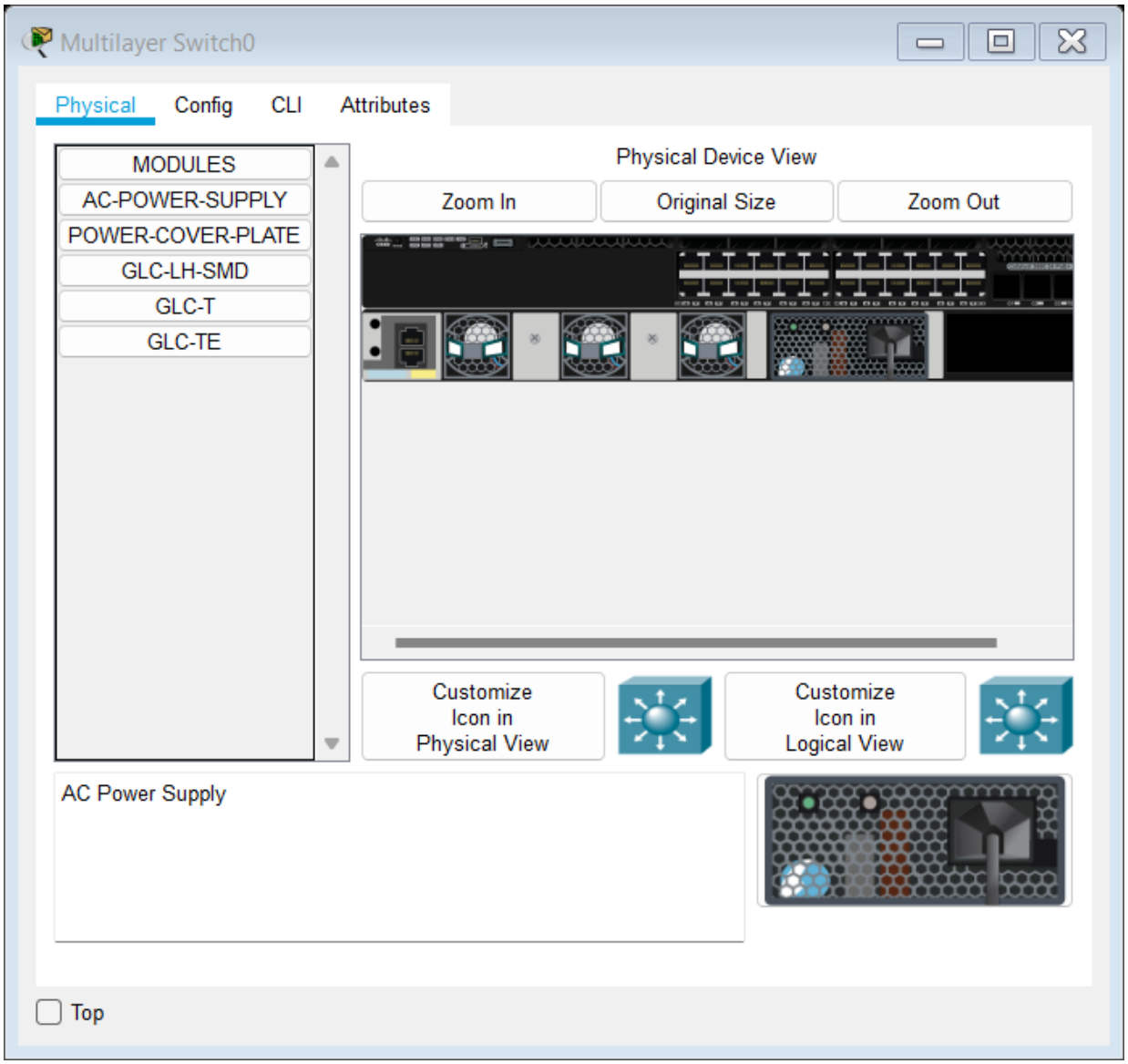

Figure 9

✓ **ADDRESS Assigning for the PC**
Click the PC then go to desktop after that you will se a screen as below

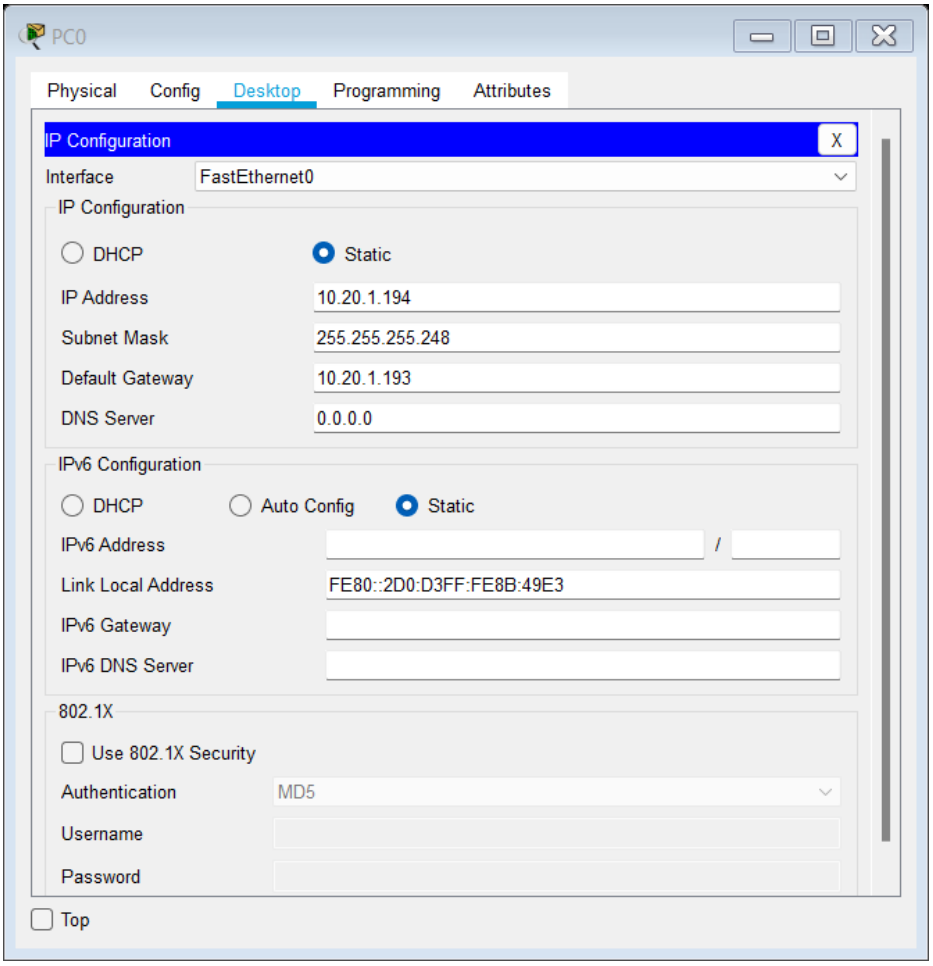

Figure 10

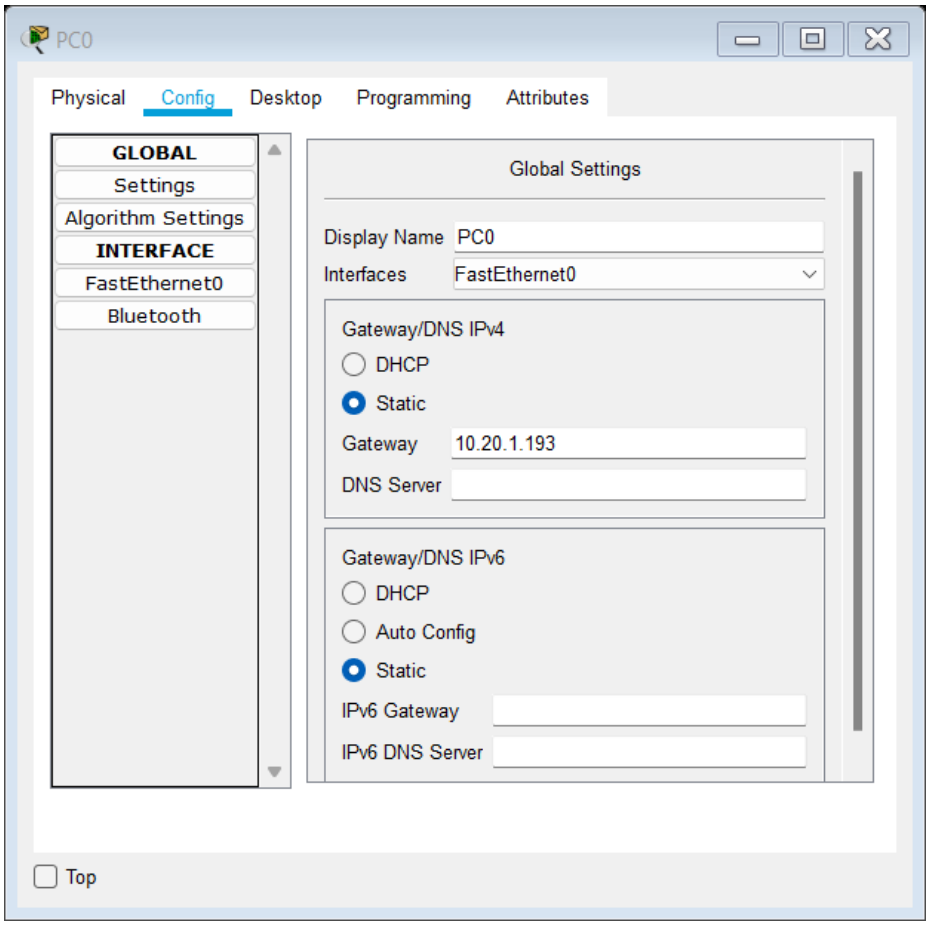

Figure 11

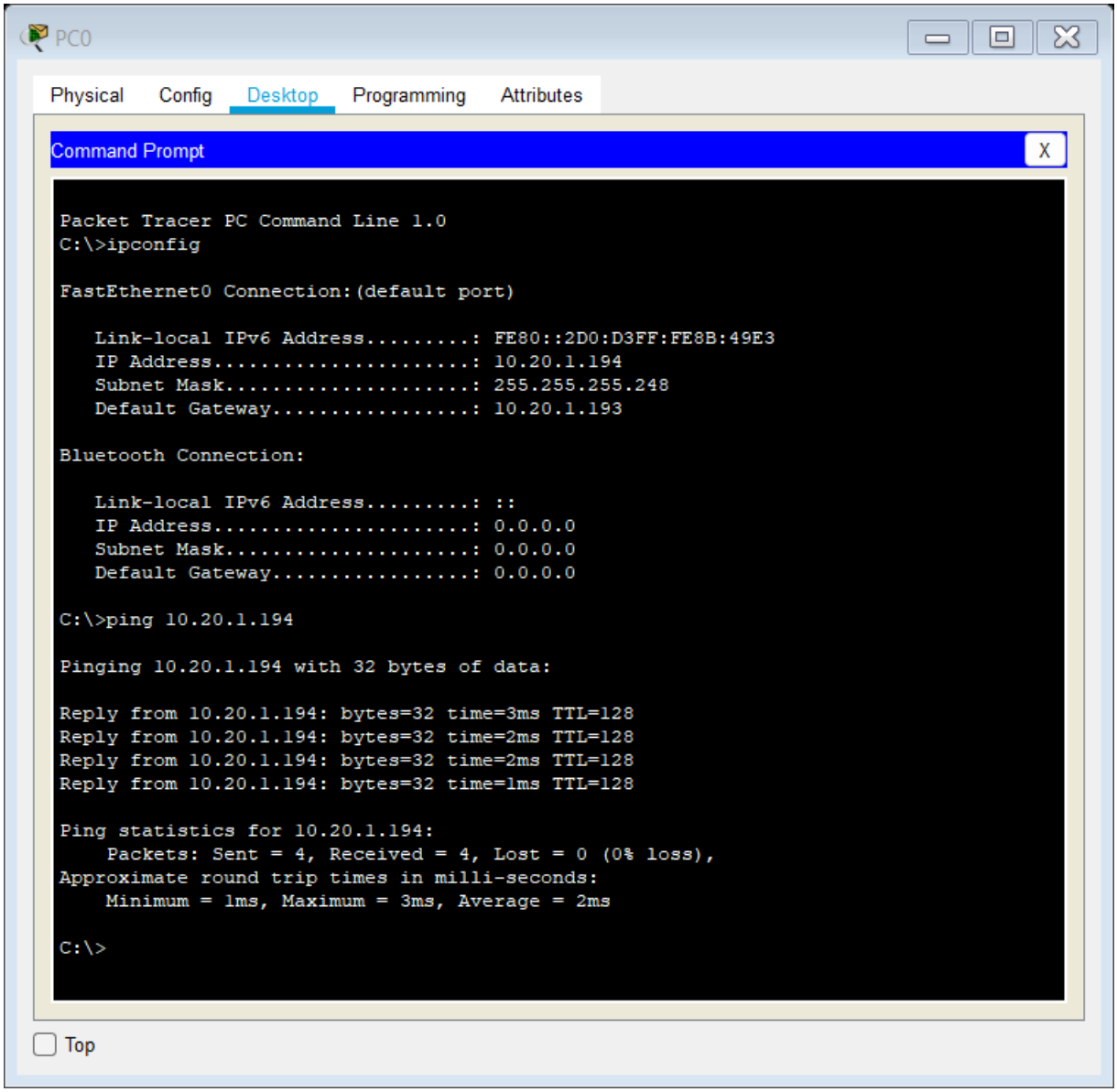
PC0
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
Packet Tracer PC Command Line 1.0
C:\>ipconfig
FastEthernet0 Connection:(default port)
Link-local IPv6 Address.....: FE80::2D0:D3FF:FE8B:49E3
IP Address.....: 10.20.1.194
Subnet Mask.....: 255.255.255.248
Default Gateway.....: 10.20.1.193
Bluetooth Connection:
Link-local IPv6 Address.....: ::
IP Address.....: 0.0.0.0
Subnet Mask.....: 0.0.0.0
Default Gateway.....: 0.0.0.0
C:\>ping 10.20.1.194
Pinging 10.20.1.194 with 32 bytes of data:
Reply from 10.20.1.194: bytes=32 time=3ms TTL=128
Reply from 10.20.1.194: bytes=32 time=2ms TTL=128
Reply from 10.20.1.194: bytes=32 time=2ms TTL=128
Reply from 10.20.1.194: bytes=32 time=1ms TTL=128
Ping statistics for 10.20.1.194:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 1ms, Maximum = 3ms, Average = 2ms
C:\>
Top

Figure 12

✓ PRINTER CONFIGURATION

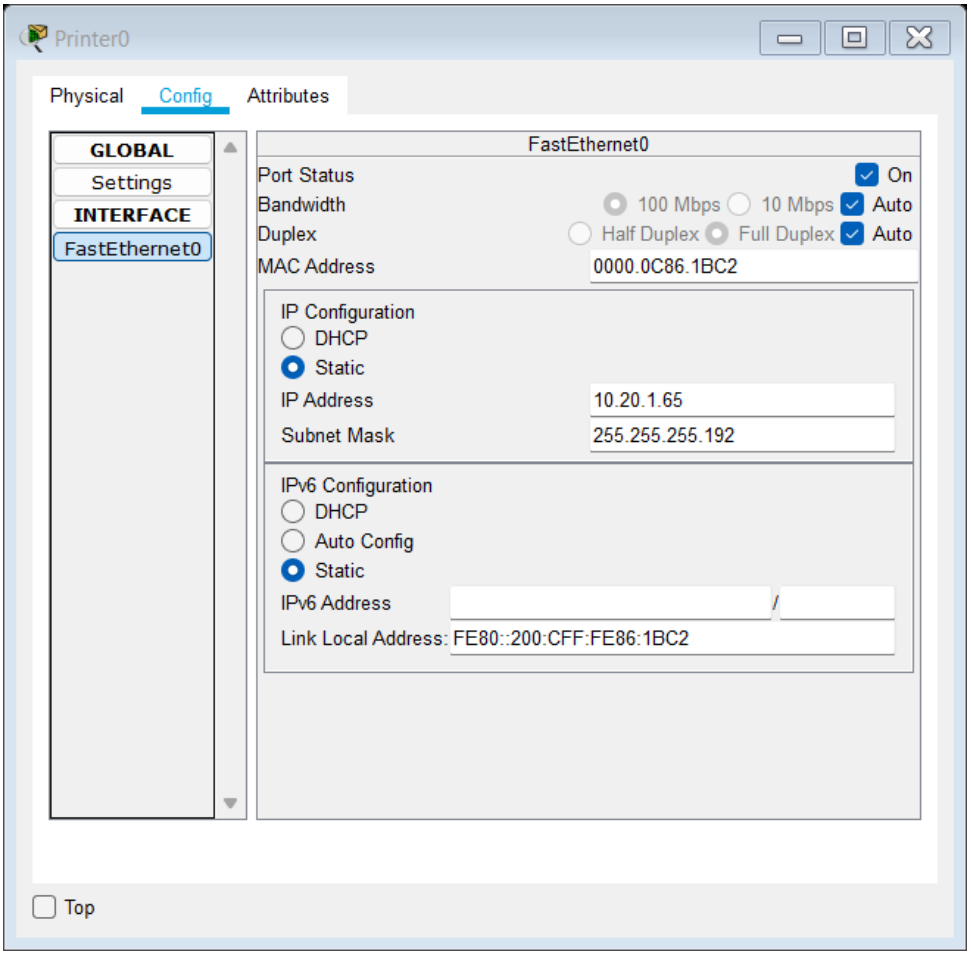

Figure 13

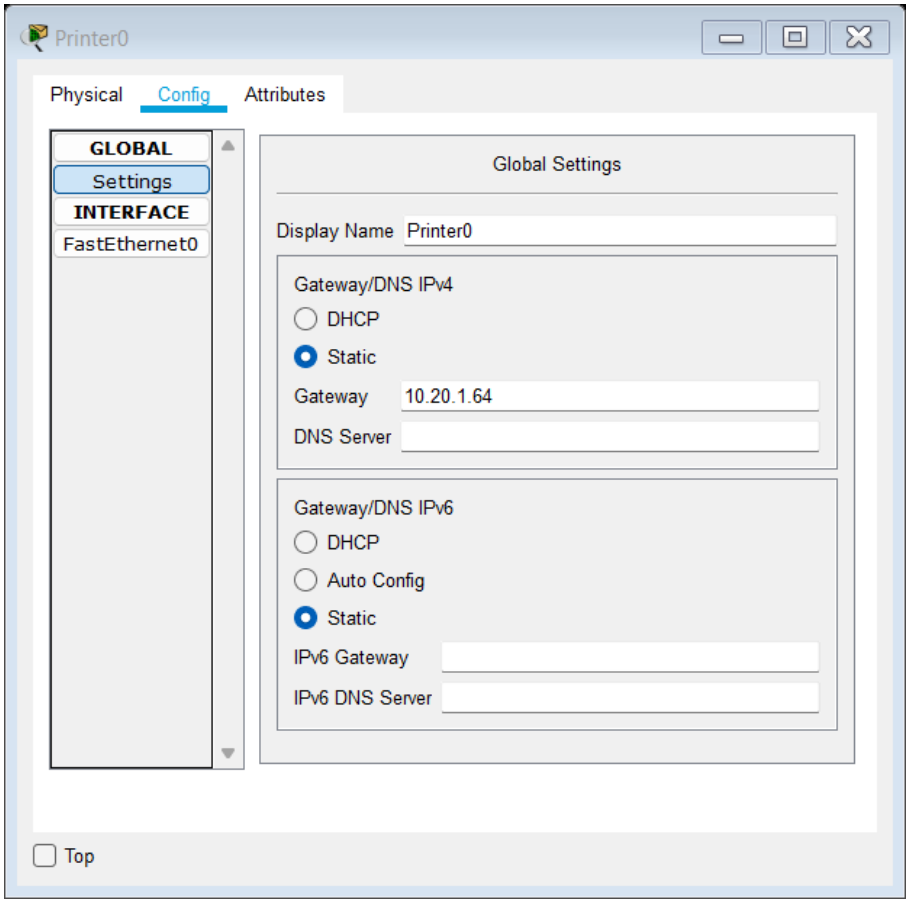

Figure 14

✓ VLANS ASSIGNING FOR EVERY SWITCHES

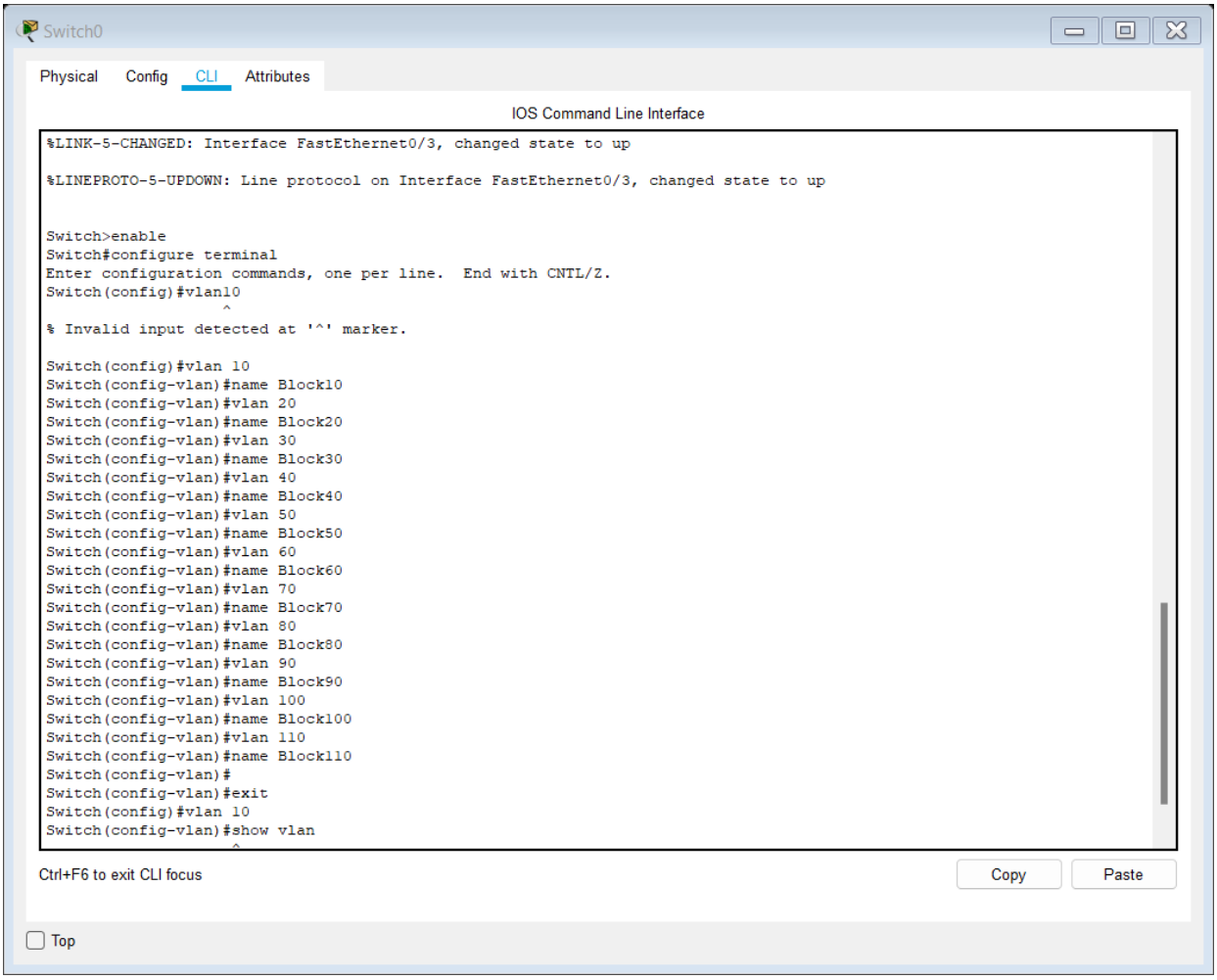

Figure 15

✓ VLANS ADDED TO THE SWITCH

Table 2

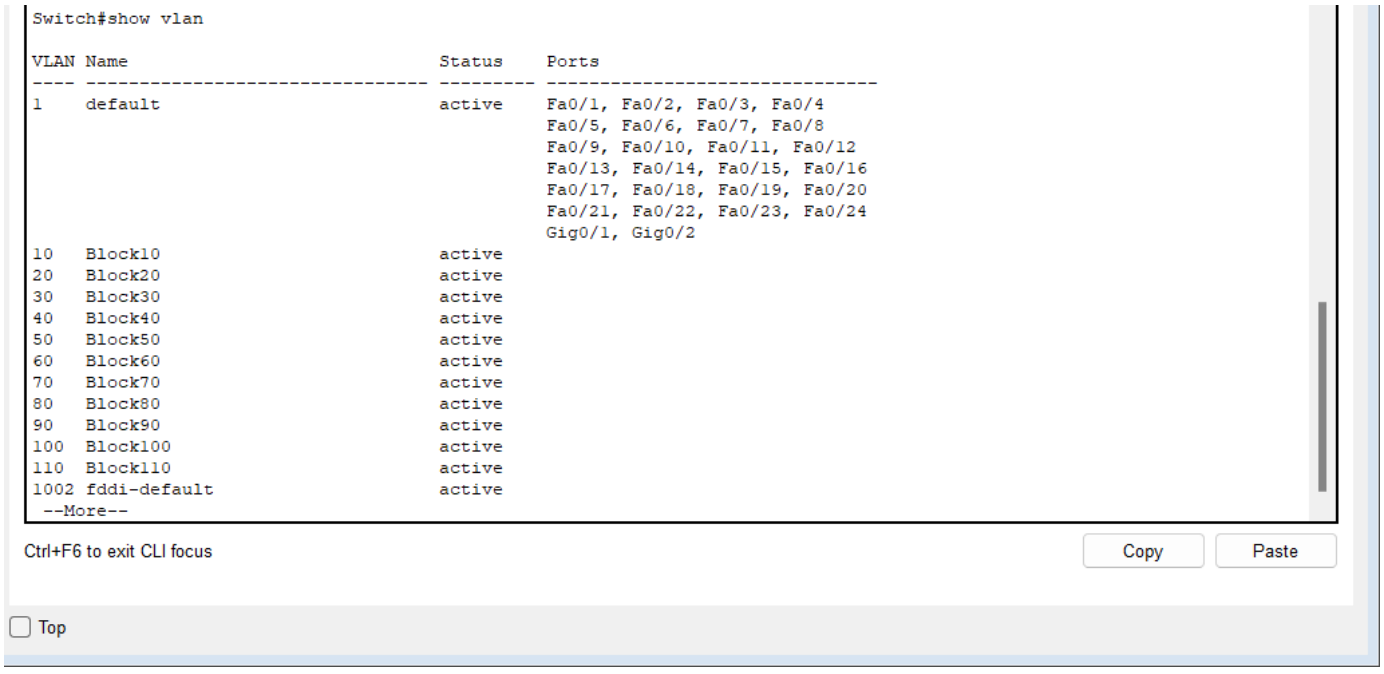

Figure 16

- ✓ Computer in staff room (vlan60) can be accessed by the another computer in staff room (vlan60)
- ✓ Computer from vlan110 cannot accessed the computer in the staff room.

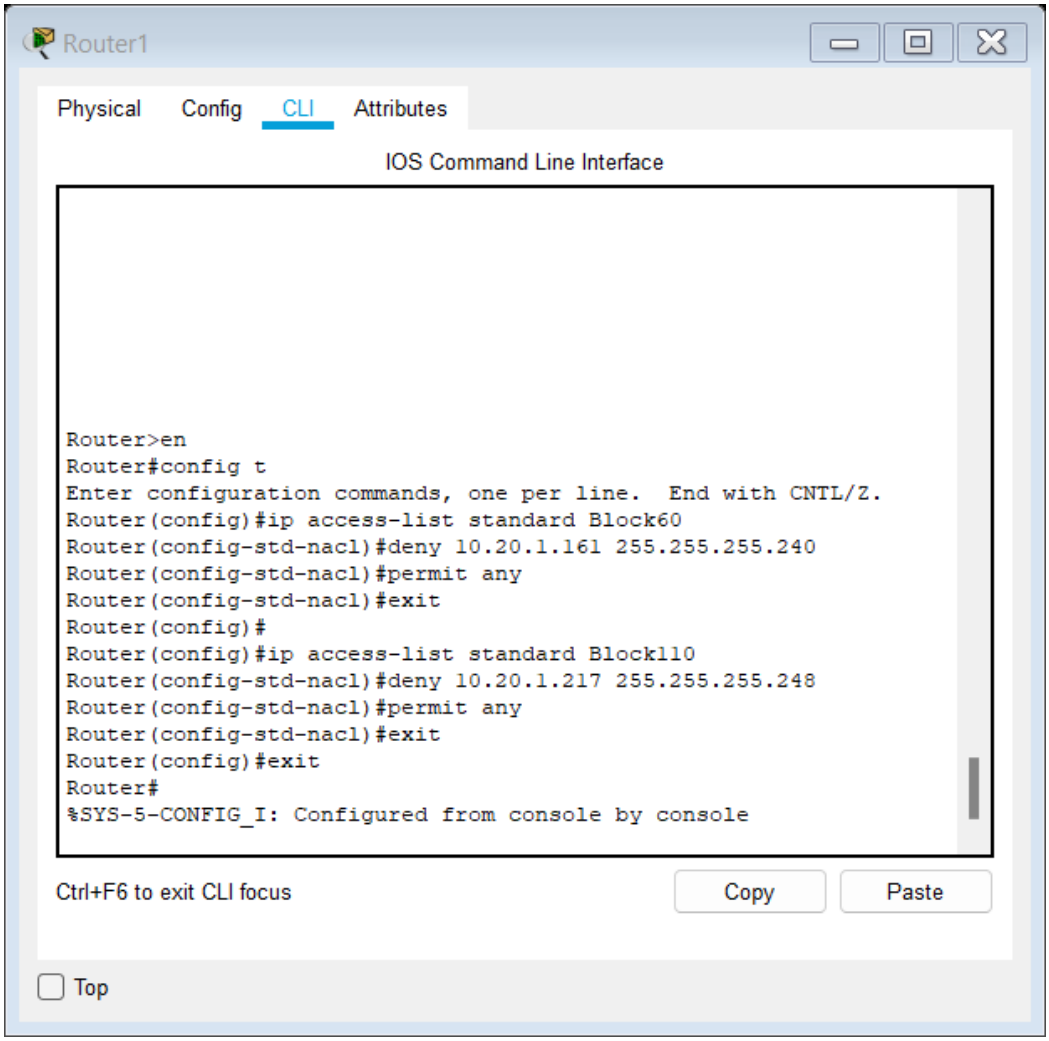

Figure 17

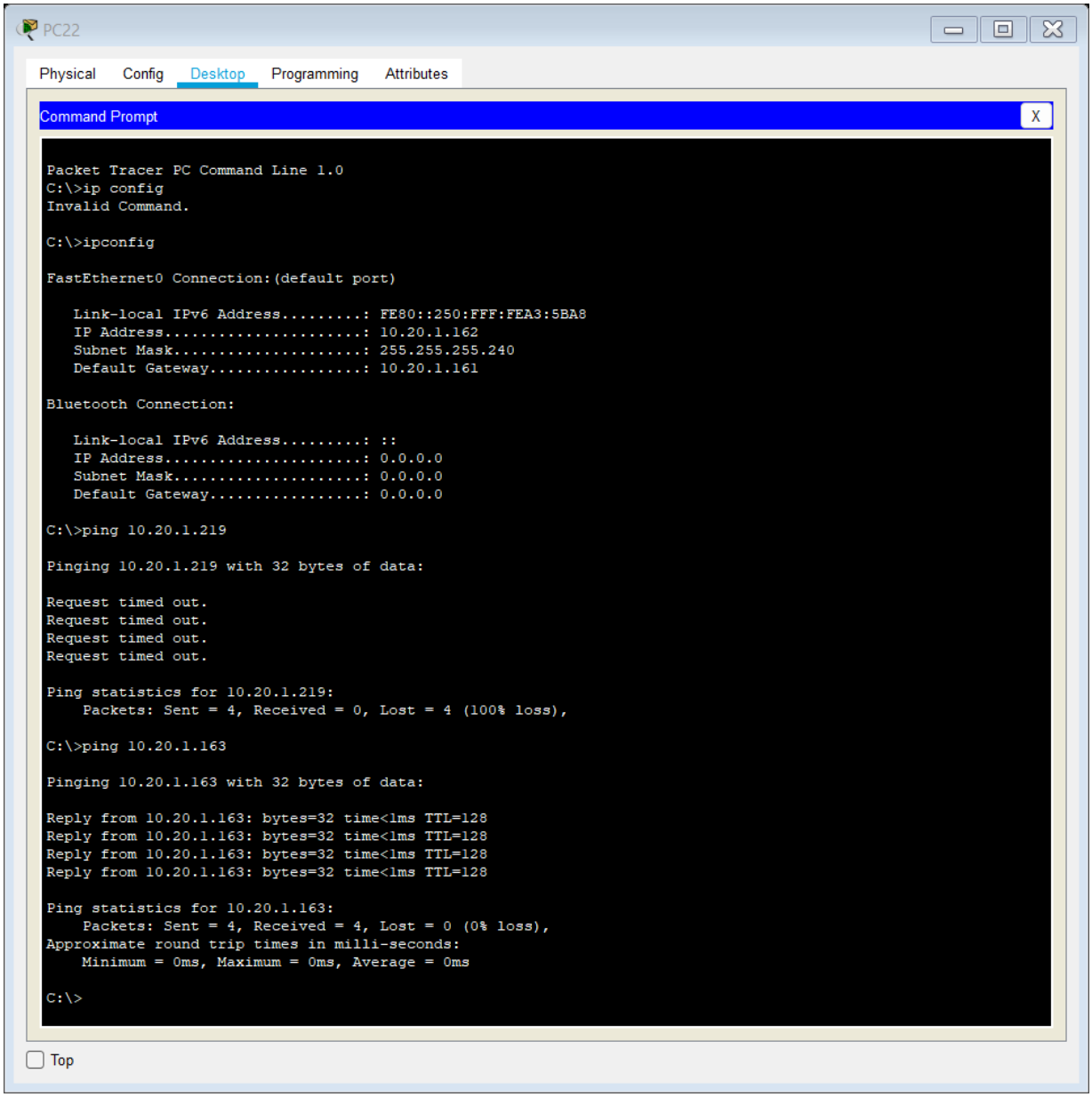

Figure 18

✓ ASSIGNED ALL THE PORTS FOR VLAN10 IN A SWITCH

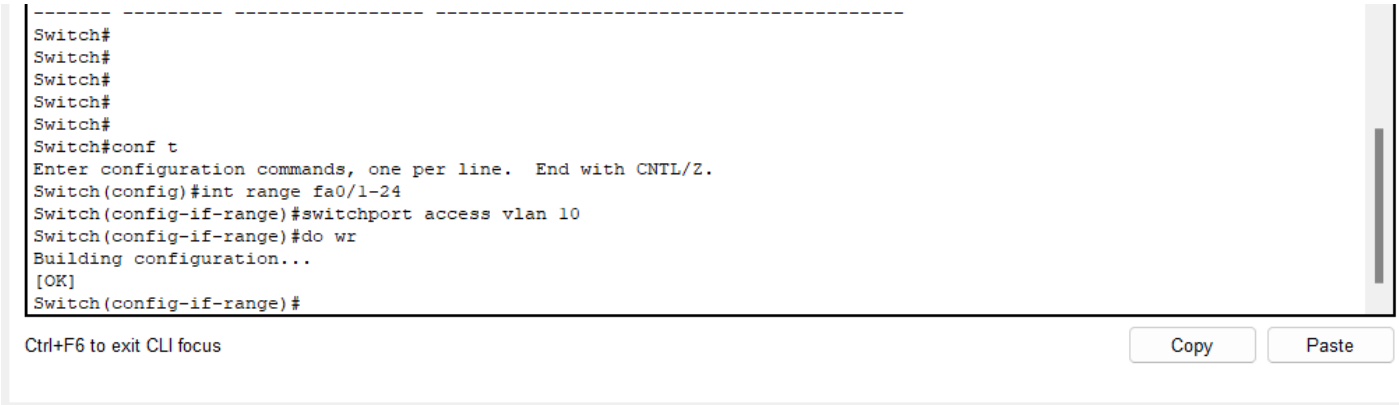

Figure 19

- ✓ **CONSIDER SWITCH 1 AS A EXAMPLE(SWITCH1 PLACED IN VLAN90)**
- ✓ **USE TRUNK ACCORDING TO YOUR NEED**

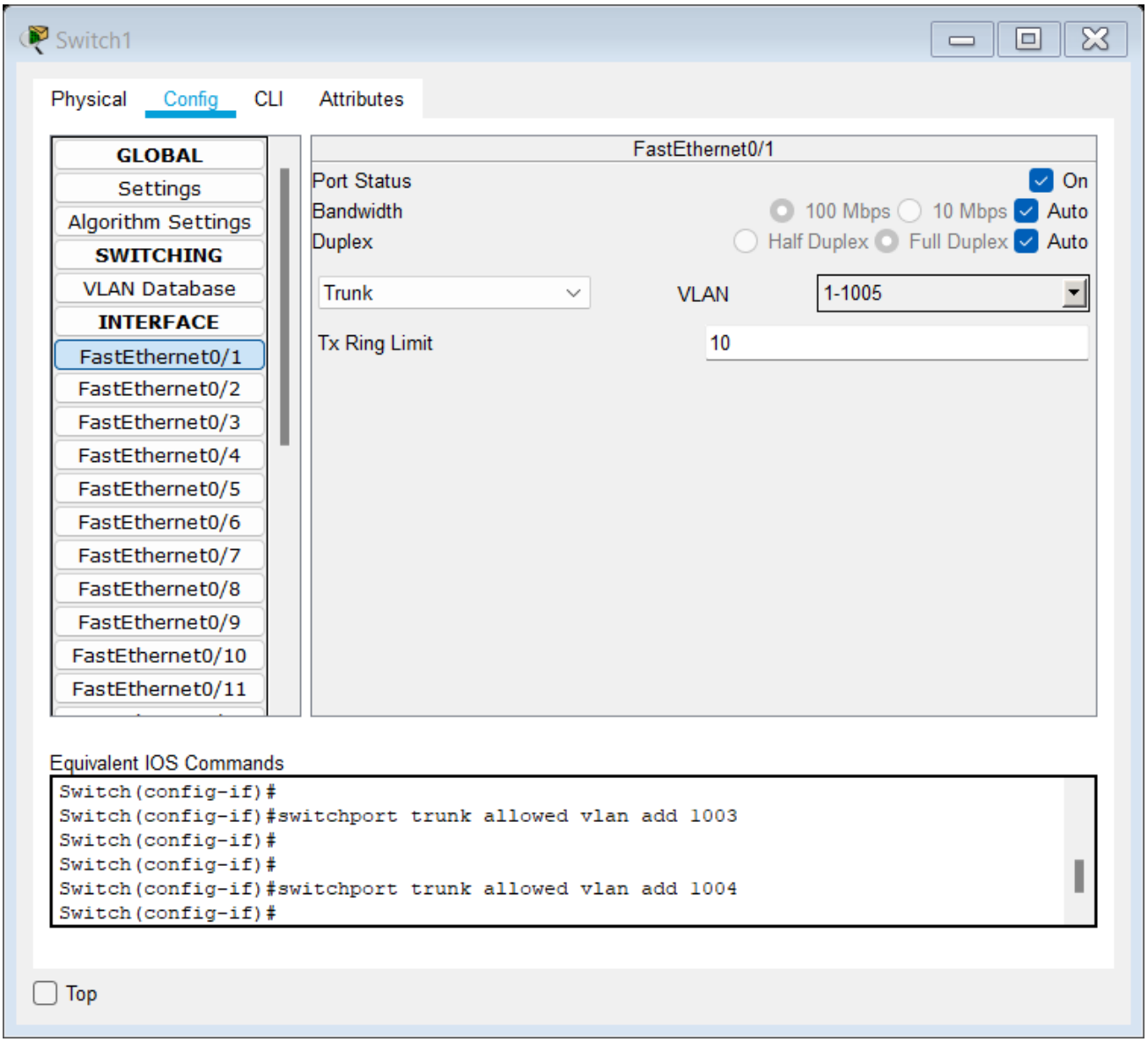

Figure 20

✓ **CONSIDER THE MULTILAYER LAYER SWITCH AND CORRESPONDING TRUNK PORT**

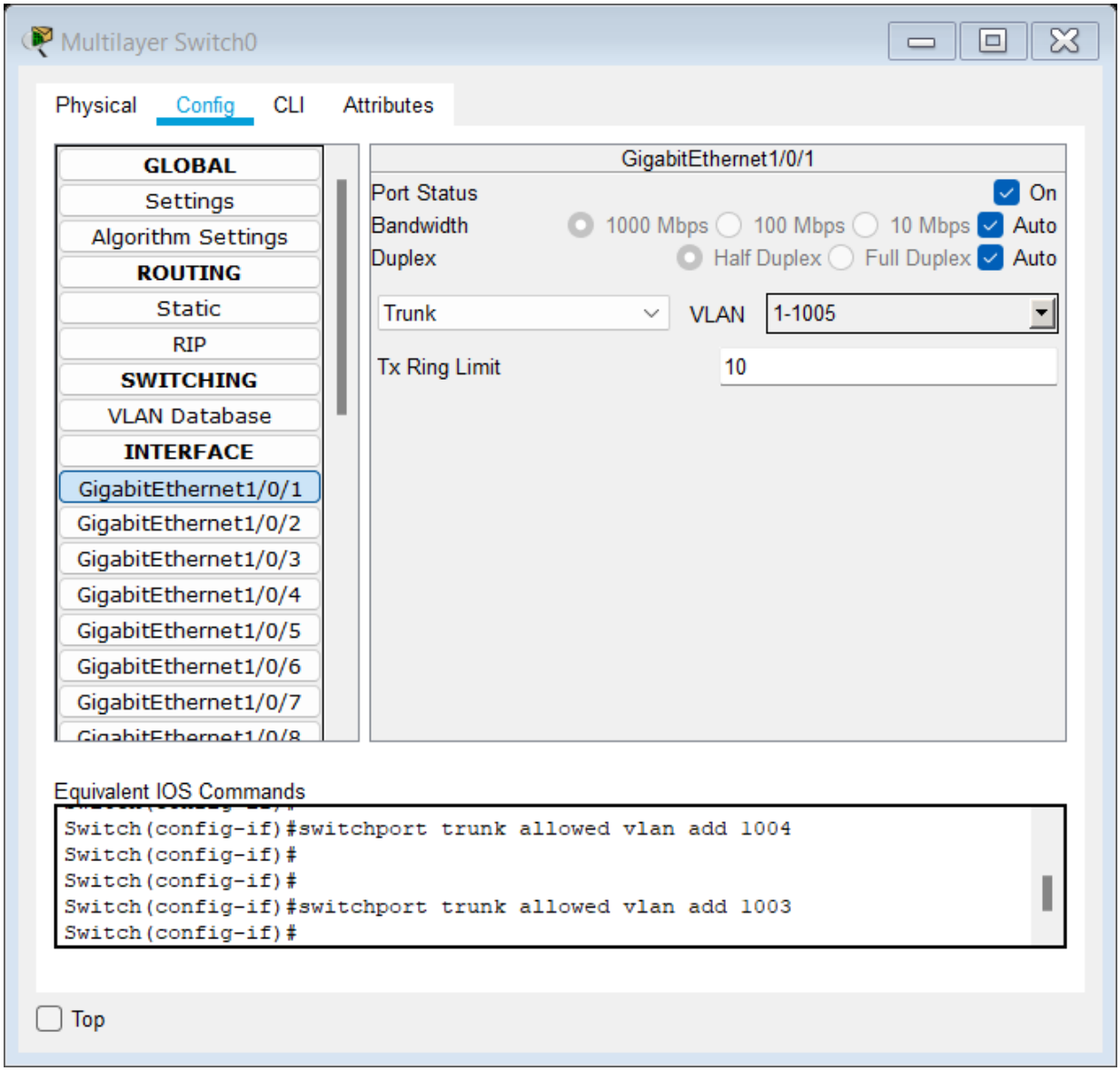

Figure 21

✓ **TAKE AN EXAMPLE STEP TO COMMUNICATE IN BETWEEN 2 VLANS**

Consider vlan 90 and vlan100,

Fa0/1 in vlan 80 and vlan10 are switched to trunk mode
Gig1/0/3 and Gig 1/0/4 also switched to trunk
Then consider the router and set the default gateway for each VLANS
Then we can able to communicate in between the vlans

✓ **ROUTER CONFIGURATION (Default gate way)**

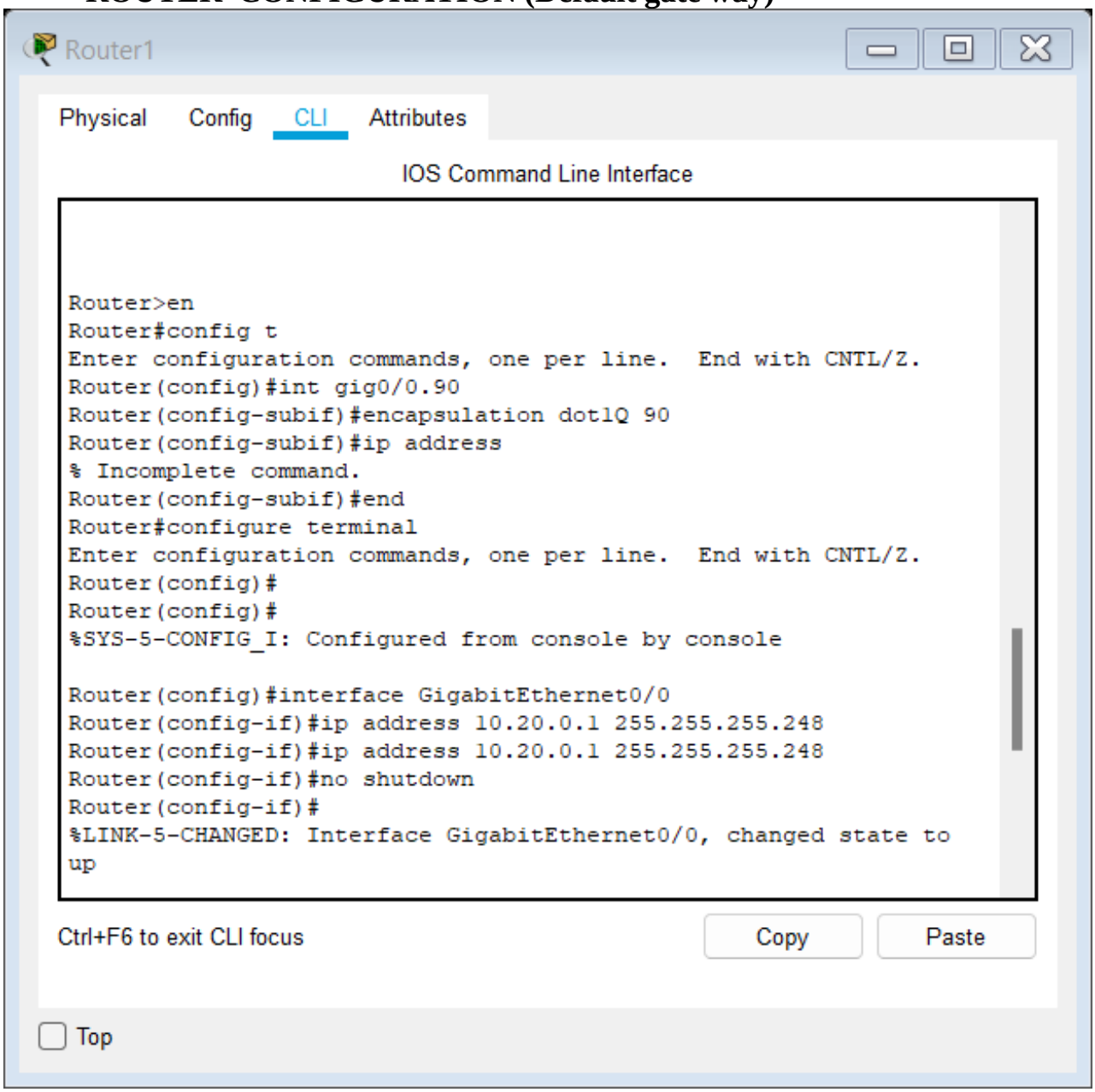

Figure 22

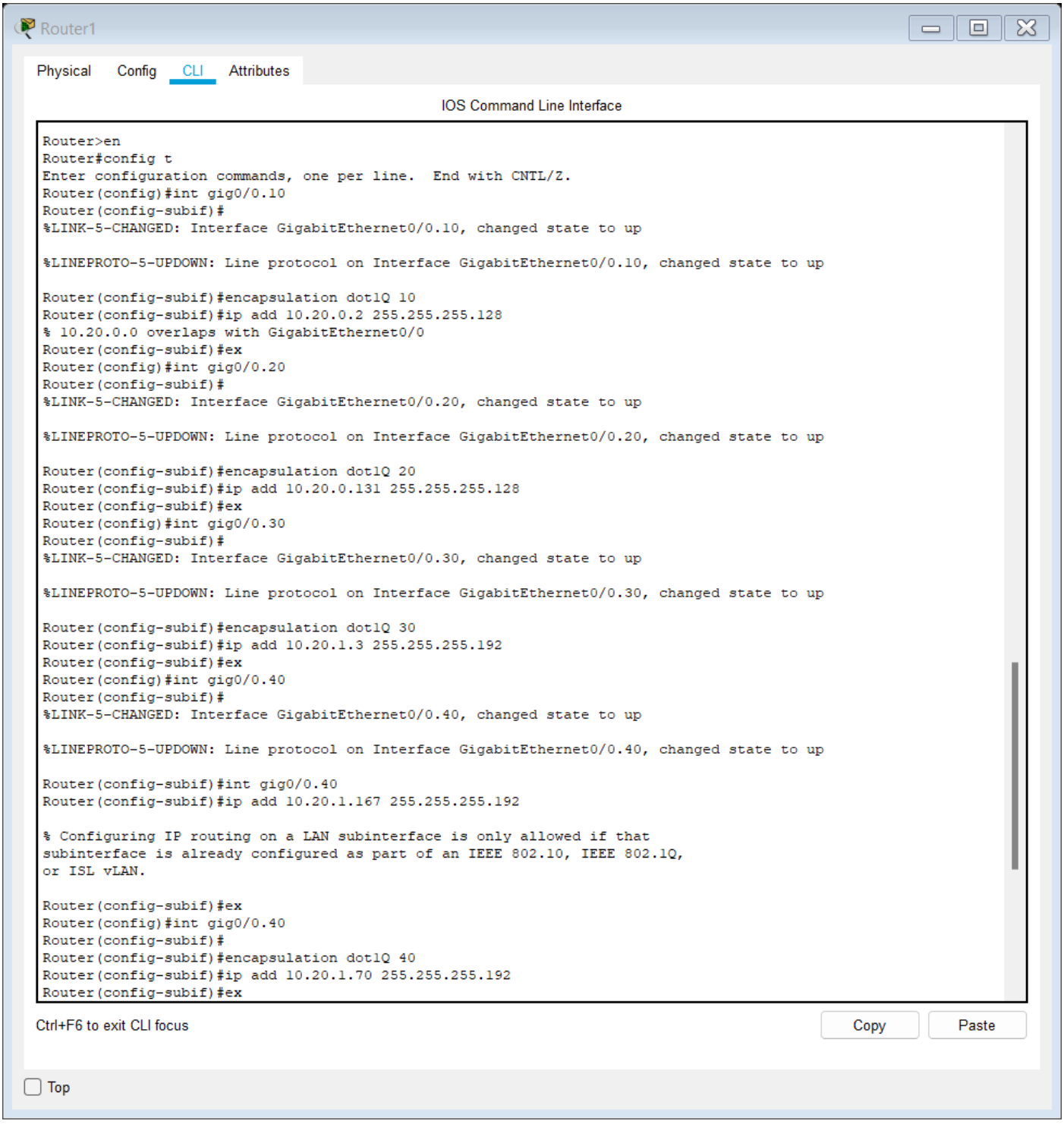
Router1
Physical
Config
CLI
Attributes
IOS Command Line Interface
Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int gig0/0.10
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.10, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.10, changed state to up
Router(config-subif)#encapsulation dot1Q 10
Router(config-subif)#ip add 10.20.0.2 255.255.255.128
% 10.20.0.0 overlaps with GigabitEthernet0/0
Router(config-subif)#ex
Router(config)#int gig0/0.20
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.20, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.20, changed state to up
Router(config-subif)#encapsulation dot1Q 20
Router(config-subif)#ip add 10.20.0.131 255.255.255.128
Router(config-subif)#ex
Router(config)#int gig0/0.30
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.30, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.30, changed state to up
Router(config-subif)#encapsulation dot1Q 30
Router(config-subif)#ip add 10.20.1.3 255.255.255.192
Router(config-subif)#ex
Router(config)#int gig0/0.40
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.40, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.40, changed state to up
Router(config-subif)#int gig0/0.40
Router(config-subif)#ip add 10.20.1.167 255.255.255.192
% Configuring IP routing on a LAN subinterface is only allowed if that
subinterface is already configured as part of an IEEE 802.10, IEEE 802.1Q,
or ISL vLAN.
Router(config-subif)#ex
Router(config)#int gig0/0.40
Router(config-subif)#
Router(config-subif)#encapsulation dot1Q 40
Router(config-subif)#ip add 10.20.1.70 255.255.255.192
Router(config-subif)#ex
Ctrl+F6 to exit CLI focus
Copy
Paste
Top

Figure 23

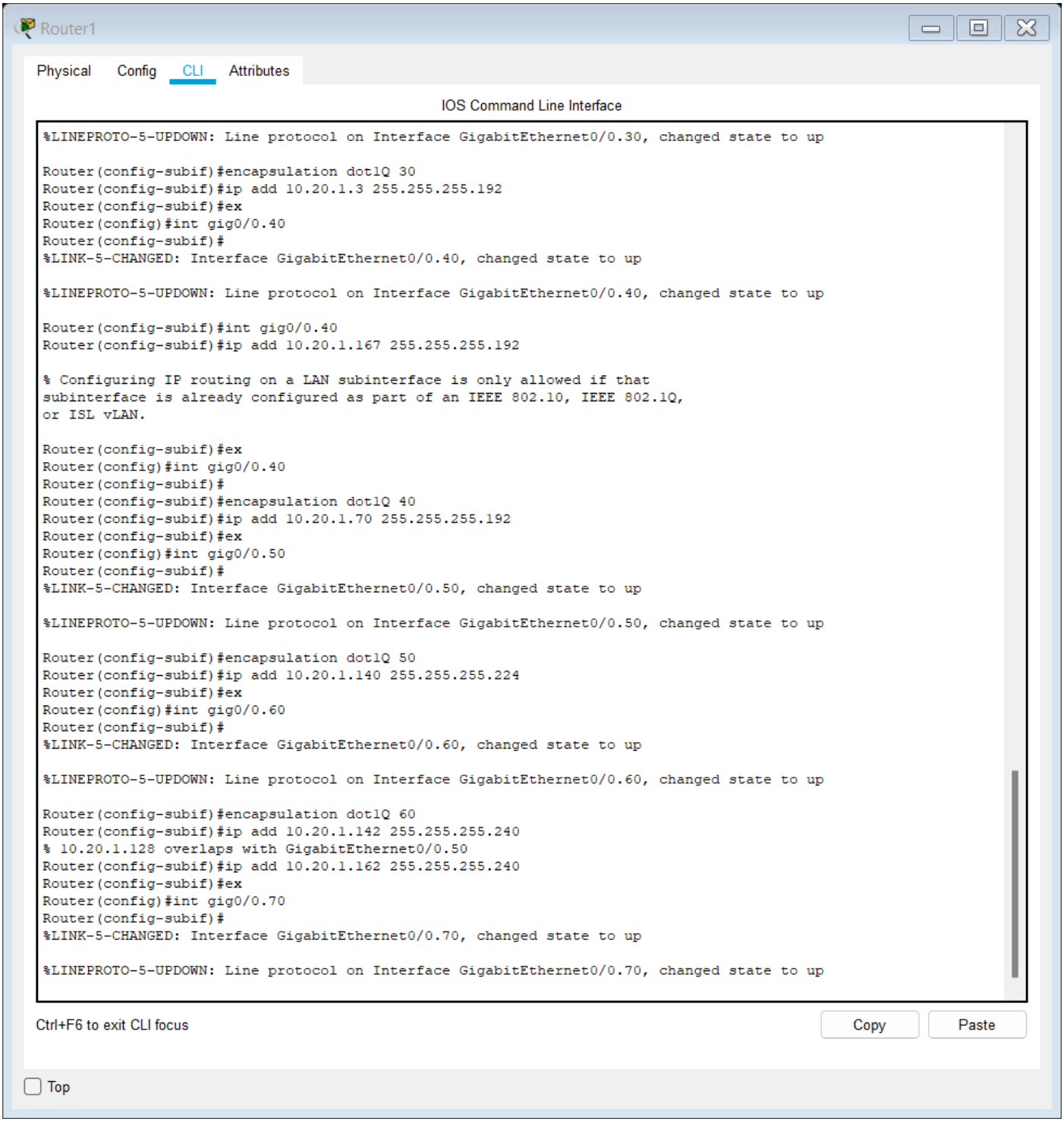
Router1
Physical
Config
CLI
Attributes
IOS Command Line Interface
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.30, changed state to up
Router(config-subif)#encapsulation dot1Q 30
Router(config-subif)#ip add 10.20.1.3 255.255.255.192
Router(config-subif)#ex
Router(config)#int gig0/0.40
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.40, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.40, changed state to up
Router(config-subif)#int gig0/0.40
Router(config-subif)#ip add 10.20.1.167 255.255.255.192
% Configuring IP routing on a LAN subinterface is only allowed if that
subinterface is already configured as part of an IEEE 802.10, IEEE 802.1Q,
or ISL vLAN.
Router(config-subif)#ex
Router(config)#int gig0/0.40
Router(config-subif)#
Router(config-subif)#encapsulation dot1Q 40
Router(config-subif)#ip add 10.20.1.70 255.255.255.192
Router(config-subif)#ex
Router(config)#int gig0/0.50
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.50, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.50, changed state to up
Router(config-subif)#encapsulation dot1Q 50
Router(config-subif)#ip add 10.20.1.140 255.255.255.224
Router(config-subif)#ex
Router(config)#int gig0/0.60
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.60, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.60, changed state to up
Router(config-subif)#encapsulation dot1Q 60
Router(config-subif)#ip add 10.20.1.142 255.255.255.240
% 10.20.1.128 overlaps with GigabitEthernet0/0.50
Router(config-subif)#ip add 10.20.1.162 255.255.255.240
Router(config-subif)#ex
Router(config)#int gig0/0.70
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.70, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.70, changed state to up
Ctrl+F6 to exit CLI focus
Copy
Paste
Top

Figure 24

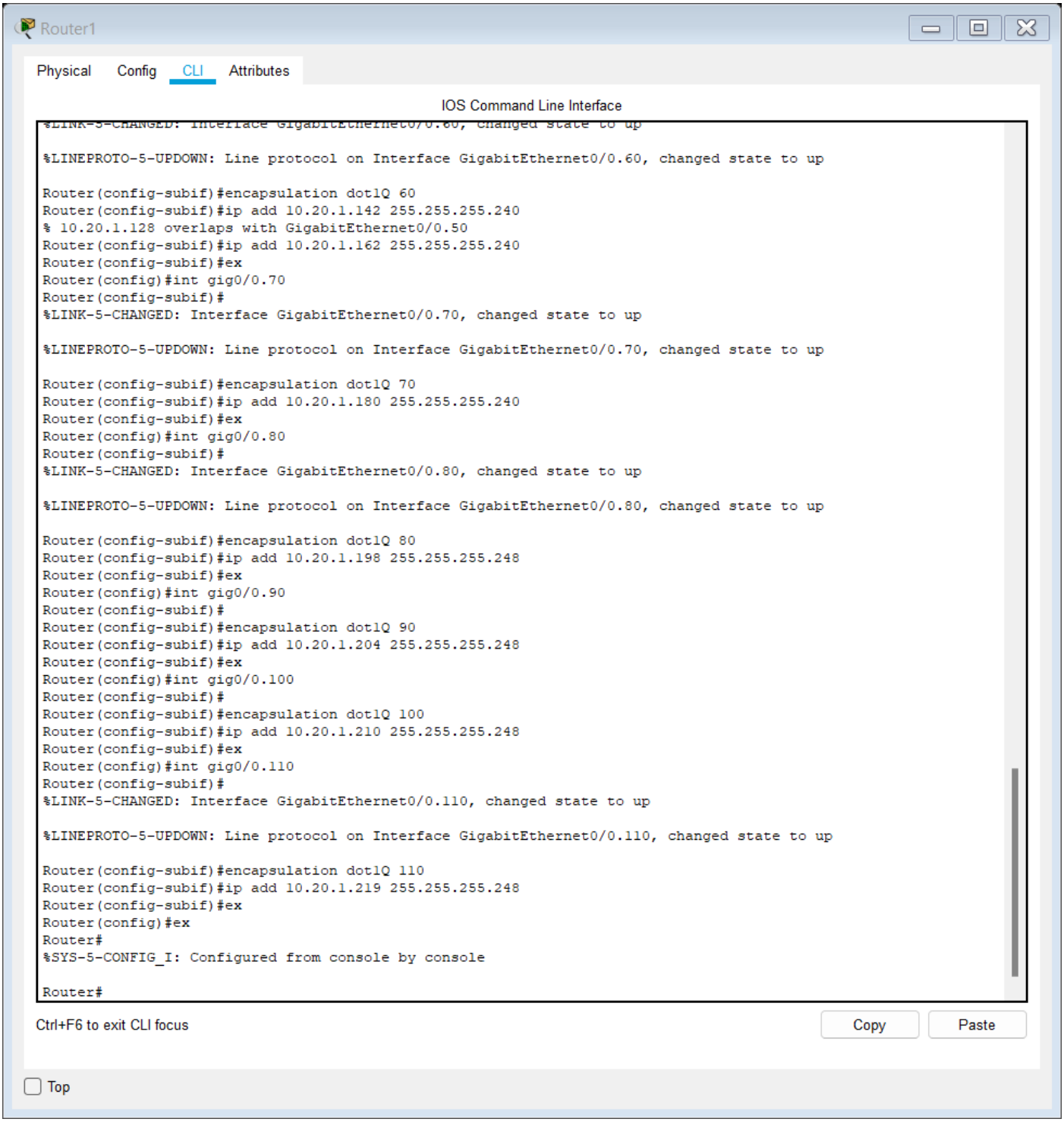
Router1
Physical
Config
CLI
Attributes
IOS Command Line Interface
%LINK-5-CHANGED: Interface GigabitEthernet0/0.60, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.60, changed state to up
Router(config-subif)#encapsulation dot1Q 60
Router(config-subif)#ip add 10.20.1.142 255.255.255.240
% 10.20.1.128 overlaps with GigabitEthernet0/0.50
Router(config-subif)#ip add 10.20.1.162 255.255.255.240
Router(config-subif)#ex
Router(config)#int gig0/0.70
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.70, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.70, changed state to up
Router(config-subif)#encapsulation dot1Q 70
Router(config-subif)#ip add 10.20.1.180 255.255.255.240
Router(config-subif)#ex
Router(config)#int gig0/0.80
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.80, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.80, changed state to up
Router(config-subif)#encapsulation dot1Q 80
Router(config-subif)#ip add 10.20.1.198 255.255.255.248
Router(config-subif)#ex
Router(config)#int gig0/0.90
Router(config-subif)#
Router(config-subif)#encapsulation dot1Q 90
Router(config-subif)#ip add 10.20.1.204 255.255.255.248
Router(config-subif)#ex
Router(config)#int gig0/0.100
Router(config-subif)#
Router(config-subif)#encapsulation dot1Q 100
Router(config-subif)#ip add 10.20.1.210 255.255.255.248
Router(config-subif)#ex
Router(config)#int gig0/0.110
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.110, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.110, changed state to up
Router(config-subif)#encapsulation dot1Q 110
Router(config-subif)#ip add 10.20.1.219 255.255.255.248
Router(config-subif)#ex
Router(config)#ex
Router#
%SYS-5-CONFIG_I: Configured from console by console
Router#
Ctrl+F6 to exit CLI focus
Copy
Paste
Top

Figure 25

✓ ALL THE DEFAULT GATEWAYS ARE GIVEN TO THE ROUTER

```
Router(config)#ex
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     10.20.0.1       YES manual up                    up
GigabitEthernet0/0.10  unassigned      YES unset  up                    up
GigabitEthernet0/0.20  10.20.0.131     YES manual up                    up
GigabitEthernet0/0.30  10.20.1.3       YES manual up                    up
GigabitEthernet0/0.40  10.20.1.70      YES manual up                    up
GigabitEthernet0/0.50  10.20.1.140     YES manual up                    up
GigabitEthernet0/0.60  10.20.1.162     YES manual up                    up
GigabitEthernet0/0.70  10.20.1.180     YES manual up                    up
GigabitEthernet0/0.80  10.20.1.198     YES manual up                    up
GigabitEthernet0/0.90  10.20.1.204     YES manual up                    up
GigabitEthernet0/0.100 10.20.1.210     YES manual up                    up
GigabitEthernet0/0.110 10.20.1.219     YES manual up                    up
GigabitEthernet0/1     unassigned      YES unset  administratively down down
Vlan1                  unassigned      YES unset  administratively down down
Router#
Router#
```

Ctrl+F6 to exit CLI focus Copy Paste

Top

Figure 26

✓ BASIC PING CONFIGURATION

PC1

Physical Config Desktop Programming Attributes

Command Prompt

```
Packet Tracer PC Command Line 1.0
C:\>ipconfig

FastEthernet0 Connection:(default port)

   Link-local IPv6 Address.....: FE80::2E0:F9FF:FE41:C94
   IP Address.....: 10.20.1.195
   Subnet Mask.....: 255.255.255.248
   Default Gateway.....: 10.20.1.193

Bluetooth Connection:

   Link-local IPv6 Address.....: ::
   IP Address.....: 0.0.0.0
   Subnet Mask.....: 0.0.0.0
   Default Gateway.....: 0.0.0.0

C:\>ping 10.20.1.195

Pinging 10.20.1.195 with 32 bytes of data:

Reply from 10.20.1.195: bytes=32 time=4ms TTL=128
Reply from 10.20.1.195: bytes=32 time<1ms TTL=128
Reply from 10.20.1.195: bytes=32 time=1ms TTL=128
Reply from 10.20.1.195: bytes=32 time=3ms TTL=128

Ping statistics for 10.20.1.195:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 4ms, Average = 2ms

C:\>ping 10.20.1.196

Pinging 10.20.1.196 with 32 bytes of data:

Reply from 10.20.1.196: bytes=32 time=13ms TTL=128
Reply from 10.20.1.196: bytes=32 time<1ms TTL=128
Reply from 10.20.1.196: bytes=32 time<1ms TTL=128
Reply from 10.20.1.196: bytes=32 time=5ms TTL=128

Ping statistics for 10.20.1.196:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 13ms, Average = 4ms

C:\>
```

Figure 27

✓ Now consider a situation

✓ If anyone trying to access the computer lab 1 (vlan20), department office (vlan110) and staff office (vlan90) then that person can only access the computer lab 2 he couldn't access the department office and staff room.

✓ Trying to access from meeting room

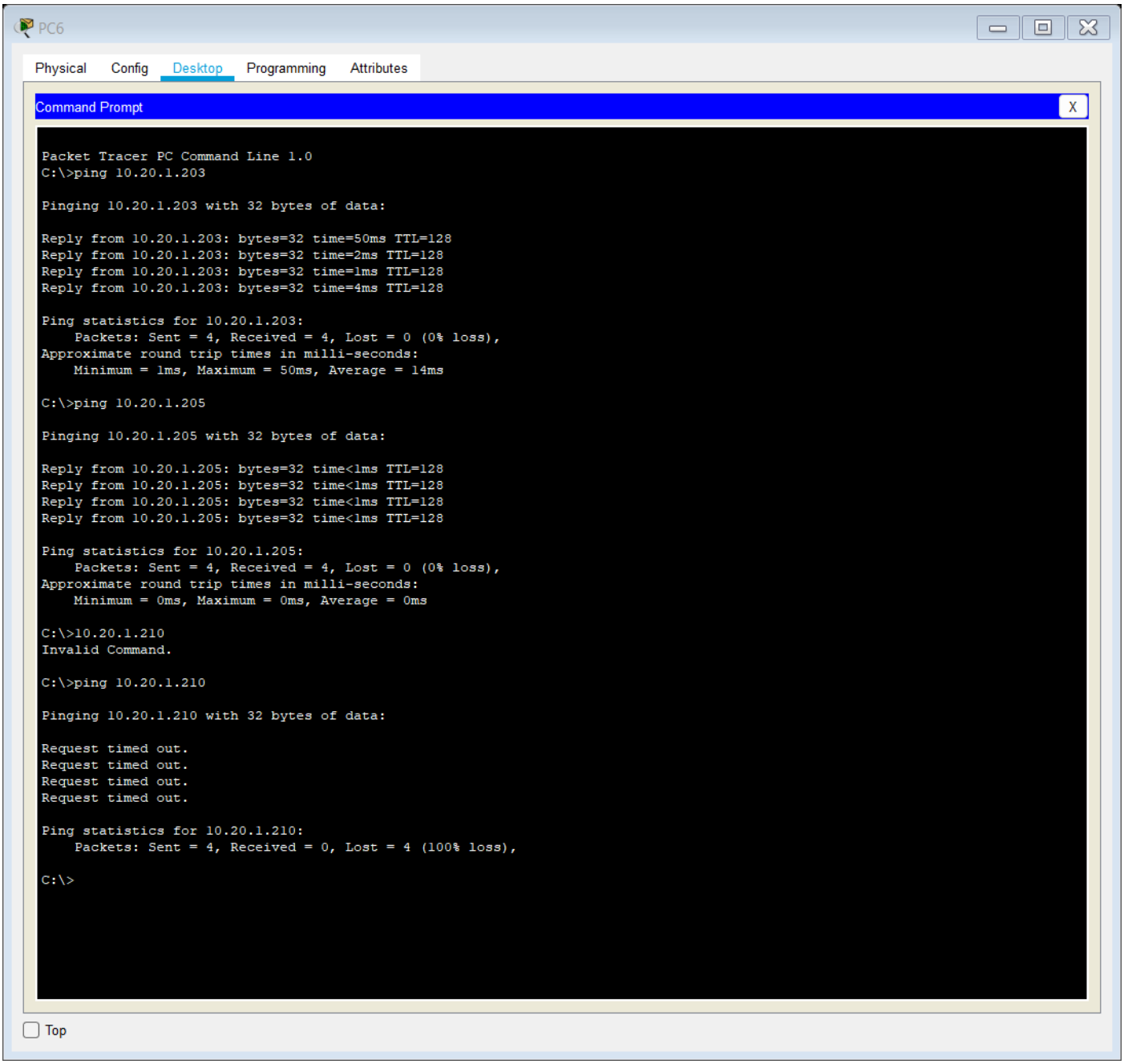

Figure 28

PING PC11 FROM MEETING ROOM TO COMPUTER LAB 1

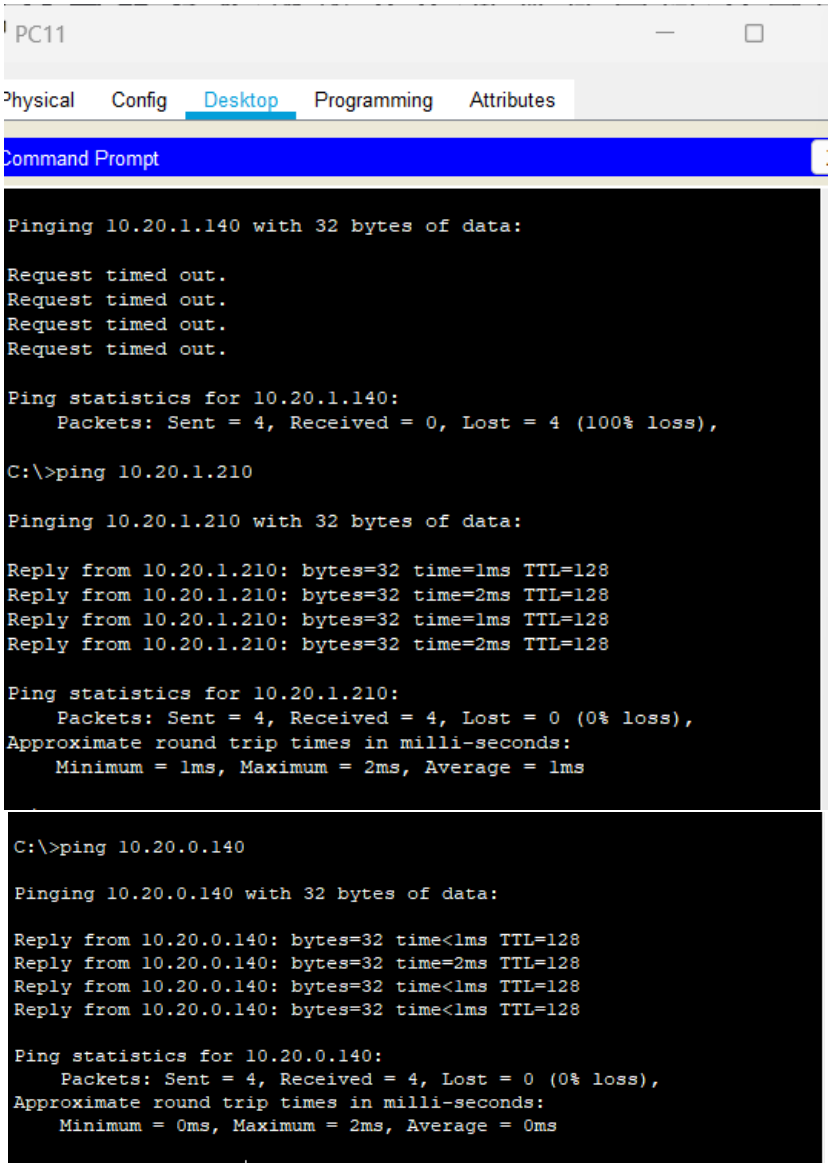

Figure 29

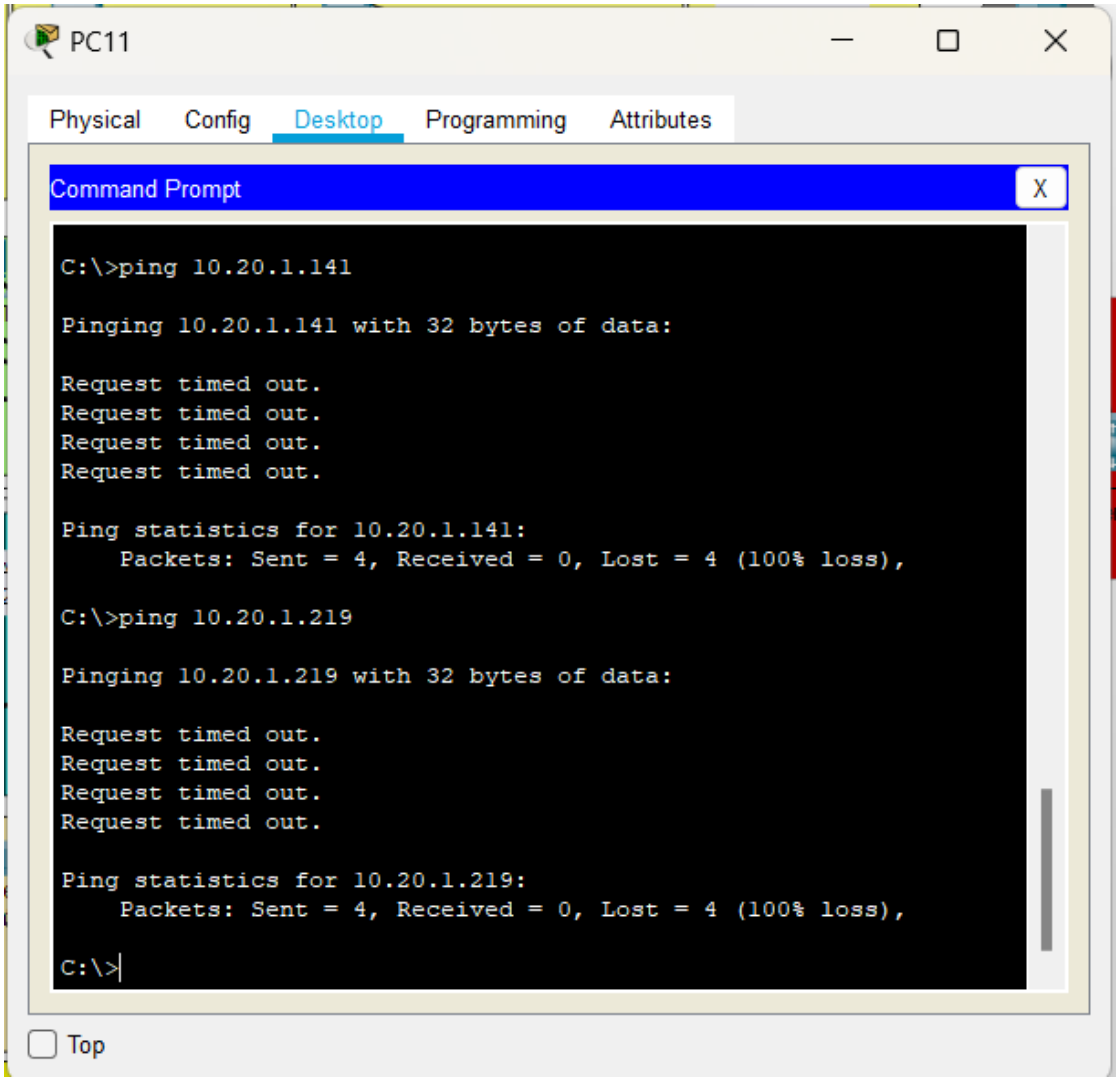

Figure 30

- ✓ **GIVING FIREWALL CONNECTION TO STAFF OFFICE AND DEPARTMENT OFFICE FOR THE SECURITY**

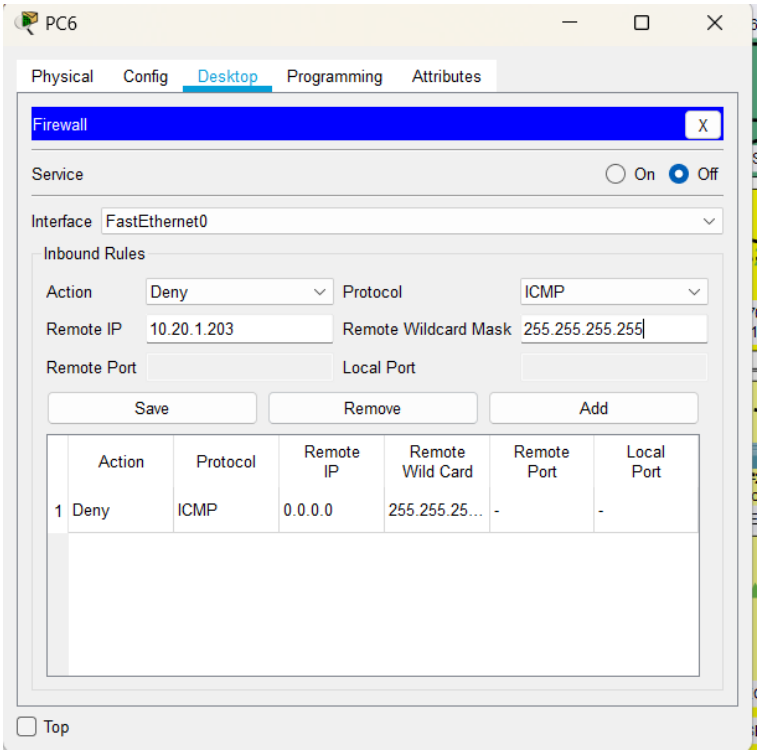

Figure 31

✓ **WIFI CONFIGURATION**

Click the Wifi router and go to the config tab

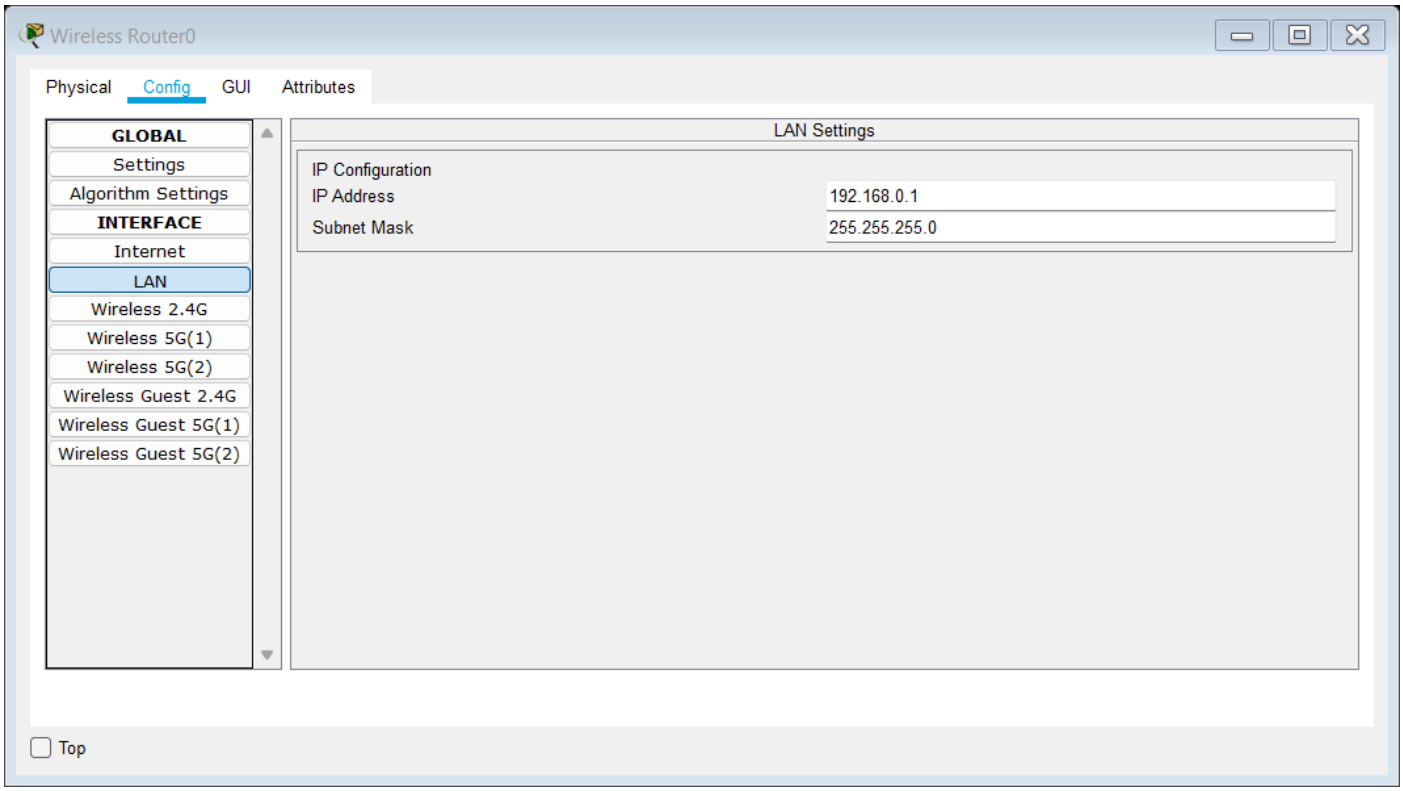

Figure 32

✓ Change the name and password , after changing the password particular devices can join to your pc by giving that password

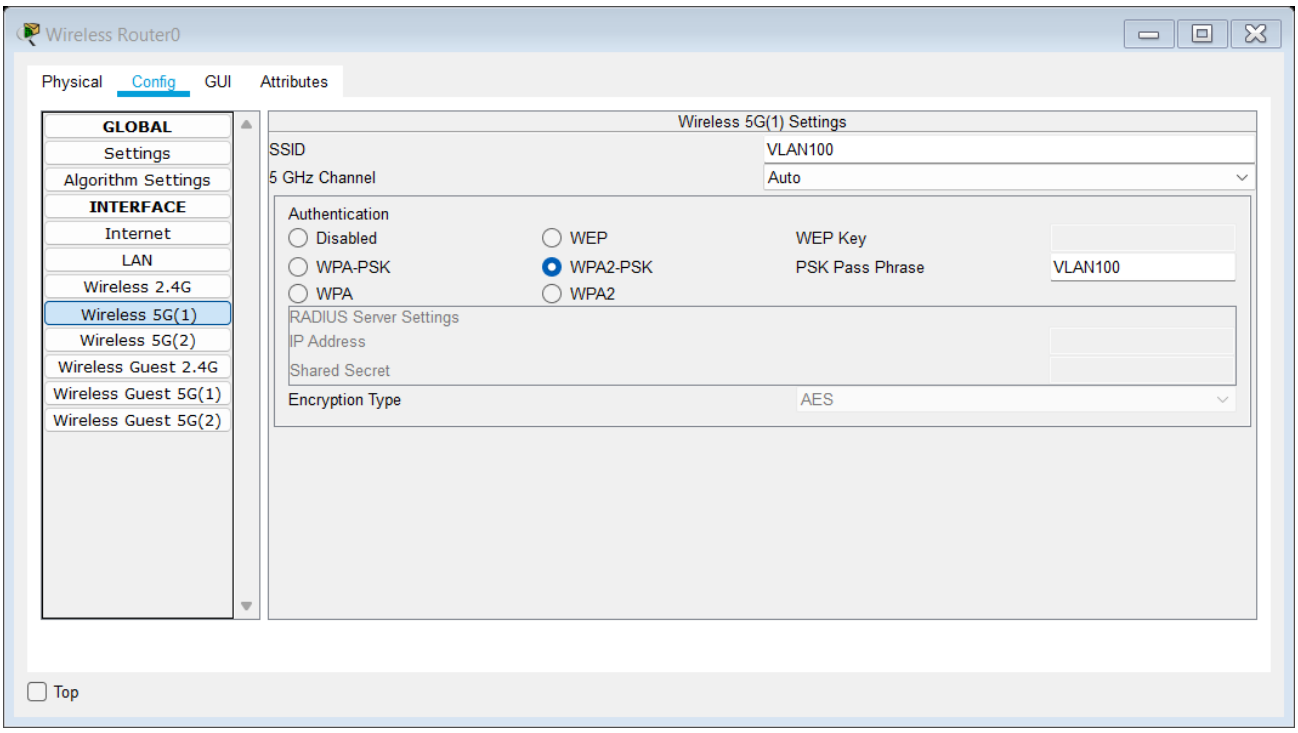

Figure 33

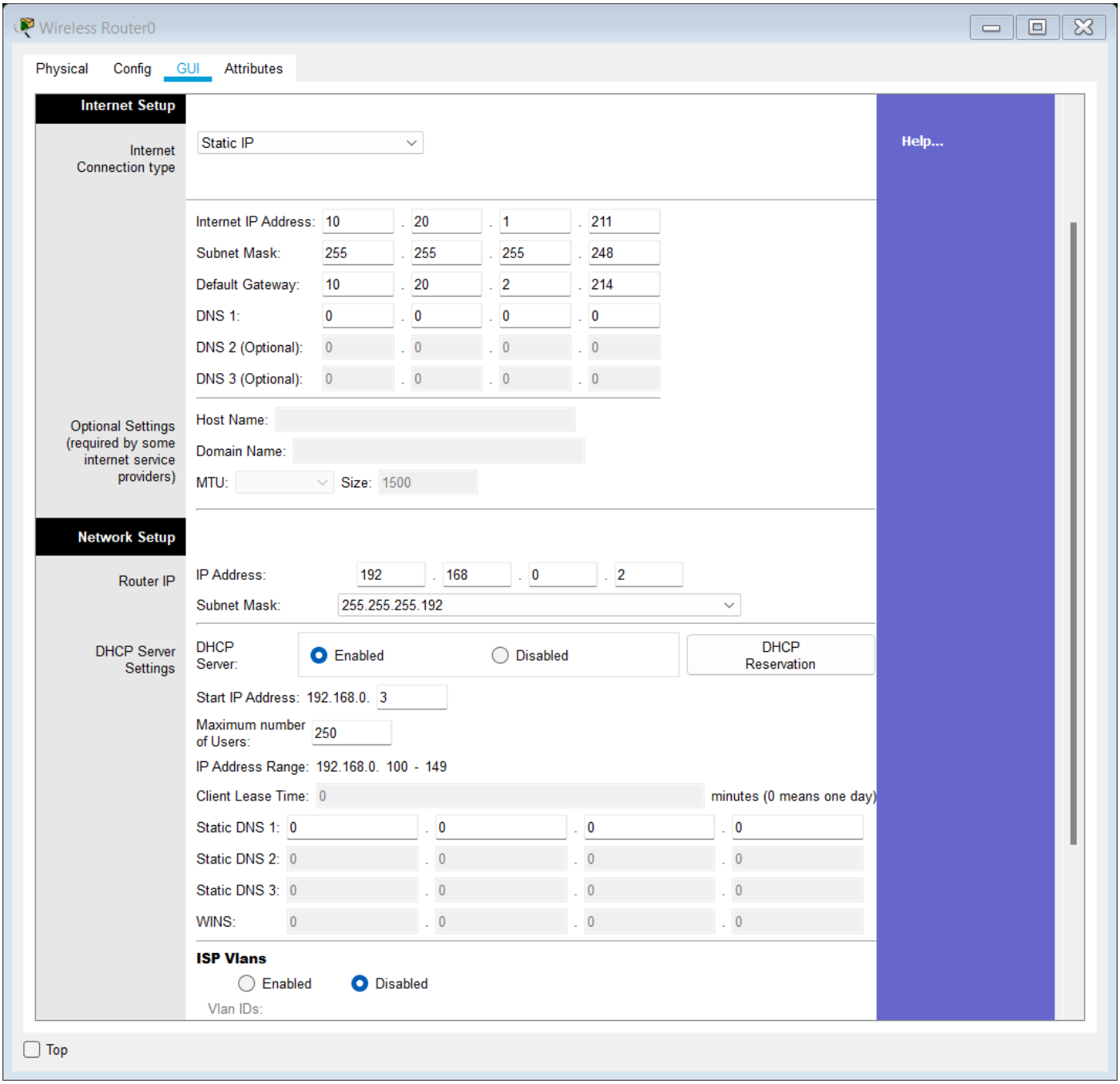

Figure 34

- ✓ Do the same thing for all the wifi and give the passwords. If anyone university student nee that wifi he / she can use that without any issues.

✓ **LOBBY WIFI**

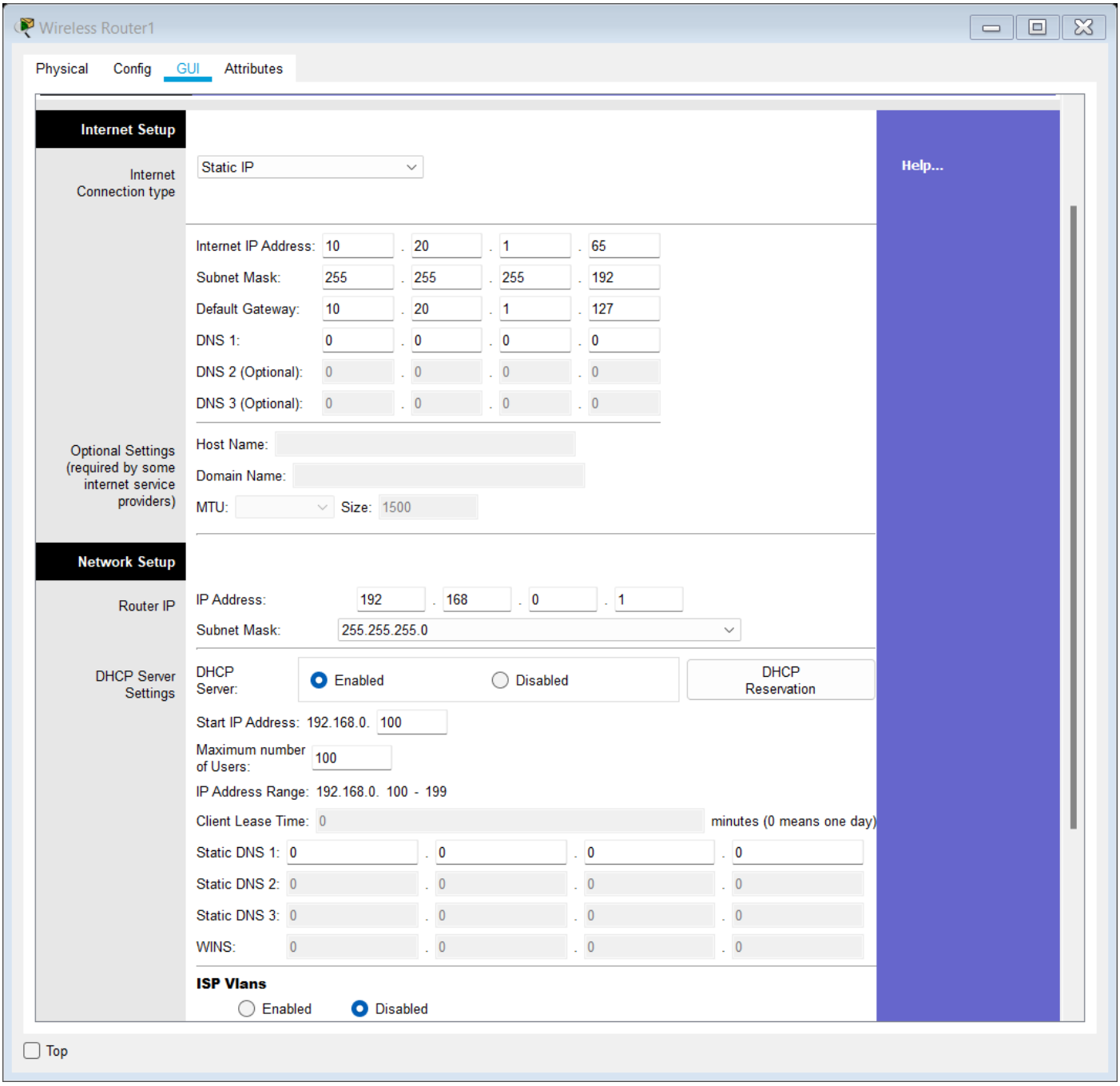

Figure 35

✓ Do the same thing for all the wifi and give the passwords. If anyone university student need that wifi he / she can use that without any issues.

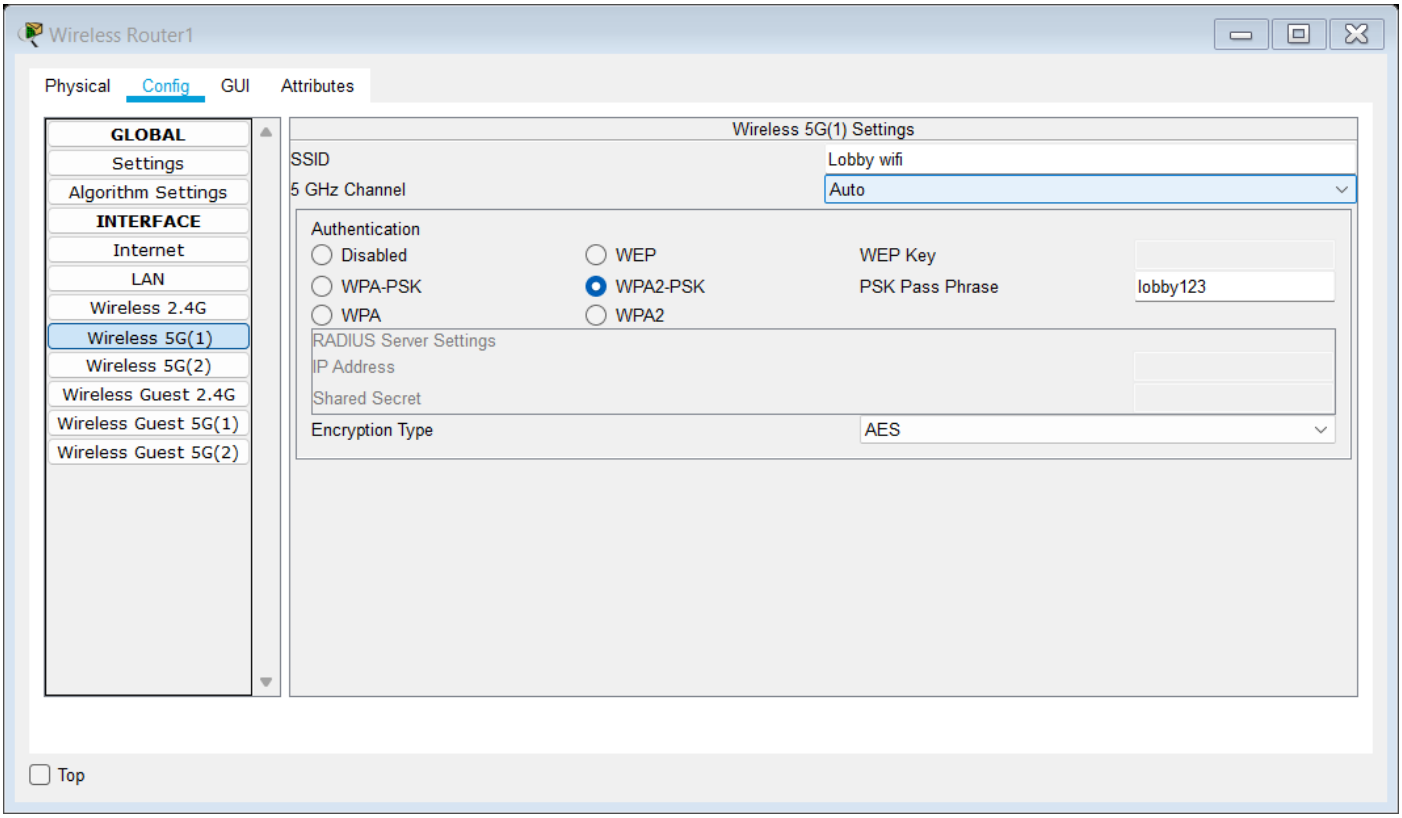

Figure 36

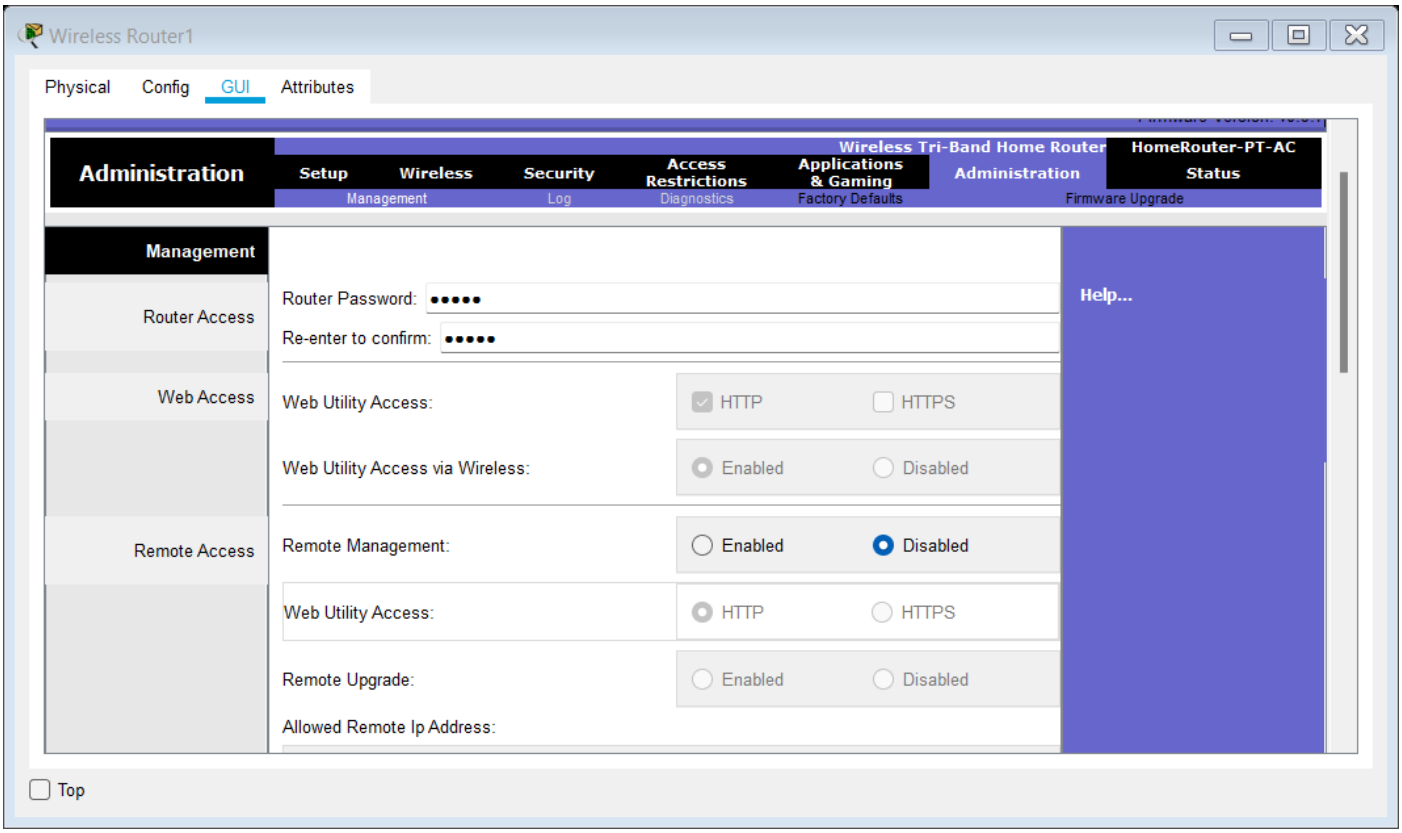

Figure 37

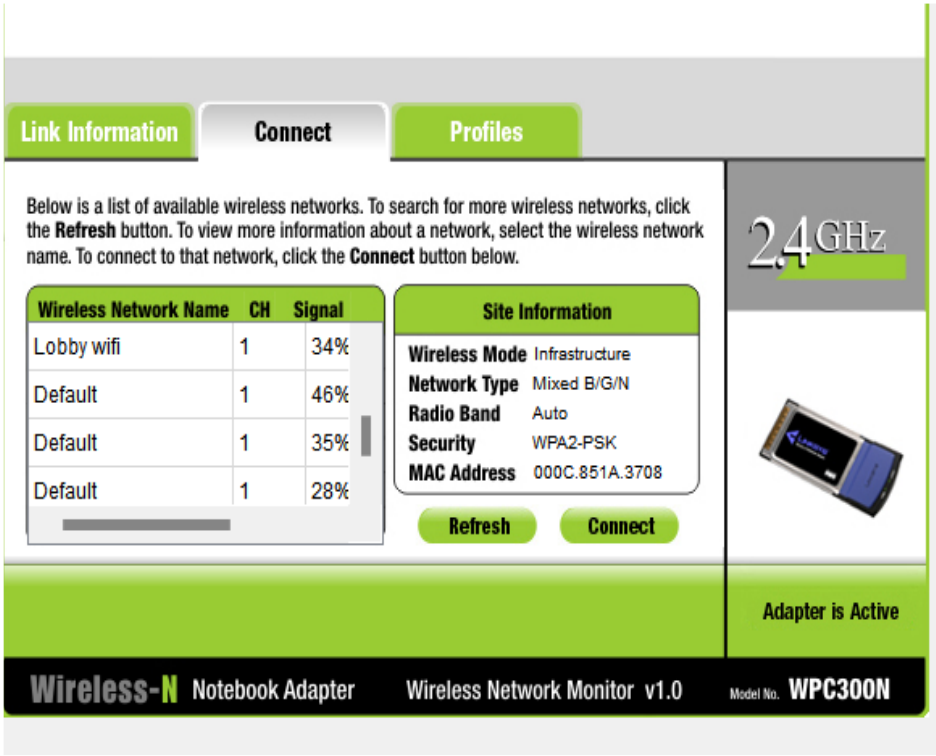

Figure 38

Figure 39

- ✓ Printer available at the department office can only be accessed by the department staffs.
- ✓ Printer available at the IT Centre printing room can only be accessed by the IT Centre staffs.
    - Each network node can only be accessed by the administrator, not others.
- ✓ Restrict access of printers by non-staffs.

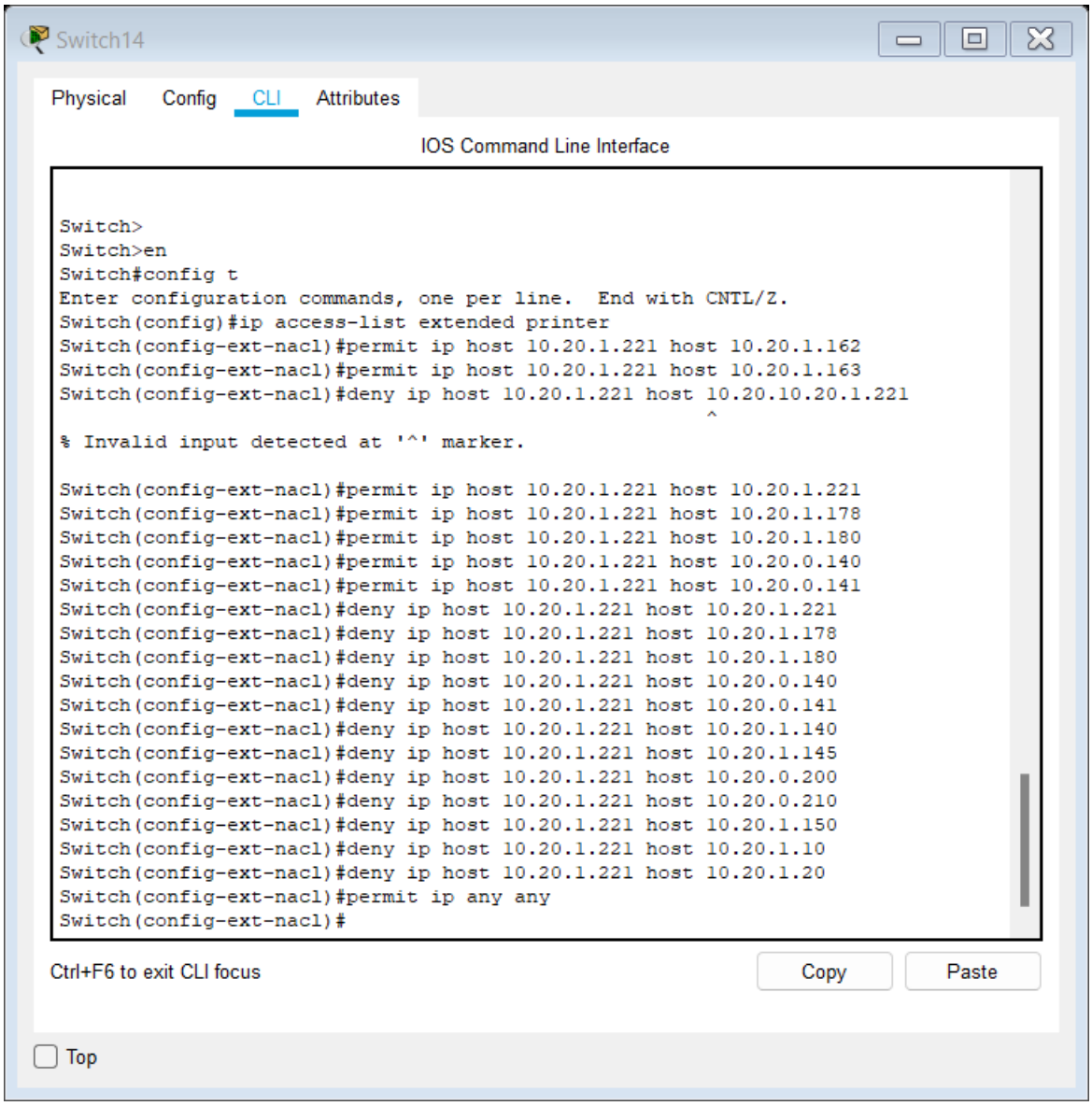

Figure 40

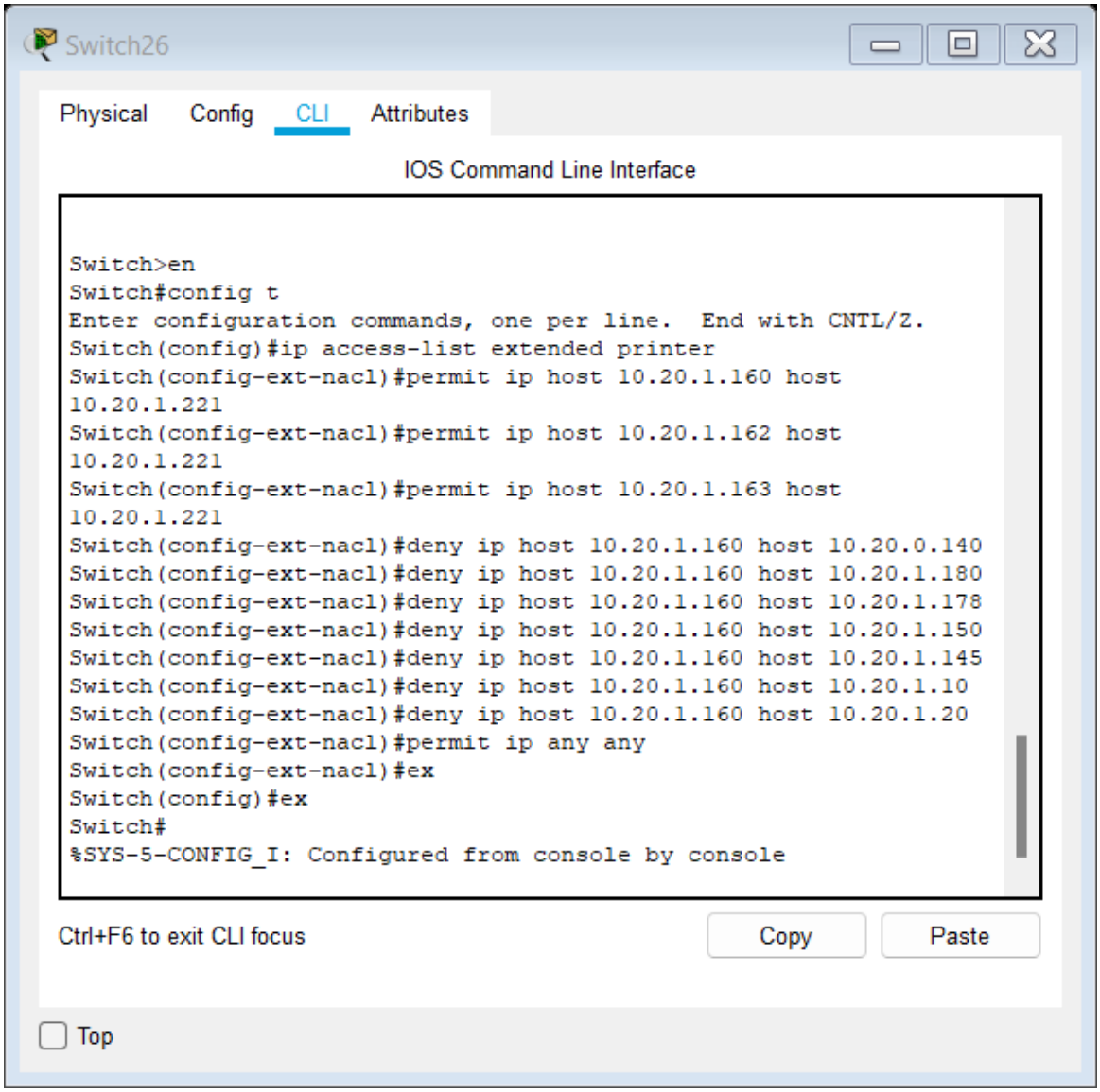
Switch26
Physical
Config
CLI
Attributes
IOS Command Line Interface
Switch>en
Switch#config t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#ip access-list extended printer
Switch(config-ext-nacl)#permit ip host 10.20.1.160 host
10.20.1.221
Switch(config-ext-nacl)#permit ip host 10.20.1.162 host
10.20.1.221
Switch(config-ext-nacl)#permit ip host 10.20.1.163 host
10.20.1.221
Switch(config-ext-nacl)#deny ip host 10.20.1.160 host 10.20.0.140
Switch(config-ext-nacl)#deny ip host 10.20.1.160 host 10.20.1.180
Switch(config-ext-nacl)#deny ip host 10.20.1.160 host 10.20.1.178
Switch(config-ext-nacl)#deny ip host 10.20.1.160 host 10.20.1.150
Switch(config-ext-nacl)#deny ip host 10.20.1.160 host 10.20.1.145
Switch(config-ext-nacl)#deny ip host 10.20.1.160 host 10.20.1.10
Switch(config-ext-nacl)#deny ip host 10.20.1.160 host 10.20.1.20
Switch(config-ext-nacl)#permit ip any any
Switch(config-ext-nacl)#ex
Switch(config)#ex
Switch#
%SYS-5-CONFIG_I: Configured from console by console
Ctrl+F6 to exit CLI focus
Copy
Paste
Top

Figure 41

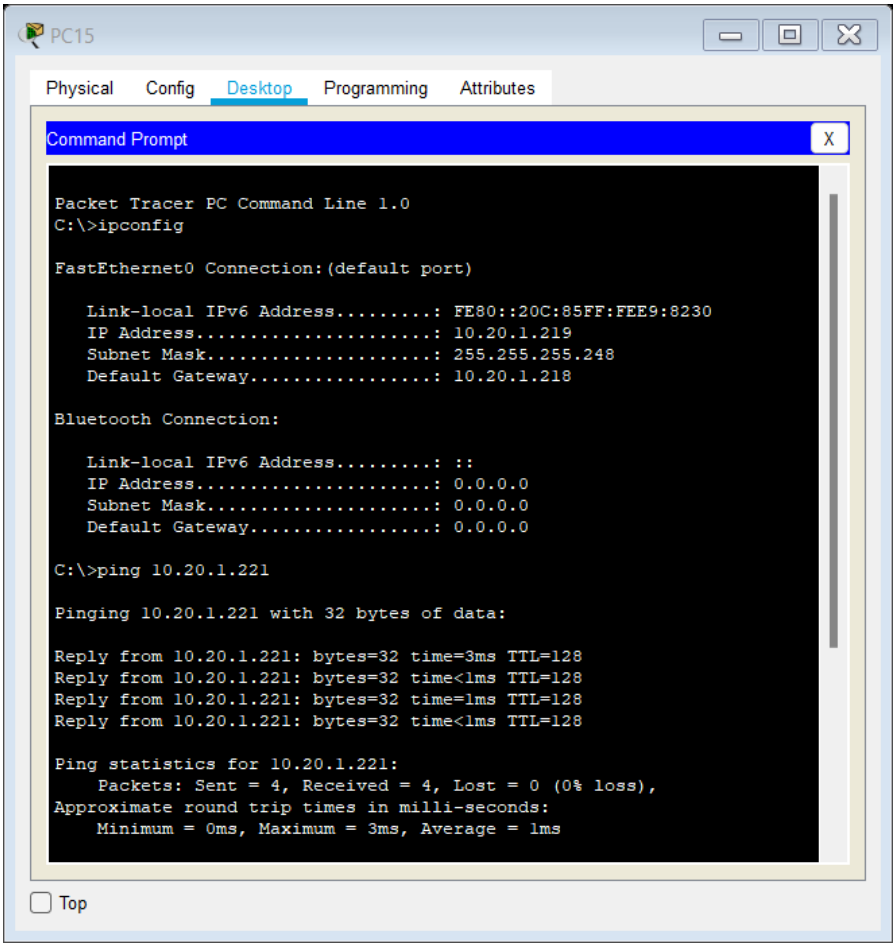

Figure 42

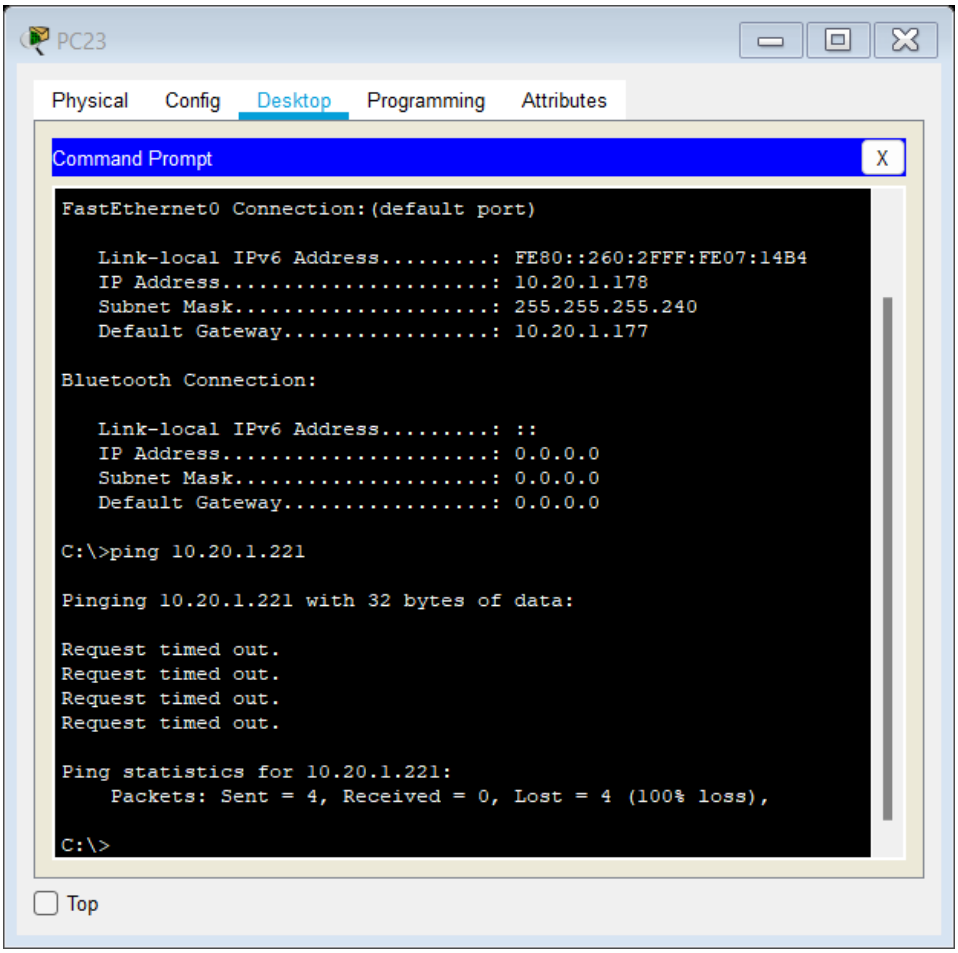

Figure 43

✓ IT CENTER RESTRICTIONS FOR THE PRINTERS

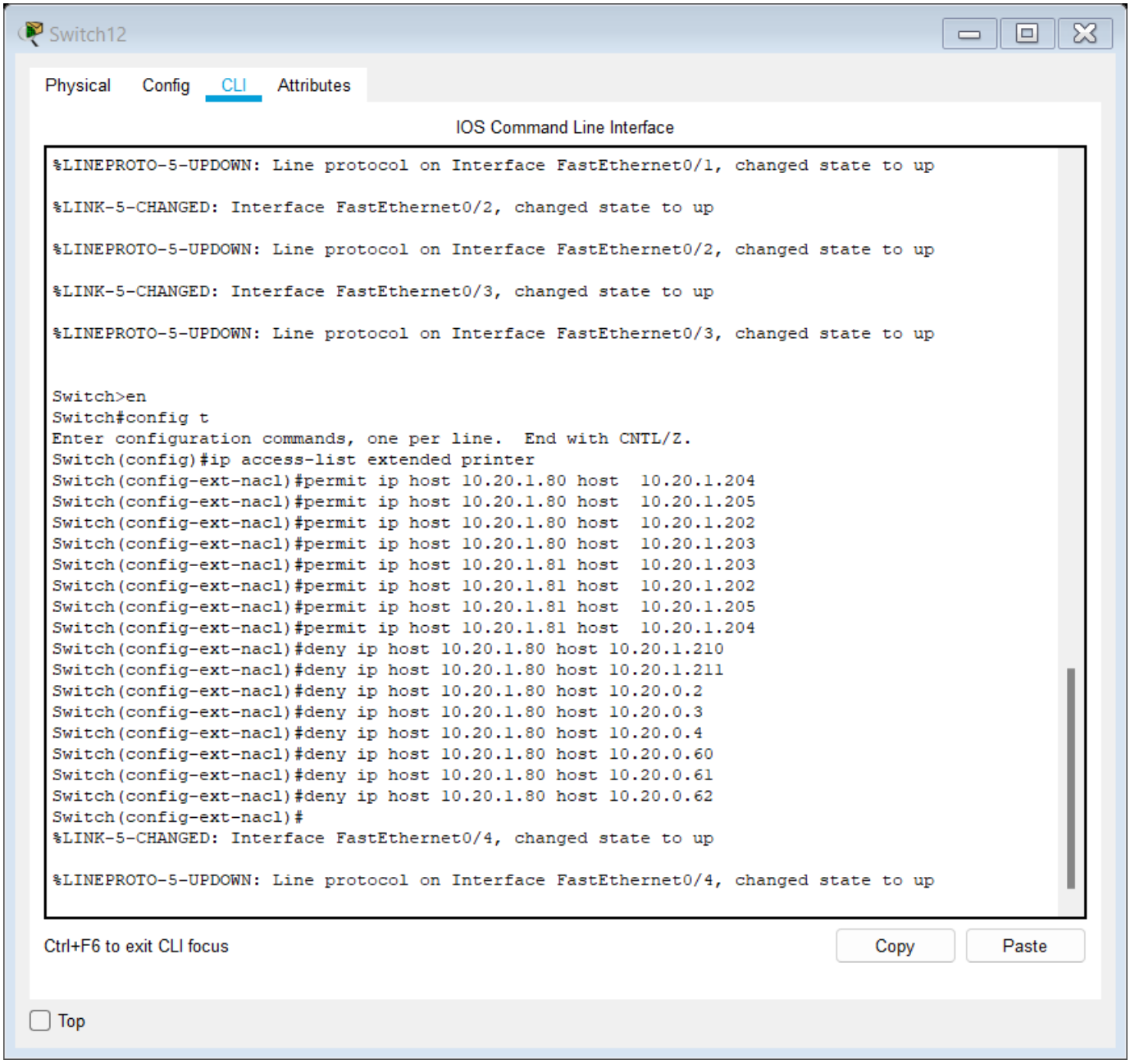

Figure 44

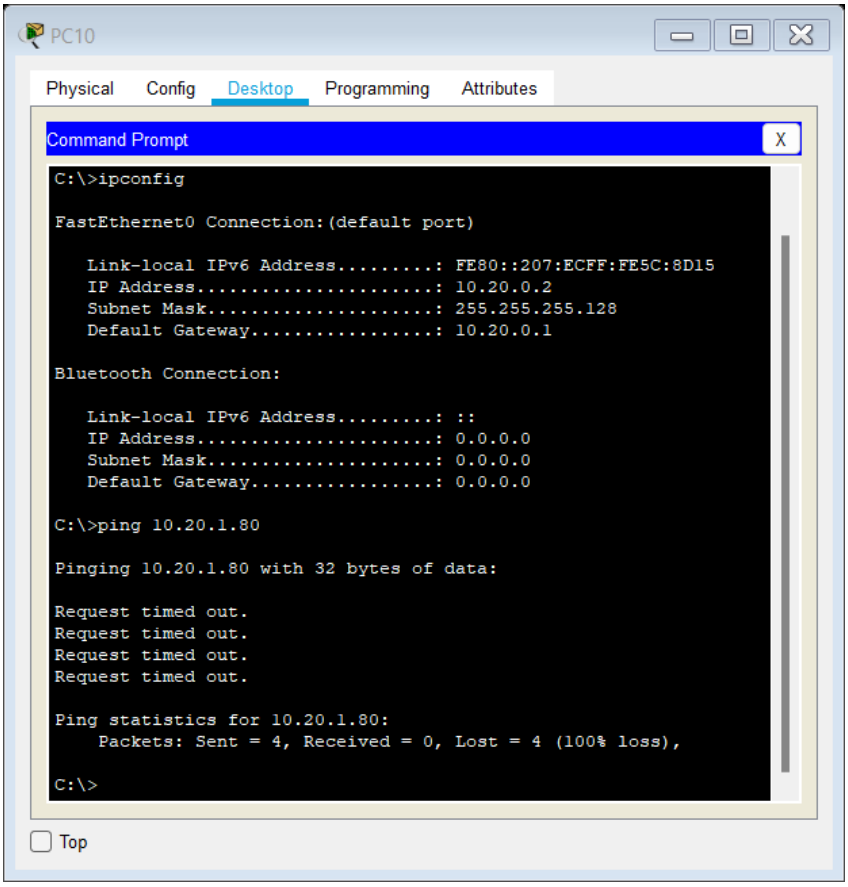

Figure 45

✓ TESTING CASE 1

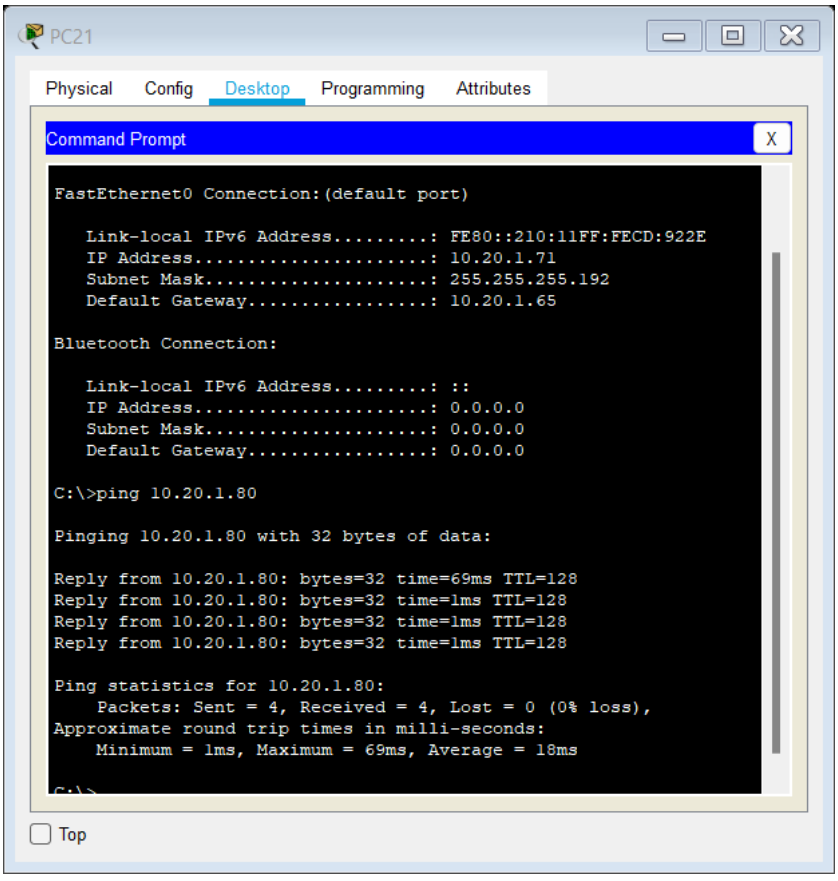

Figure 46

✓ TESTING CASE 2

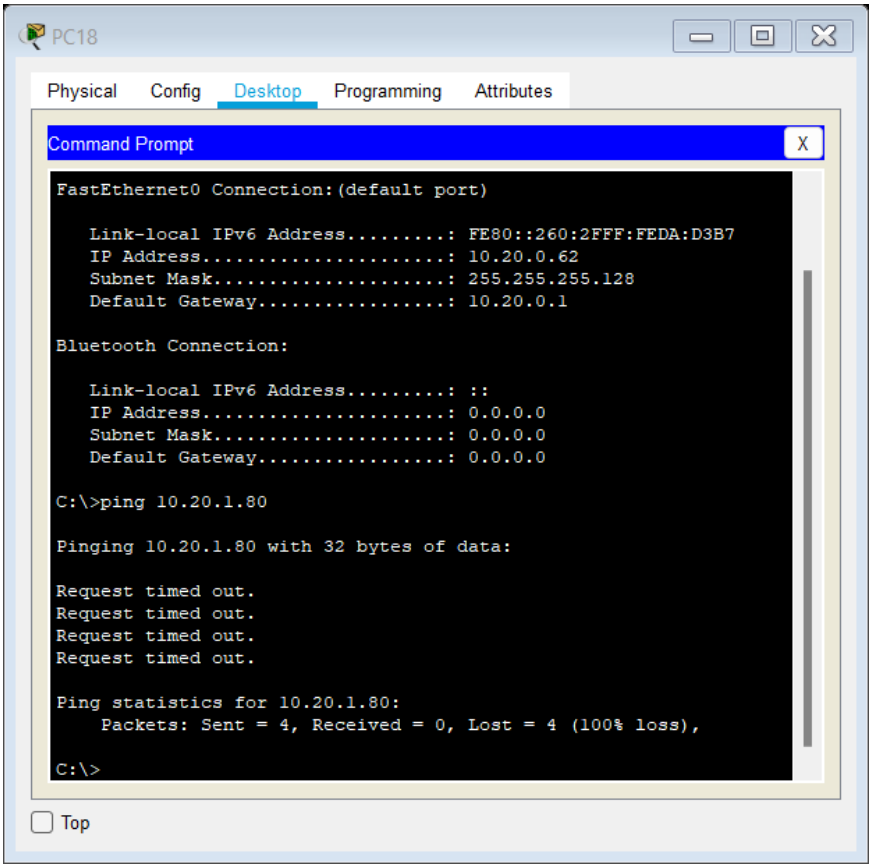

Figure 47

✓ ADMIN BLOCK CAN ACCESS ANY OF THE DEVICES

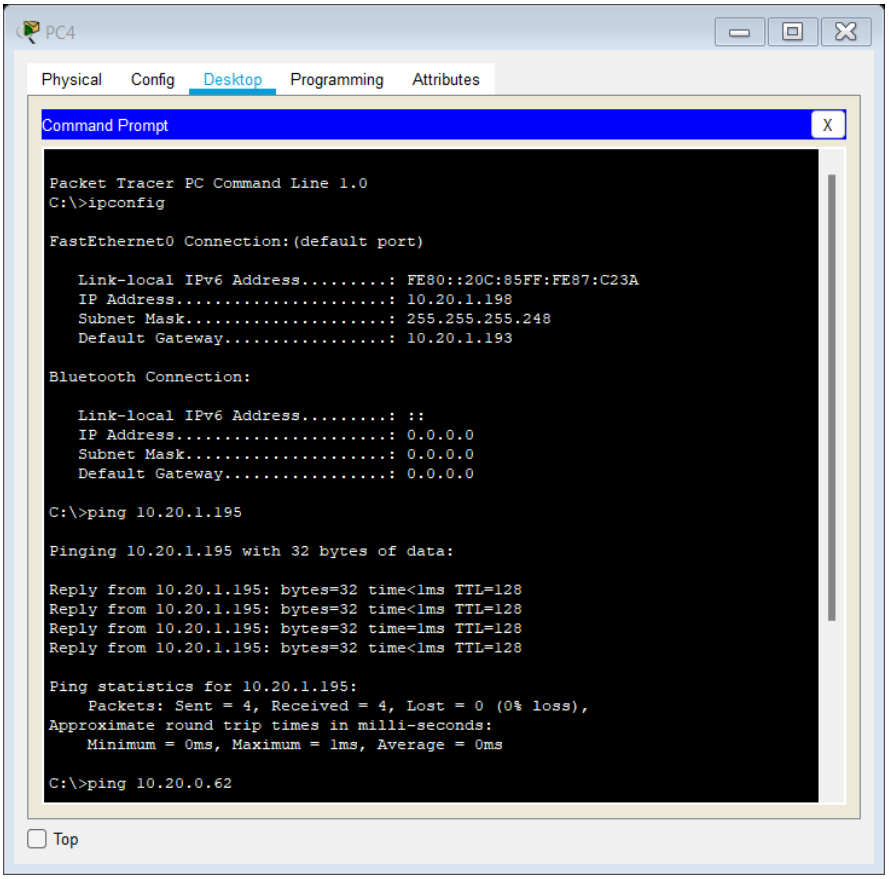

Figure 48