College Area Network
Using Cisco Packet Tracer

Duration

15th August, 2023 – 18th September, 2023

By:

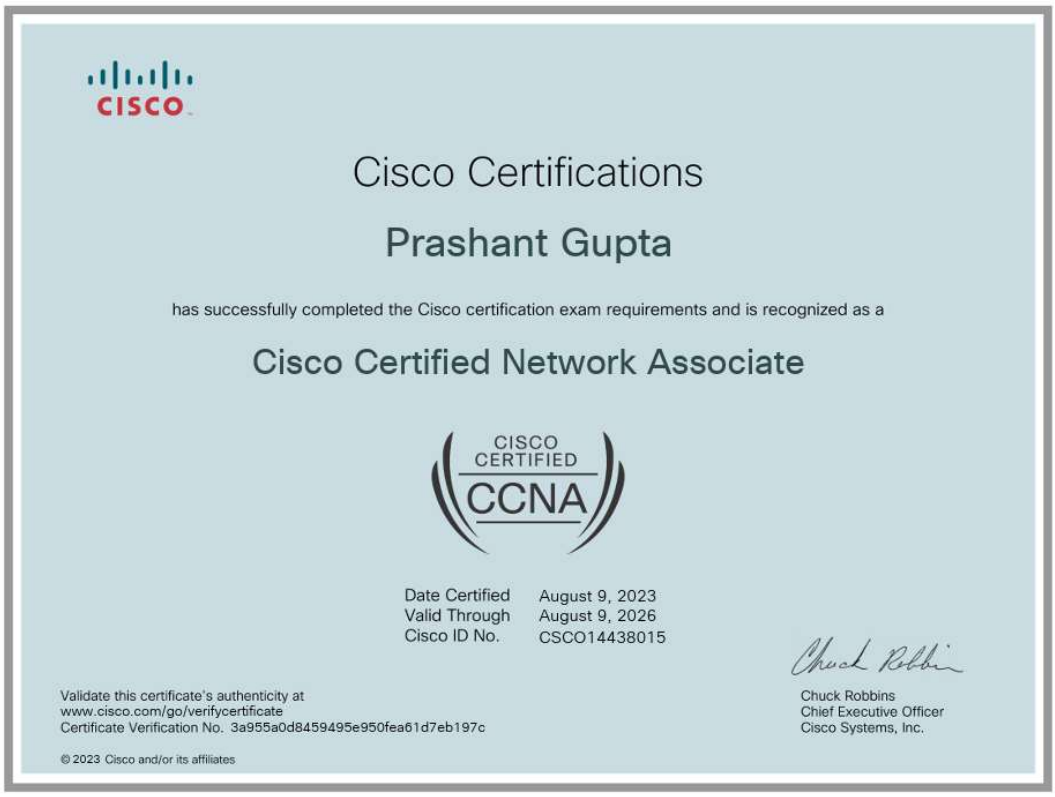
Prashant Gupta(04376803120/IT-3/2020-24)

At:

CCNA

By Cisco

CERTIFICATE



ACKNOWLEDGEMENT

I would like to express my great gratitude towards our supervisors at CISCO, who has given us support and suggestions. Without their help I could not have presented this dissertation up to the present standard. I also take this opportunity to thank all others who gave us support for the project or in other aspects of our study at Guru Tegh Bahadur Institute of Technology, Guru Gobind Singh Indraprastha University, Delhi.

Date: / / .

Prashant Gupta

(04376803120/IT-3/2024)

prashant46820@gmail.com

ABSTRACT

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:
Common Room: Boys Common Room and Girls Common Room
Academic Blocks: Lecture Block and Lab Block
BVS Block and Exam Cell
Library

CONTENTS

Introduction

INTRODUCTION TO THE PROJECT:

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 digitalization, hence the campus should adapt to digital means of networking as well and become a “digital campus”. Going wireless plays an important role in this digitalization. The wireless network makes the connection easy with a reduction in the use of wires or cables. A wired connection makes it difficult to keep track of all the devices and to manage the cable connection, which is not only chaotic but also challenging to handle.

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.

WHAT THE SYSTEM MAINLY CONSISTS OF:

Computer Networking

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.
The 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.

HARDWARE
AND
SOFTWARE
REQUIREMENTS

INTRODUCTION

In this chapter we mentioned the software and hardware requirements, which are necessary for successfully running this system. The major element in building systems is selecting compatible hardware and software. The system analyst has to determine what software package is best for "Networking in College Using Cisco Packet Tracer" and, where software is not an issue, the kind of hardware and peripherals needed for the final conversion.

SYSTEM ENVIRONMENT:

After analysis, some resources are required to convert the abstract system into the real one. The hardware and software selection begins with requirement analysis, followed by a request for proposal and vendor evaluation.

Software and real system are identified. According to the provided functional specification all the technologies and its capacities are identified.

Basic functions and procedures and methodologies are prepared to implement.

Some of the Basic requirements such as hardware and software are described as follows: -

HARDWARE AND SOFTWARE SPECIFICATION:

SOFTWARE REQUIREMENTS:

- Operating systems : Windows 10
- Coding Language : Python 3.8
- Web Framework : Google colab, Jupyter

HARDWARE REQUIREMENTS:

- System : Pentium i3 Processor
- Hard Disk : 500 GB
- Monitor : 15” LED
- Input Devices : Keyboard, Mouse
- Ram : 4 GB

SYSTEM ANALYSIS

PURPOSE:

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.

PROJECT SCOPE:

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.

The 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.

TOOLS
AND
TECHNOLOGIES

1. Cisco Packet Tracer

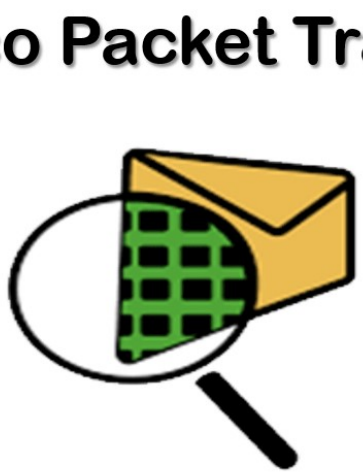


Figure : Cisco Packet Tracer

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 towards Cisco Networking 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.

Packet Tracer can be run on Linux, Microsoft Windows, and mac OS. Similar Android and iOS apps are also available. Packet Tracer allows users to create simulated network topologies by dragging and dropping routers, switches and various other types of network devices. A physical connection between devices is represented by a 'cable' item. Packet Tracer supports an array of simulated Application Layer protocols, as well as basic routing with RIP, OSPF, EIGRP, BGP, to the extents required by the

current CCNA curriculum. As of version 5.3, Packet Tracer also supports the Border Gateway Protocol.

In addition to simulating certain aspects of computer networks, Packet Tracer can also be used for collaboration. As of Packet Tracer 5.0, Packet Tracer supports a multi-user system that enables multiple users to connect multiple topologies together over a computer network. Packet Tracer also allows instructors to create activities that students have to complete. Packet Tracer is often used in educational settings as a learning aid. Cisco Systems claims that Packet Tracer is useful for network experimentation.

Packet Tracer allows students to design complex and large networks, which is often not feasible with physical hardware, due to costs. Packet Tracer is commonly used by NetAcad students, since it is available to them for free. However, due to functional limitations, it is intended by Cisco to be used only as a learning aid, not a replacement for Cisco routers and switches. The application itself only has a small number of features found within the actual hardware running a current Cisc IOS version. Thus, Packet Tracer is unsuitable for modelling production networks. It has a limited command set, meaning it is not possible to practice all of the IOS commands that might be required. Packet Tracer can be useful for understanding abstract networking concepts, such as the Enhanced Interior Gateway Routing Protocol by animating these elements in a visual form. Packet Tracer is also useful in education by providing additional components, including an authoring system, network protocol simulation and improving knowledge an assessment system.

SYSTEM DESIGN

1. Brief knowledge about our approach

The proposed wireless network is implemented for a university campus. We have made a virtual visualization of the network using the Cisco Packet tracer which provides a huge platform for users to test their projects using simulation tools. A Wireless network in an educational campus makes it easier for teachers and students to access educational resources, by enabling an important platform to exchange information.

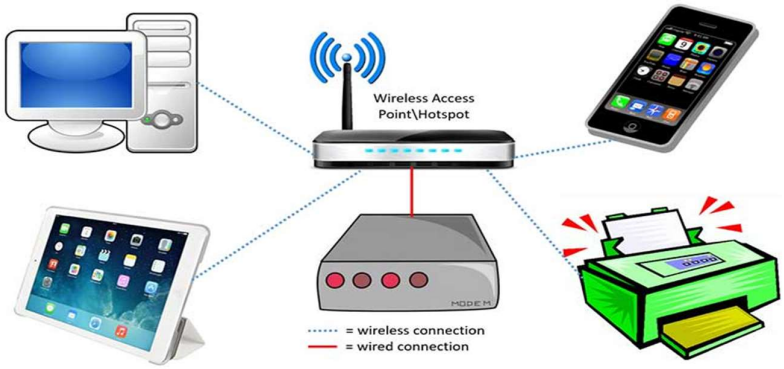


Figure : Shows the wireless connection access by various tool

2. Network Requirements

Manipal University Jaipur outline is considered for this wireless university network. The network is divided into 2 areas :

1. Campus Area
   The Campus area is further divided into various accessing points like Dome building, Library, Academic Blocks (AB1 and AB2), Server Center, and IT consulting.
2. Hostel Area
   The Hostel area is further divided into Boys blocks and Girls blocks respectively.

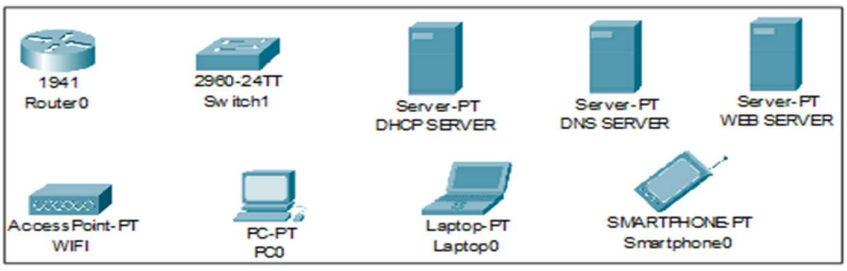


Figure : Devices used in the network

Devices Used In The Network

Devices	Quantity
1) Router (1941)	3
2) Switches (2960-24TT)	3
3) EMAIL server	1
4) DNS server	1
5) WEB server (HTTP)	1
6) Wireless Device (Access Point)	7
7) PCs	12
8) Laptops	10
9) Smartphones	2

3. Implementation and Flow Diagram

- To design the wireless network of the university we initially started by placing the core devices into the frame as mentioned in the layout.

- Firstly, we placed the **main router** at the center of the university outline, which was further connected to the **server switch** using the gigabit ethernet port with copper straight-through cable and sub routers (**campus router and common room router**) using the serial port with serial DCE cable at the hostel area and campus area respectively.

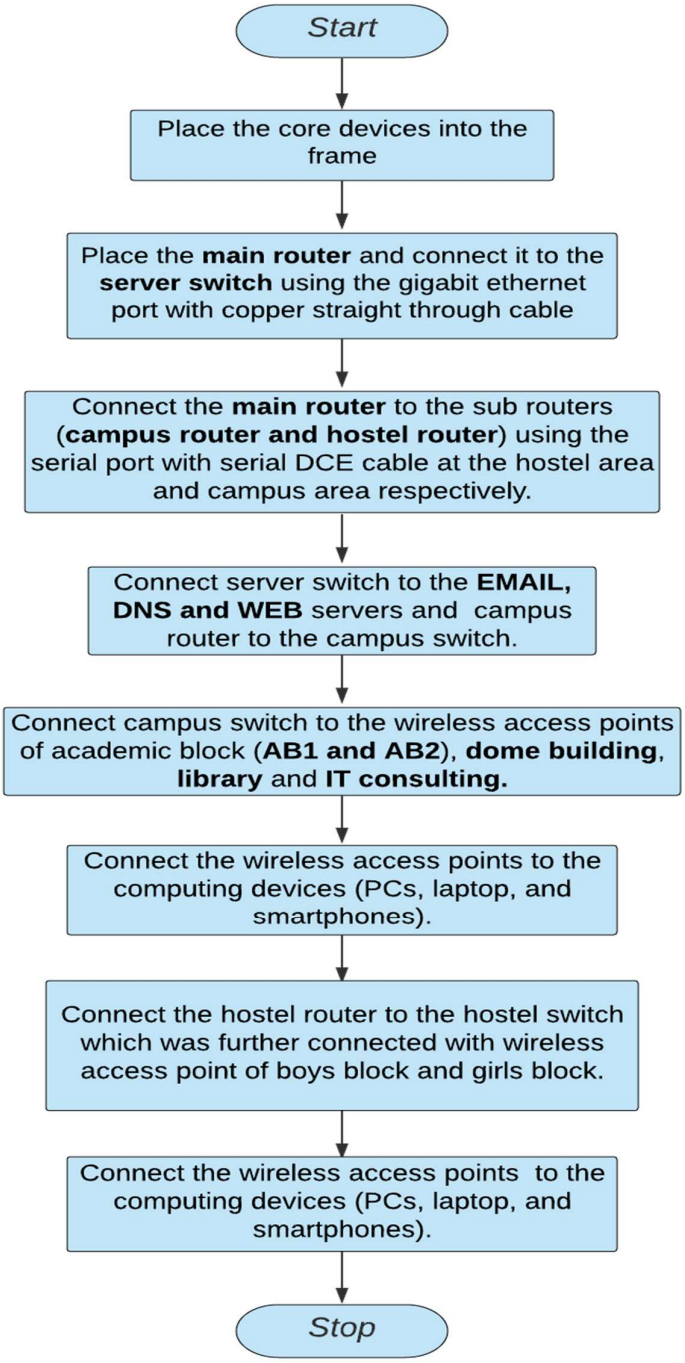
- The server switch was further connected to the **EMAIL, DNS, and WEB** servers respectively.
- Campus router was connected to the campus switch which was further connected with wireless access points of the academic block (**Lecture Block and Lab Block**), **BVS Block**, **library,** and **Exam Cell.**

- The wireless access points were then connected to computing devices (PCs, laptops, and smartphones).

- Similarly, the common room router was connected to the switch which was further connected with the wireless access point of boy common room and girls common room.

- The wireless access points were then connected to the computing devices (PCs, laptops, and smartphones), every area has a dedicated access point which can only be connected with the help of a password.

- All these connections are made through ethernet ports (gigabit ethernet and fast ethernet) using copper straight-through cables.

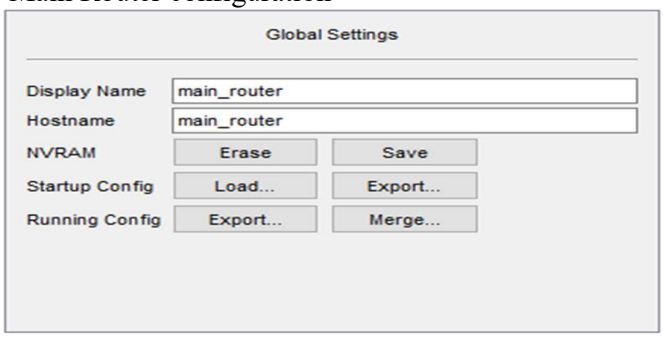


This is the flow diagram for a better understanding of the steps mentioned above.

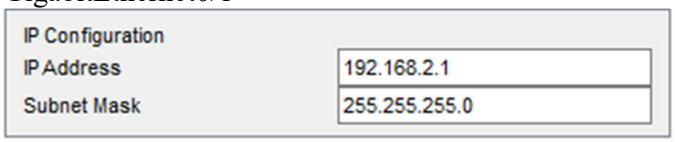
4. Configuring IP Addresses

We have attached the screenshots of all the IP configuration below:

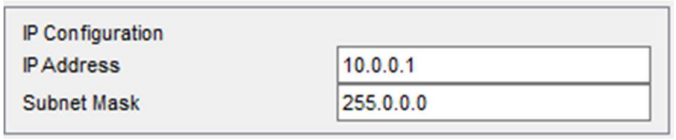
- Main Router configuration



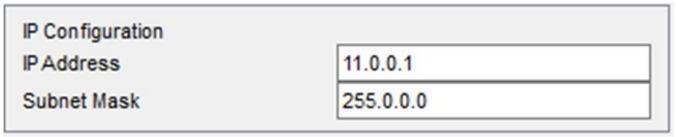
GigabitEthernet0/1



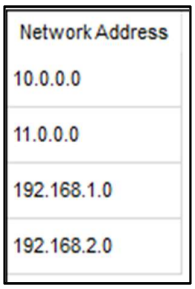
Serial0/1/0



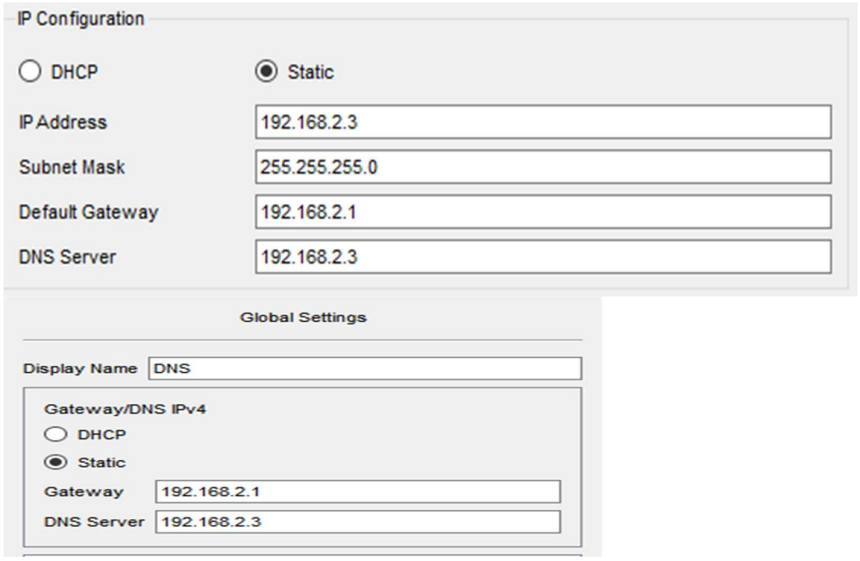
Serial0/1/1



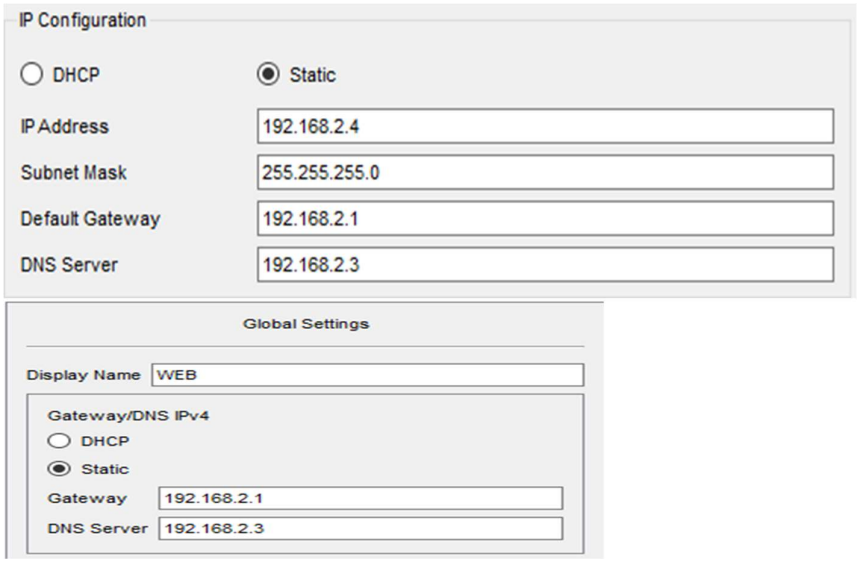
RIP



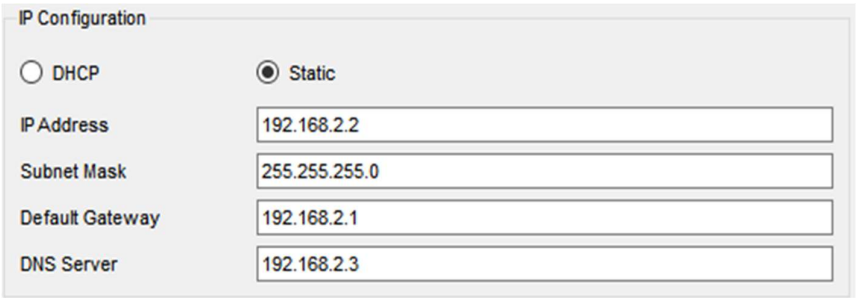
- DNS SERVER

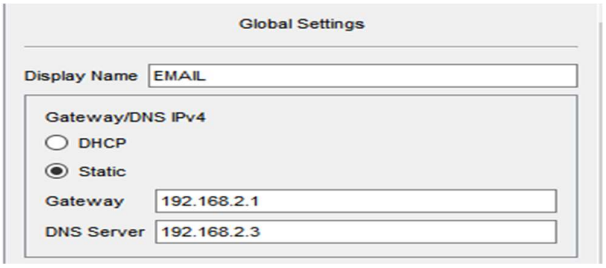


- WEB SERVER



- EMAIL SERVER

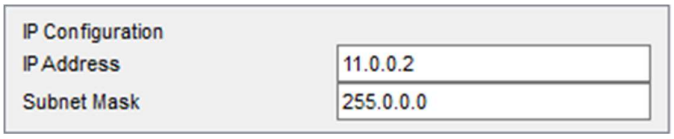




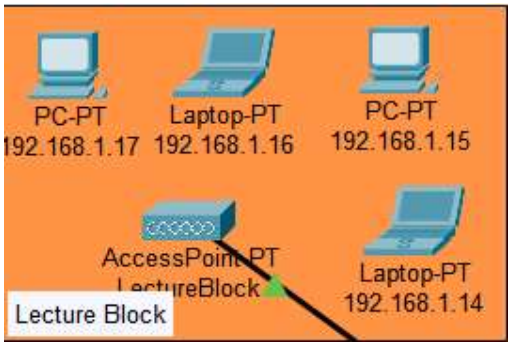
- COLLEGE ROUTER

GigabitEthernet0/0

Serial0/1/0

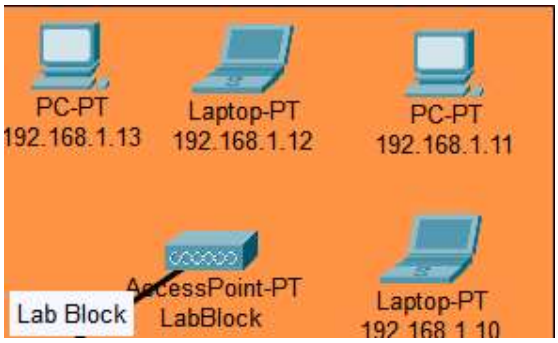


- LECTURE BLOCK



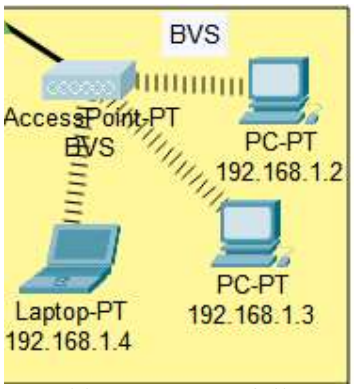
IP Address are as follows
192.168.1.14- Laptop
192.168.1.15- PC
192.168.1.16- Laptop
192.168.1.17- PC
Subnet Mask- 255.255.255.0
Default Gateway- 192.168.1.1
DNS Server- 192.168.2.3

- LAB BLOCK



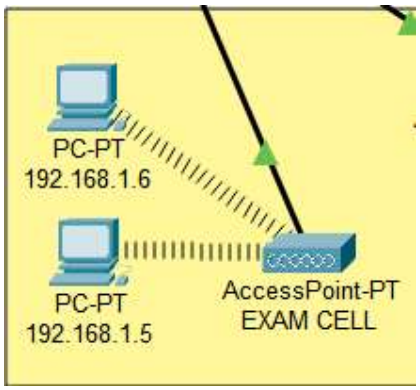
IP Address are as follows
192.168.1.10- Laptop
192.168.1.11- PC
192.168.1.12- Laptop
192.168.1.13- PC
Subnet Mask- 255.255.255.0
Default Gateway- 192.168.1.1
DNS Server- 192.168.2.3

- BVS BLOCK



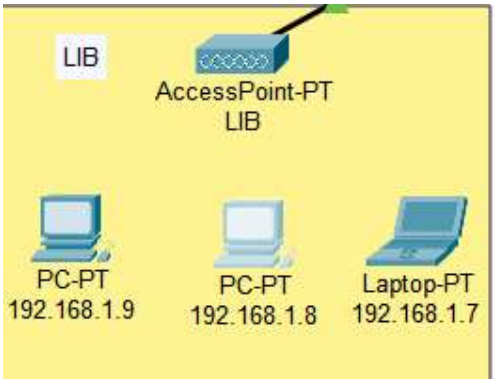
IP Addresses are as follows
192.168.1.2- PC
192.168.1.3- PC
192.168.1.4- Laptop
Subnet Mask- 255.255.255.0
Default Gateway- 192.168.1.1
DNS Server- 192.168.2.3

- EXAM CELL



IP Addresses are as follows
192.168.1.5- PC
192.168.1.6- PC
Subnet Mask- 255.255.255.0
Default Gateway- 192.168.1.1
DNS Server- 192.168.2.3

- LIBRARY

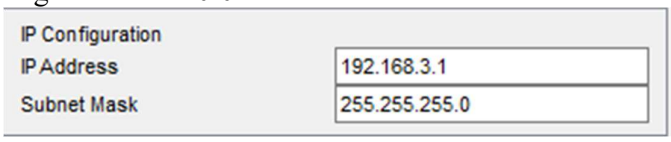


IP Addresses are as follows
192.168.1.7- Laptop
192.168.1.8- PC
192.168.1.9- PC
Subnet Mask- 255.255.255.0
Default Gateway- 192.168.1.1
DNS Server- 192.168.2.3

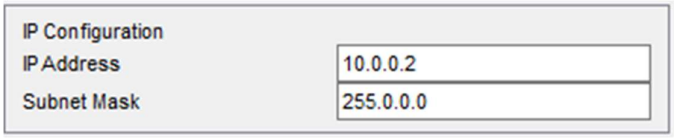
- Common Room ROUTER

Network Address
10.0.0.0
192.168.3.0

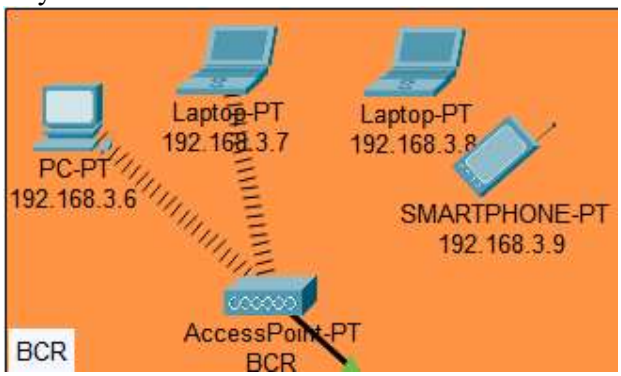
GigabitEthernet0/0



Serial0/1/0

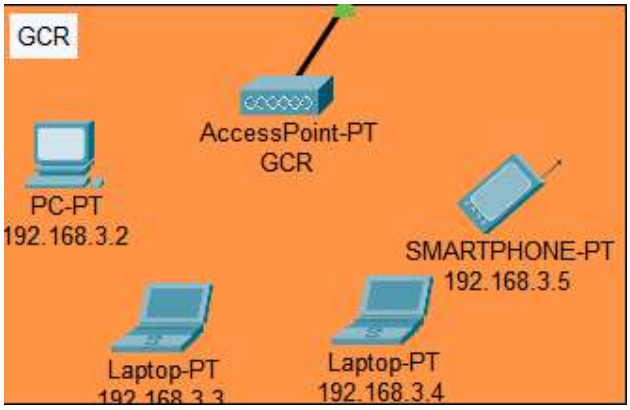


- Boys Common Room



IP Addresses are as follows
192.168.3.6- PC
192.168.3.7-Laptop
192.168.3.8- PC
192.168.3.9- Smartphone
Subnet Mask- 255.255.255.0
Default Gateway- 192.168.3.1
DNS Server- 192.168.2.3

- Girls Common Room



IP Addresses are as follows
192.168.3.2- PC
192.168.3.3-Laptop
192.168.3.4- PC
192.168.3.5- Smartphone
Subnet Mask- 255.255.255.0
Default Gateway- 192.168.3.1
DNS Server- 192.168.2.3

- WIRELESS ACCESS POINT

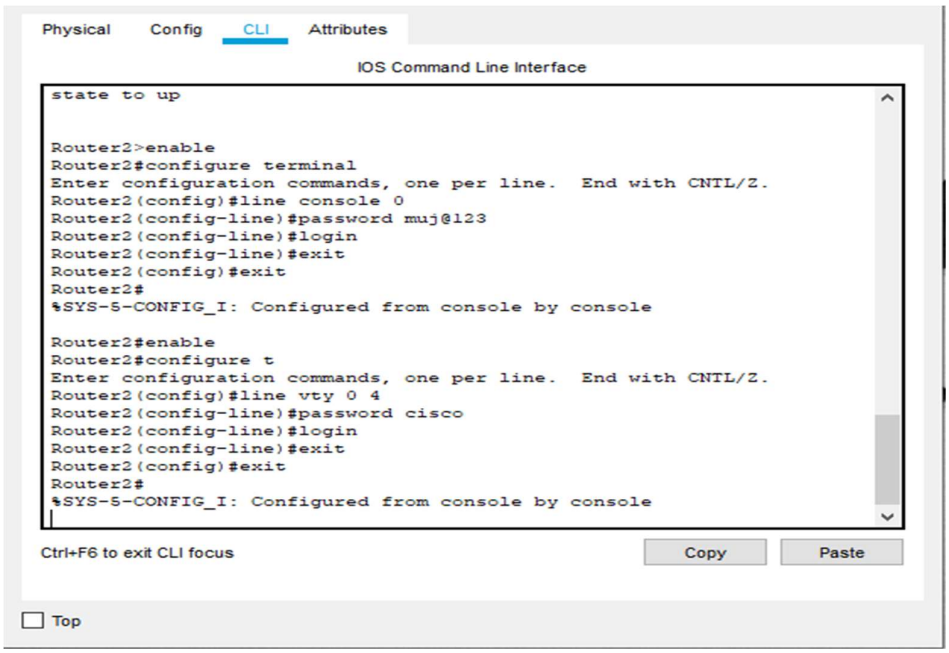
SSID	Password
1) GTBIT_LIB	1234567890
2) GTBIT_ GTBIT_ExamCell	1234567890
3) GTBIT_BVS	1234567890
4) GTBIT_LectureBlock	1234567890
5) GTBIT_LabBlock	1234567890
6) GTBIT_BCR	1234567890
7) GTBIT_GCR	1234567890

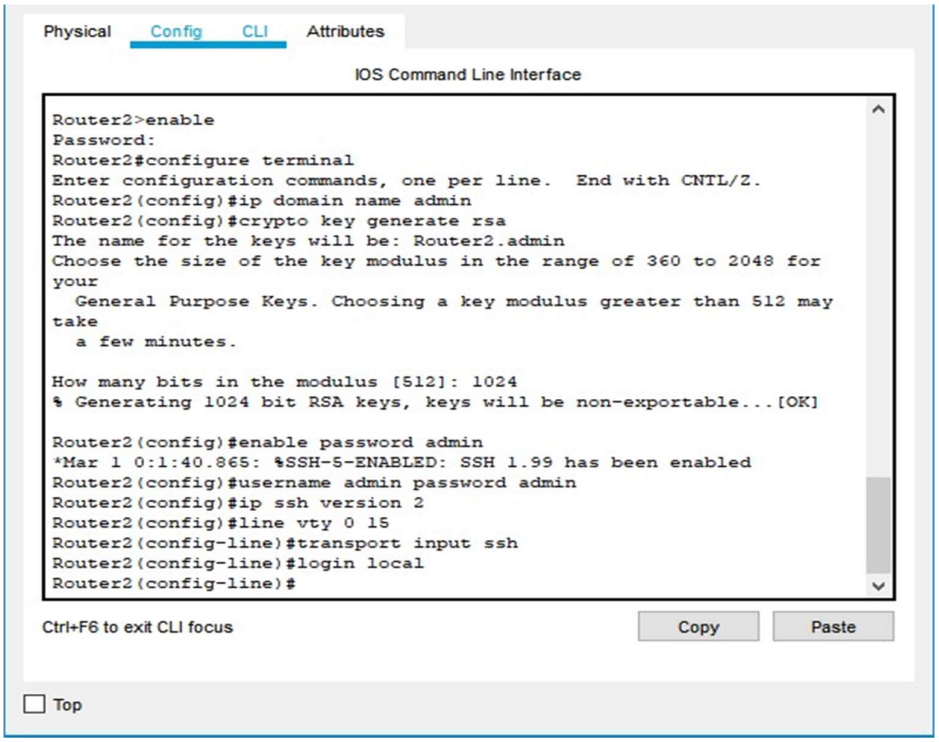
5. Securing the network

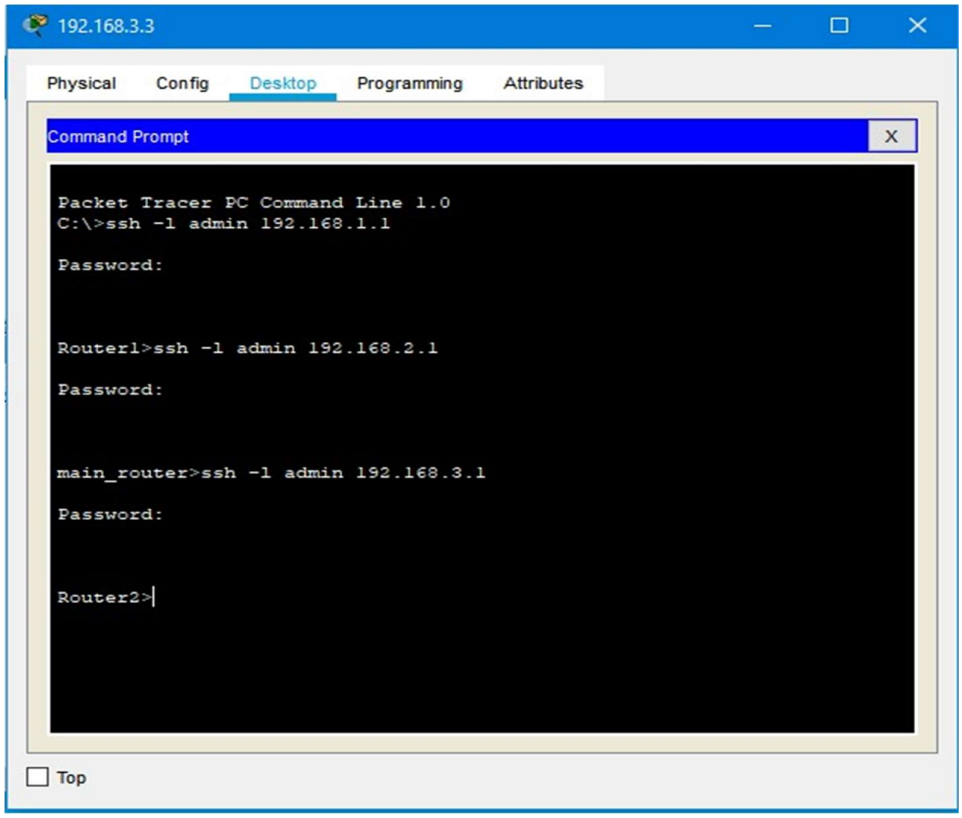
Passwords are used in accessing the router and all the wireless networks (mentioned in step 5 wireless access point) to make the access limited to University authorized users only.

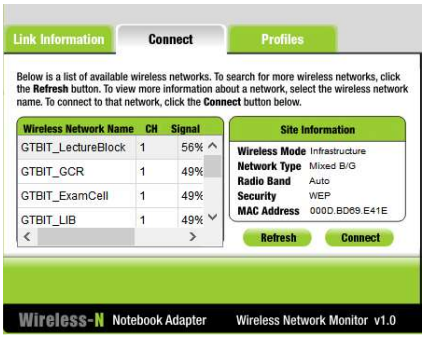
Routers are also secured with ssh (Secure Shell). Routers and their assigned passwords are mentioned below:

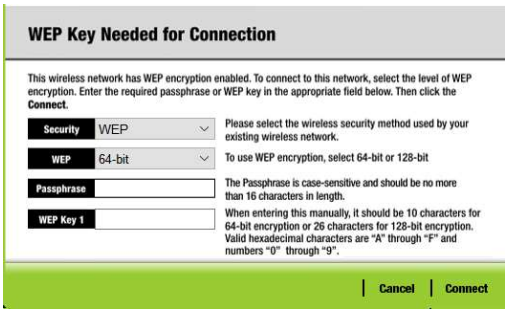
Router Name	Passwords
1)main_router	Console password: cisco ssh password: admin
2)Router1(College Router)	Console password: gtbit@123 ssh password: admin
3)Router2(Common Room Router)	Console password: gtbit@123 ssh password: admin


Physical
Config
CLI
Attributes
IOS Command Line Interface
state to up
Router2>enable
Router2#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router2(config)#line console 0
Router2(config-line)#password muj@123
Router2(config-line)#login
Router2(config-line)#exit
Router2(config)#exit
Router2#
%SYS-5-CONFIG_I: Configured from console by console
Router2#enable
Router2#configure t
Enter configuration commands, one per line. End with CNTL/Z.
Router2(config)#line vty 0 4
Router2(config-line)#password cisco
Router2(config-line)#login
Router2(config-line)#exit
Router2(config)#exit
Router2#
%SYS-5-CONFIG_I: Configured from console by console
Ctrl+F6 to exit CLI focus
Copy
Paste
Top


Physical
Config
CLI
Attributes
IOS Command Line Interface
Router2>enable
Password:
Router2#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router2(config)#ip domain name admin
Router2(config)#crypto key generate rsa
The name for the keys will be: Router2.admin
Choose the size of the key modulus in the range of 360 to 2048 for
your
General Purpose Keys. Choosing a key modulus greater than 512 may
take
a few minutes.
How many bits in the modulus [512]: 1024
% Generating 1024 bit RSA keys, keys will be non-exportable...[OK]
Router2(config)#enable password admin
*Mar 1 0:1:40.865: %SSH-5-ENABLED: SSH 1.99 has been enabled
Router2(config)#username admin password admin
Router2(config)#ip ssh version 2
Router2(config)#line vty 0 15
Router2(config-line)#transport input ssh
Router2(config-line)#login local
Router2(config-line)#
Ctrl+F6 to exit CLI focus
Copy
Paste
Top







Connectivity of wireless network on computing devices

CONCLUSION

CONCLUSION:

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.

FUTURE SCOPE:

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 of our existing network.

REFERENCES

[1]https://en.wikipedia.org/wiki/Packet_Tracer

[2]https://www.paessler.com/it-explained/server

[3]https://computernetworking747640215.wordpress.com/2018/07/05/secure-shell-ssh-configuration-on-a-switch-and-router-in-packet-tracer/

[4]http://router.over-blog.com/article-how-to-configure-cisco-router-password-106850439.html

[5]https://www.cognoscape.com/benefits-going-wireless/

APPENDIX
SCREENSHOTS

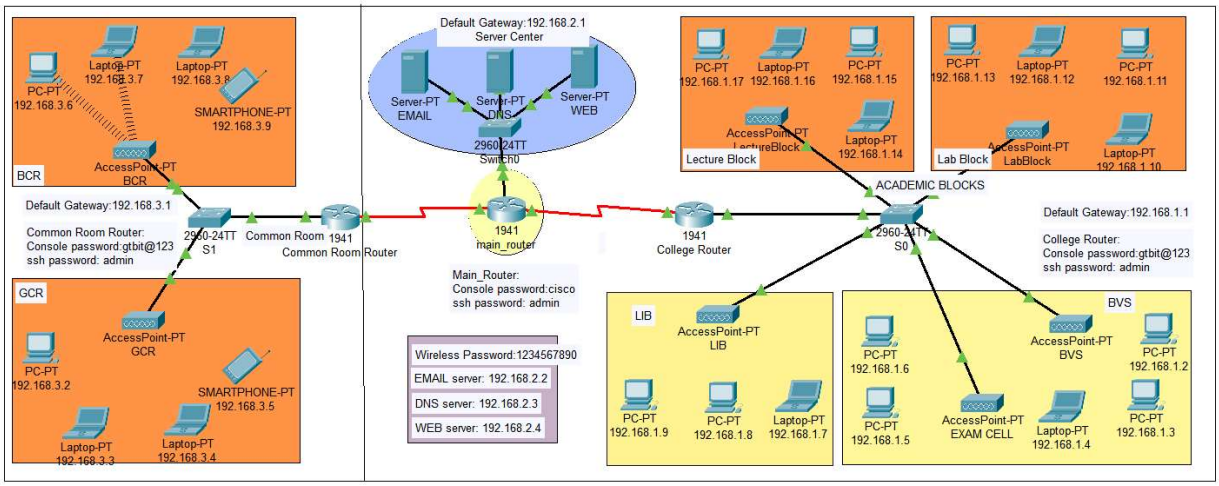


Figure: The complete diagram of the College Area Network Scenario created in Packet Tracer environment

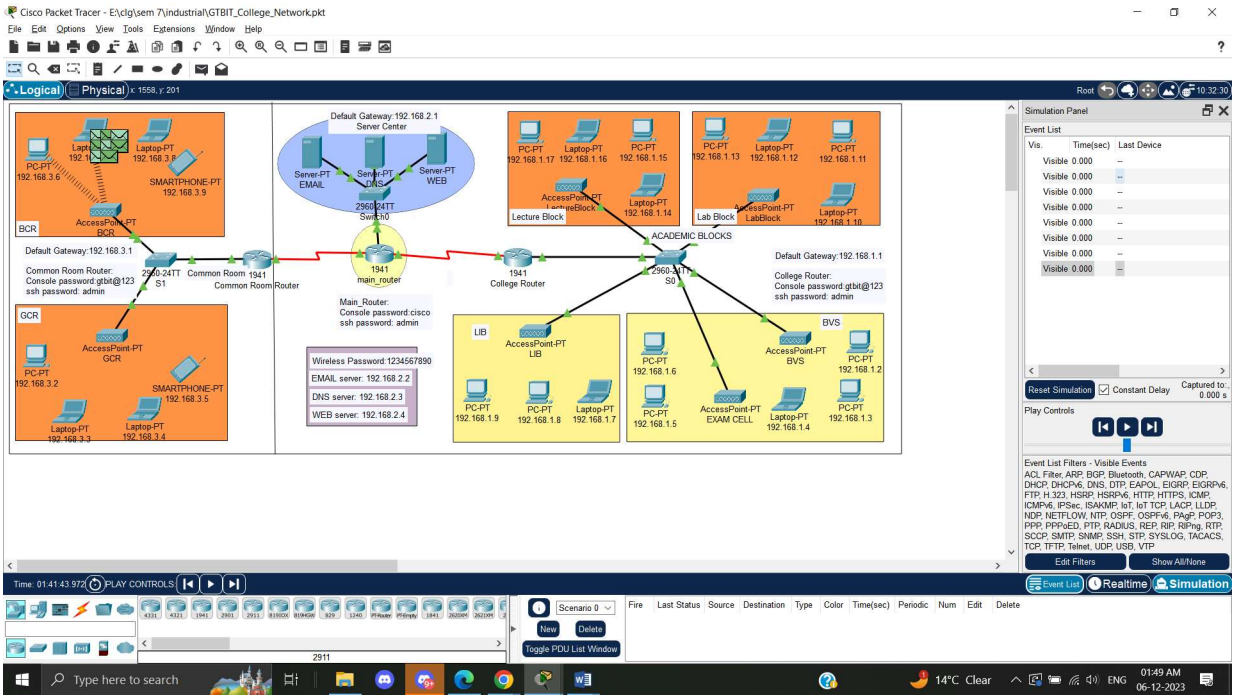


Figure: Final simulation for the network system to check all the connections.

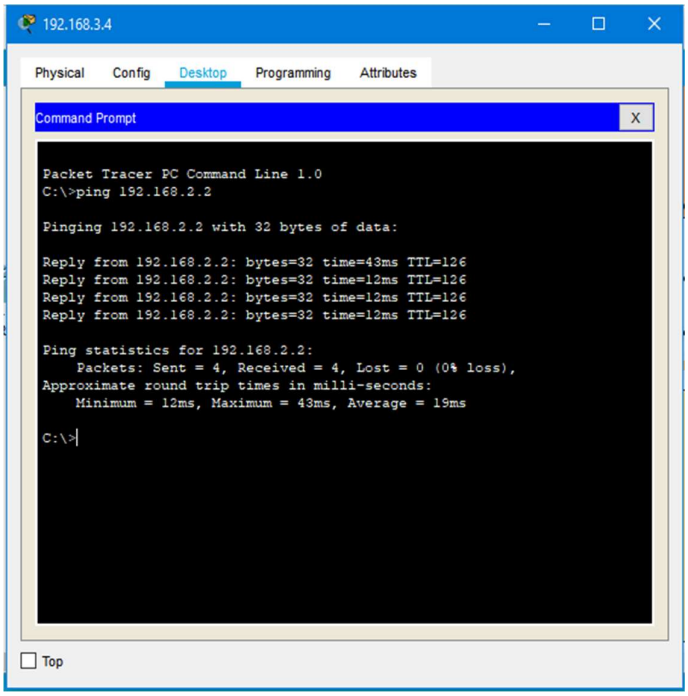


Figure: Ping Test for EMAIL server

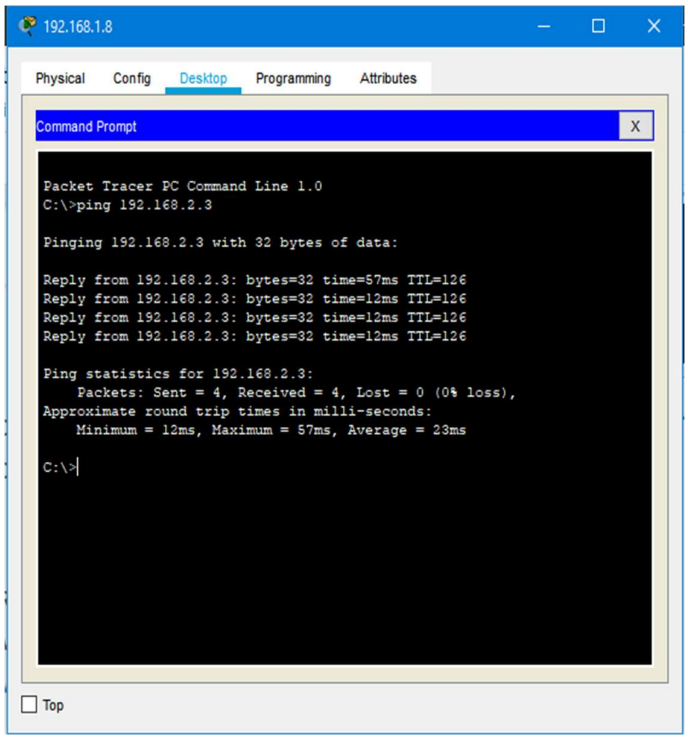


Figure: Ping Test for DNS server

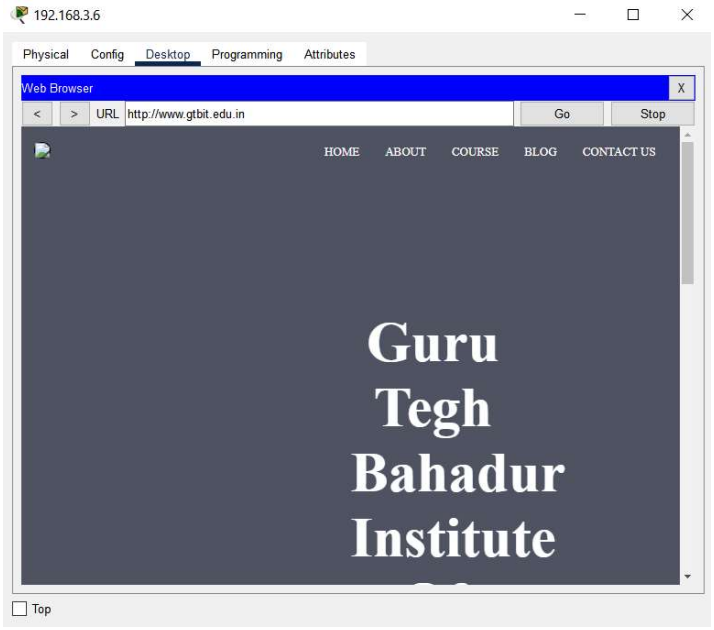


Figure: Website accessed through Web Browser in Packet Tracer

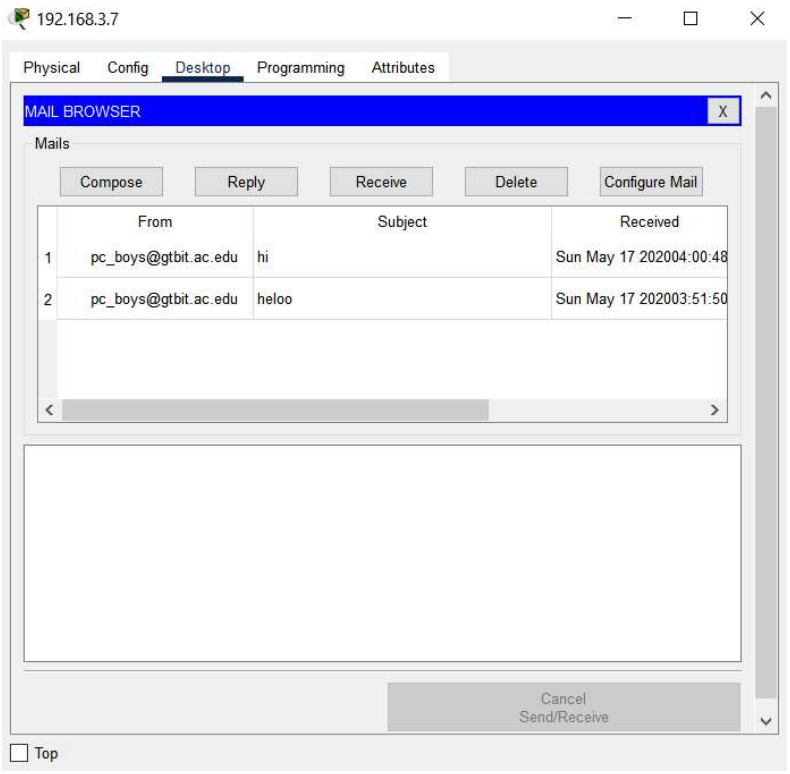


Figure: Email received on device sent through EMAIL server