University Campus Networking

Submitted by

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with Specialization in Software Engineering

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BONAFIDE CERTIFICATE

Certified that this project report titled **"University Campus Networking"** is the bonafide work done by Gaurav Raj (063), Garv Jaiswal (035), Ashish Prakash Singh(060), Bedanta Gautom (048), Karan Keshri (044) who carried out the Project under my supervision. Certified further, that to the best of my knowledge the work reported herein does not form part of any other work.

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1. ABSTRACT

This project is to design a suitable network system for universities in developing countries. The aim was to design a network with high security and low cost. This project will help to enhanced education of developing countries. The advantages of networking can be seen clearly in terms of efficiency, security, manageability and cost as it allows collaboration between users in a wide area. To improve college campus network design, the technology used was creating LAN, WLAN and using cheap device to reduce cost of the network. But the network can also become better using routing protocols and other protocol. So, we are going to use such protocols using less number of devices and will also maintain the cost of the network less. To design such network, we are going to use software Cisco-Packet Tracer.

2. OBJECTIVE OF THE PROJECT

Computer networks have a significant impact on the working of an organization. Universities depend on the proper functioning and analysis of their networks for education, administration, communication, e-library, automation, etc. An efficient network is essential to facilitate the systematic and cost-efficient transfer of information in an organization in the form of messages, files, and resources. The project provides insights into various concepts such as topology design, IP address configuration, and how to send information in the form of packets to the wireless networks of different areas of a University.

The aim of this project is to design the topology of the university network using the software Cisco Packet Tracer with the implementation of wireless networking systems. This university network consists of the following devices:

1) Router (1941)
2) Switches (2960-24TT)
3) Email server
4) DNS server
5) WEB server (HTTP)
6) Wireless Device (Access Point)
7) PCs
8) Laptops
9) Smartphones

The design includes the following parts of the University:

- Dental College
- Tech Park
- Bio-Tech Block
- Main Campus
- University Building

3. INTRODUCTION

The word “digital is very significant in today’s world, with an increase in the development of technology the entire world is moving towards the digital era. The educational institution plays an important role in this digitalisation; hence the campus should adapt to digital means of networking as well and become a “digital campus”.

Campus networking via wireless connection becomes an important part of campus life and provides the main way for teachers and students to access educational resources, which gives an important platform to exchange information. As laptops and intelligent terminals are widely used, demand for access to information anytime and anywhere has become more and more urgent, but traditional cable networks cannot meet this requirement. Then wireless network construction becomes necessary and essential. The wireless network is one of the important components of a digital campus and wisdom campus. It provides an efficient way to explore the internet with a mobile terminal for teachers and students regardless of cables and places. This is an important mark of the modern campus as a supplement of a cable network. With the development of network and communication technology, cable networks on a university campus bring much convenience for teaching and research work. But for mobility and flexibility, it has obvious shortcomings. A wireless network can overcome these drawbacks and has been applied to the university campus.

PROJECT STATEMENT:

In this mini-project, we defined a simulation of campus networks based on wireless networking. The network is divided into two sets: one for the campus area and the other for the hostel area. Major aim of this project is to show the wireless connectivity that is used in universities to make the network efficient and mobile at the same time. Mobility is the major concentration of this project. In order to provide equal functionality to all the users (college staff and students), we have added DNS, Email, and HTTP servers for the maximum utilization of resources. Hence the campus network provides different services such as connecting the user to the internet, data sharing among users (students, teachers, and different university members), accessing different web services for different functionalities, so it needs wireless networking for smooth processing.

4. LITERATURE REVIEW

- **What is Packet Tracer?**

Packet Tracer is a cross-platform visual simulation tool designed by Cisco Systems that allows users to create network topologies and imitate modern computer networks. The software allows users to simulate the configuration of Cisco routers and switches using a simulated command-line interface. Packet Tracer makes use of a drag-and-drop user interface, allowing users to add and remove simulated network devices as they see fit. The software is mainly focused on Certified Cisco Network Associate Academy students as an educational tool for helping them learn fundamental CCNA concepts. Previously students enrolled in a CCNA Academy program could freely download and use the tool free of charge for educational use.

- **Router**

A router is a device like a switch that routes data packets based on their IP addresses. The router is mainly a Network Layer device. Routers normally connect LANs and WANs together and have a dynamically updating routing table based on which they make decisions on routing the data packets. Router divides broadcast domains of hosts connected through it.

- **Switch**

A network switch (also called switching hub, bridging hub, officially MAC bridge is networking hardware that connects devices on a computer network by using packet switching to receive and forward data to the destination device. A network switch is a multiport network bridge that uses MAC addresses to forward data at the data link layer (layer 2) of the OSI model. Some switches can also forward data at the network layer (layer 3) by additionally incorporating routing functionality. Such switches are commonly known as layer-3 switches or multilayer switches.

- **Network Packet**

A network packet is a formatted unit of data carried by a packet-switched network. A packet consists of control information and user data, which is also known as the payload.

- **Server**

A server is a computer or system that provides resources, data, services, or programs to other computers, known as clients, over a network. In theory, whenever computers share resources with client machines they are considered servers. There are many types of servers, including web servers, mail servers, and virtual servers.

Many networks contain one or more of the common servers. The servers used in our project are as follows:

➢ **DNS Server**

DNS stands for Domain Name System servers which are application servers that provide a human-friendly naming method to the user computers in order to make IP addresses readable by users. The DNS system is a widely distributed database of names and other DNS servers, each of which can be used to request an otherwise unknown computer name. When a user needs the address of a system, it sends a DNS request with the name of the desired resource to a DNS server. The DNS server responds with the necessary IP address from its table of names.

➢ **WEB Server**

One of the widely used servers in today's market is a web server. A web server is a special kind of application server that hosts programs and data requested by users across the Internet

or an intranet. Web servers respond to requests from browsers running on client computers for web pages, or other web-based services.

- **Wireless Network**

A wireless network broadcasts an access signal to the workstations or PCs. This enables mobility among laptops, tablets, and PCs from room to room while maintaining a firm network connection continuously. A wireless network also presents additional security requirements.

- **Ethernet**

This is the backbone of our network. It consists of the cabling and is typically able to

transfer data at a rate of 100mb/s. It is a system for connecting a number of computer systems to form a local area network, with protocols to control the passing of information and to avoid simultaneous transmission by two or more systems. Among the different types of ethernet, we have used Gigabit Ethernet, which is a type of Ethernet network capable of transferring data at a rate of 1000 Mbps and fast Ethernet is a type of Ethernet network that can transfer data at a rate of 100 Mbps.

- **Computing Device**

Computing devices are the electronic devices that take user inputs, process the inputs, and then provide us with the end results. These devices may be Smartphones, PC Desktops, Laptops, printer, and many more.

- **Internet Protocol**

Internet Protocol (IP) is one of the fundamental protocols that allow the internet to work. IP addresses are a unique set of numbers on each network and they allow machines to address each other across a network. It is implemented on the internet layer in the IP/TCP model.

- **SSH Protocol**

Secure Shell enables a user to access a remote device and manage it remotely. However, with SSH, all data transmitted over a network (including usernames and passwords) is encrypted and secure from eavesdropping.

SSH is a client-server protocol, with an SSH client and an SSH server. The client machine (such as a PC) establishes a connection to an SSH server running on a remote device (such as a router). Once the connection has been established, a network admin can execute commands on the remote device.

- **Benefits of wireless networking over wired networking**

To better understand the wide usage of wireless networking in today's world, is to start with the benefits it has over traditional wired networking is crucial for our project implementation. Some major aspects have been stated below that show the various advantages of a wireless network over wired ones.

1. Mobility

One of the major advantages of wireless is mobility. Users have the freedom to move within the area of the network with their computing devices staying connected to a network without being concerned about the cable connection.

2. Less Hassle

The wireless network helps in the reduction of large amounts of cables or wires which becomes chaotic and difficult to maintain, it makes the connection hassle-free.

3. Accessibility

Provide network access across your organization, even in areas that have been challenging to reach with the wired network, so your entire team can stay in touch.

4. Expandability

The wireless network helps in the expansion of the network to a wide range by adding multiple new users and locations without additional need to run cables and wires.

5. Guest Access

Offer secure network access to guest users, including customers and business partners, while keeping your network resources protected.

With lots of advantages, there come disadvantages as well, like security issues which can be resolved using strict protection passwords. Also, the Speed of wireless networks is considered to be slow and having low bandwidth when compared to the direct cable connection networks.

- Simulation Environment

The simulations of our network topology can be easily achieved using cisco packet tracer. Using a simulation mode, you can see packets flowing from one node to another and can also click on a packet to see detailed information about the OSI layers of the networking. Packet Tracer offers a huge platform to combine realistic simulation and visualize them

simultaneously. Cisco Packet Tracer makes learning and teaching significantly easier by supporting multi-user collaboration and by providing a realistic simulation environment for experimenting with projects.

Routing Information Protocol (RIP)

Routing Information Protocol (RIP) is a dynamic routing protocol that uses hop count as a routing metric to find the best path between the source and the destination network. It is a distance-vector routing protocol that has an AD value of 120 and works on the Network layer of the OSI model. RIP uses port number 520.

Hop Count

Hop count is the number of routers occurring in between the source and destination network. The path with the lowest hop count is considered as the best route to reach a network and therefore placed in the routing table. RIP prevents routing loops by limiting the number of hops allowed in a path from source and destination. The maximum hop count allowed for RIP is 15 and a hop count of 16 is considered as network unreachable.

Features of RIP

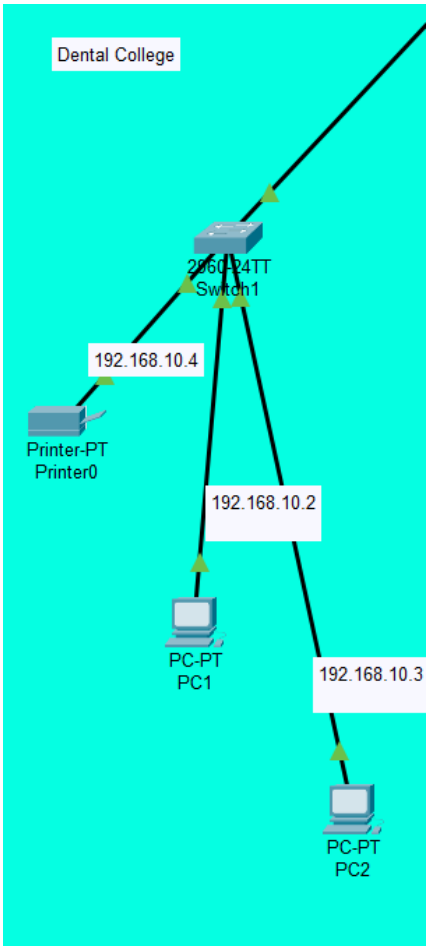
1. Updates of the network are exchanged periodically.
2. Updates (routing information) are always broadcast.
3. Full routing tables are sent in updates.
4. Routers always trust routing information received from neighbor routers. This is also known as *Routing on* rumors.

5. MODULES IN THE PROJECT

1. Dental College
2. University Building
3. Bio Tech Block
4. Tech Park
5. Main Campus

6. DESCRIPTION OF THE MODULES IN THE PROJECT

1) **Dental College**



IP Configuration of the module:

PC1- 192.168.10.2

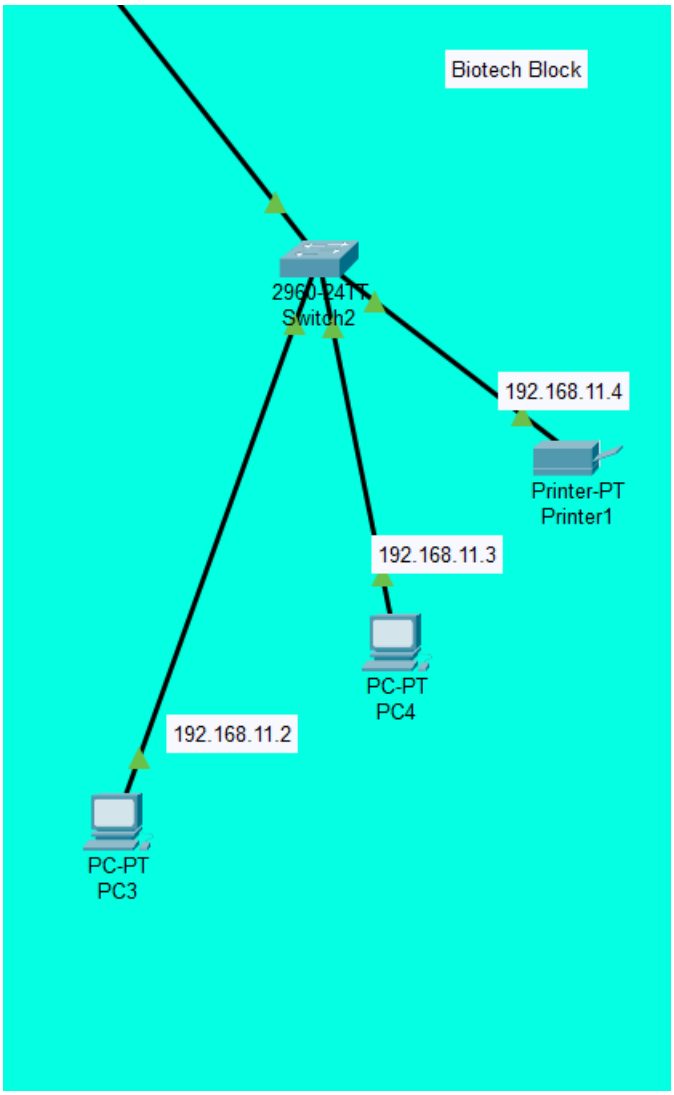
PC2-192.168.10.3

Printer0-192.168.10.4

Default Gateway- 192.168.10.1

Subnet Mask- 255.255.255.0

2) **BioTech Block**



IP Configuration of the module:

PC3- 192.168.11.2

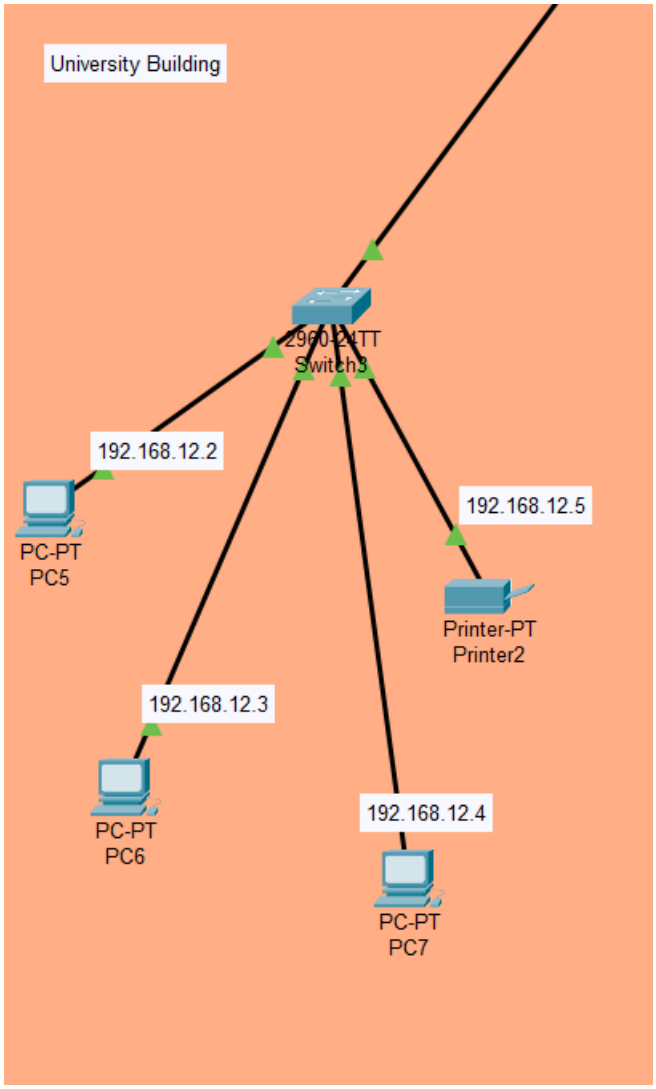
PC4-192.168.11.3

Printer1-192.168.11.4

Default Gateway- 192.168.11.1

Subnet Mask- 255.255.255.0

3) University Building



IP Configuration of the module:

PC5- 192.168.12.2

PC6-192.168.12.3

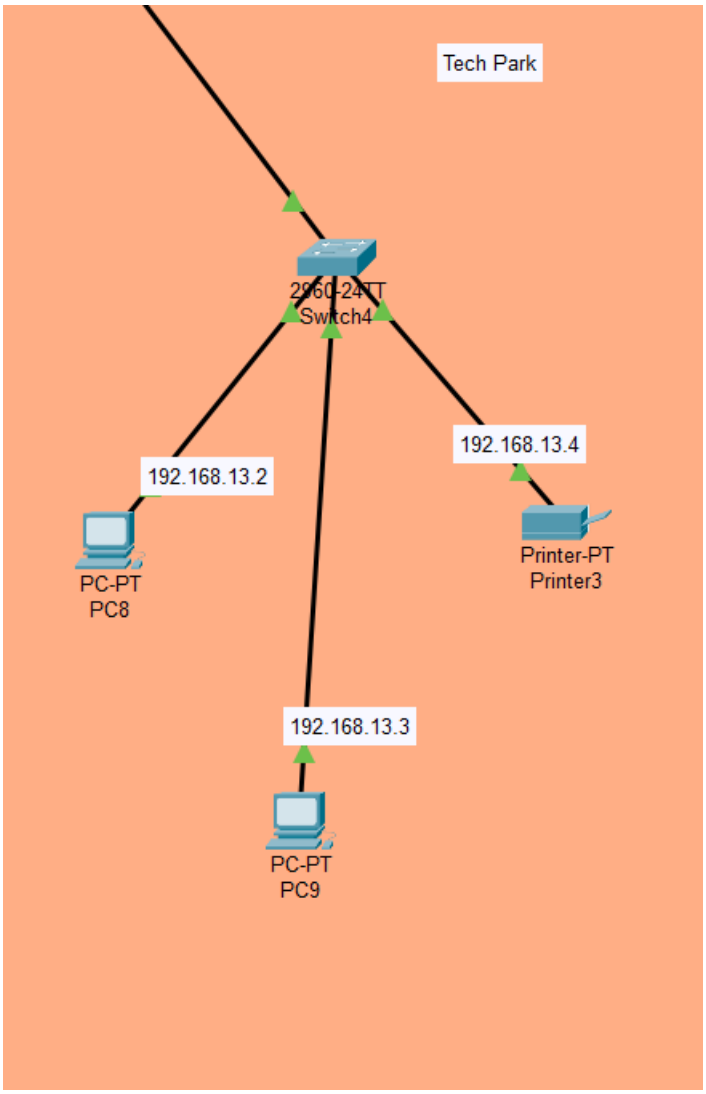
PC7-192.168.12.4

Printer2-192.168.12.5

Default Gateway- 192.168.12.1

Subnet Mask- 255.255.255.0

4) **Tech Park**



IP Configuration of the module:

PC8- 192.168.13.2

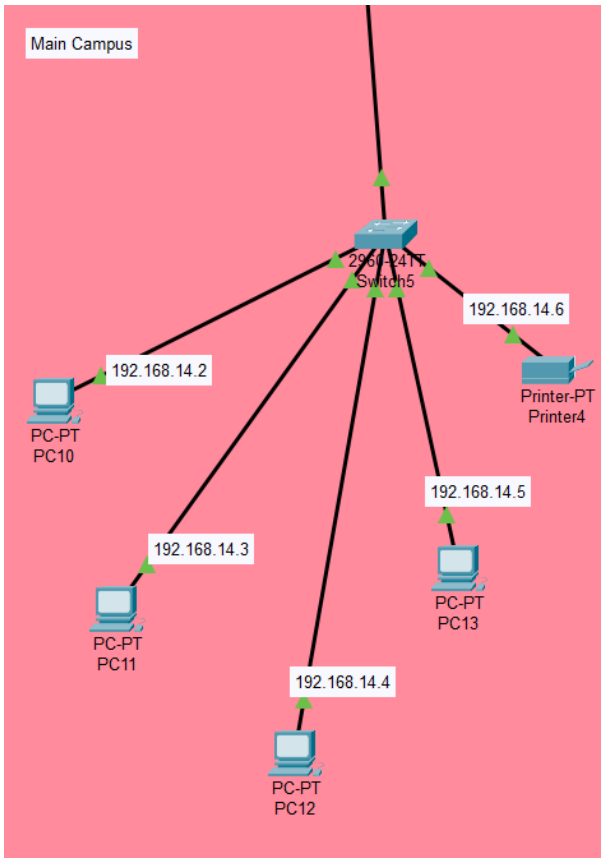
PC9-192.168.13.3

Printer3- 192.168.13.4

Default Gateway- 192.168.13.1

Subnet Mask- 255.255.255.0

5) Main Campus



IP Configuration of the module:

PC10- 192.168.14.2

PC11-192.168.14.3

PC12-192.168.14.4

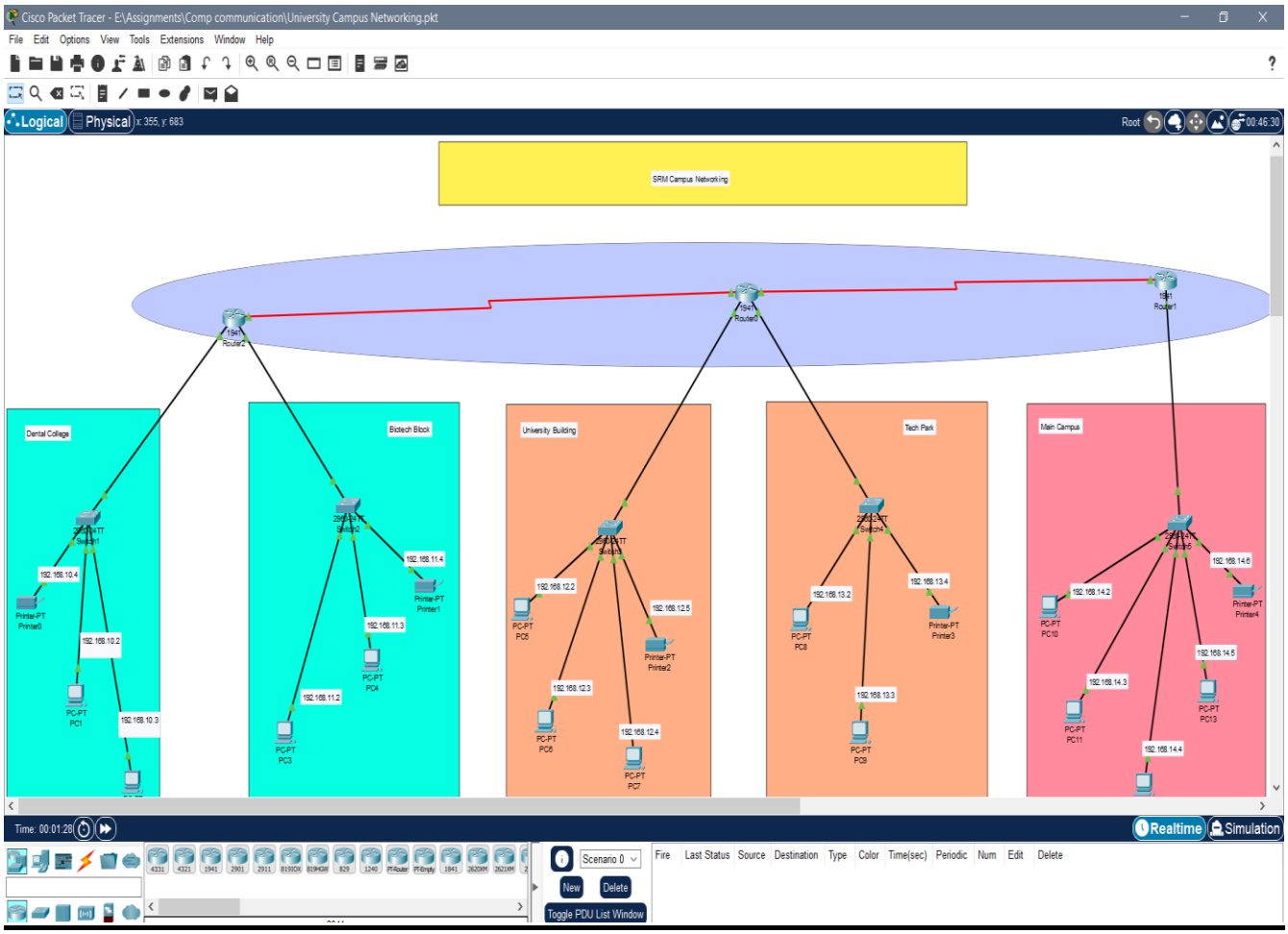
PC13-192.168.14.5

PC14-192.168.14.6

Default Gateway- 192.168.14.1

Subnet Mask- 255.255.255.0

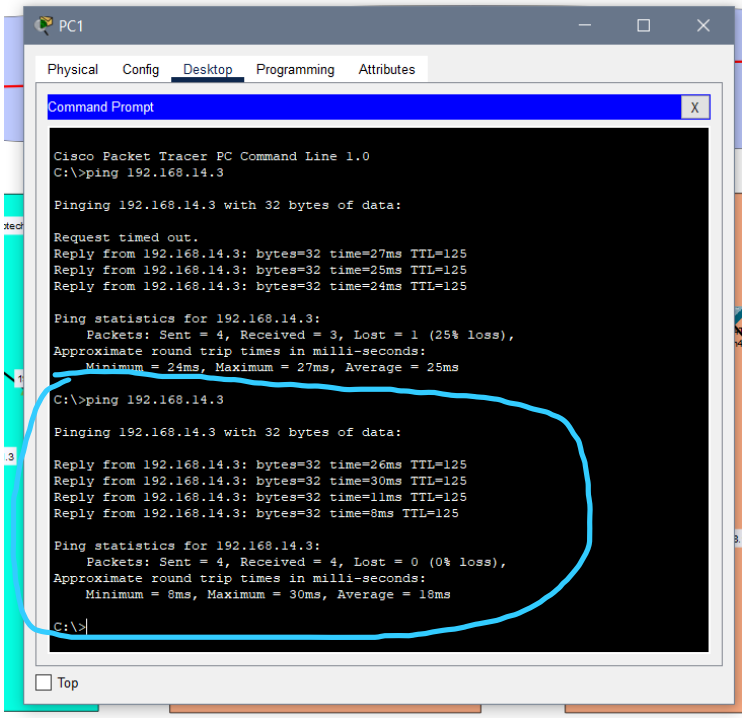
7. PROJECT Screenshot



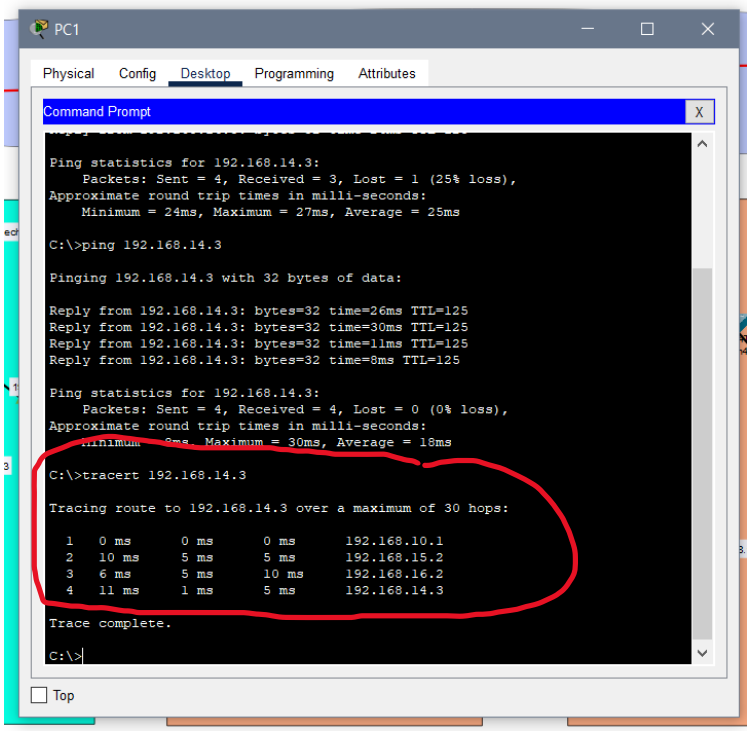
8. Results and Inferences

Results:-

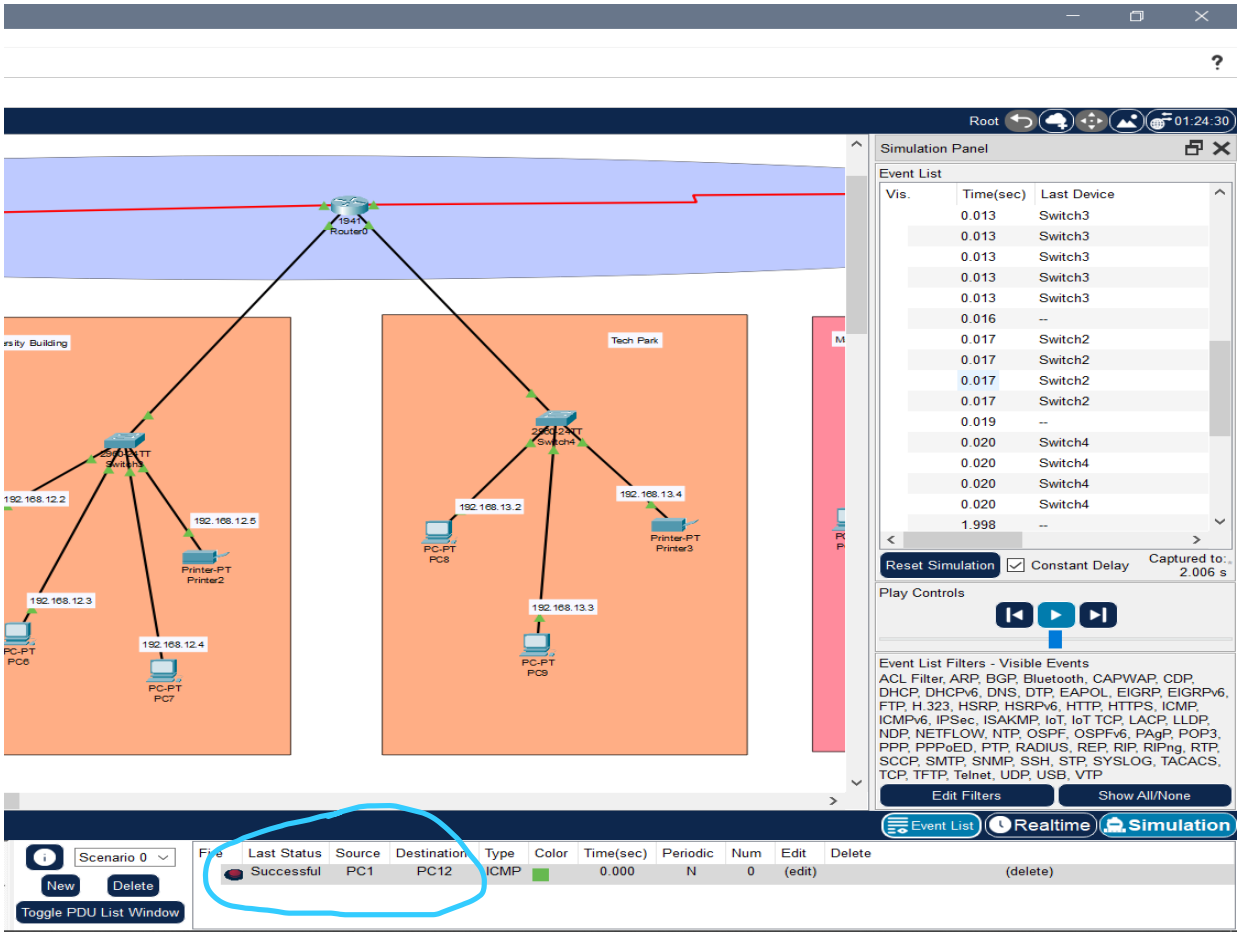
Ping test from PC1 (192.168.10.2) to PC11 (192.168.14.3) to check for connectivity:-



Tracert test for 192.168.14.3 to see all the hops:-



Sending message from one PC to another to check proper connection :-



- **Inference**

We started our discussion with the word “digitalization” and in order to achieve it, we aimed to start with an educational institute, and finally, we designed a network for a University, which is wireless. As we mentioned, mobility and efficiency are the key aspects of wireless networks, which were our main goal, and hence, we decided to shift to a wireless network instead of a wired one, making our network clean and less chaotic.

In this project, we designed a University Network using Cisco Packet Tracer that uses a networking topology implemented using servers, routers, switches, and end devices in a multiple area networks. We have covered all the necessary features that are required for a network to function properly. We have included a DNS server and a web server for establishing a smooth communication system between different areas of our network and specifically for the communication between students and teachers. We have included an email server to facilitate intra university communication through emails within the domain. We have used console passwords and ssh protocol to ensure a safe and secure transfer of data.

9. REFERENCES

Books:-

- Data and Computer communication by William Stallings
- Computer Communication and Network technologies by Bill Hancock

Websites:-

- www.geeksforgeeks.org
- www.ibm.com
- www.javatpoint.com

----------The End----------