Green University of Bangladesh

Department of Computer Science and Engineering (CSE)
Semester: (Spring, Year: 2023), B.Sc. in CSE (Day)

University Campus Networking (Wireless) Using Cisco Packet Tracer

Course Title: Computer Networking Lab
Course Code: CSE 312
Section: 203 D1

Students Details

Name	ID
Joy Pal	201002418
Prodip Sarker	203002016

Submission Date: 16th June, 2023
Course Teacher's Name: Tanpia Tasnim

[For teachers use only: Don't write anything inside this box]

Lab Project Status	
Marks:	**Signature:**
Comments:	**Date:**

Contents

Chapter 1

Introduction

1.1 Overview

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.

1.2 Motivation

Campus networking via wireless connection becomes an important part of campus life. It 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, the demand for access to information anytime and anywhere has become more and more urgent, but traditional cable networks cannot meet this requirement. The 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 to a cable network. With network and communication technology development, 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. [**?**].

1.3 Problem Definition

1.3.1 Problem 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. 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), and accessing different web services for different functionalities, so it needs wireless networking for smooth processing

1.3.2 Complex Engineering Problem

Engineering challenges or concerns that are intricate, and multifaceted, and call for advanced knowledge, analysis, and problem-solving abilities are referred to as complex engineering problems. These issues frequently combine technical, practical, and theoretical elements, and they could call for a thorough comprehension of numerous engineering specialties.

Table 1.1: Summary of the attributes touched by the mentioned projects

Name of the P Attributess	**Explain how to address**
P1: Depth of knowledge required	Project Management, Emerging Technologies, Security Knowledge, Troubleshooting Skills, Design, and Architecture.
P2: Range of conflicting requirements	Performance vs. Cost, Performance vs. Energy Efficiency, Safety vs. Functionality, Scalability. vs. Complexity, Security vs. Accessibility, Reliability vs. Cost
P3: Depth of analysis required	Conceptual Analysis, Theoretical Analysis, Quantitative Analysis, Qualitative Analysis, System-level Analysis, Risk Analysis, Cost-Benefit Analysis.
P4: Familiarity of issues	Technical Familiarity, Operational Familiarity, Security Familiarity, User Familiarity, Integration Familiarity
P5: Extent of applicable codes	—-
P6: Extent of stakeholder involvement and conflicting requirements	End Users, Administrators, IT Department, Faculty and Academic Departments, External Entities
P7: Interdependence	Economical,Political,Social,Technological

1.4 Design Goals/Objectives

- Ensure reliable and high-speed connectivity throughout the university campus.
- Design a scalable network infrastructure to accommodate future growth and increasing demands.
- Implement robust security measures to protect sensitive data and ensure the privacy of students, faculty, and staff.
- Ensure network reliability and minimize downtime through redundancy and fault-tolerant design.
- Enable efficient collaboration and communication among students, faculty, and staff.

1.5 Application

Campus-wide Wi-Fi Connectivity: The network provides seamless wireless connectivity across the entire campus, allowing students, faculty, and staff to access the network and educational resources from their devices.

Remote Labs and Simulations: The campus network enables remote access to virtualized lab environments, where students can perform experiments and simulations remotely using networked lab equipment and software.

Virtual Learning Environment (VLE) System: The campus network integrates with a VLE system that provides online course materials, virtual classrooms, discussion forums, and assignment submission platforms.

Chapter 2

Design/Development/Implementation of the Project

2.1 Introduction

A campus Networking system is a comprehensive software solution designed to streamline and automate various administrative and operational tasks within an educational institution. It provides a centralized platform for managing and organizing various campus activities, resources, and information. Universities, colleges, schools, and other educational organizations typically use this system to improve efficiency, enhance communication, and ensure smooth operations. The main purpose of a campus networking system is to integrate and simplify various processes involved in running an educational institution.

2.2 Project Details and Tools

A University campus networking system using Cisco Packet Tracer provides reliable connectivity, supports collaborative learning and communication, fosters research and innovation, ensures campus safety and security, enhances administrative efficiency, enables wireless connectivity and mobility, and optimizes resources for cost savings. By leveraging these capabilities, educational institutions can create a modern and connected learning environment that enhances the educational experience for students, faculty, and staff.

Tools:

- Dell Inspiron core i3 10th GEN
- Cisco Packet Tracer 8.2.1
- Devices: Routers, Switches, Email Server, DNS Server, Wireless Devices (Access Point), Laptops, PCs, etc.

- The design includes the following parts of the University:
  Hostel Blocks: Girl's Block and Boy's Block
  Academic Blocks: AB1 and AB2
  Dome Building and Library IT Consulting

2.3 Implementation

- 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 hostel 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 (AB1 and AB2), dome building, library, and IT consulting.
- The wireless access points were then connected to computing devices (PCs, laptops, and smartphones).
- Similarly, the hostel router was connected to the hostel switch which was further connected to the wireless access point of the boy's block and the girl's block.
- 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.
- At last, we add some webcam for security with the help of a Registration server.

2.3.1 Configuring Devices

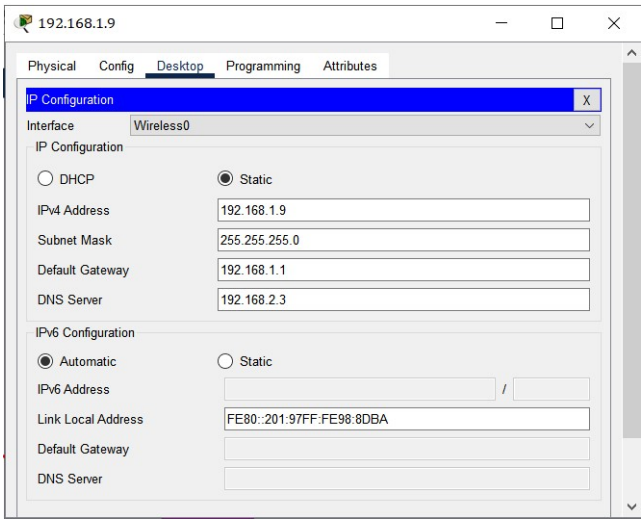

Figure 2.1: Pc

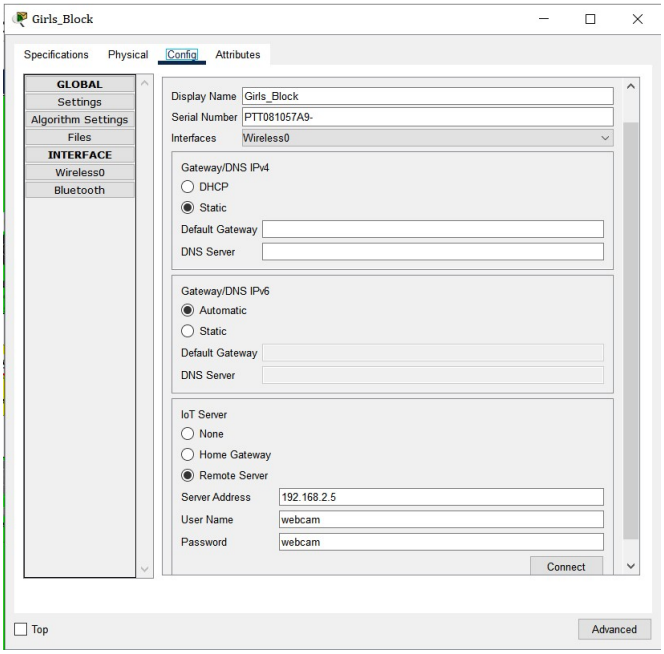

Figure 2.2: WebCam

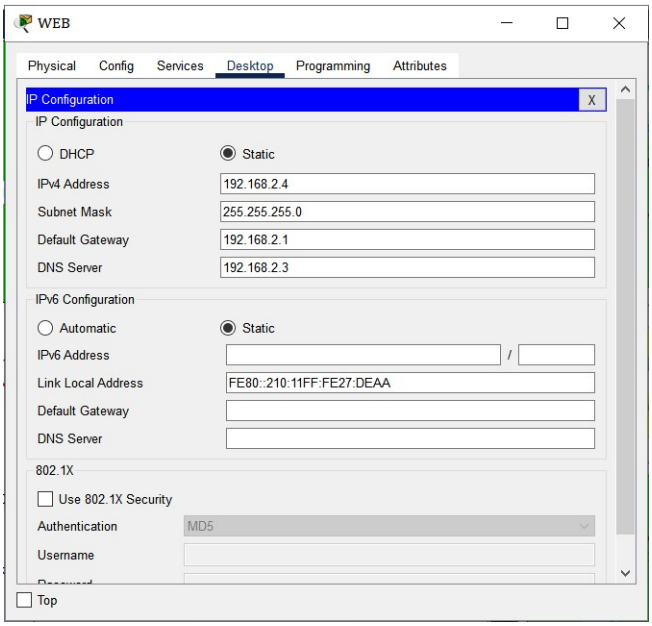

Figure 2.3: Web server

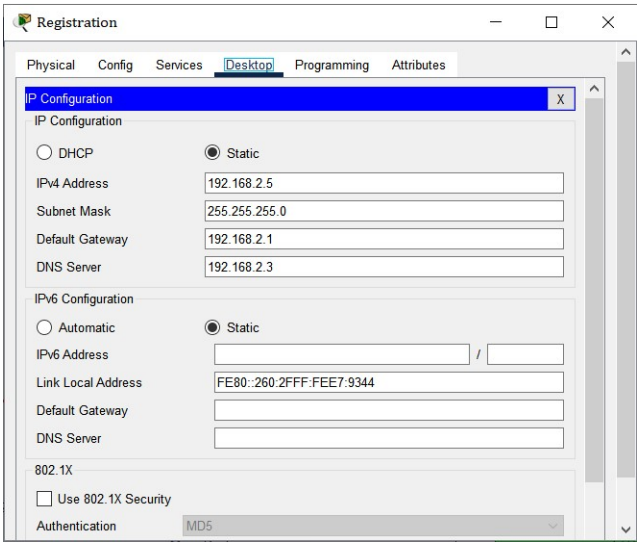

Figure 2.4: Registration server for WebCam

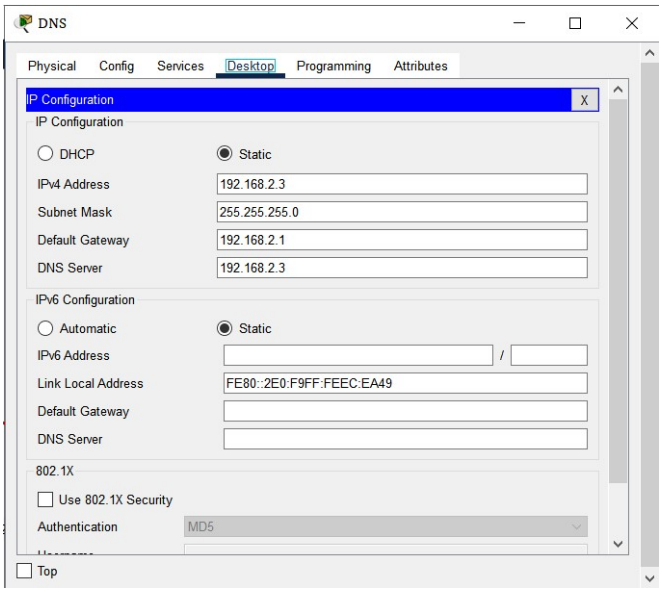

Figure 2.5: DNS server

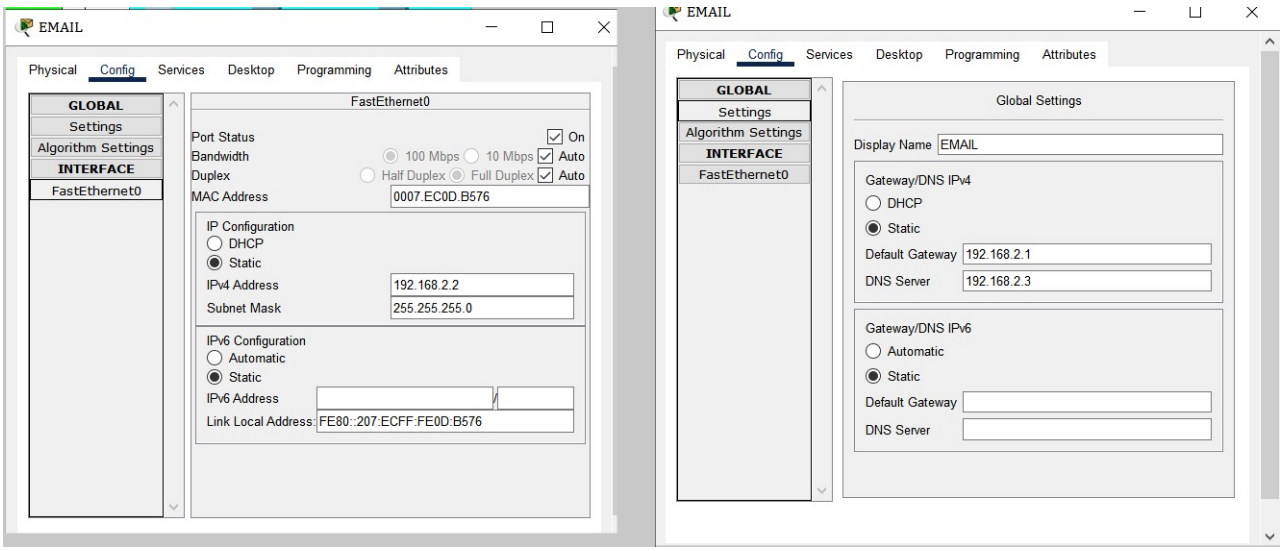

Figure 2.6: Email Server

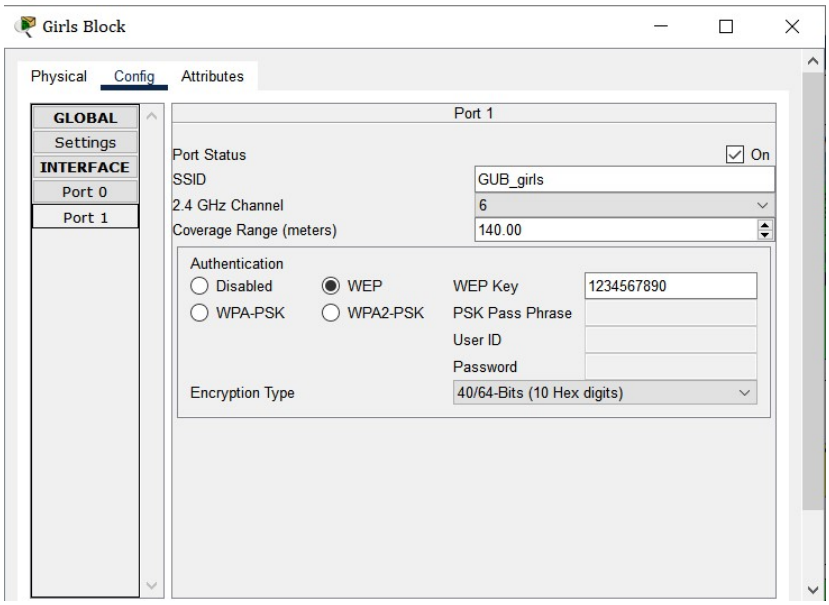

Figure 2.7: Access Point

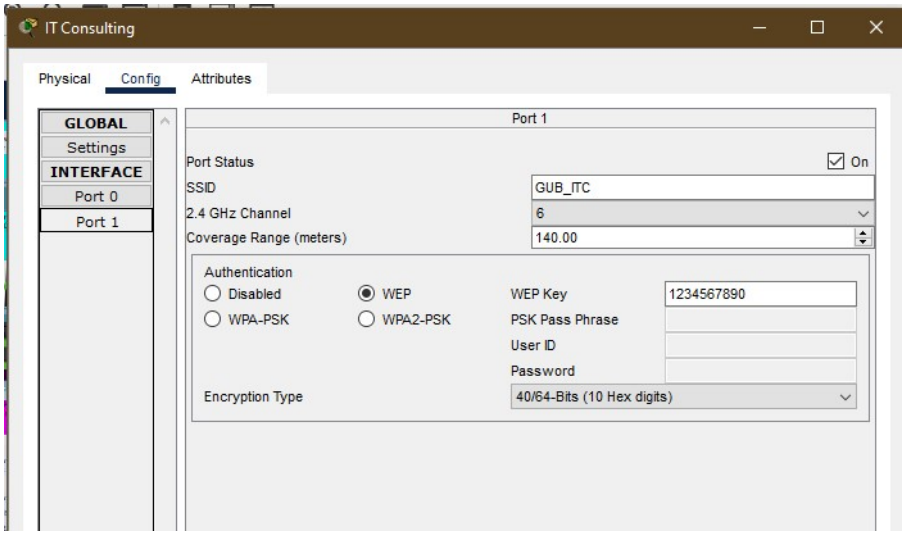

Figure 2.8: WEP setting

Chapter 3

Performance Evaluation

3.1 Simulation Environment

- By positioning components like switches, routers, access points, and servers in the appropriate locations, you may plan the physical structure of the campus. Consider the logical and physical locations of these devices to represent the actual campus network.
- Configure each network device with the appropriate IP addresses, VLANs, routing protocols, security features, and service configurations. Use the device's GUI or command-line interface (CLI) to make these configurations.
- Join the devices with cables to establish network connections. Use the appropriate cable types (such as Ethernet cables or fiber optic cables) depending on the interfaces of the devices and the distances between them. Make sure the correct device connectivity is according to the network design.
- The wireless network in the simulation environment needs additional wireless access points. The access points should have the appropriate SSIDs, security settings (such as WPA2 encryption), and channel allocations. Ensure that the entire campus has wireless device coverage and connectivity.
- According to the subnetting and network architecture specifications, give devices IP addresses. Utilize a campus-capable addressing scheme that can accommodate the various network segments and devices there.
- Set up OSPF or EIGRP or another routing protocol on routers to enable dynamic routing on the campus network. Set routing parameters like network advertisements and routing metrics to mimic efficient packet routing.
- Set up DHCP servers to assign IP addresses to devices automatically and configure DNS servers to provide name resolution within the network.
- Run simulation tests to verify that the campus management system is working after the network has been configured. Test connectivity, VLAN separation, routing, wireless access, and other features to make sure they work as intended.

- Use Packet Tracer's network monitoring features to keep an eye on the operation and condition of the hardware in your network. Keep a watch on crucial indicators like CPU usage, bandwidth utilization, and device availability to ensure that the network is performing at its peak.

3.2 Results Analysis/Testing

3.2.1 Complete Design

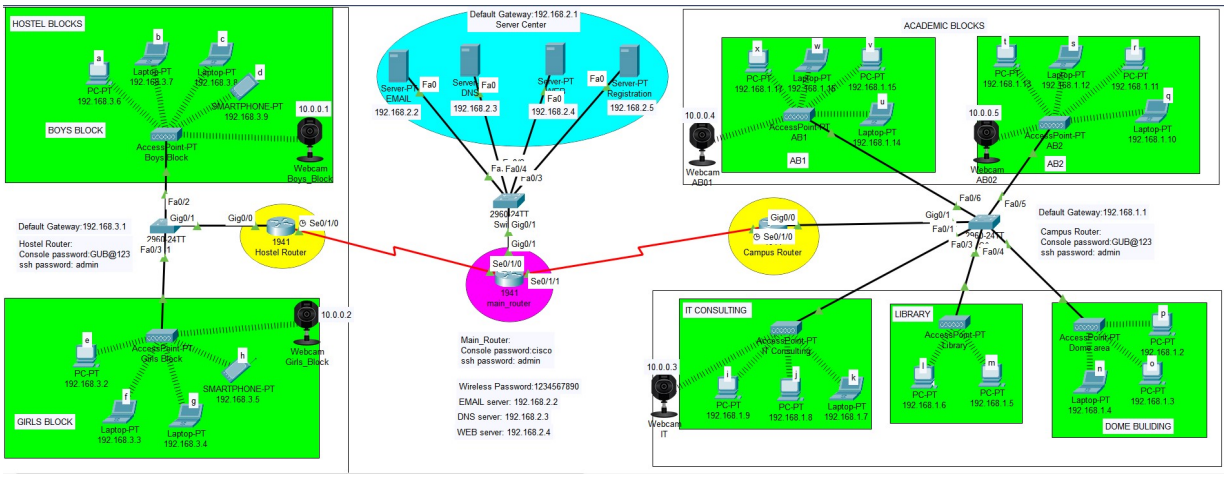

Figure 3.1: Abstract View

3.2.2 Output and Testing

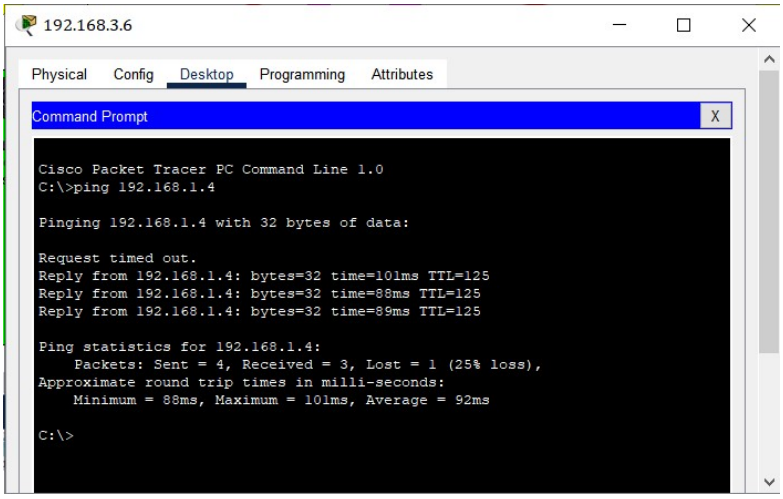

Figure 3.2: Ping A to N Device

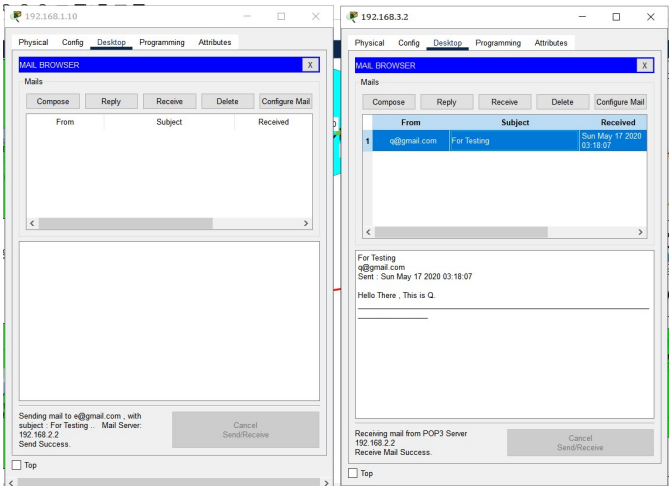

Figure 3.3: Mail from Q to E

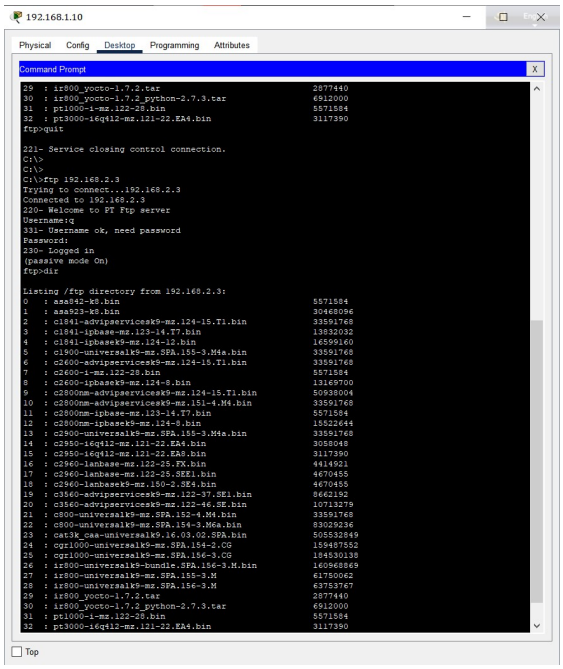

Figure 3.4: Access File directory from Q Device

3.3 Results Overall Discussion

In Simulation Mode, you can watch your network run at a slower pace, observing the paths that packets take and inspecting them in detail. The proposed architecture, when simulated on Cisco Packet Tracer, produced results that are demonstrated as follows:

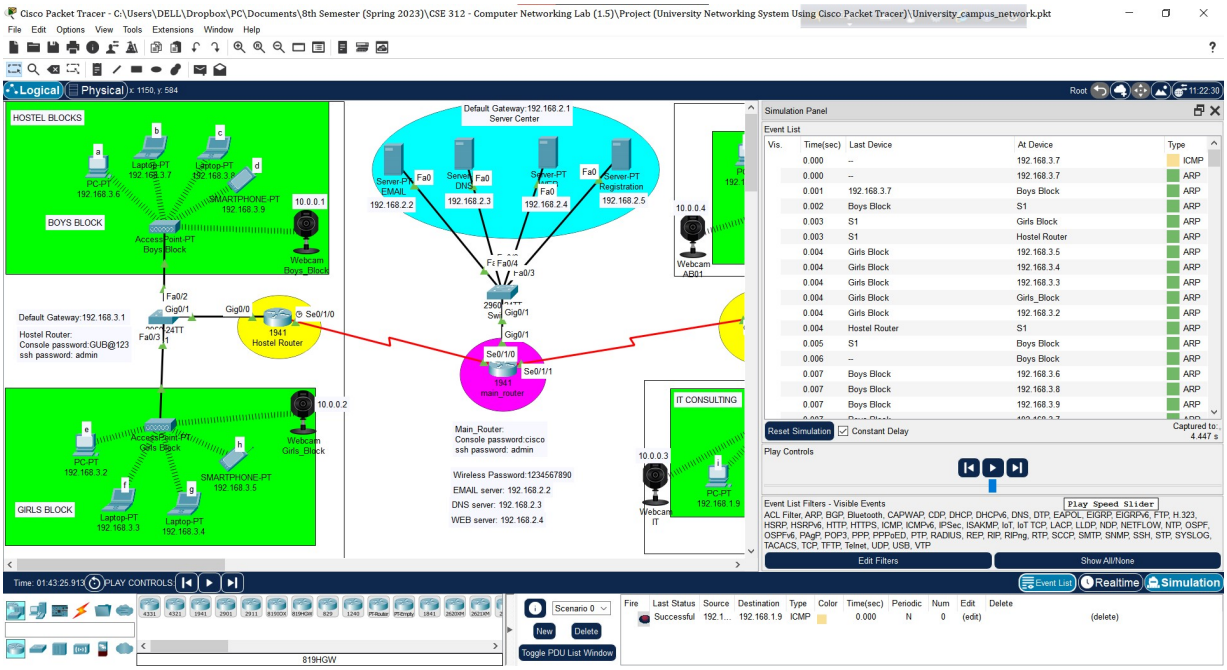

Figure 3.5: Final Simulation

Finally, we have combined all the steps as mentioned in chapter 3 and implemented the desired wireless network for University. We have the complete network providing various facilities to the teaching staff, non-teaching staff, and students.

Chapter 4

Conclusion

4.1 Discussion

We began our conversation with the term "digitalization," and in order to do it, we set out to begin with an educational institution. Finally, we created a wireless network for a university. We chose to switch from a wired network to a wireless one because, as we have already discussed, mobility and efficiency are major features of wireless networks. This will make our network more orderly and less chaotic.
In this project, we created a university network using Cisco Packet Tracer, implementing a networking topology employing servers, routers, switches, and end devices in several area networks. We have covered every feature that is necessary for a network to operate effectively. A DNS server and a web server have been added to our network specifically to facilitate communication between students and professors as well as other parts of our network. To make intra-university communication via emails possible within the domain, we have incorporated an email server. For a safe and secure data transfer, we have employed the ssh protocol and console passwords.

4.2 Limitations

Despite the fact that a campus management system created in Cisco Packet Tracer has numerous advantages, it also has certain drawbacks. As a simulation tool, Packet Tracer only approximates the behavior of networks in the actual world. Because of this, performance assessments may not be accurate and may not provide a fully real experience. Furthermore, Packet Tracer offers a small selection of devices and features in comparison to actual network equipment, which may limit the project's complexity and scalability. Because Packet Tracer doesn't offer real-time monitoring or network statistics, this is another drawback. It might therefore not fully reflect the dynamic nature of a true campus network.

4.3 Scope of Future Work

The setup and requirements are for the initial prototype; further functionality can be added and the prototype can be subsequently enhanced to support and cover more of our current network.