AIM/OBJECTIVE

To design a computer network to these buildings of the University with optimum use of network IP addresses. Available IP address ranges 10.20.0.0/16

IT Centre Block:

- Director Office –will be equipped with two desktop computers with network connection.
- Network Manager Room–Network manager office will be equipped with one desktop computer with network connection.
- 2 Technical Officers Room–Each network officers' room will be equipped with 1Computerswith network connection.
- Staff Office–will be equipped with 5Computerswith network connection.
- Meeting Room-2 data points (one for Video Conference Facility and one data points to connect computer) and Wi-Fi Coverage
- Lobby area –Wi-Fi Coverage
- Computer Lab 1–will be equipped with 60Computerswith network connection.
- Computer Lab 2 –will be equipped with 60Computerswith network connection.
- Digital Learning and Media Centre –will be equipped with 30Computersand one printer with network connections.
- Printing Room –will be equipped with two printers with network connection.

Department Block:

- 4lecture halls –Each lecture hall will be equipped with one desktop computer and one interactive multimedia projector with network connections.
- 14staff rooms –Each staff room will be equipped with one desktop computer with network connection.
- 4Technical Officers Rooms –Each technical officers room will be equipped with one
- desktop computer.
- Department Meeting Room –2data points (one for Video Conference Facility and one data points to connect computer)and Wi-Fi Coverage.
- Computer Lab 1 –will be equipped with 50Computerswith network connection.
- Computer Lab 2 –will be equipped with 50Computerswith network connection.
- Network Engineering Lab –will be equipped with10Computerswith network connection.
- Microprocessor Lab –will be equipped with 12Computerswith network connection.
- Computer Vision and Machine Learning Lab -will be equipped with 50Computerswith network connection.
- Department Office –will be equipped with 2 Computers with network connection and one printer with network connection.

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.

Network diagram in cisco packet tracer

The network design was developed by referencing the 3-tier type network design model. It consists of core layer with a router, distribution layer with multilayer switch and access layer with switches and end devices. The factors considered in designing network are scalability (accommodate further growth), resilient (tolerate faults) and manageability (ease manage devices).

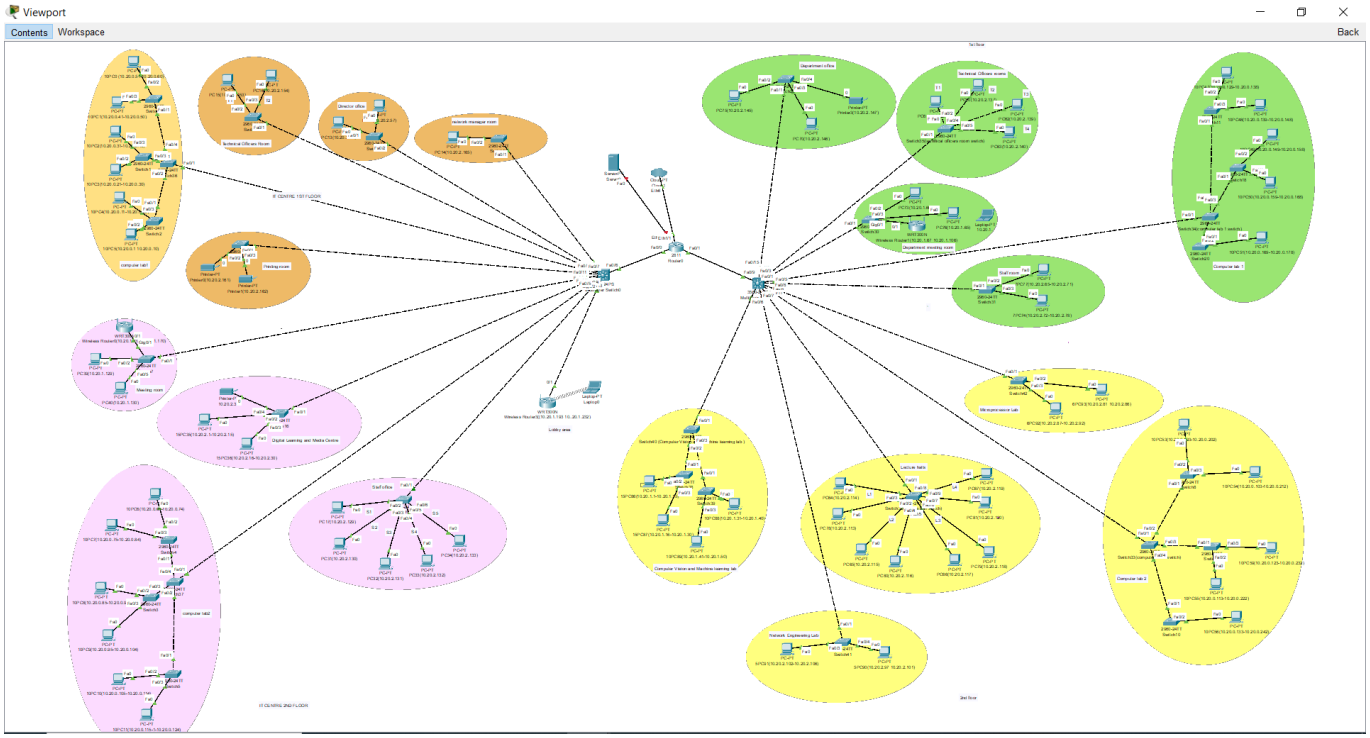


Figure 1: The network setup for the given requirements

- : IT block first floor
- Yellow: IT block second floor
- Brown: Department block first floor
- Pink: Department block second floor

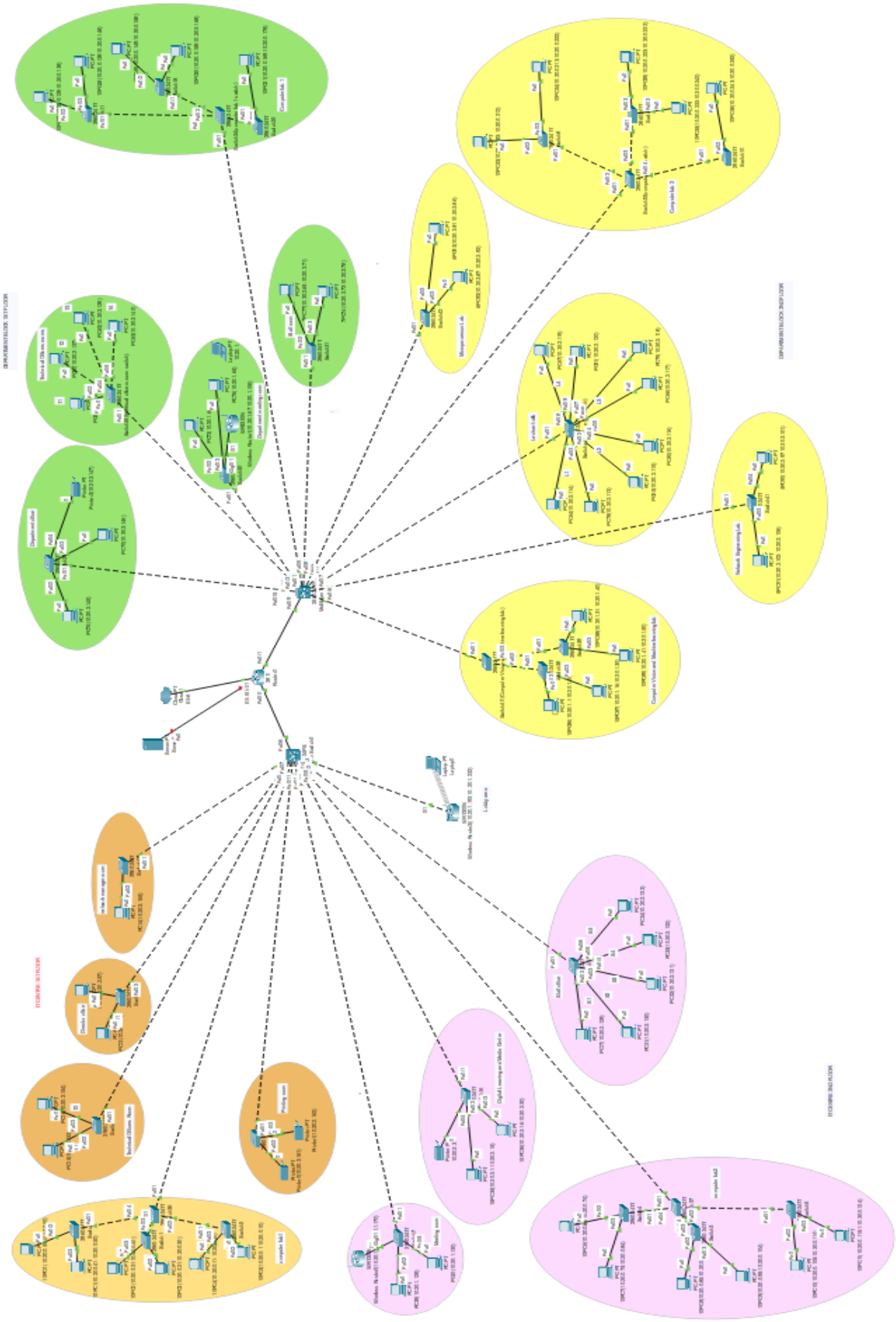


Figure 1: The network diagram for the given requirements

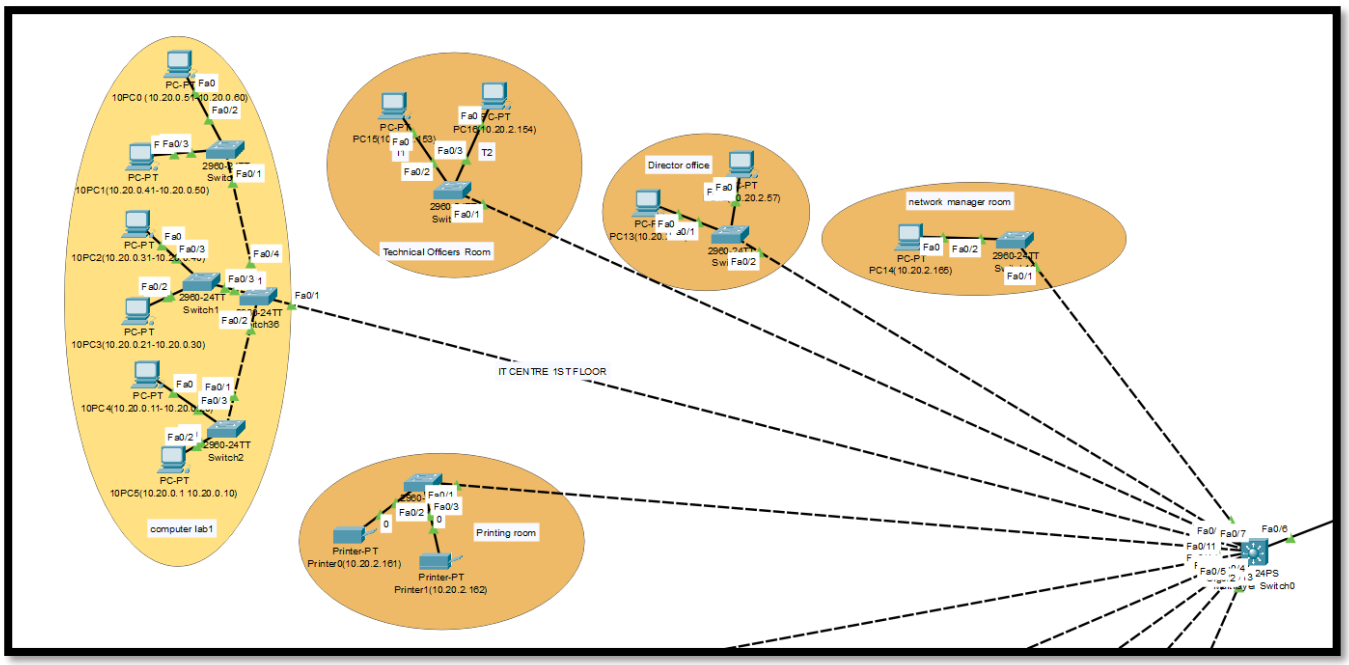


Figure 2:Diagram of IT Centre block first floor

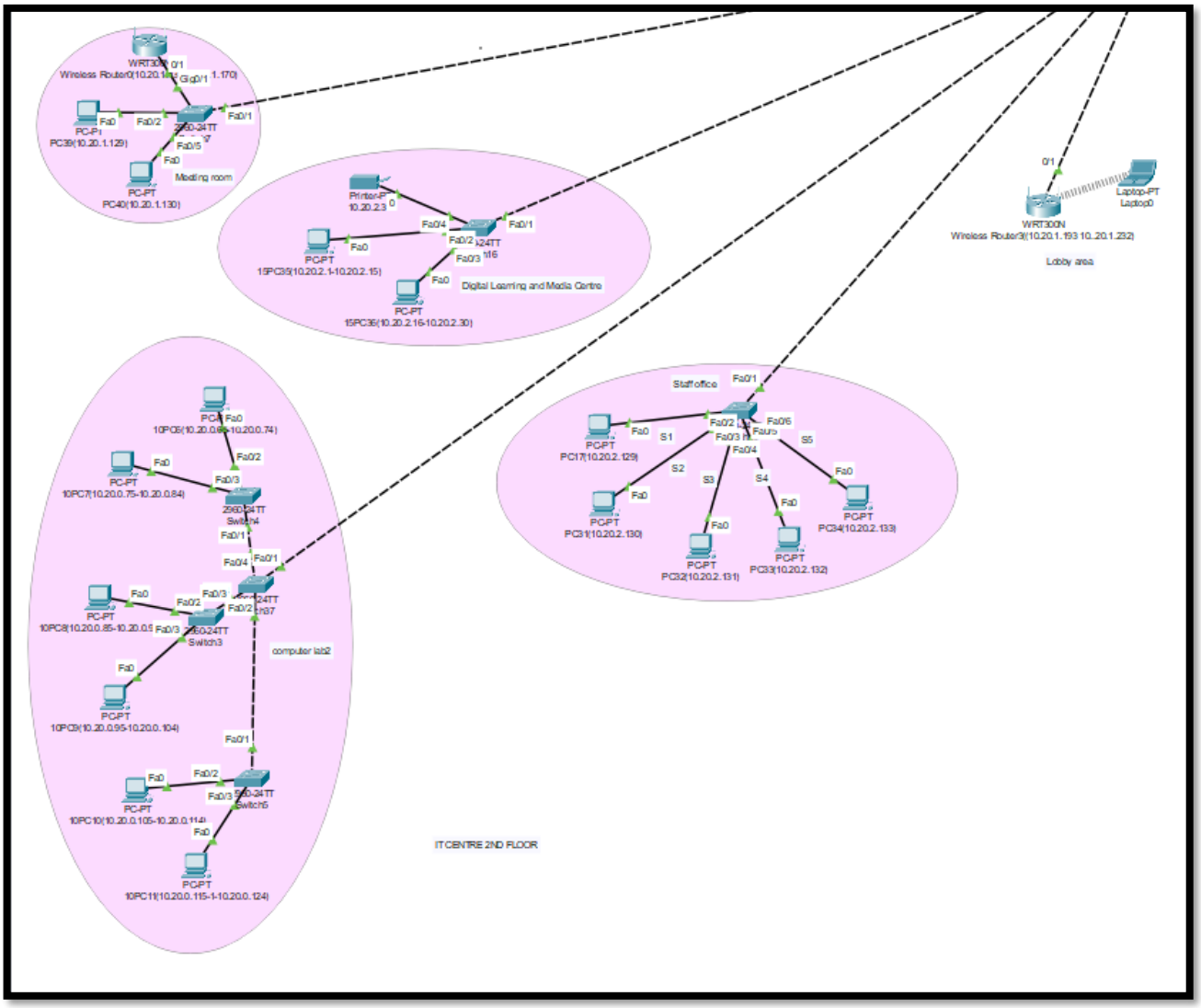


Figure 3:Diagram of IT Centre block second floor

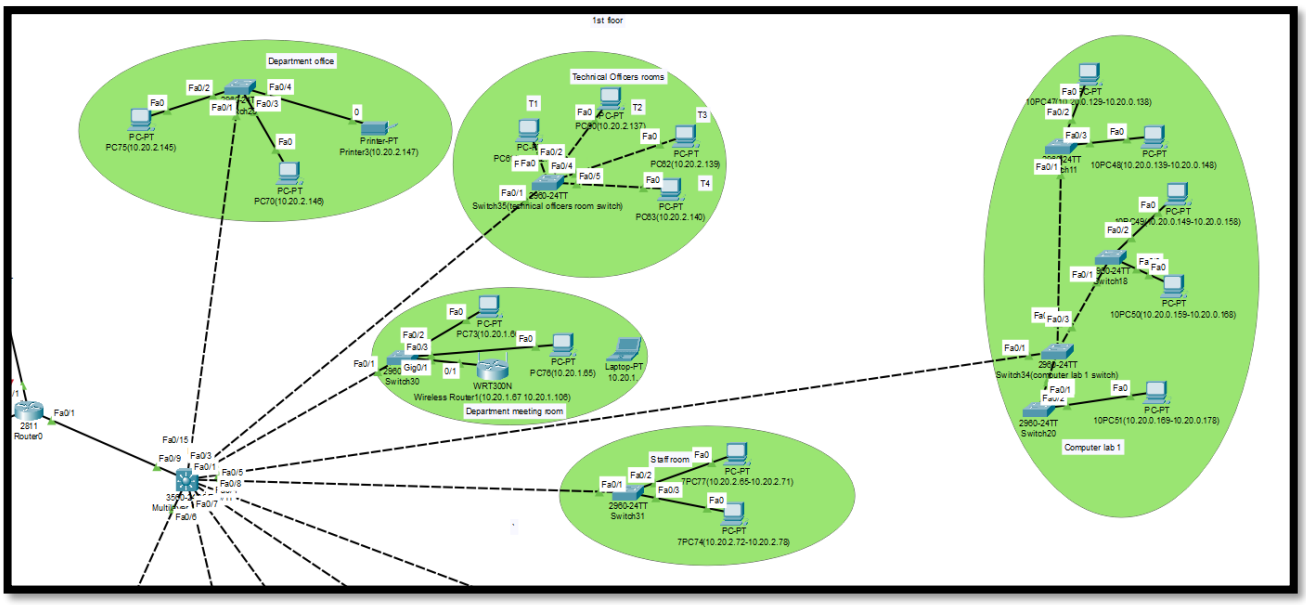


Figure 4:Diagram of Department block first floor

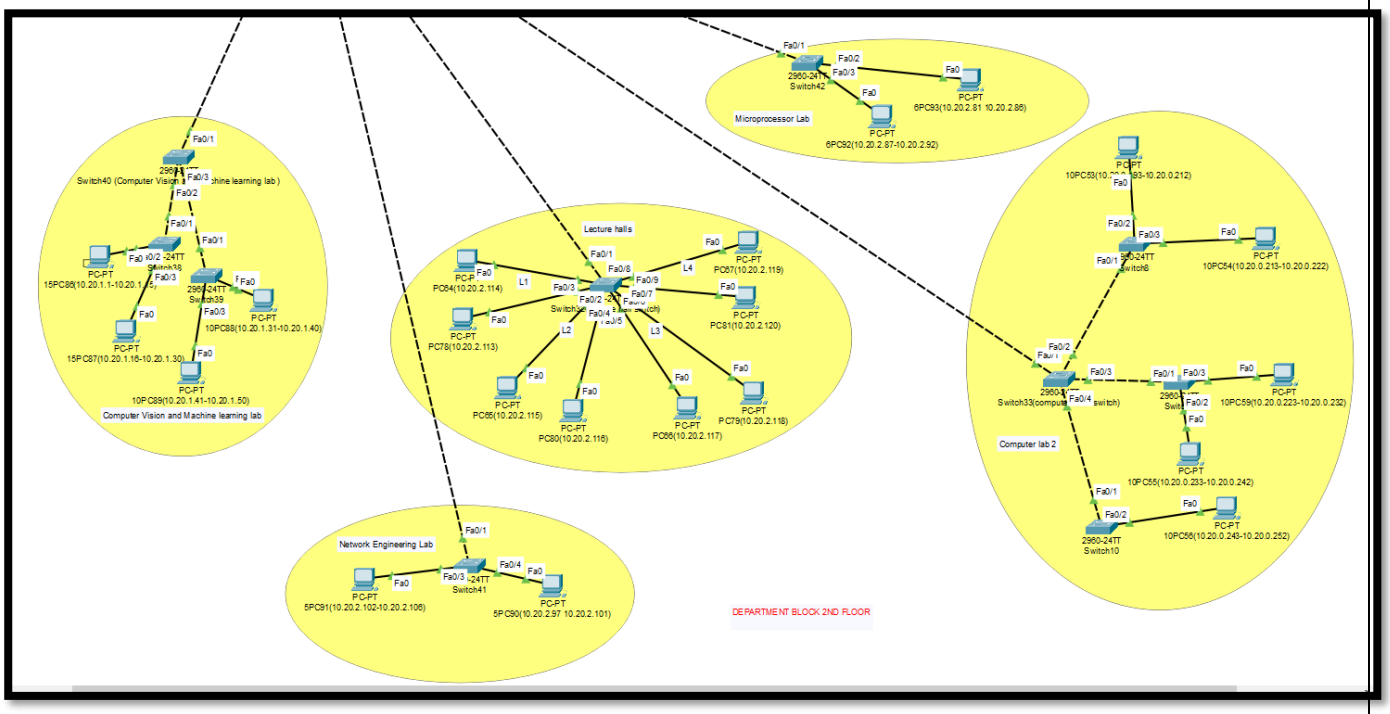


Figure 5:Diagram of IT Centre block second floor

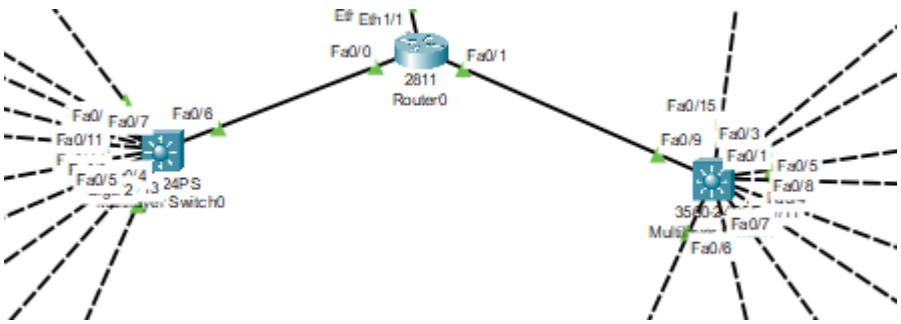
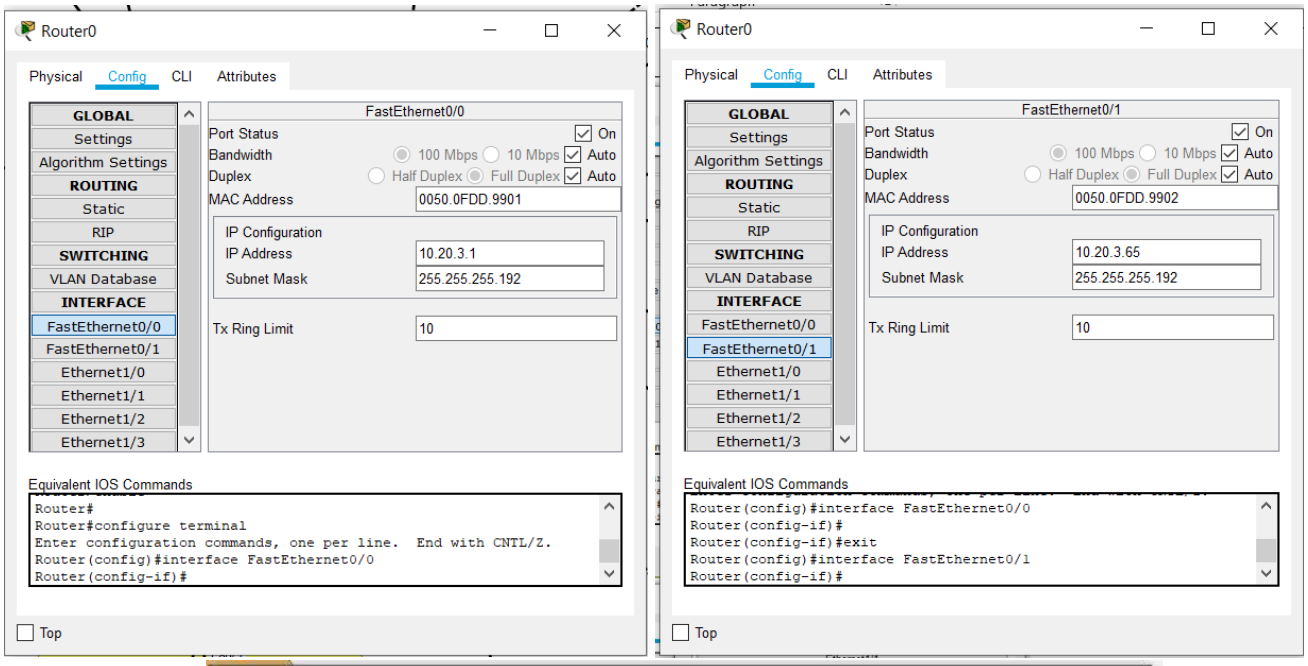


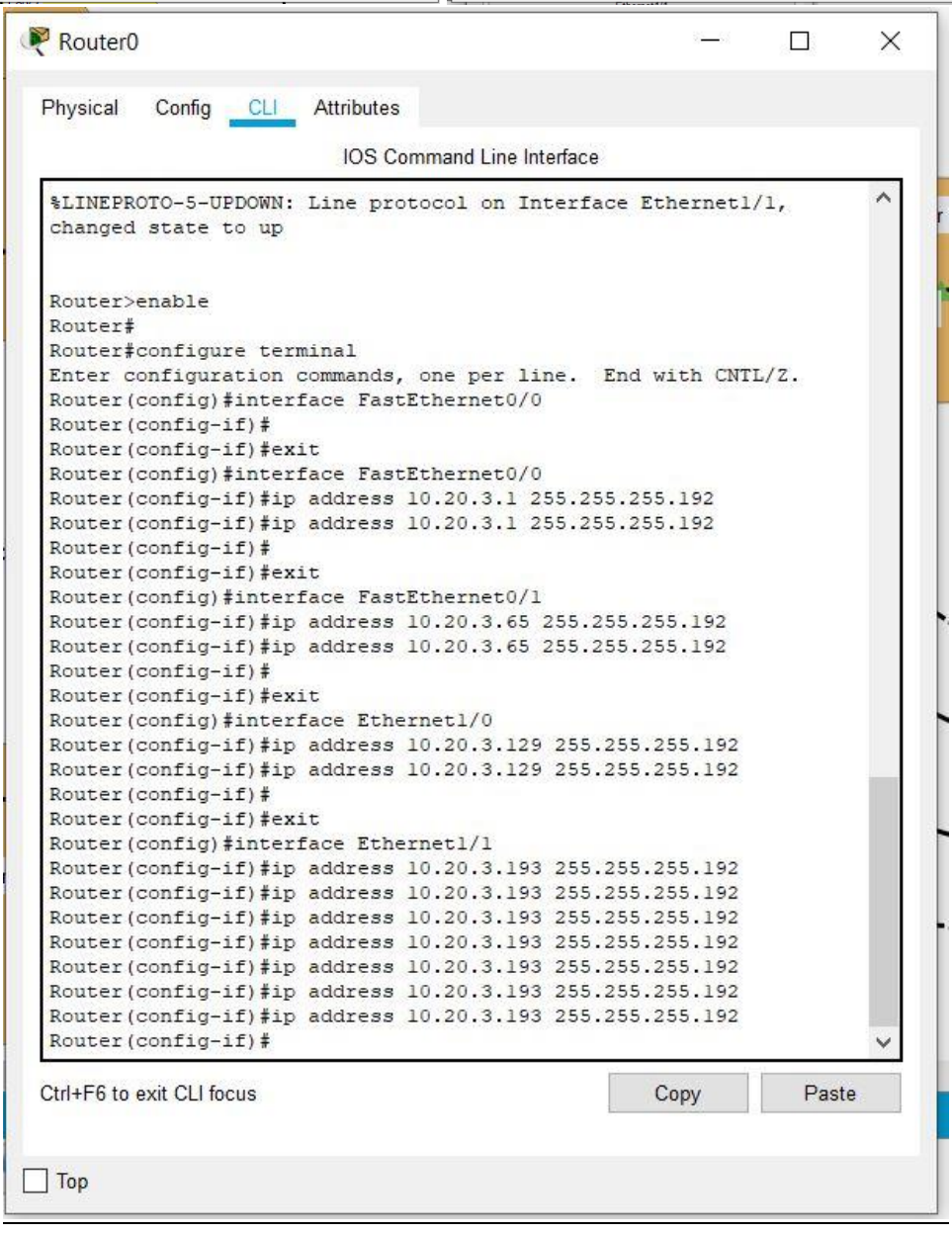
Figure 6:Diagram of two switches corresponding to each department with router

Details of the vlans, installed devices , assigned IP address ranges and subnet masks

VLAN	Segments	Installed devices	Allocated size	Network ID	IP address range	Broadcast ID	Subnet mask	CIDR
10	Computer Lab 1 IT Block	60	64	10.20.0.0	10.20.0.0 10.20.0.63	10.20.0.63	255.255.255.192	26
20	Computer Lab 2 IT Block	60	64	10.20.0.64	10.20.0.64 10.20.0.127	10.20.0.127	255.255.255.192	26
30	Computer Lab 1 Department Block	50	64	10.20.0.128	10.20.0.128 10.20.0.191	10.20.0.191	255.255.255.192	26
40	Computer Lab 2 Department Block	50	64	10.20.0.192	10.20.0.192 10.20.0.255		255.255.255.192	26
50	Computer Vision and Machine Learning Lab	50	64	10.20.1.0	10.20.1.0 10.20.1.63	10.20.1.63	255.255.255.192	26
60	Department Meeting Room	2+40 seating capacity Wifi	64	10.20.1.64	10.20.1.64 10.20.1.127	10.20.1.127	255.255.255.192	26
70	Meeting Room	2+40 seating capacity Wifi	64	10.20.1.128	10.20.1.128 10.20.1.191	10.20.1.191	255.255.255.192	26
80	Lobby area	40 seating capacity Wifi	64	10.20.1.192	10.20.1.192 10.20.1.255	10.20.1.255	255.255.255.192	26
90	Digital Learning and Media Centre	30PC +1 printer	64	10.20.2.0	10.20.2.0 10.20.2.63	10.20.2.63	255.255.255.192	26
100	14 staff rooms	14	16	10.20.2.64	10.20.2.64 10.20.2.79	10.20.2.79	255.255.255.240	28
110	Microprocessor Lab	12	16	10.20.2.80	10.20.2.80 10.20.2.95	10.20.2.95	255.255.255.240	28
120	Network Engineering Lab	10	16	10.20.2.96	10.20.2.96 10.20.2.111	10.20.2.111	255.255.255.240	28
130	4 lecture halls	4 PC+4 Projector	16	10.20.2.112	10.20.2.112 10.20.2.127	10.20.2.127	255.255.255.240	28
140	Staff Office Director office	5	8	10.20.2.128	10.20.2.128 10.20.2.135	10.20.2.135	255.255.255.248	29
150	4 Technical Officers Rooms Department office	4	8	10.20.2.136	10.20.2.136 10.20.2.143	10.20.2.143	255.255.255.248	29
160	Department office	2PC +1 Printer	8	10.20.2.144	10.20.2.144 10.20.2.151	10.20.2.151	255.255.255.248	29
170	2 Technical Officers Room	2	4	10.20.2.152	10.20.2.152 10.20.2.155	10.20.2.155	255.255.255.252	30
180	Director office	2PC	4	10.20.2.156	10.20.2.156 10.20.2.159	10.20.2.159	255.255.255.252	30
190	Printing Room	2 printer	4	10.20.2.160	10.20.2.160 10.20.2.163	10.20.2.163	255.255.255.252	30
200	Network Manager Room	1	4	10.20.2.164	10.20.2.164 10.20.2.167	10.20.2.167	255.255.255.252	30

Router configuration





PC configuration

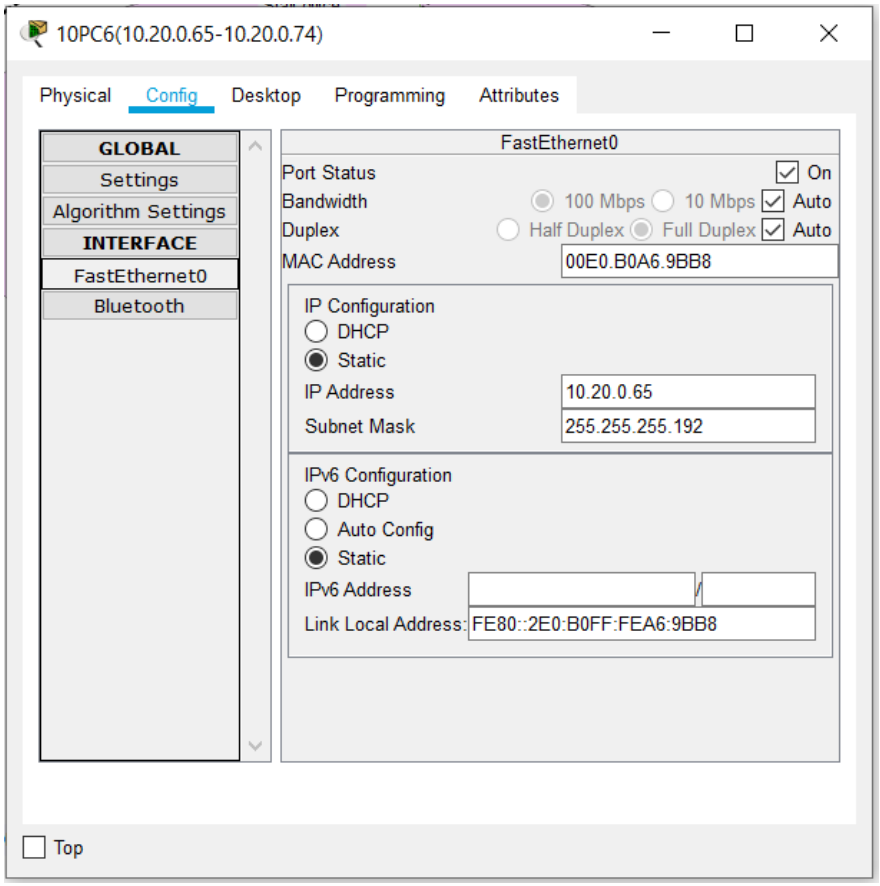


Figure: Allocate IP address and enter subnet mask for a PC

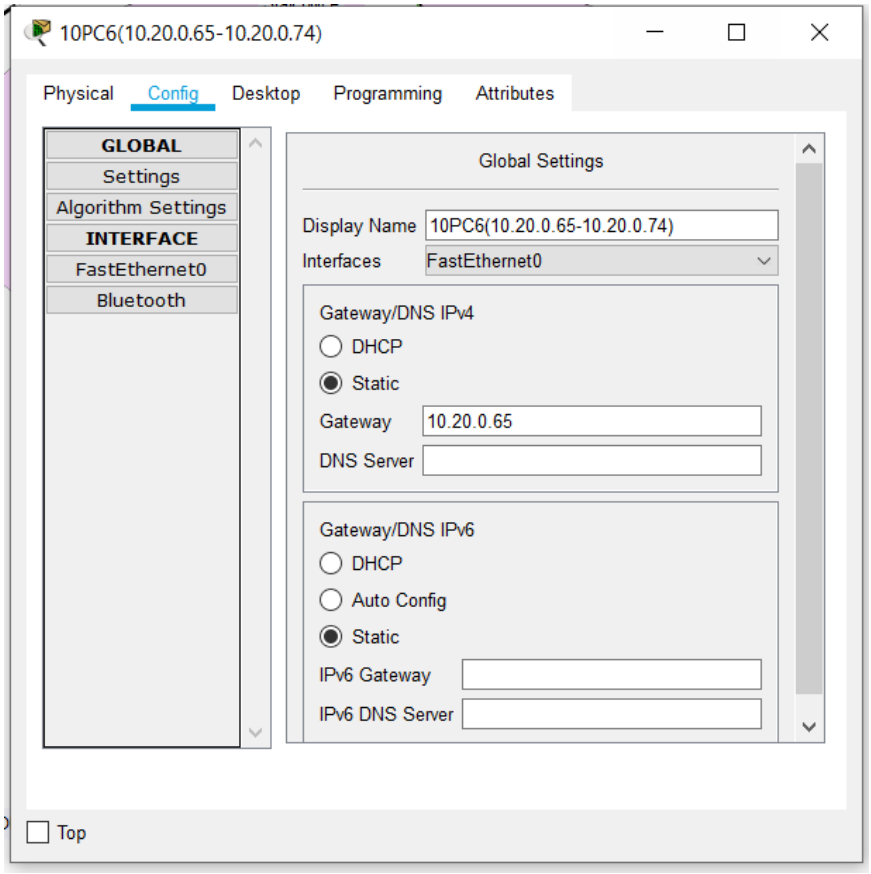


Figure: Assign a gate way for the corresponding pc

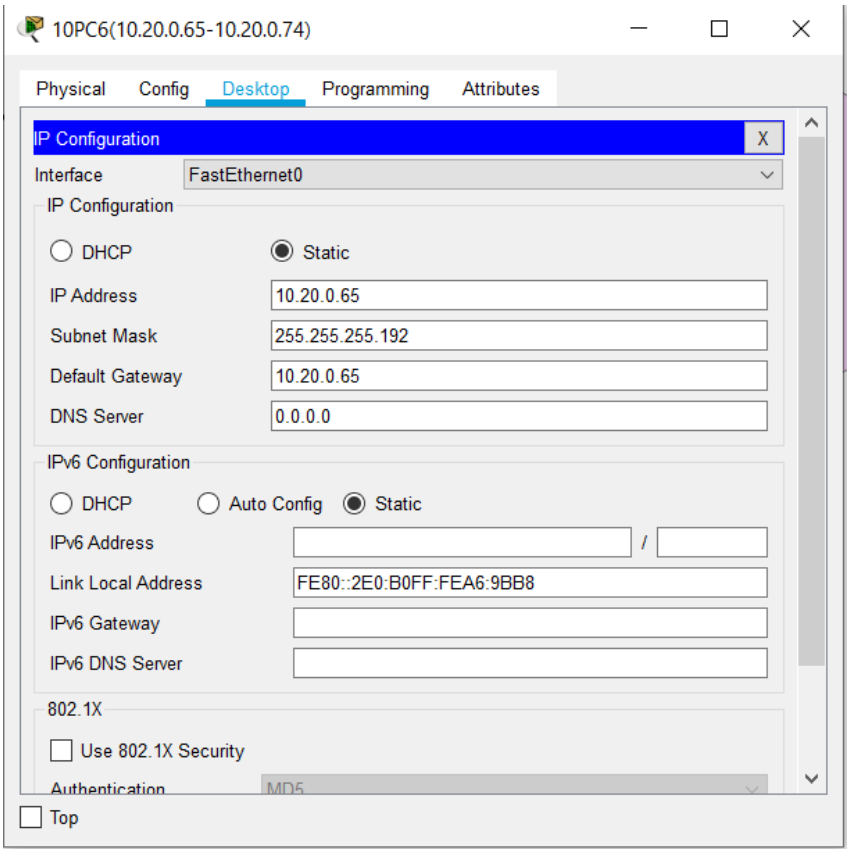


Figure : Configuration of IP

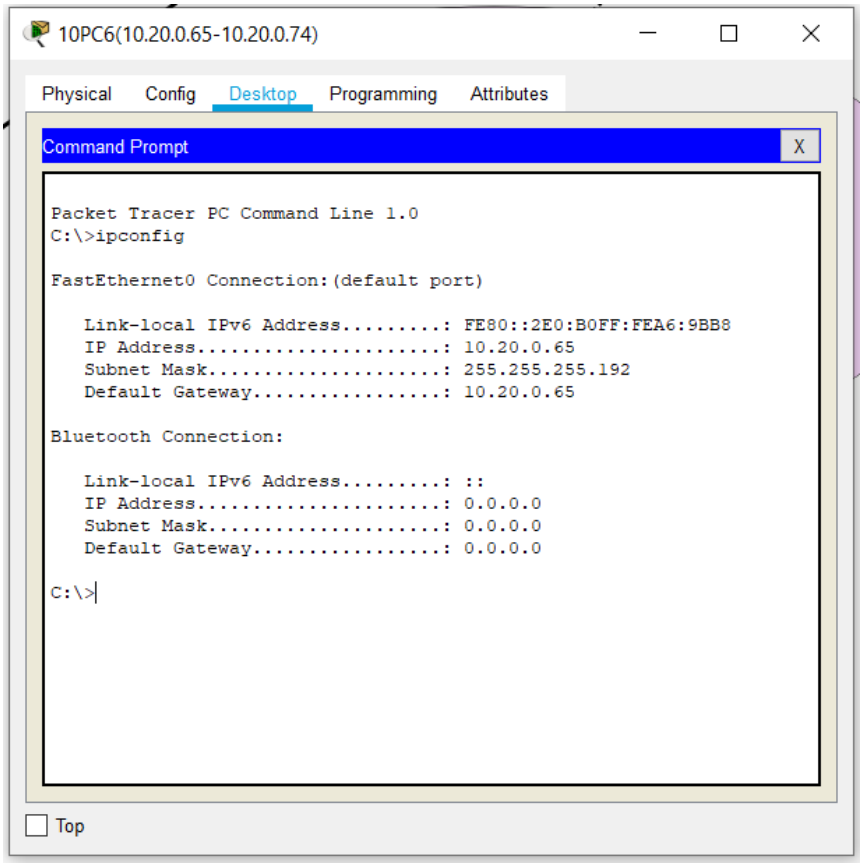


Figure : Configuration of IP in command line

Pinging

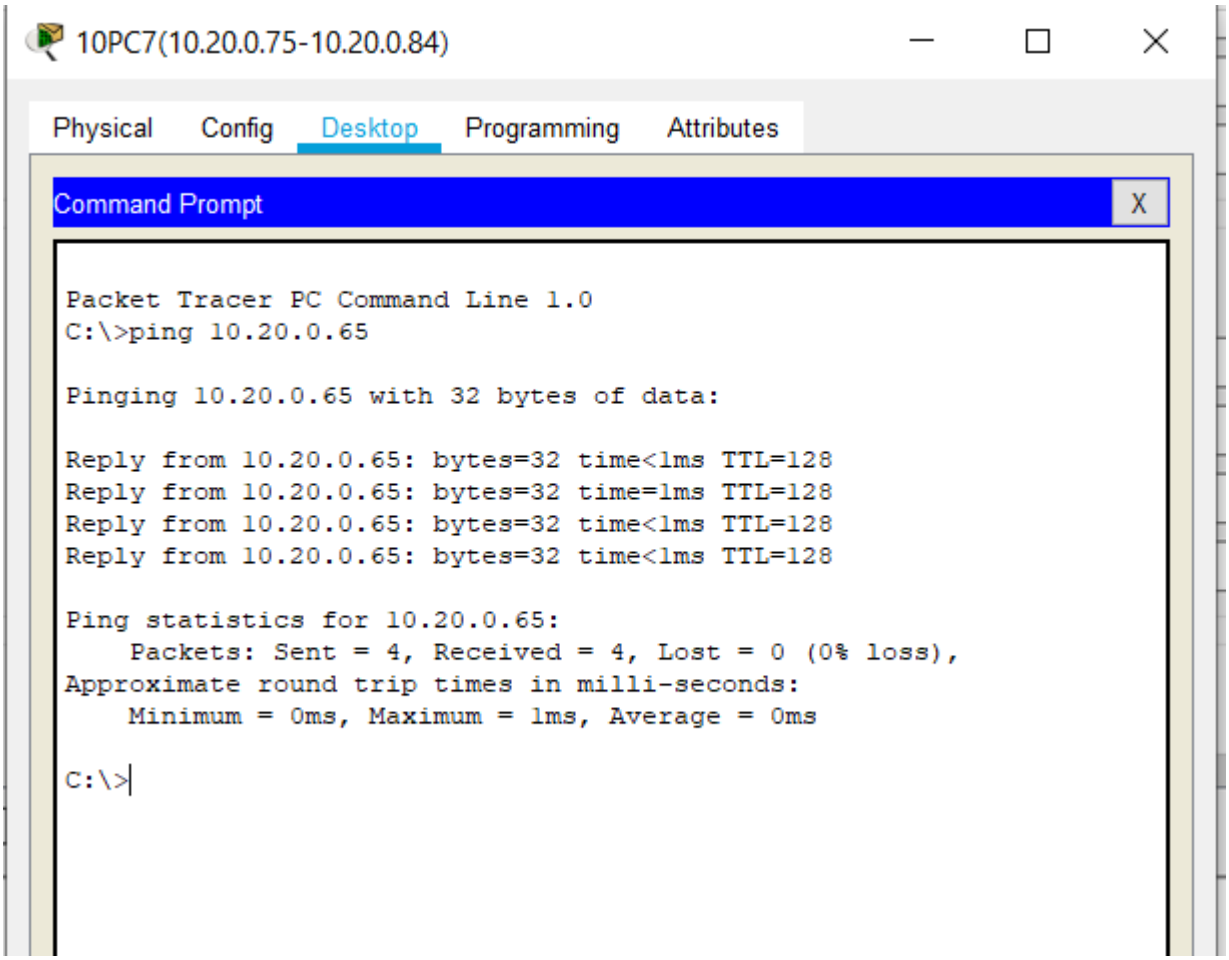


Figure : Pinging the configured PC

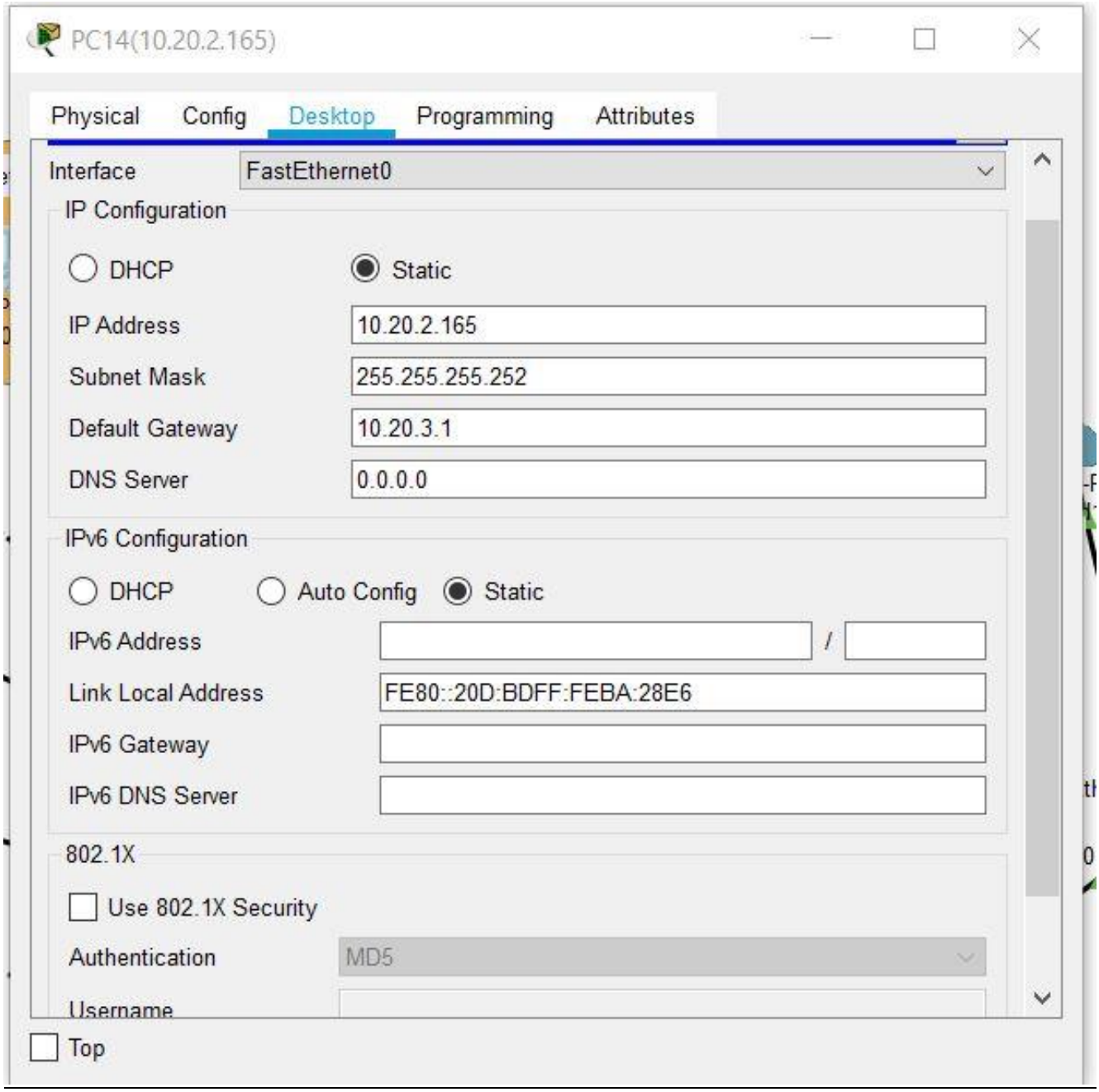


Figure : Configuration of IP for another PC

Printer configuration

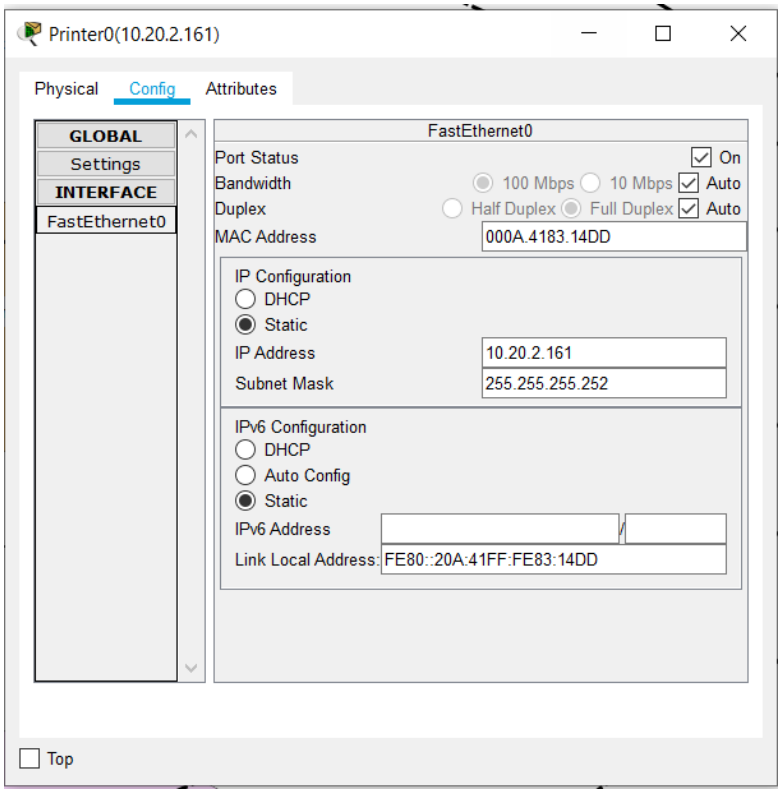


Figure : Printer configuration (Printing room)

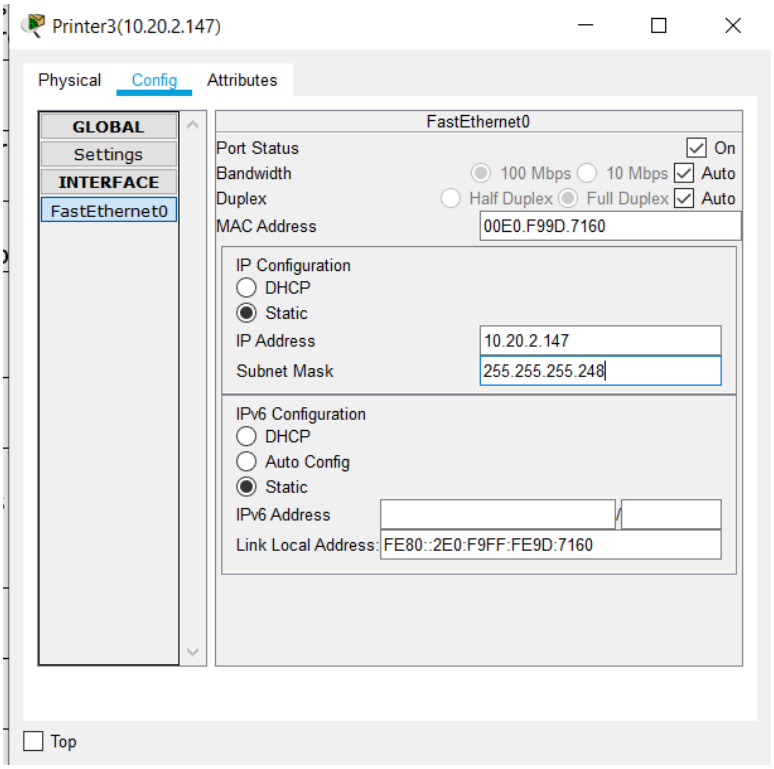
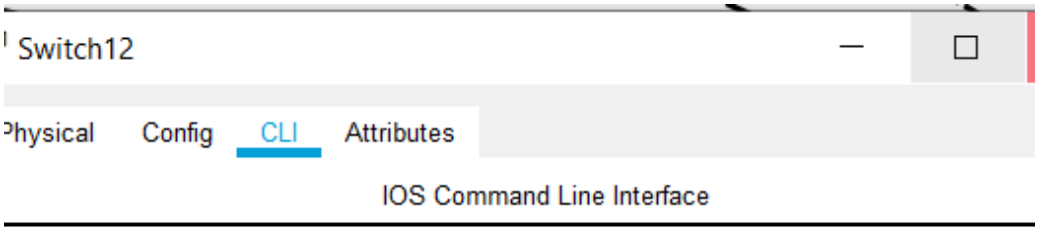


Figure : Printer configuration




```
Switch>enable
Switch#config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#ip access-list extended Printer
Switch(config-ext-nacl)#permit ip host 10.20.2.162 host
10.20.2.129
Switch(config-ext-nacl)#permit ip host 10.20.2.162 host
10.20.2.130
Switch(config-ext-nacl)#permit ip host 10.20.2.162 host
10.20.2.131
Switch(config-ext-nacl)#permit ip host 10.20.2.162 host
10.20.2.132
Switch(config-ext-nacl)#permit ip host 10.20.2.162 host
10.20.2.133
Switch(config-ext-nacl)#permit ip host 10.20.2.161 host
10.20.2.129
Switch(config-ext-nacl)#permit ip host 10.20.2.161 host
10.20.2.130
Switch(config-ext-nacl)#permit ip host 10.20.2.161 host
10.20.2.131
Switch(config-ext-nacl)#permit ip host 10.20.2.161 host
10.20.2.132
Switch(config-ext-nacl)#permit ip host 10.20.2.161 host
10.20.2.133
Switch(config-ext-nacl)#deny ip host 10.20.2.162 host 10.20.0.1
Switch(config-ext-nacl)#deny ip host 10.20.2.162 host 10.20.2.153
Switch(config-ext-nacl)#deny ip host 10.20.2.162 host 10.20.2.56
Switch(config-ext-nacl)#deny ip host 10.20.2.162 host 10.20.2.165
Switch(config-ext-nacl)#deny ip host 10.20.2.162 host
10.20.2.1.129

Switch(config-ext-nacl)#deny ip host 10.20.2.162 host
10.20.1.129
Switch(config-ext-nacl)#deny ip host 10.20.2.162 host  10.20.1.0
Switch(config-ext-nacl)#deny ip host 10.20.2.162 host  10.20.1.1
Switch(config-ext-nacl)#deny ip host 10.20.2.162 host  10.20.0.65

Switch(config-ext-nacl)#deny ip any any
Switch(config-ext-nacl)#permit ip any any
Switch(config-ext-nacl)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console
```

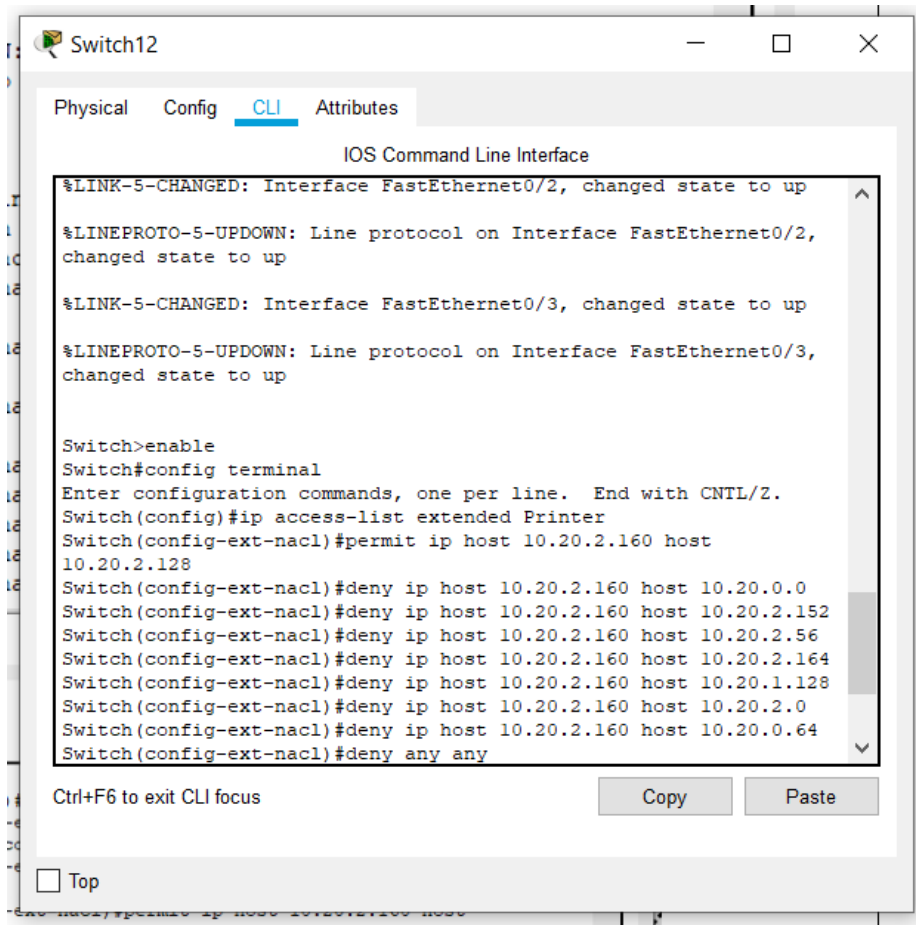
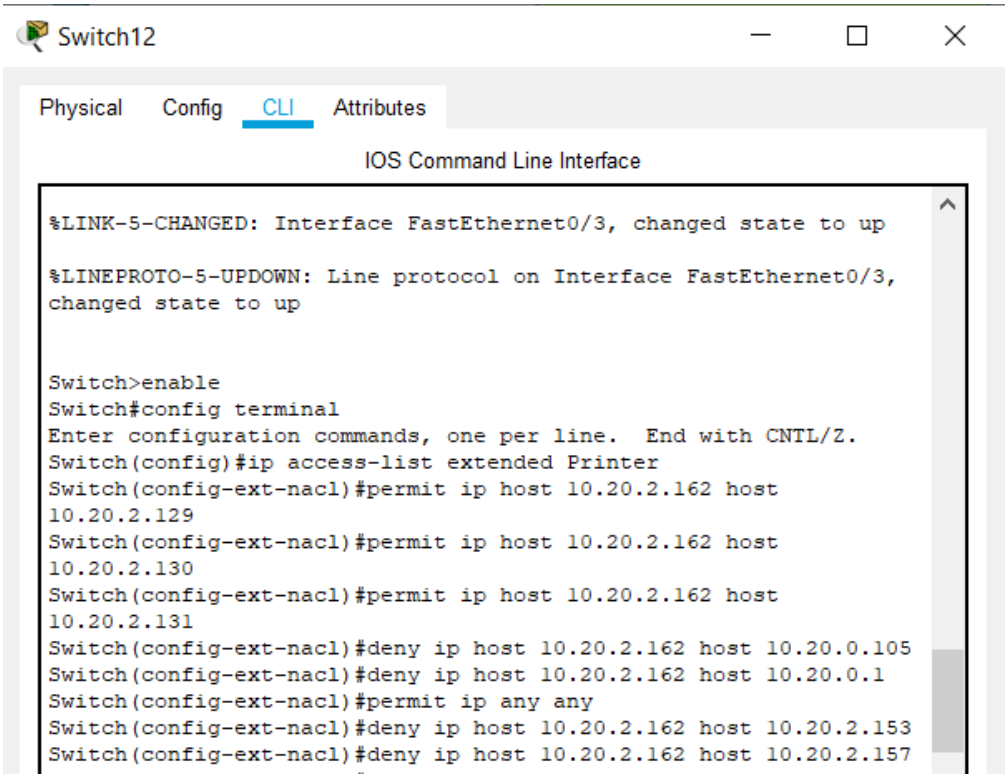


Figure : Printer access of printing room can be only accessed by staff office



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Pinging

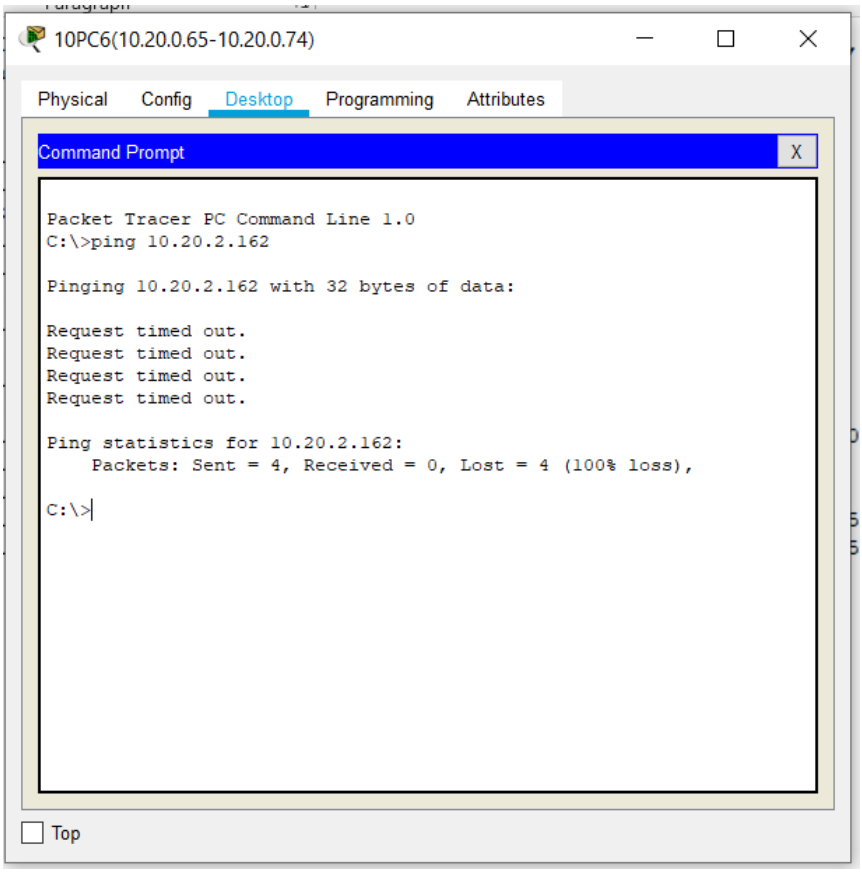

Figure : Printer restriction for a PC 10.20.0.65 in computer lab 2

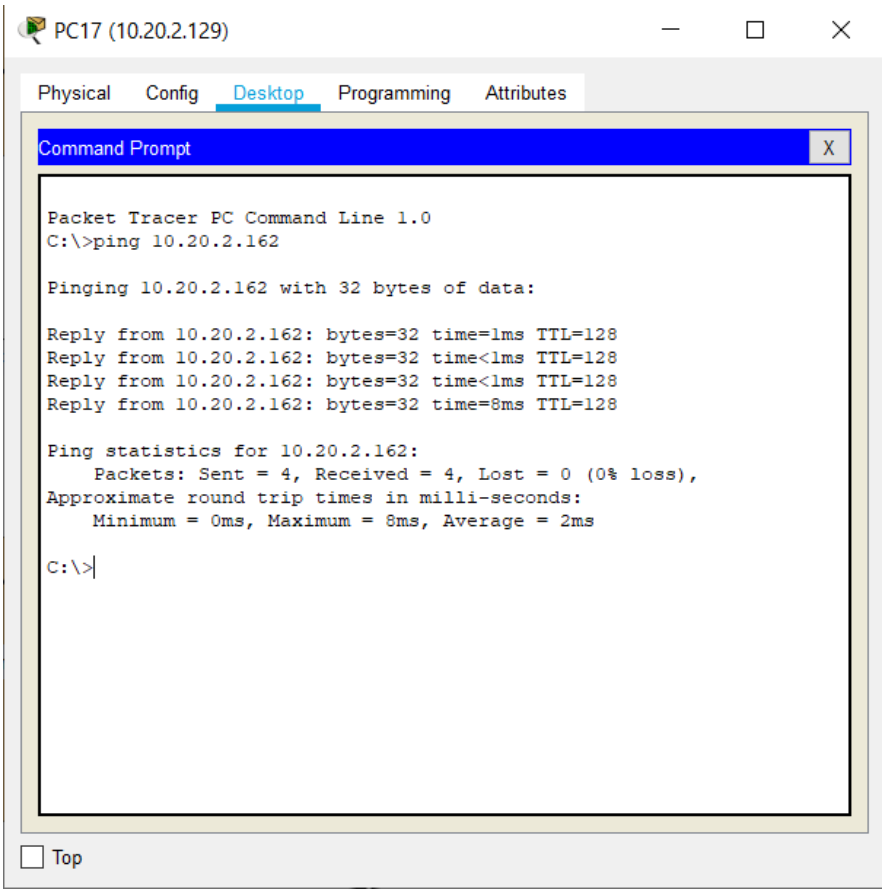

Figure : Printer accessed

Switch configuration

Assigning vlans for IT block

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#hostname mainswitch1
mainswitch1(config)#vlan 10
mainswitch1(config-vlan)#name computerlab1
mainswitch1(config-vlan)#vlan 20
mainswitch1(config-vlan)#name computerlab2
mainswitch1(config-vlan)#vlan 70
mainswitch1(config-vlan)#name MeetingRoom
mainswitch1(config-vlan)#vlan 80
mainswitch1(config-vlan)#name LobbyArea
mainswitch1(config-vlan)#vlan 90
mainswitch1(config-vlan)#name DigitalLearningAndMediaCentre
mainswitch1(config-vlan)#vlan 140
mainswitch1(config-vlan)#name StaffOffice
mainswitch1(config-vlan)#vlan 170
mainswitch1(config-vlan)#name TOofficeRoom
mainswitch1(config-vlan)#vlan 180
mainswitch1(config-vlan)#name DirectorOffice
mainswitch1(config-vlan)#vlan 190
mainswitch1(config-vlan)#name PrintingRoom
mainswitch1(config-vlan)#vlan 200
mainswitch1(config-vlan)#name NetworkManagerRoom
mainswitch1(config-vlan)#end
mainswitch1#
%SYS-5-CONFIG_I: Configured from console by console
```

Figure :vlan configuration on mainswitch 1

```
mainswitch1(vlan)#exit
APPLY completed.
Exiting....
mainswitch1#show vlan

VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                 Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                 Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                                 Fa0/13, Fa0/14, Fa0/15, Fa0/16
                                                 Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                                 Fa0/21, Fa0/22, Fa0/23, Fa0/24
                                                 Gig0/1, Gig0/2
10   computerlab1                      active
20   computerlab2                      active
70   MeetingRoom                       active
80   LobbyArea                         active
90   DigitalLearningAndMediaCentre     active
140  StaffOffice                       active
170  TOofficeRoom                      active
180  DirectorOffice                    active
190  PrintingRoom                      active
200  NetworkManagerRoom                active
1002 fddi-default                      active
1003 token-ring-default                active
 --More--
```

Figure :vlan configuration on mainswitch 1 with ‘show vlan’ on command prompt before assigning interfaces

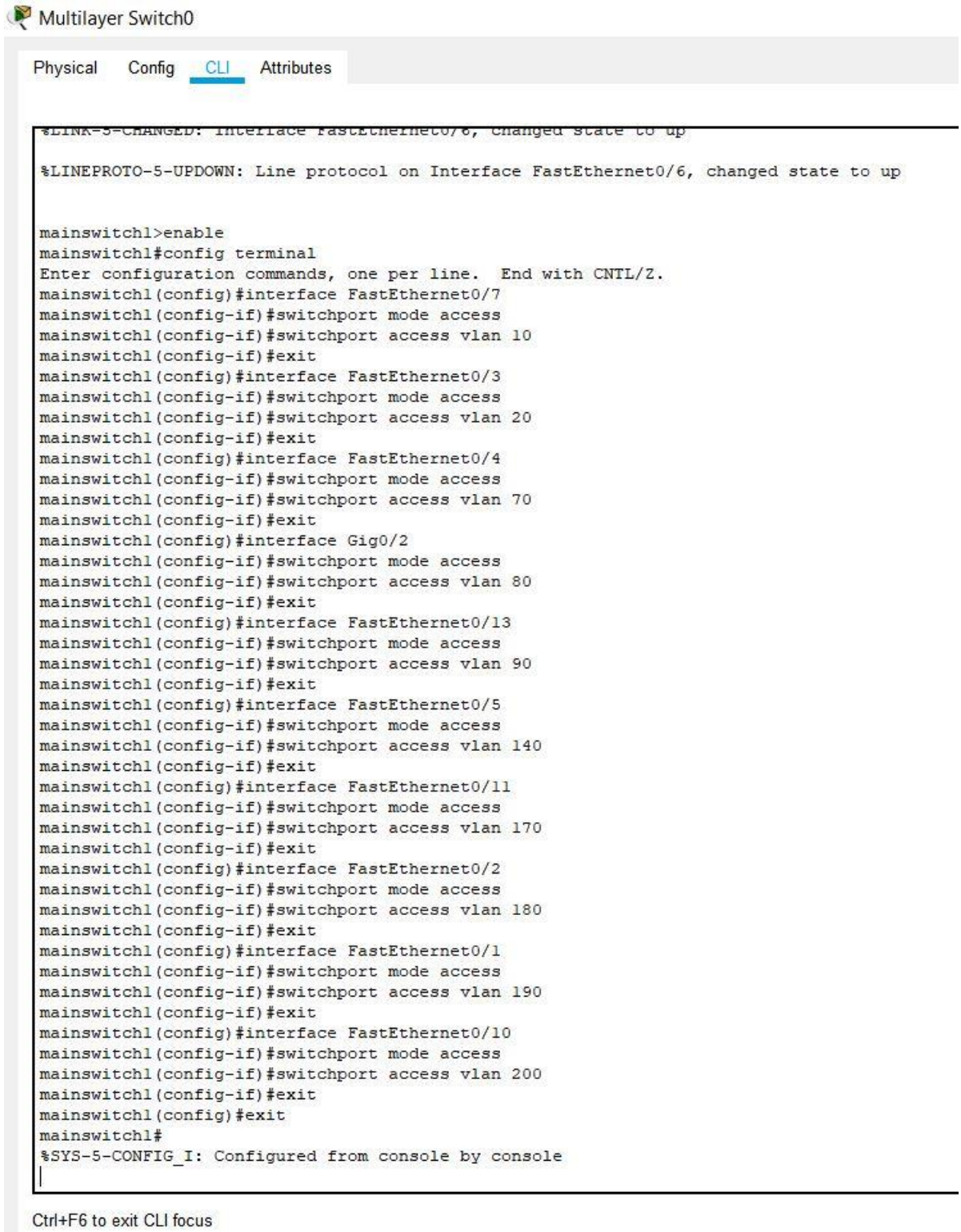

Figure: Assigning interfaces for every Vlans in IT block

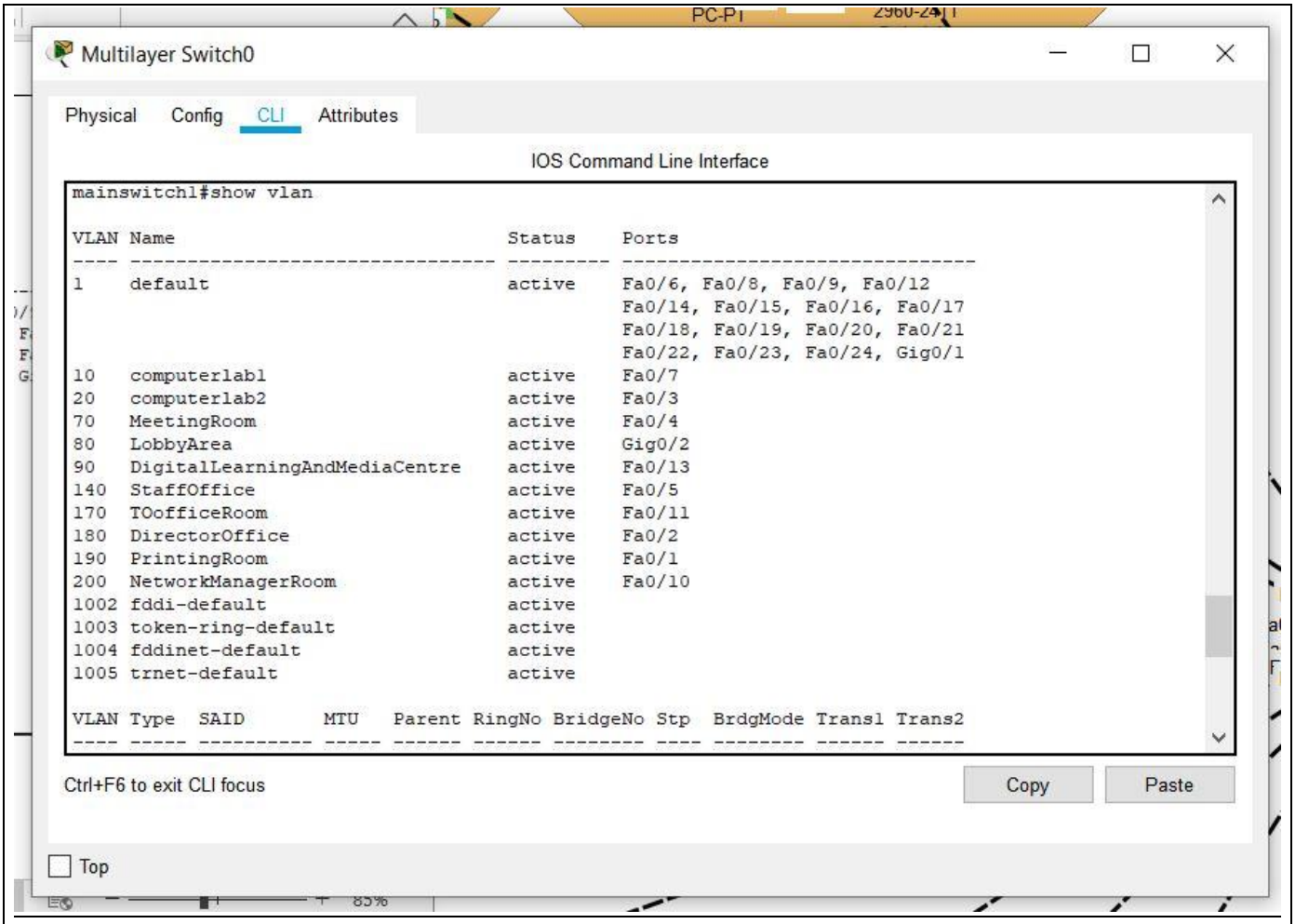

Figure : Show vlans after assigning the interfaces for vlans

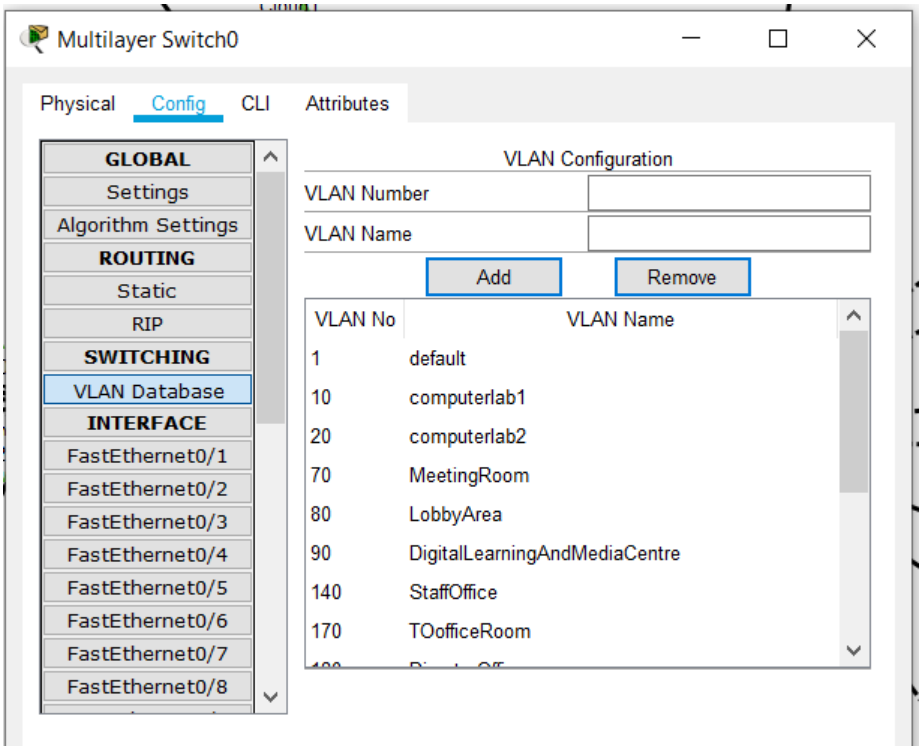

Figure : vlan data base of IT block switch

Department block vlan set up

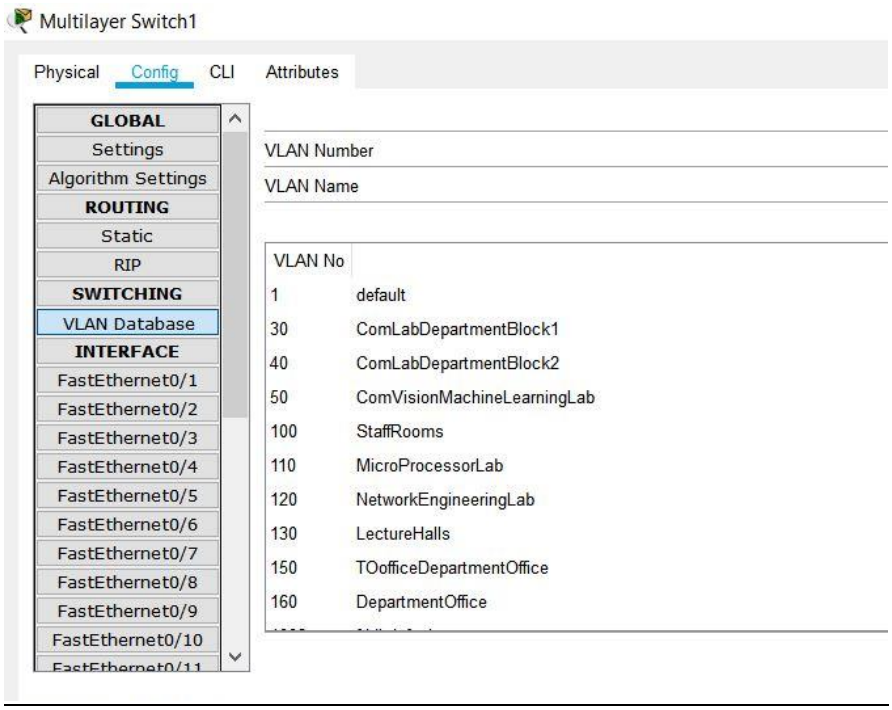

Figure : vlan data base of Department block switch

Figure : vlan data base operations in cmd line interfaces

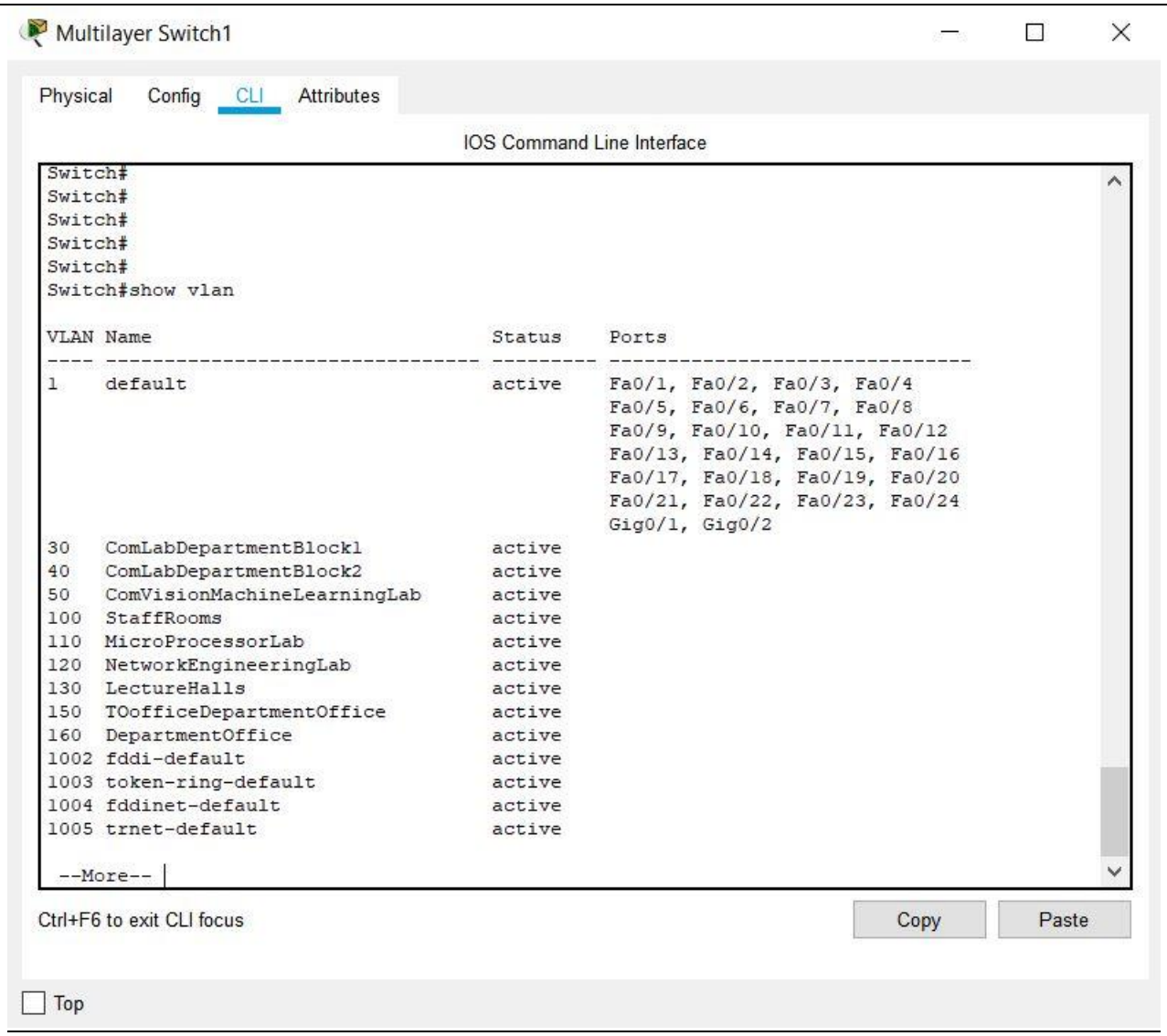

Figure : Show vlans before assigning the interfaces for vlans

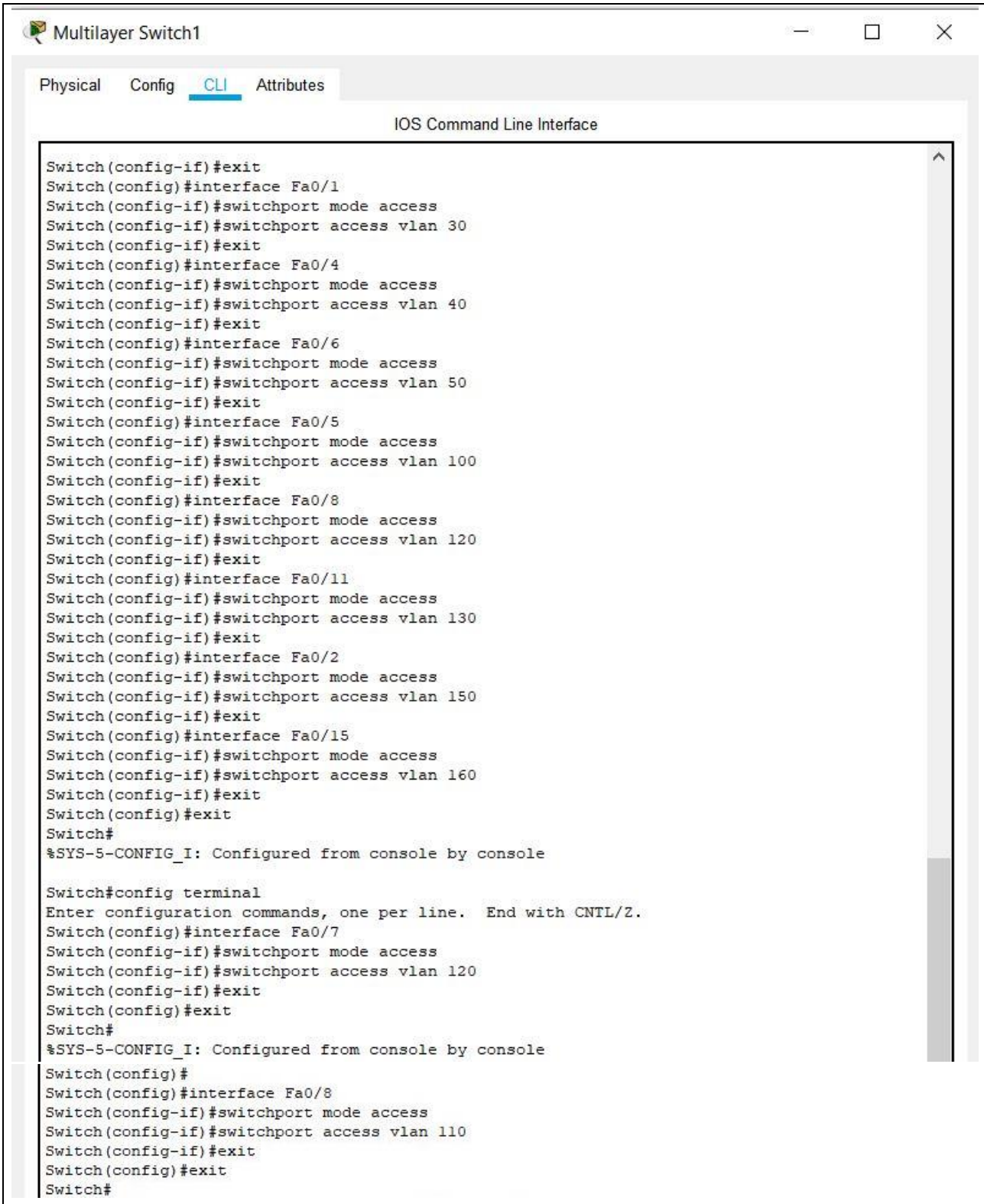

Figure: Assigning interfaces for every Vlans in Department block

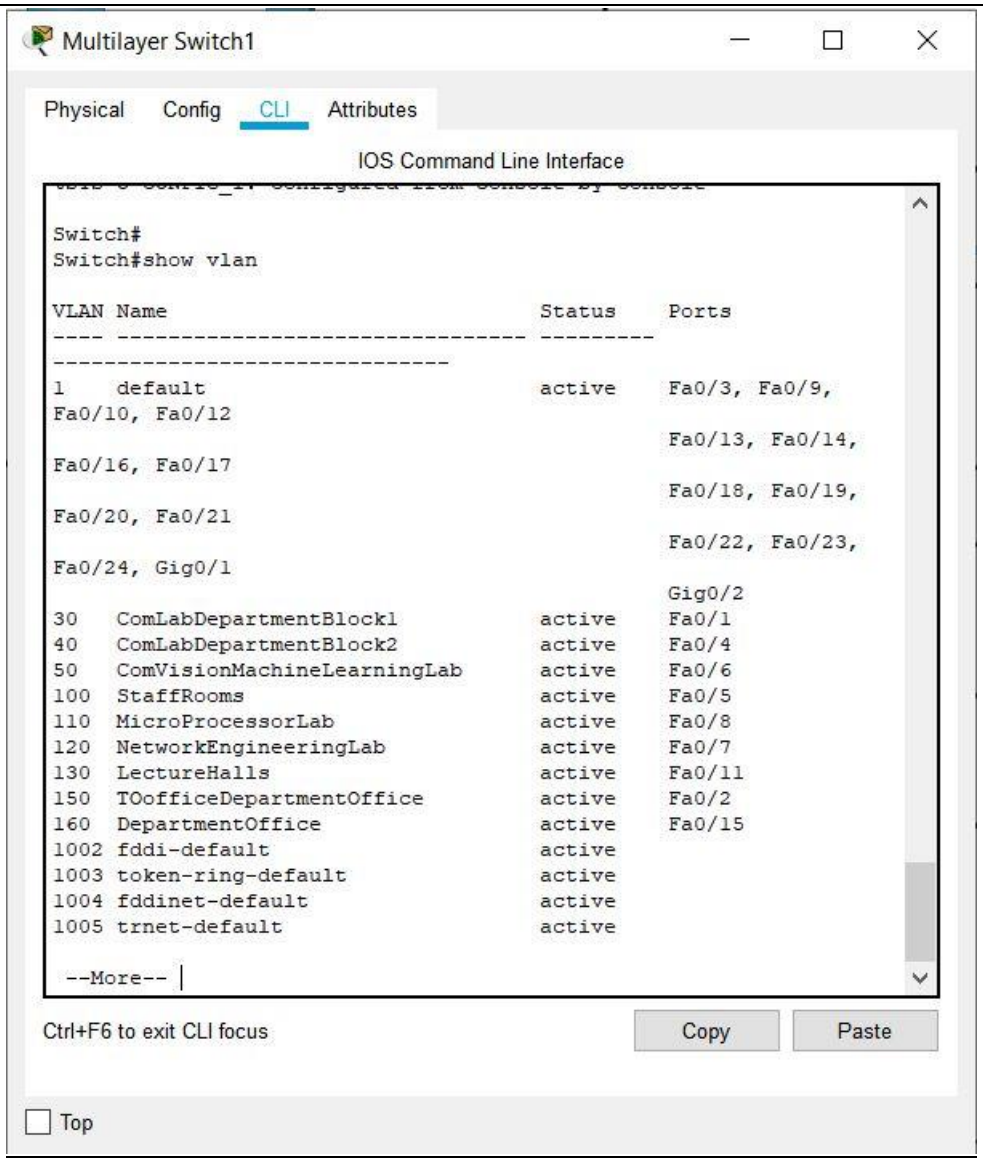

Figure : Show vlans after assigning the interfaces for vlans

Wifi configuration

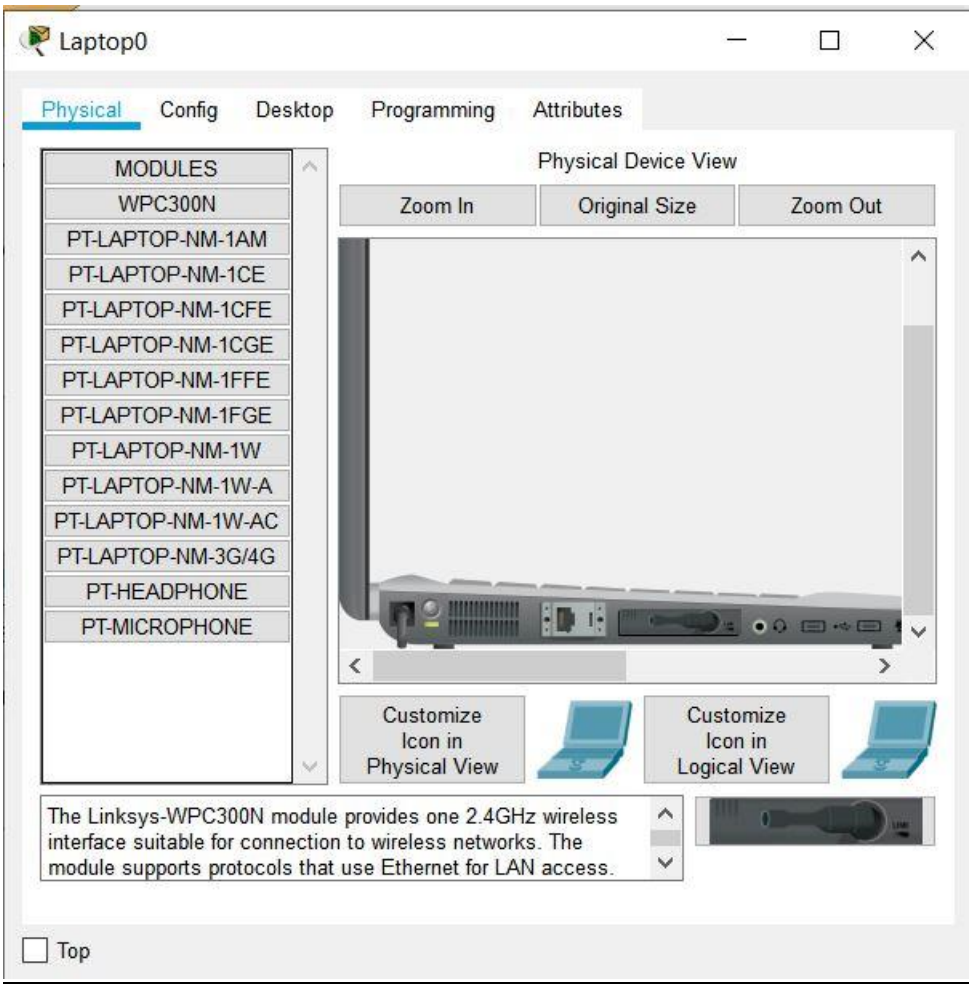

Figure : Assign physical terminal

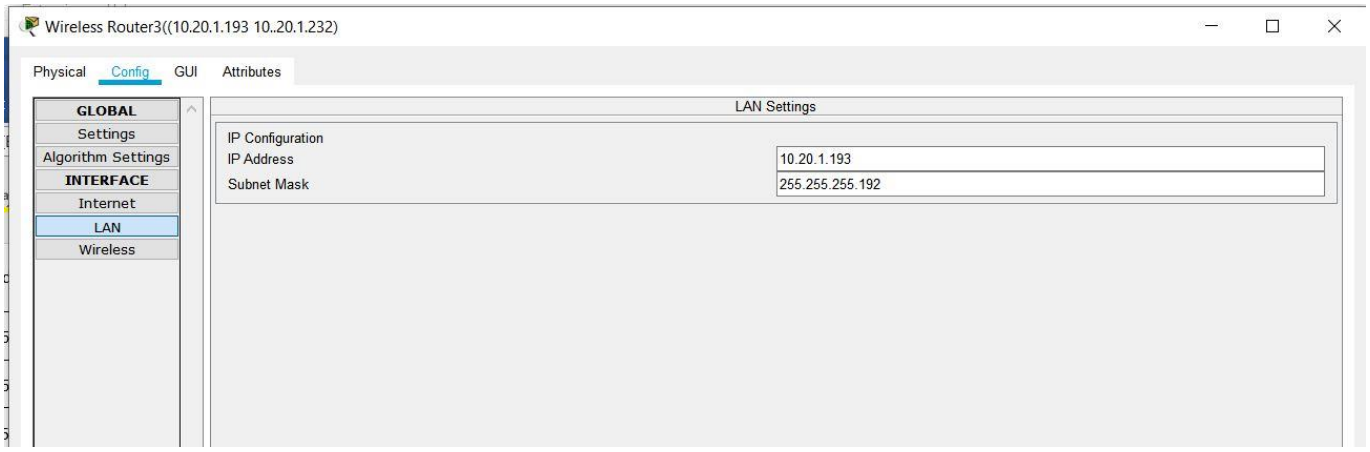

Figure : Wireless router LAN settings

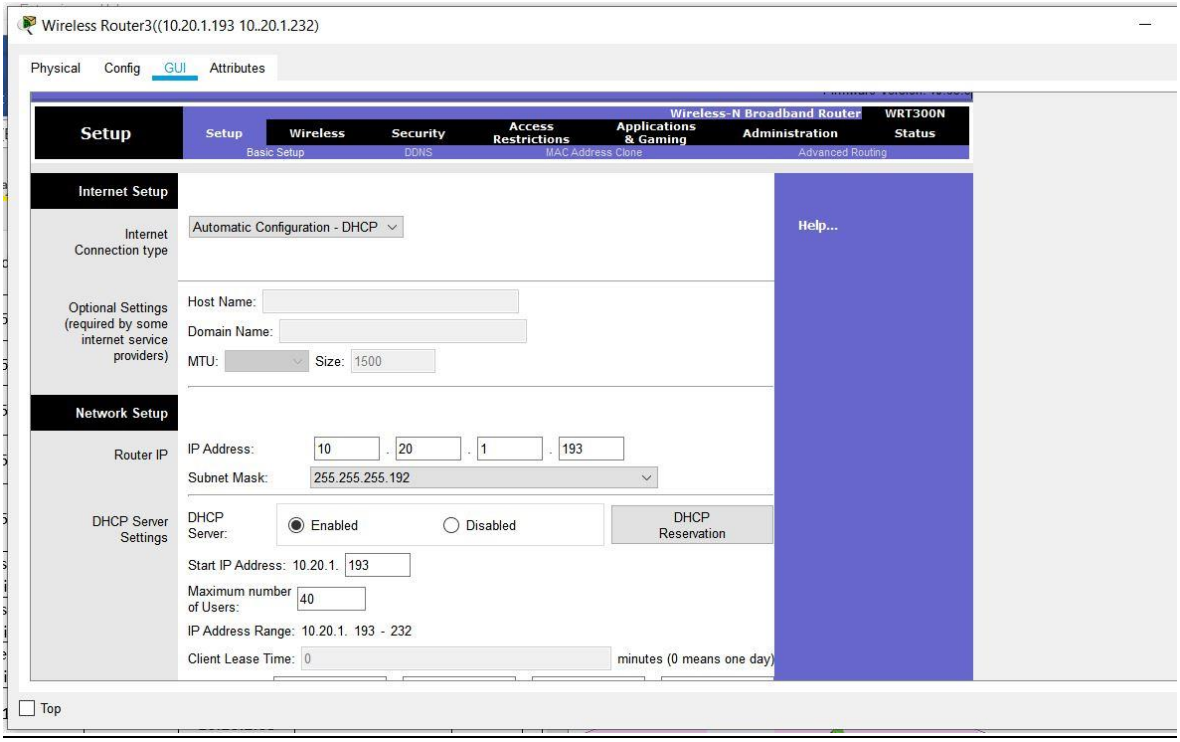

Figure : Network Setup for wireless

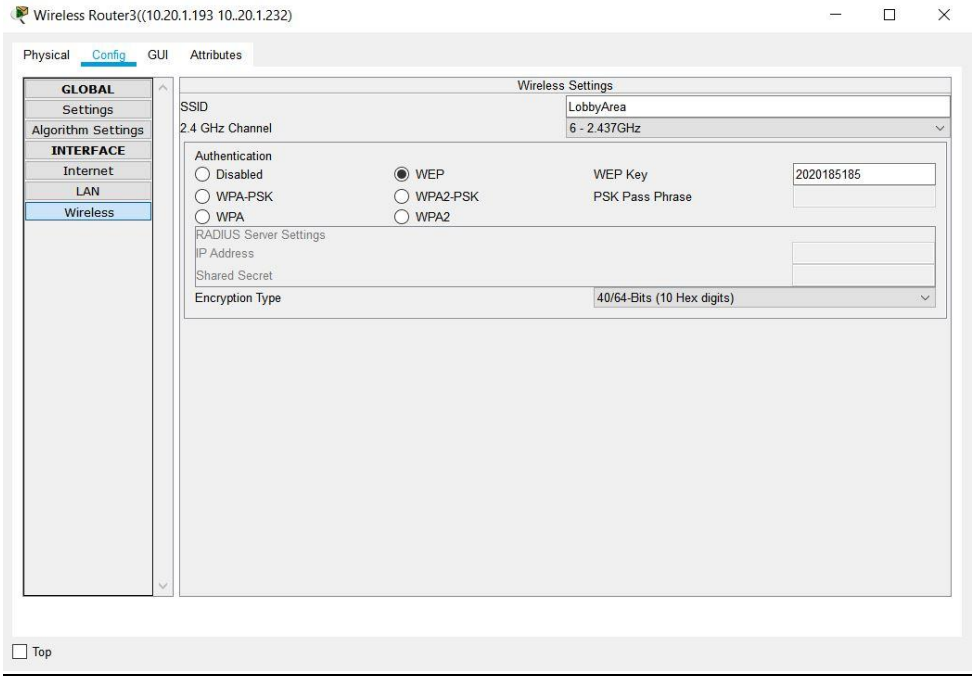

Figure : Assign WEP key

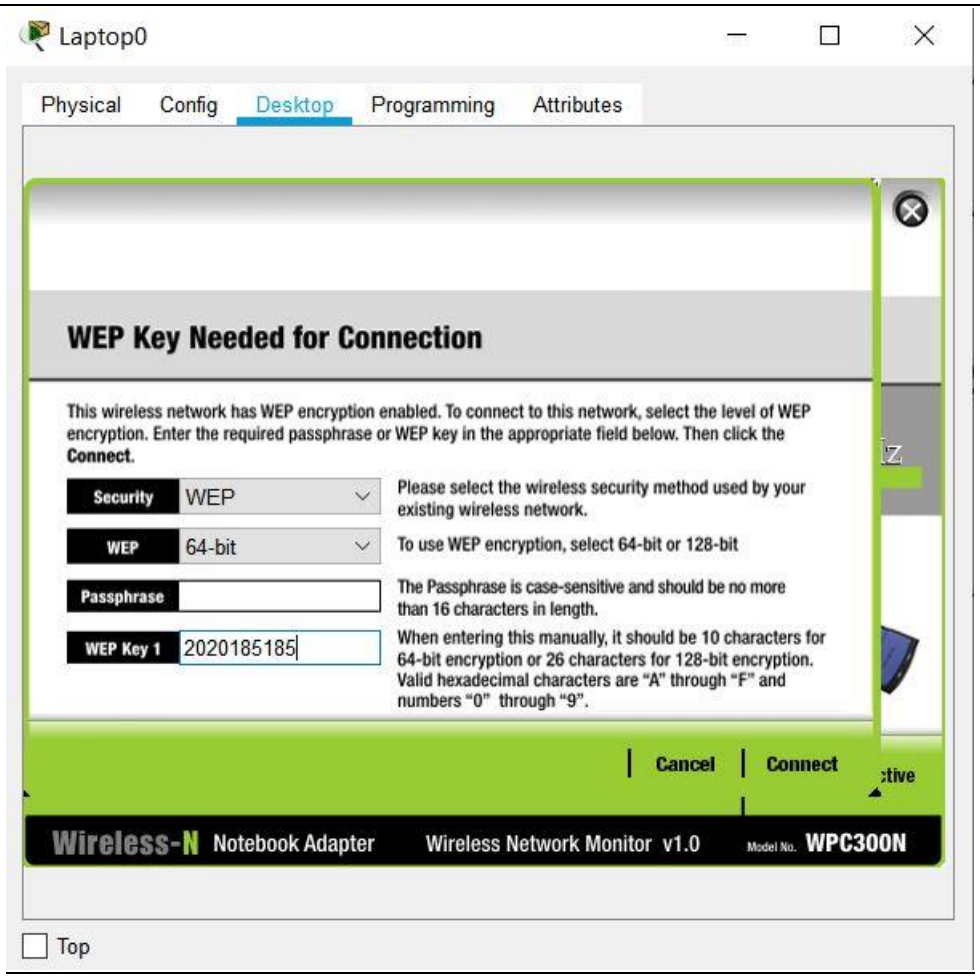

Figure : Connect Wireless

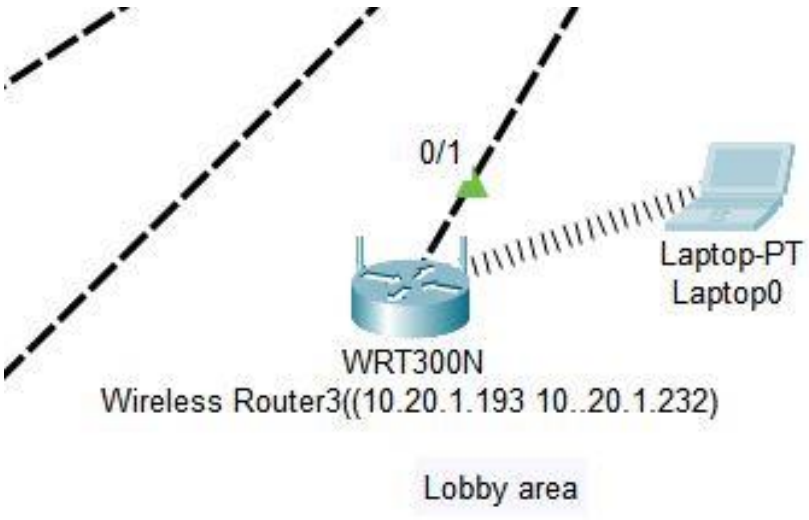

Figure : Access shown in network diagram

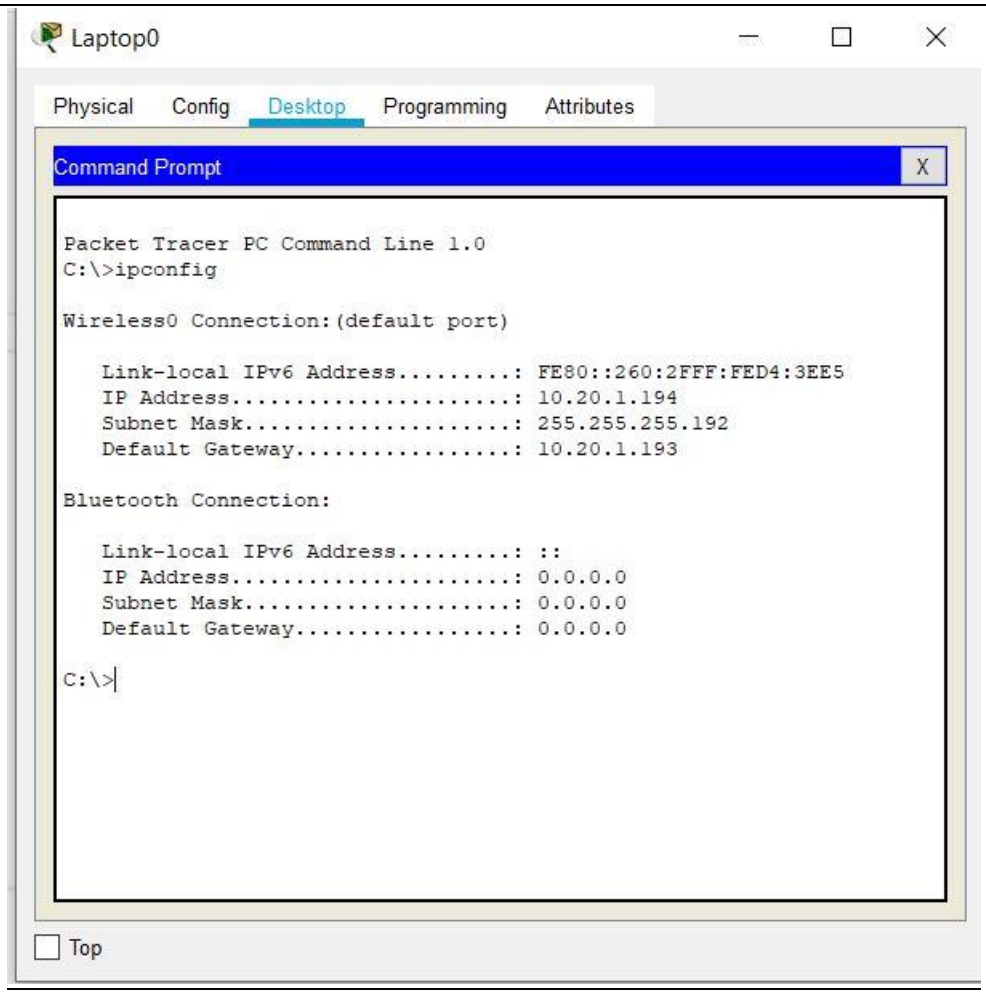

Figure : ipconfig for the laptop connected through wireless

DISCUSSION

The above network set up was built based on the requirements provided. Here we use minimum number of switches and routers to minimize the additional costs. Routers and switches are more expensive. And for end devices we want more ip addresses to allocate. But on other way better transmission speeds can get by using multiple routers as a single router can only serve so many devices at a time. Having multiple Wi-Fi routers helps share the load caused by several devices requesting packets simultaneously. This is a limitation of this setup.