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Implementation of College Network Module using Cisco Packet Tracer Simulator

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Abstract: A Campus Network Module is a type of network designed for establishing the Internet network on the campus. A Campus Network Module is a project which can be usefully established for the network in any college or campus. In this project, we used the Cisco Packet Tracer software for designing this network module. This project is implemented in this software using real-time simulation that confirms live data transfer is working or not. We have a project on the Campus Network Module that will help network designing have an edge over others when it comes to cost and product designing. The study on computer networking and technology provides an insight into various concepts like the design of topology, IP address configuration and moreover how to send information in form of packets in a single network and the use of Virtual Local Area Networks (VLANs) to separate the traffic generated by different departments this can be studied easily using the cisco packet tracer virtually.

Keywords: Computer Networks, Masking, IP Addresses, Ping Test, Simulation Tool, Sub-netting, VLANs, Routing protocols.

I. INTRODUCTION

The need for computer networking emerged out of the need to use personal computers for sharing information within an organization in form of media, messages, sharing files and databases and so forth. Whether the institution or organization or company is located in one building or spread over a large campus, the need for networking the computers cannot be overemphasized.

Network and Computer Systems Administrators are responsible for day-to-day operations and maintaining the efficiency of an organization's computer networks. To organize, design, install and support an organization's computer systems, including: i) Local Area Networks (LANs) ii) Wide Area Networks (WANs) iii) Network segments iv) Intranets v) Data Communication Systems.

As the name implies, a Local Area Network (LAN) interconnects computer in a limited geographic territory. It provides high-bandwidth communication and inexpensive transmission of data over a wide range of area. Today’s network requirement is a strategy that must be accessible anytime from anywhere-simultaneously offering fast, secure, reliable services at scale regardless of location.

The main purpose of a network is to reduce isolated users and workgroups and expand the workspace to a wide range. All systems should be capable of communicating with others and should provide the desired information and maintain to keep the connection. Additionally, physical networking systems and devices such as mobile devices or laptops should be able to maintain and provide satisfactory performance, reliability and security.

In this project, we designed this project in Cisco Packet Tracer using Servers, Routers, PCs, Laptops, Wireless Routers (WIFI campus), etc and for the connection purposes, we have used the optic fibre cables and copper cables for the best efficiency in network purpose. This project is developed for the college campus taking into consideration the phases like the main building, library, hostels, etc.

II. DESIGNING OF NETWORK

The work-flow diagram is shown in figure 1. In starting, we have the main ISP Server that provides the main internet line to the college, further it is given to the college server that is data centre from where the connections to the whole campus are provided.

One line is given for the main building in which series router connections (Bus Topology) are provided for the different floor connections which are further extended to the star topology for connections at different labs and offices. The second line from the college server (data centre) is provided to the library which is further extended to the hostel. Again, the star topology is implemented in the hostel for wireless connections (WIFI).

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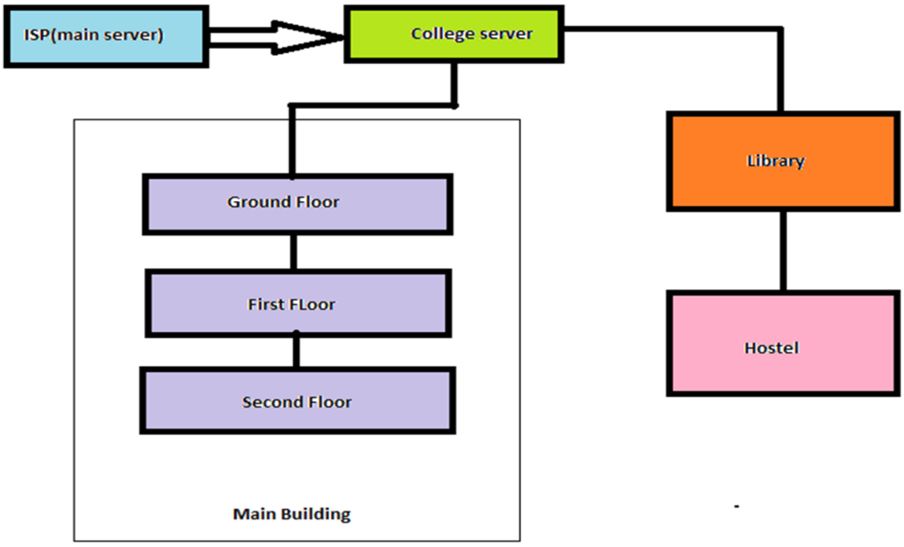

Figure 1 Work-Flow Diagram

The various sub-parts of the network are shown below,
i) ISP (Main-service provider):

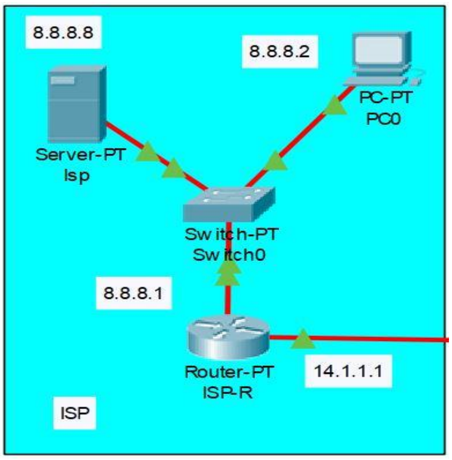

Figure 2 ISP (Internet Service Provider)

From the fig 2 we can see that the main internet service provider (8.8.8.8) is implemented & its connection is given to switch extended to the router which is further passed to the college server(data-centre). The default gateway here is 8.8.8.1.
ii)Data-Centre (College server):

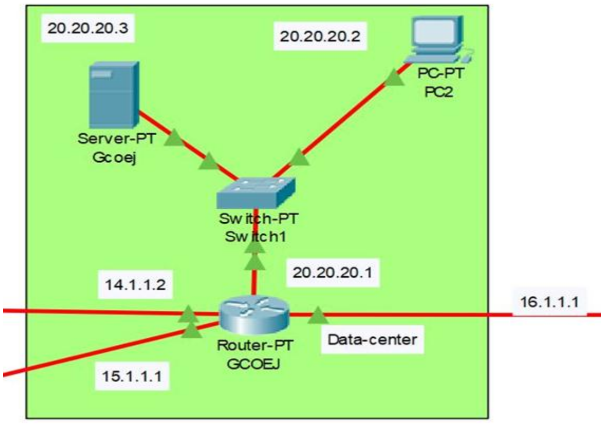

Figure 3 Data-Centre

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From the figure 3 below we can see the college server, that is data-centre from where the internet service is provided to whole college. The college server has IP 20.20.20.3, whose further connection is given to the router (GCOEJ-IP: - 20.20.20.1) through a switch. From this router connections to the main building that is to all floors and lab in the college is provided and library and hostel is provided.
A separate pc with IP 20.20.20.2 is provided for any network connections problems diagnostics in the campus.

iii)Floor plan (Main building floors):

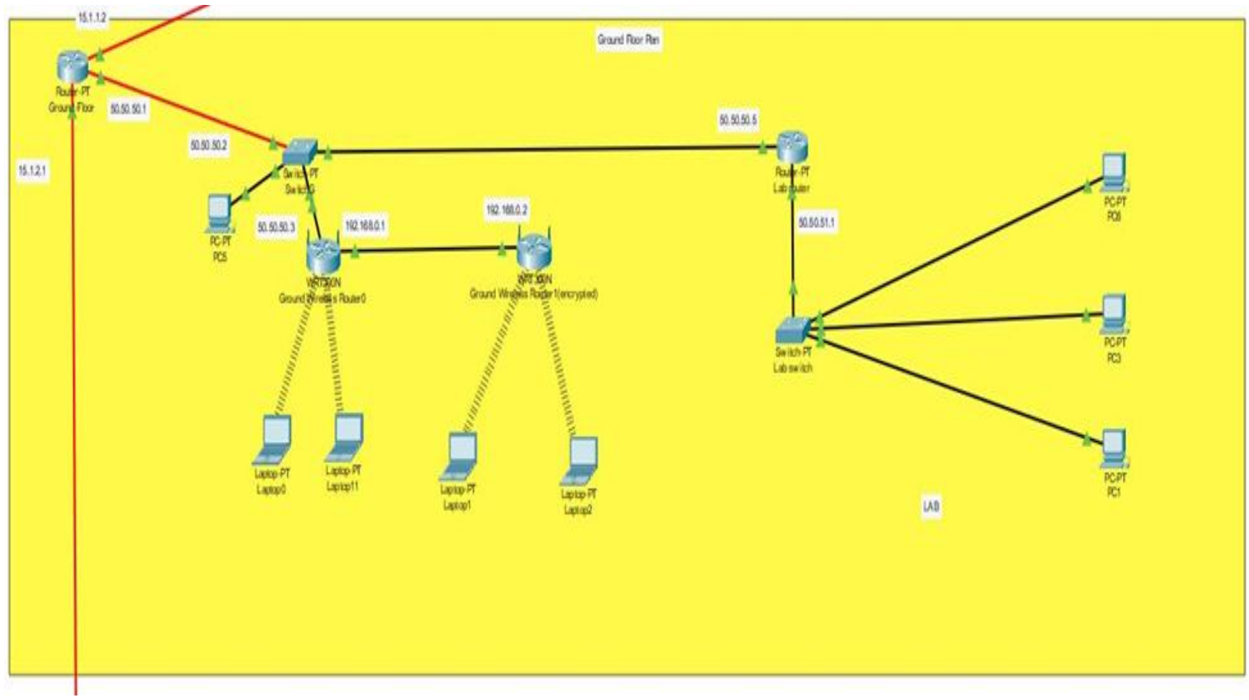
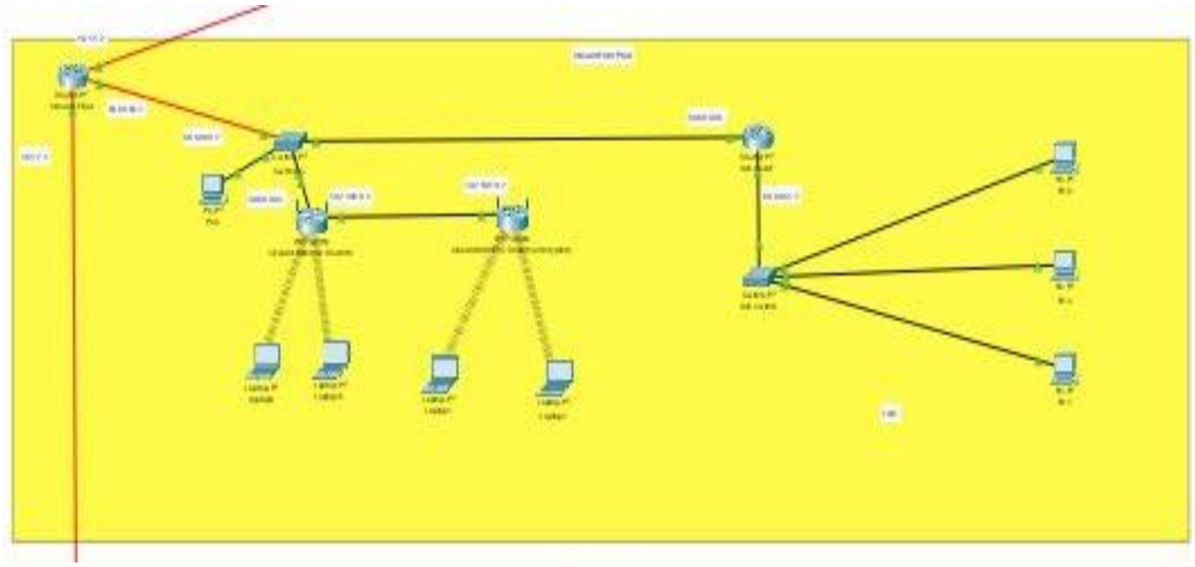


Figure 4 Floor plan

From the figure 4 we can see the router(ip:15.1.1.2) provide the connection to whole floor, whose connection is given through a switch to the further routers for the labs and wireless routers for the WIFI purpose. The wireless routers are provided with the service of encryption so that with proper authentication one would not be able to access the internet service. Similar connection of routers is done in the main building for internet connection, we can see that the routers are connected serially from figure 5 i.e. the bus topology is implemented for the floor to floor connection and further the star topology through the switch for wireless routers and lab routers.



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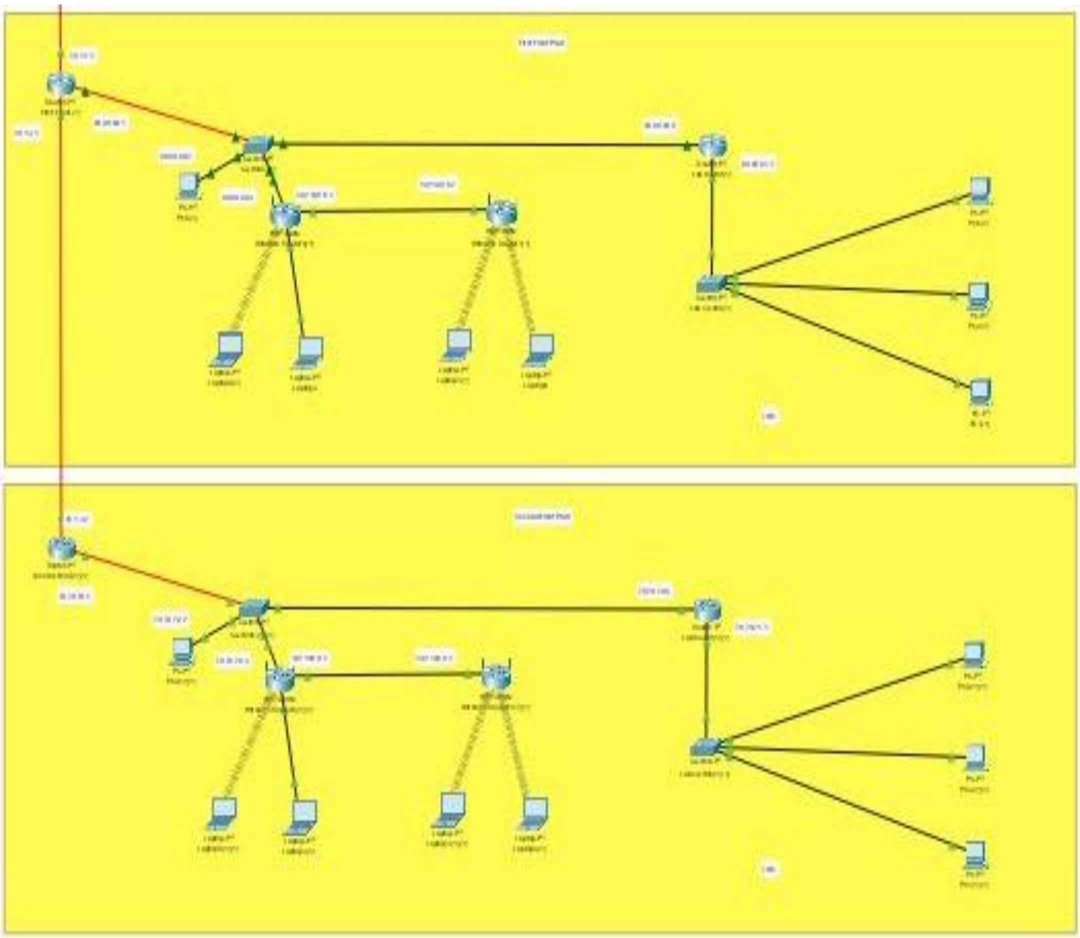

Figure 5 Main Building

iv)Library:

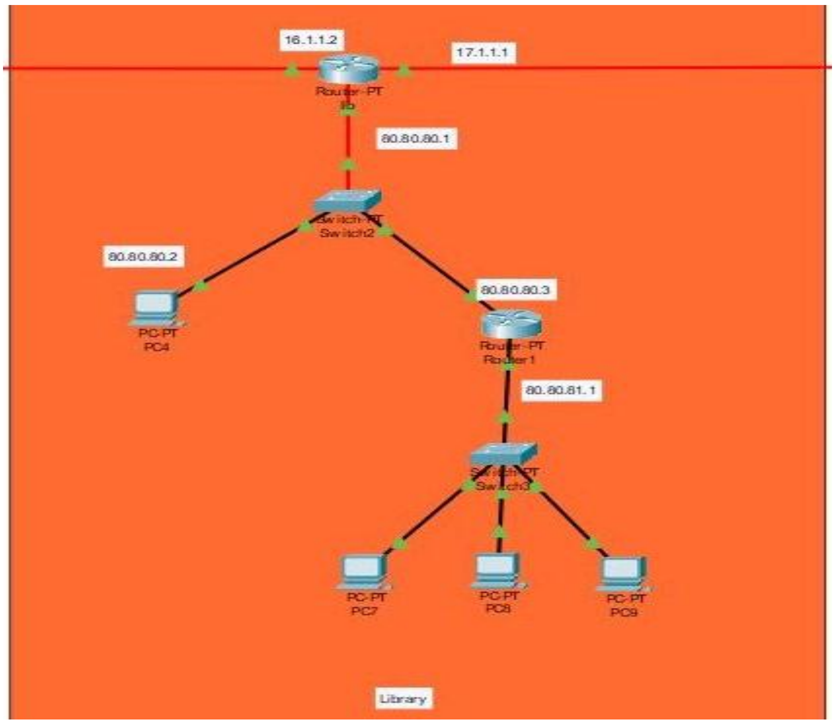

Figure 6 Library

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From the figure 6 we can see that the hostel network is implemented. The net connection comes to the router(ip:16.1.1.2) from which the further connections are provided using a switch in which again the star topology is implemented.

v)Hostel:

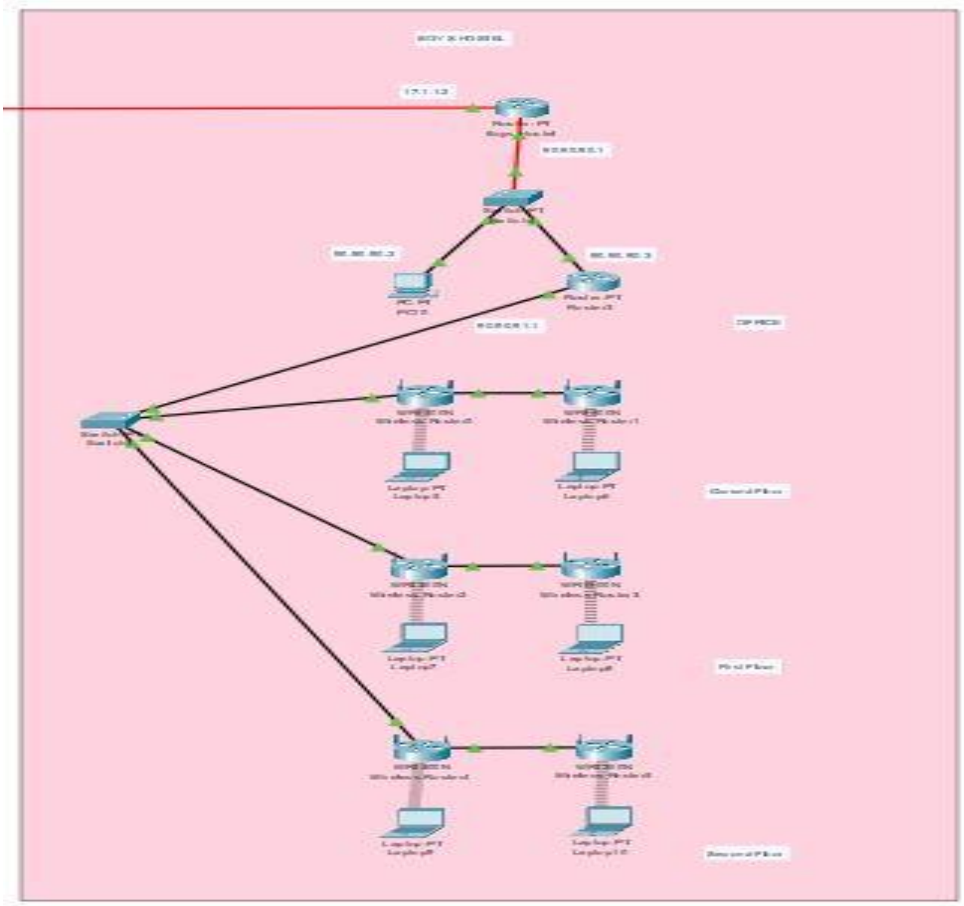

Figure 7 Hostel

The figure 7 shows the network implementation for the hostel. The router with ip 17.1.1.2 is the main router here from where the further connections are provided to the routers using a switch. Again, here the star topology is implemented for the wireless routers through a switch.
From fig we can see that a separate pc and router is provided for the office from which the floor to floor connections are provided using the switch. And the wireless routers are connected serially on the floor which shows that the bus topology is implemented here.

6)Whole campus:

The figure 8 shows the network implementation in whole campus.

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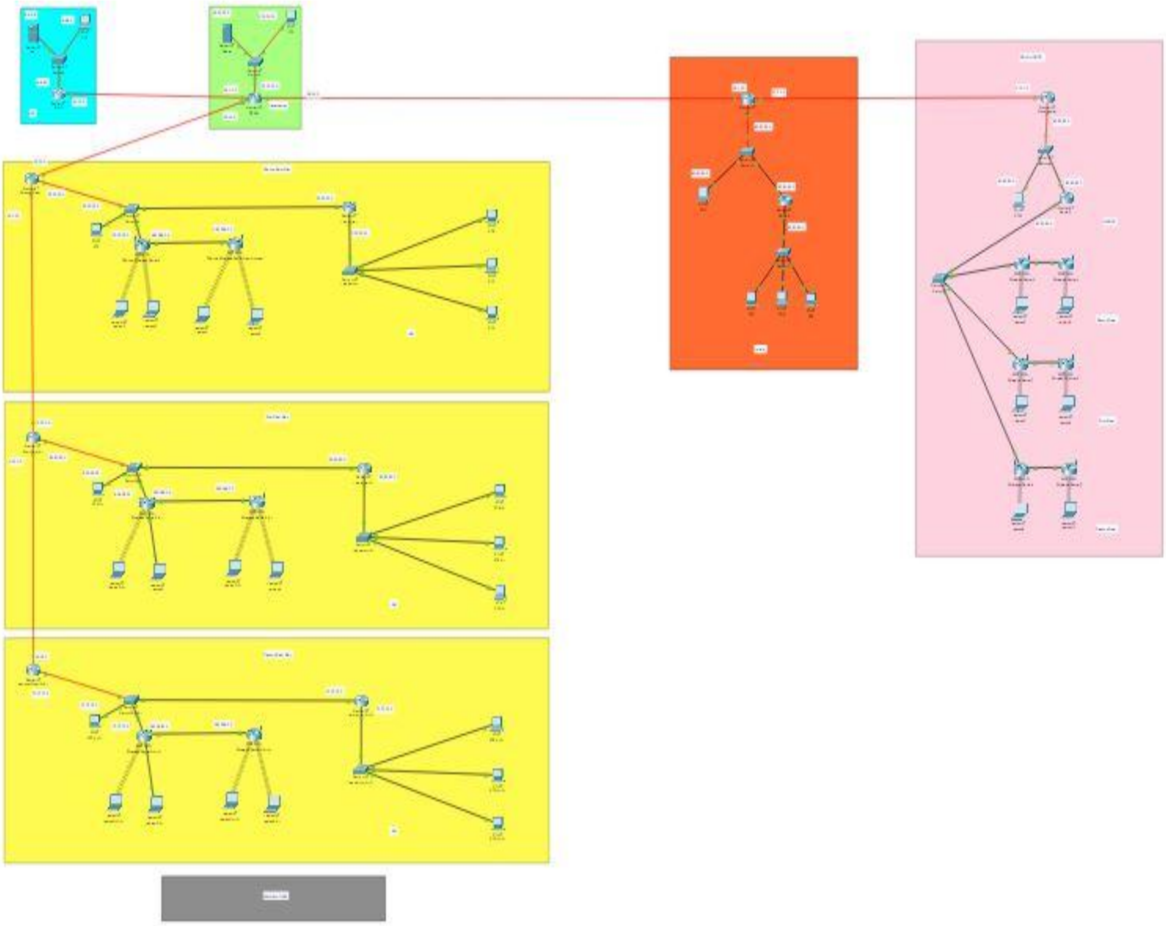

Figure 8 Whole Campus

III. TYPES OF TOPOLOGY USED

For interconnectivity of components, devices, network topology describe the physical and logical appearance and interconnection between the arrangement of computers, cables and other components in a data communication network and how it can be used for sending a packet from one device than through the network to another device on a different network.

A network topology is the physical layout of computers, cables, and other networking components on a network. There are a number of different network topologies, and a network can be built using multiple network topologies.

The different types of network topologies are Bus topology, Star topology, Mesh topology, Ring topology, Hybrid topology and also Wireless topology. The bus topology usually uses a cable running through the area requiring connectivity. Devices that need to get connected to the network they are tapped into this nearby cable. To prevent signal bounce, a terminator is designed to absorb the signal.

The Star Topology is a network topology in which all the clients or machines on the network are connected to a central device (central station) known as a hub or switch. Each workstation has a cable that goes from the network card to the hub or switch device and then to the device. One of the major benefits of the star topology is that a breakdown in the cable causes only specific workstation that is connected to the cable to go down and not the entire network as it is happening with the bus topology.

Also, alternatively line topology, bus topology is a network setup in which each computer and network device is connected to a single cable or backbone by tapping them. Depending on the type of network card used in each computer of the bus topology, a coaxial cable or an RJ-45 network cable or optic fiber cable is used to connect them together. Some networks of today are implemented by having a combination of two or more than one topology star and bus, star and ring, ring and bus or ring, bus and star to attain higher efficiency. Networks topologies implemented in this way are said to be hybrids topologies.

A wireless topology is one in which few cables are used to connect systems/devices to the network. The network is made up of transmitters that broadcast the packets using radio frequencies in the air. The network contains special transmitters

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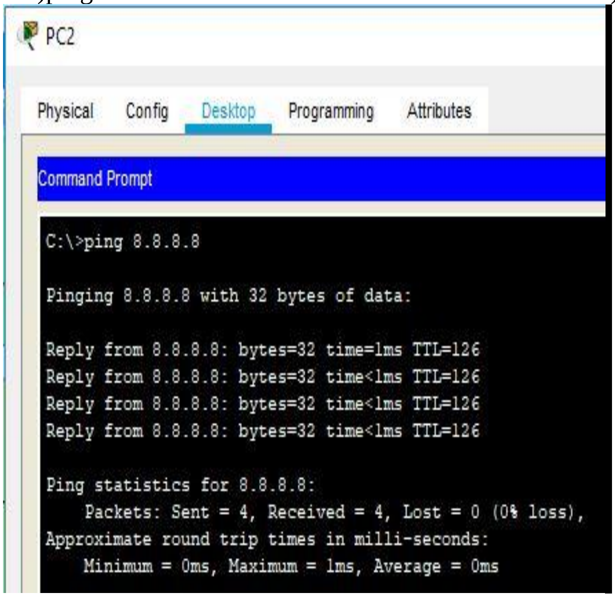
called wireless access points which extend a radio sphere in the shape of a bubble around the transmitter for ex: WIFI connections. Either an ad-hoc or an infrastructure-based implementation can be wireless topology.

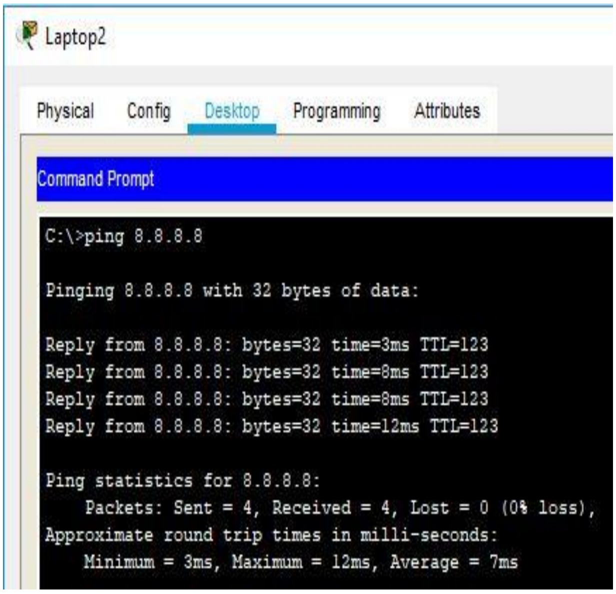
IV. OUTPUTS

The internet service is working efficiently from every corner of the network, the following figures show the pinging to main server from various accessing points,

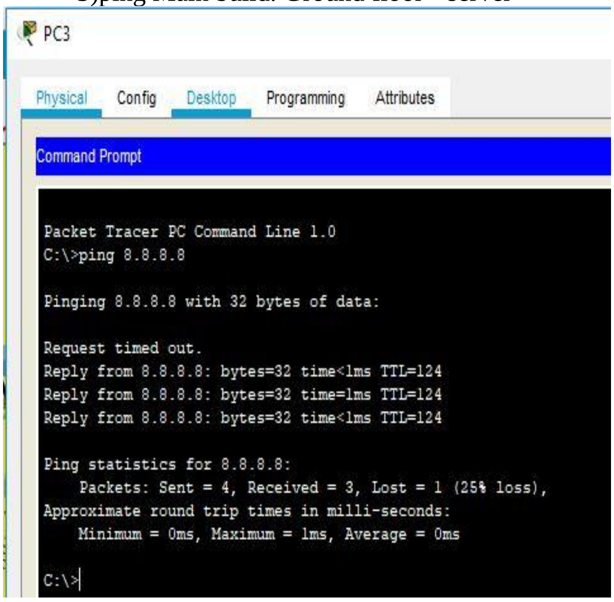
1)ping from data-center to main server



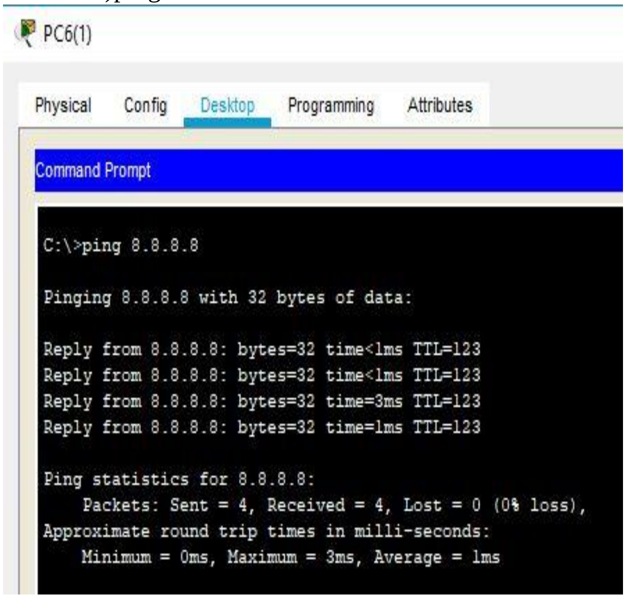
2) ping from main building ground floor wifi to server



3)ping Main build. Ground floor->server



4)ping Main build. 1st floor->server



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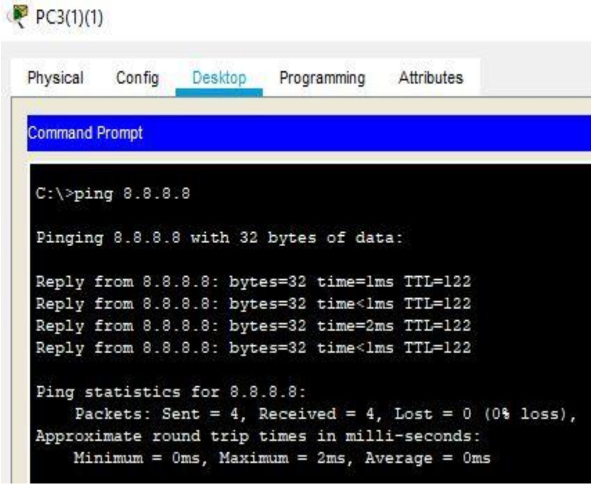
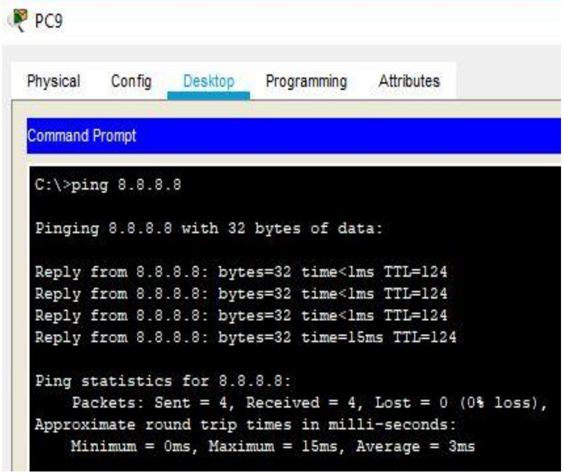
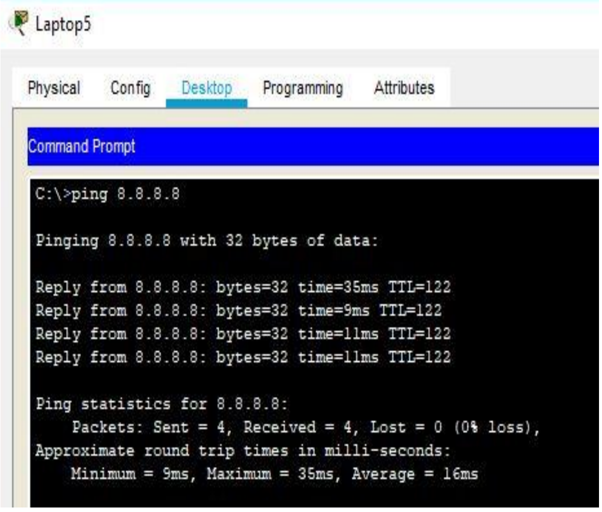
5)ping Main build. 2nd floor->server



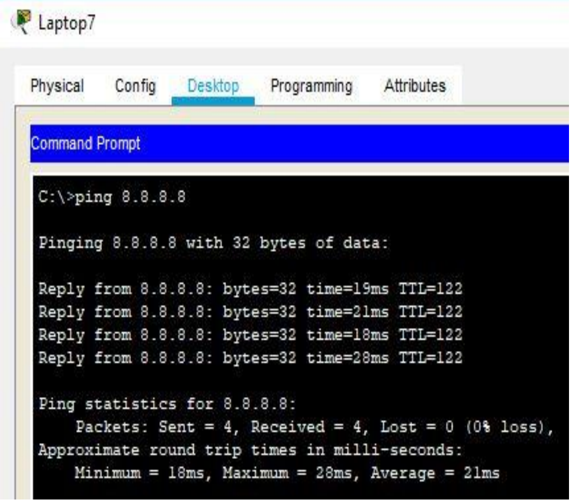
6)ping library->server



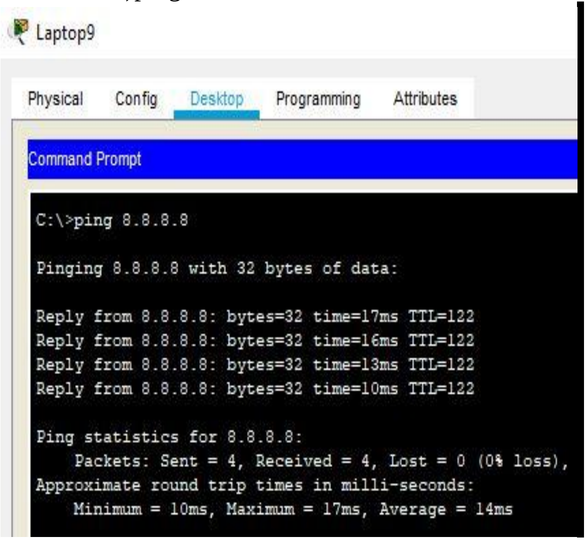
7)ping hostel ground floor->server



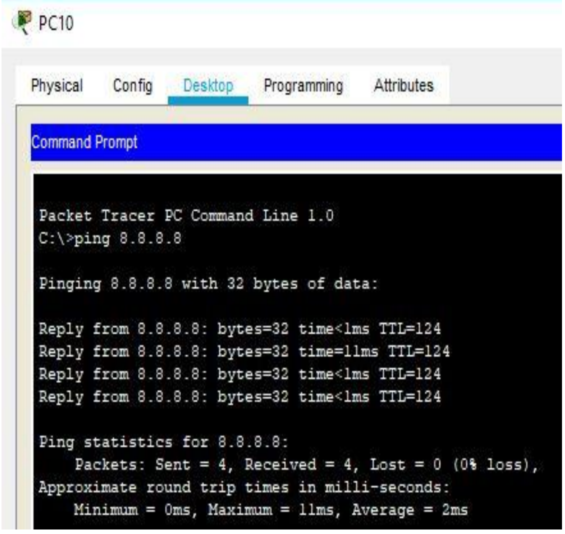
8)ping hostel 1st floor->server



9)ping hostel 2nd floor->server



10)ping hostel office->server



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V. CONCLUSION

Thus, in this way we developed the "College Network Module" using cisco packet tracer for designing the network topology. In this experiment we learnt to how to design and implement the networking module using cisco packet tracer. We successfully implemented the college networking module for the main building, library, and hostel along with the main internet service provider and college server.
It is noteworthy that, the configuration and specifications are for the initial prototype and can further be developed and additional functionality can be added to increase support and coverage as well as security. The procedures provide a veritable approach for the design of LANs for end-to-end IP network connectivity for next generation network (NGN) architecture implementations moreover the security for accessing the network can be increased by making registering the MAC addresses of the devices in the system and then accessing the network by giving the pass keys if the MAC is not registered then that user is unable to connect to the network.

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