University Campus Network System

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MINI LAB PROJECT REPORT

This Report Presented in Partial Fulfillment of the course **CSE314: Computer Networks Lab in the Computer Science and Engineering Department**

DAFFODIL INTERNATIONAL UNIVERSITY
Dhaka, Bangladesh

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DECLARATION

We hereby declare that this lab project has been done by us under the supervision of **Mr. Md. Monarul Islam**, **Lecturer**, Department of Computer Science and Engineering, Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere as lab projects.

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COURSE & PROGRAM OUTCOME

The following course have course outcomes as following:.

Table 1: Course Outcome Statements

CO's	**Statements**
CO1	**Understand** different types of **networks**, the organization of computer networks, proper placement of different layers of OSI model and factors influencing network development.
CO2	**Analyze** the conceptual and **implementation** aspects of network applications and its use in most of the applications; Transport and Data link layer protocols for implementing enterprise network.
CO3	**Apply**the knowledge of basic **binary** system to solve **sub-netting** problems and can identify and make evaluation on the underlying principles of routing algorithms and its related protocols being applied to the Internet.
CO4	**Demonstrate** the components, services, principle and protocol provided in wireless network and can categorized between different wireless securities systems.

Table 2: Mapping of CO, PO, Blooms, KP and CEP

CO	**PO**	**Blooms**	**KP**	**CEP**
CO1	PO1	C1, C2	KP3	EP1,EP3
CO2	PO2	C2	KP3	EP1,EP3
CO3	PO3	C4, A1	KP3	EP1,EP2
CO4	PO3	C3, C6, A3, P3	KP4	EP1,EP3

The mapping justification of this table is provided in section **4.3.1**, **4.3.2** and **4.3.3**.

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Chapter 1

Introduction

1.1 Introduction

Computer networking plays a vital role in connecting devices to facilitate resource sharing and communication. It serves as the backbone of modern institutions, enabling collaboration, communication, and efficient resource utilization. This project explores the design and simulation of a university campus network using Cisco Packet Tracer. A secure and efficient network topology was implemented to connect multiple buildings and departments. By implementing a secure and efficient network topology, the project connects multiple buildings and departments, paving the way for seamless communication and resource sharing within the campus.

1.2 Motivation

The increasing reliance on digital infrastructure in education necessitates secure and efficient campus networks. A well-structured campus network fosters better communication between departments, supports administrative tasks, and enhances the learning experience for students. This project demonstrates how a university network can be designed to address these needs using affordable and scalable solutions. The practical application of networking concepts in this project highlights its relevance in today's tech-driven academic environment.

1.3 Objectives

The main objectives of this project are:

- To simulate a functional campus network using Cisco Packet Tracer.
- To implement VLANs and secure communication protocols.
- To enable connectivity between departments and external servers.

1.4 Feasibility Study

The project relies on Cisco Packet Tracer, a versatile and widely-used simulation tool that allows the creation and testing of complex network topologies without requiring physical hardware. This study identified VLANs, dynamic IP configuration, and routing protocols as feasible solutions for creating an efficient campus network. Furthermore, the use of virtual simulation reduces costs and enables extensive testing under various scenarios to ensure reliability and scalability.

1.5 Gap Analysis

Existing university networks often suffer from inefficiencies due to outdated technology, lack of segmentation, and minimal security measures. This project addresses these gaps by introducing VLANs for network segmentation, implementing routing protocols for better communication, and using secure configurations to protect against potential threats. The approach ensures an optimized, secure, and scalable network that meets modern demands.

1.6 Project Outcome

- Successfully simulated a secure and efficient university campus network.
- Achieved seamless connectivity across departments.
- Implemented VLANs for better network segmentation and security.
- Configured routing protocols to ensure reliable inter-departmental communication.
- Enabled secure access to external servers, including email services hosted on the cloud.

Chapter 2

Proposed Methodology/Architecture

2.1 Requirement Analysis & Design Specification

2.1.1 Overview

In this chapter, we will propose our methodology for this project. Basically, we are following the following questions step by step. Daffodil International University is a large university with 4 main buildings and 1 boys and 1 girls hostel. The students of the university are distributed in 4 departments: These include Computer Science and Engineering, Electrical and Electronic Engineering, IT Office, Admission Office and Play Ground. Each member has a PC and students have access to the faculty laptops or PCs and hostel admission office.

2.1.2 Proposed Methodology/System Design

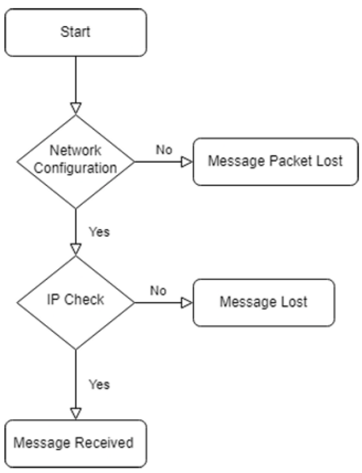


Figure 2.1: Flow Chart of University Campus Network System

2.1.3 UI Design

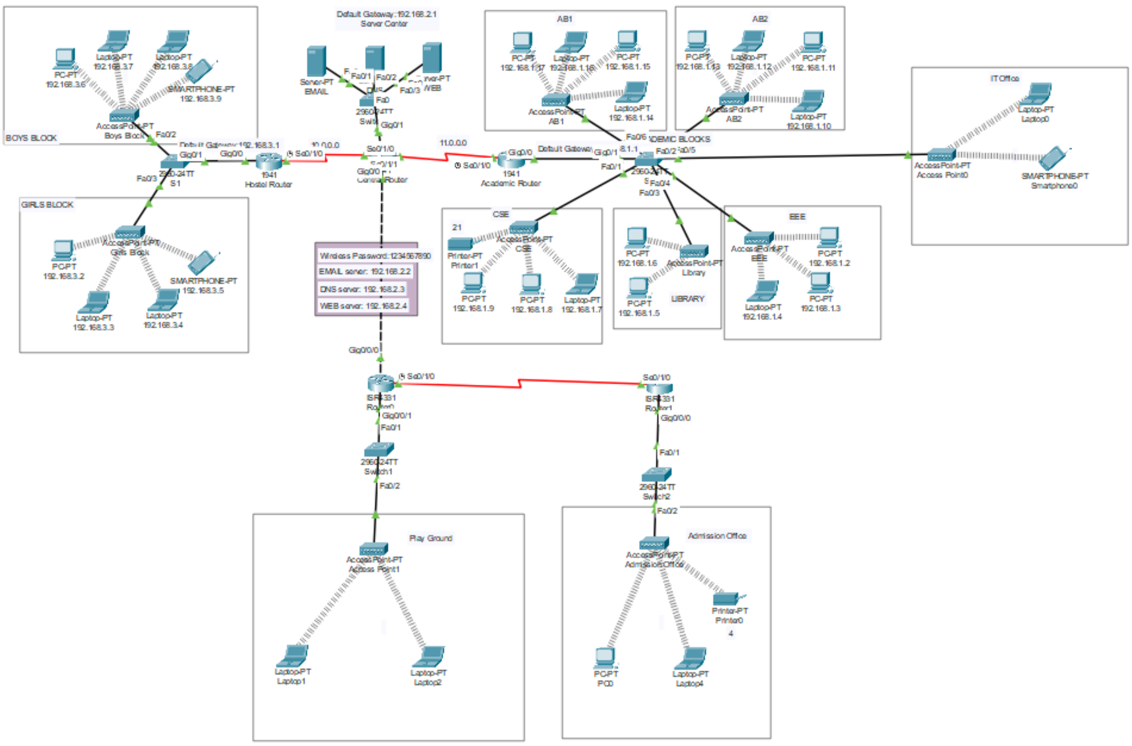


Figure 2.2: University Campus Network System

2.2 Overall Project Plan

- Design the network topology for the campus.
- Configure VLANs and wireless routing protocols.
- Test communication between departments and with external servers.
- Analyze and optimize configurations.

Chapter 3

Implementation and Results

Every chapter should start with 1-2 sentences on the outline of the chapter.

3.1 Implementation

The network was designed and simulated using Cisco Packet Tracer. VLANs were configured for departmental segmentation, and wireless routing protocols were implemented to ensure inter-department connectivity and access to external servers. The design included specific configurations for switches and routers to ensure seamless communication. Additionally, email, DNS and web server were set up to facilitate essential communication, easy access to information, and a user-friendly online presence for students, faculty, and staff, allowing them to send emails, navigate websites, and find relevant data through easily remembered domain names, all within a centralized system. Create a network topology with the main components to support the following: Here we will create a network for Computer Science Engineering Department Electrical Electronics Engineering Admission Office IT Office Boys Hostel and Girls Hostel Playground and Library for this we need four routers five switches and some wireless routers and here as per each blog we have used some smartphones some laptops and some printers. And here we have mainly used email server DNA server and web server for our project. So what is the network system of our campus we will need all these devices and some software if we are going to implement below let's see the implementation.

A. Central Router Configuration

Our university campus network has a central router, all the other routers are dynamically connected to this router, so here we can see five network addresses. These five network addresses are dynamically connected to each of them. As a result, each device does not have to assign its interface to the PC separately. They can communicate with the help of the router, for which the security is very high and it can easily choose a small number of routes, which will send the router in the direction of the shortest distance from one device to another. For this reason, the dynamic router is very good because with dynamic configuration, there is no need to give each device a separate IP setup.

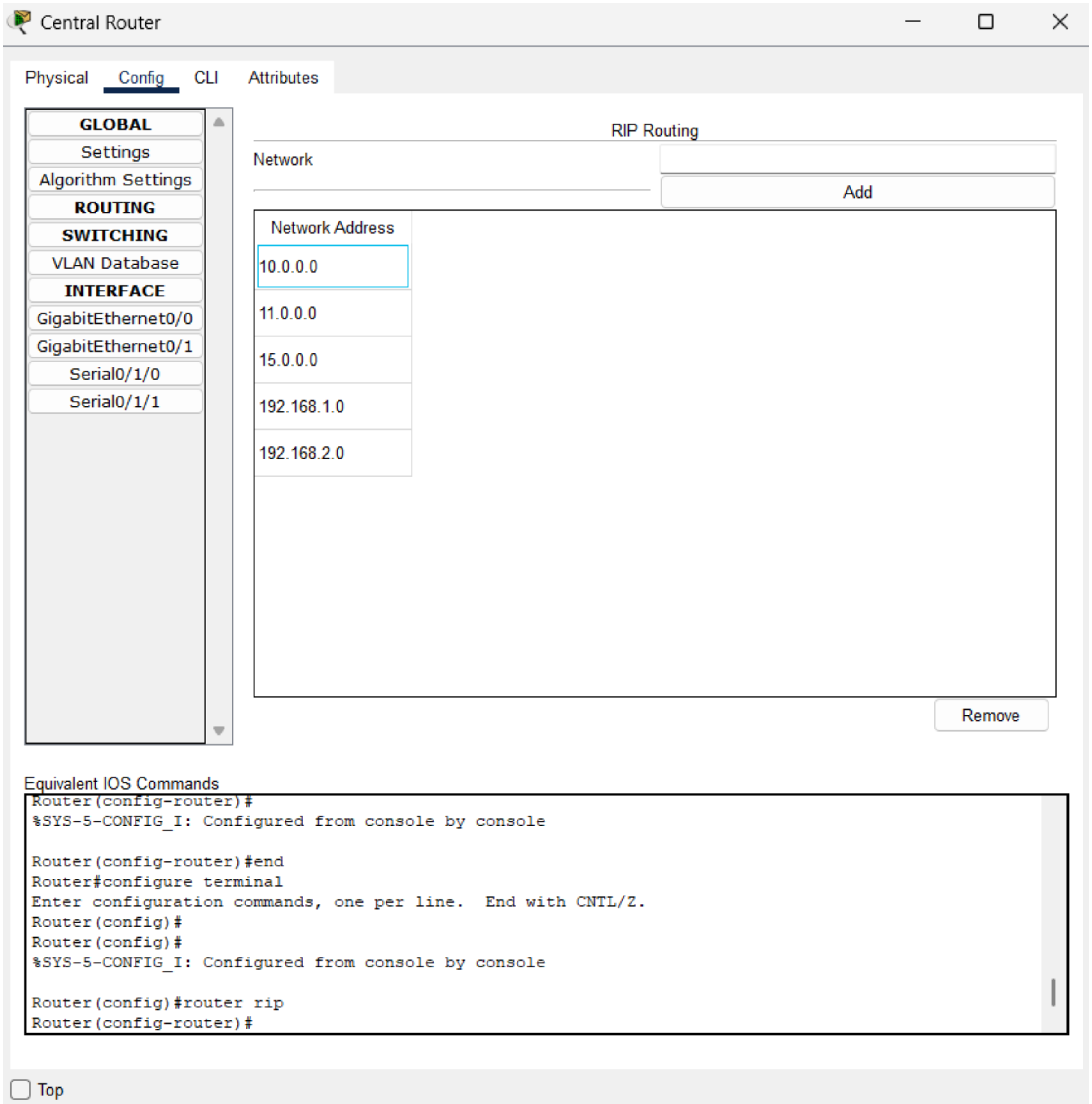


Figure 3.1: Central router configuration

B.Emial Server Configuration:

This is our email server page where we can see many usernames in the service. It is basically saved in the email server with the username and password of all the users of my project so that when one user sends an email to another user, one user can send an email to another user through this email server and the other can receive the email. This server basically helps in email exchange. The default gateway of the email server is 192.168.2.1 and the DNS server is 192.168.2.3.

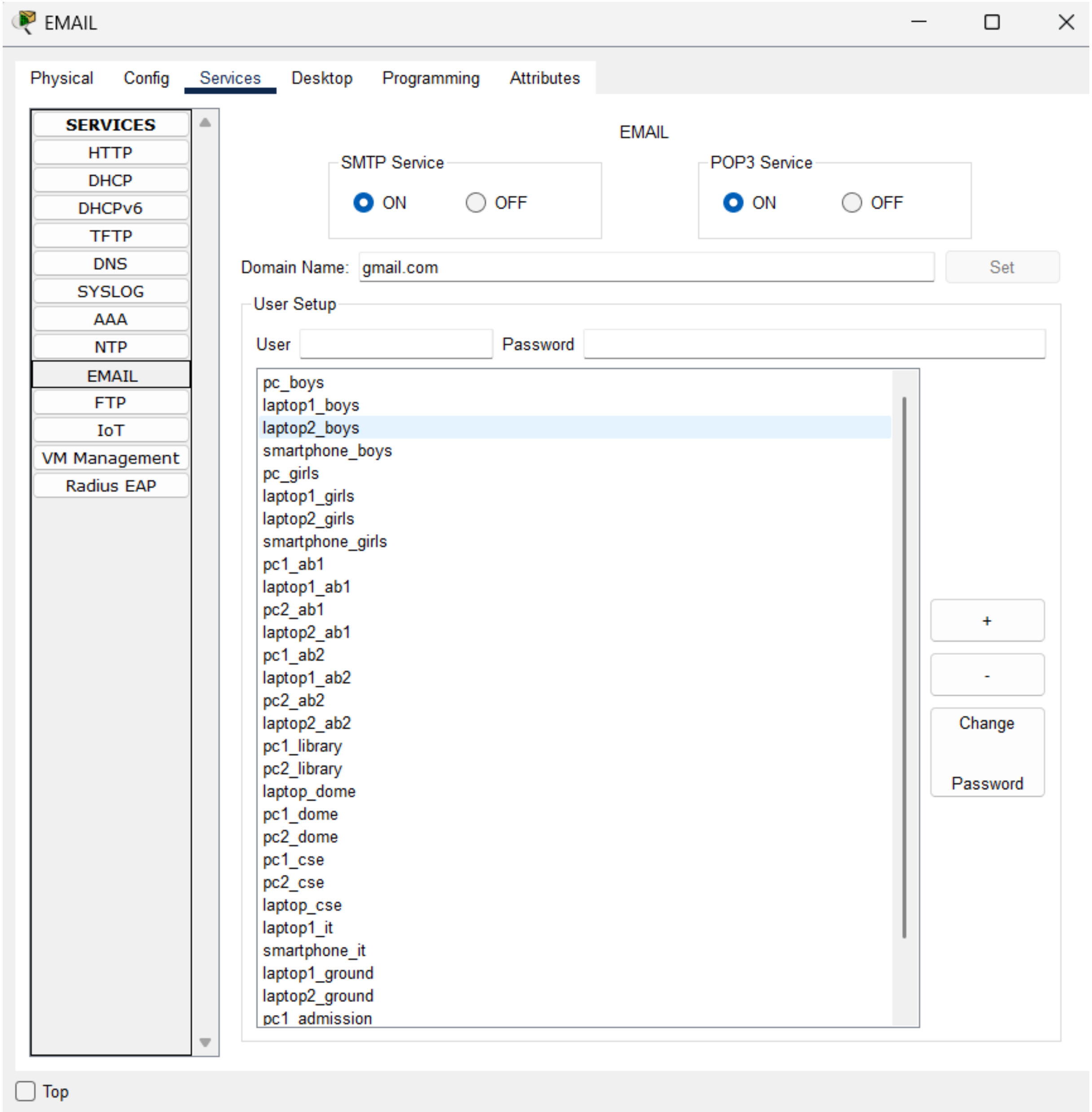


Figure 3.2: Emial Server Configuration.

C. Web Server Configuration:

This is my web server connection page. Web server usually works with DNS server. When we search for a webpage from PC or by the name of a webpage, then it calls the webpage through DNS server and shows the data that is already stored on that web to us PC user. The default gateway of web server is 192.168.2.1 and DNS server is 192.168.2.3.

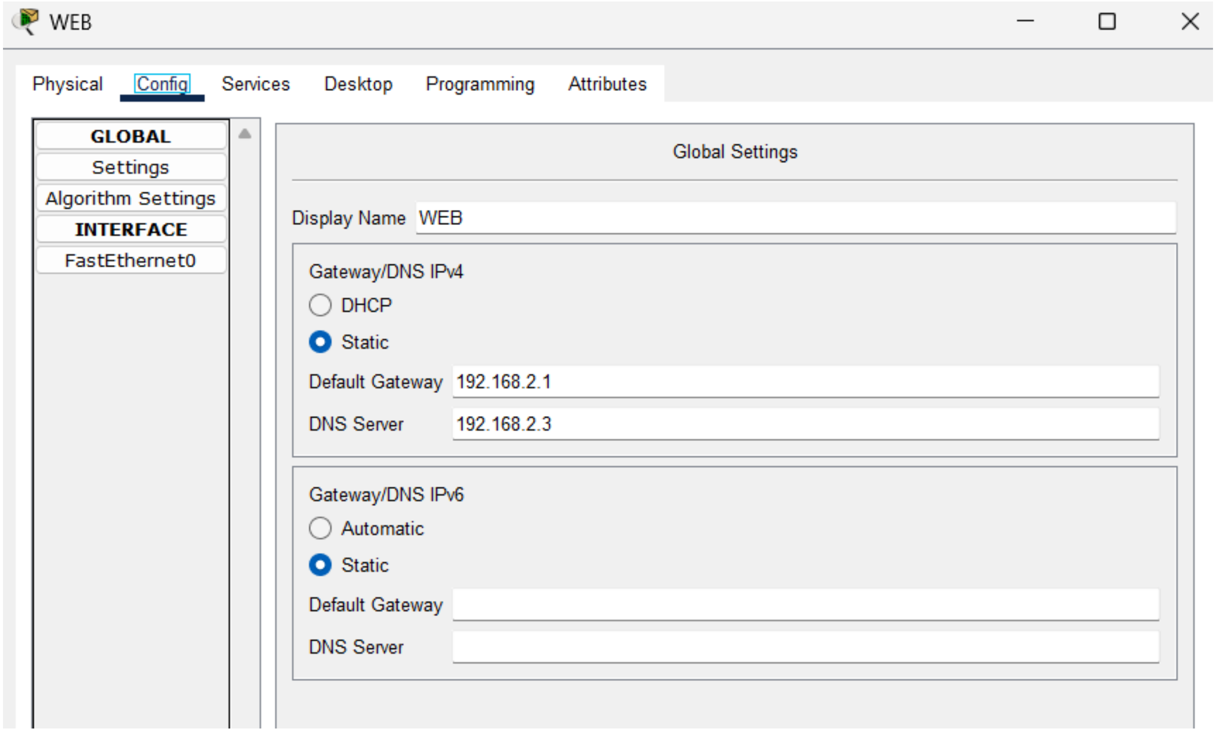


Figure 3.3: Web Server Configuration.

D. CSE Department Wireless Router Configuration:

This is a wireless router of our CSE department. I can see the configuration page of this router. Here we have configured it on the 2.4 GHz channel through the secondary WEP key, whose password is from 1 to 09. Through this wall switch, all the users of the CSC department will be able to access their laptop computers and smartphones and printers wirelessly, through which one user can communicate with another user and can visit emails and websites. They can communicate through this network.

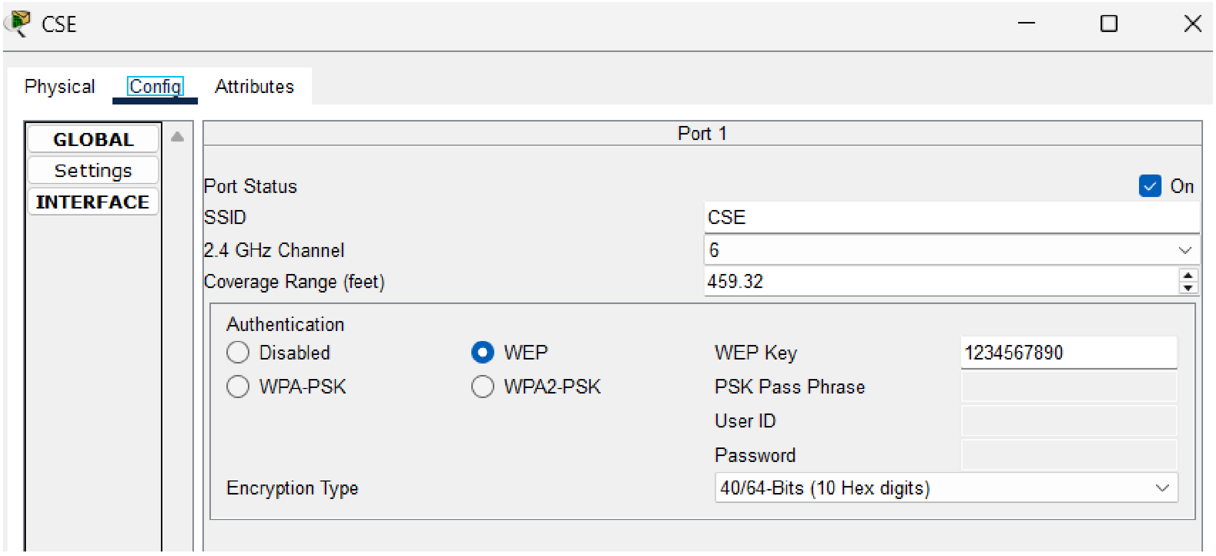


Figure 3.4: Wireless Router Configuration.

E. CSE Department Laptop Configuration:

This is the configuration of our Computer Science Engineering Department laptop where IP address is 192.168.1.7 and subnet mask is 255.255.255.0 Default Gateway is 192.168.1.1 and DNS server is 192.168.2.3 Through this configuration, a PC connects to all networks and can communicate with each other.

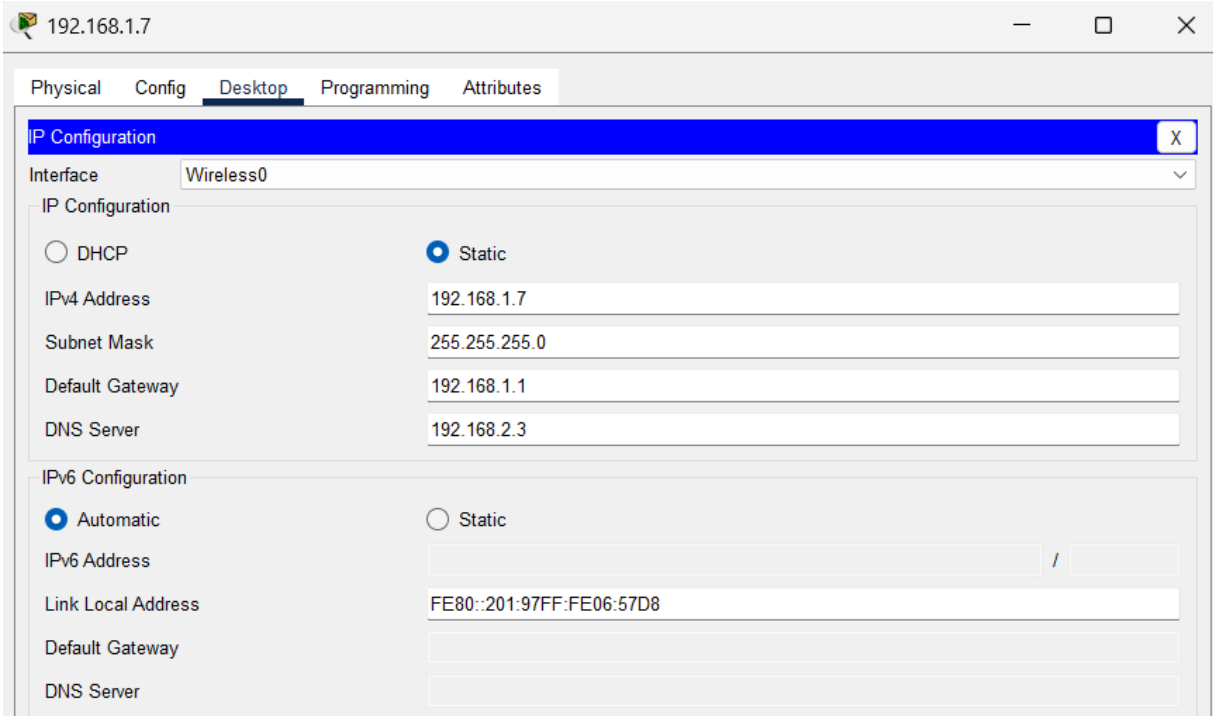


Figure 3.5: Laptop Configuration

3.2 Performance Analysis

A. Using Command Prompt

The ping command is a very common method for troubleshooting the accessibility of devices. It uses a series of Internet Control Message Protocol (ICMP) Echo messages to determine:

- Whether a remote host is active or inactive.
- The round-trip delay in communicating with the host.
- Packet loss.

The ping command rst sends an echo request packet to an address, then waits for a reply. The ping is successful only if:

- the echo request gets to the destination, and
- the destination is able to get an echo reply back to the source within a predeter mined time called a timeout. The default value of this timeout is two seconds on Cisco routers.

Fig.3.6 and 3.7 shows a different way to check if our network connectivity is reliable.

Ping Command check:

Playground Laptop1 to Boys Block PC1: 16.1.1.2 to 192.168.3.6

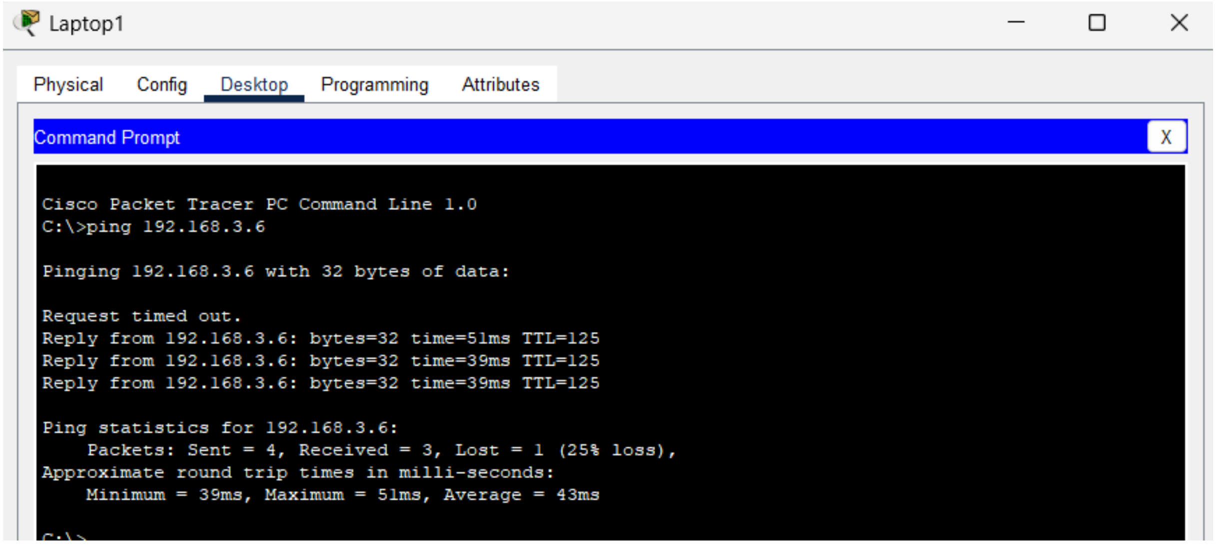


Figure 3.6: Playground Laptop1 to Boys Block PC1

Ping Command check:

Admissions office PC0 to CSE Department PC: 18.1.1.2 to 192.168.1.9.

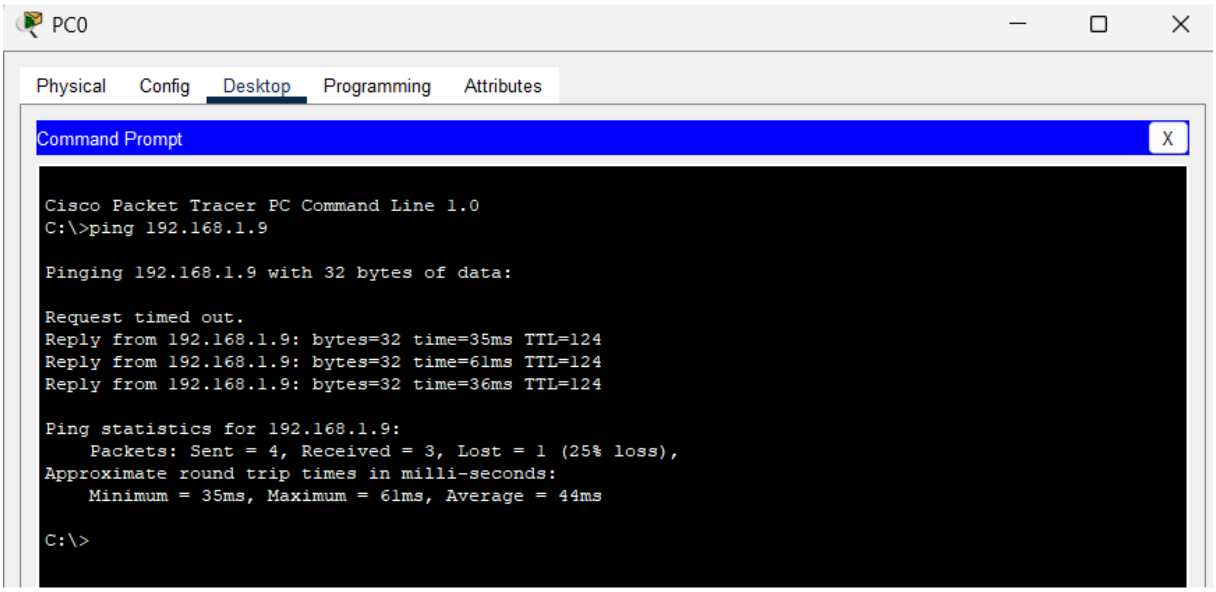


Figure 3.7: Admissions office PC0 to CSE Department PC

3.3 Results and Discussion

Send Email CSE Department To Admission Office:

Here is an email from the Computer Science and Engineering Department to the Admissions Office requesting information for all Computer Science and Engineering students. Here we can see that our email has been sent to the Admissions Office in full.

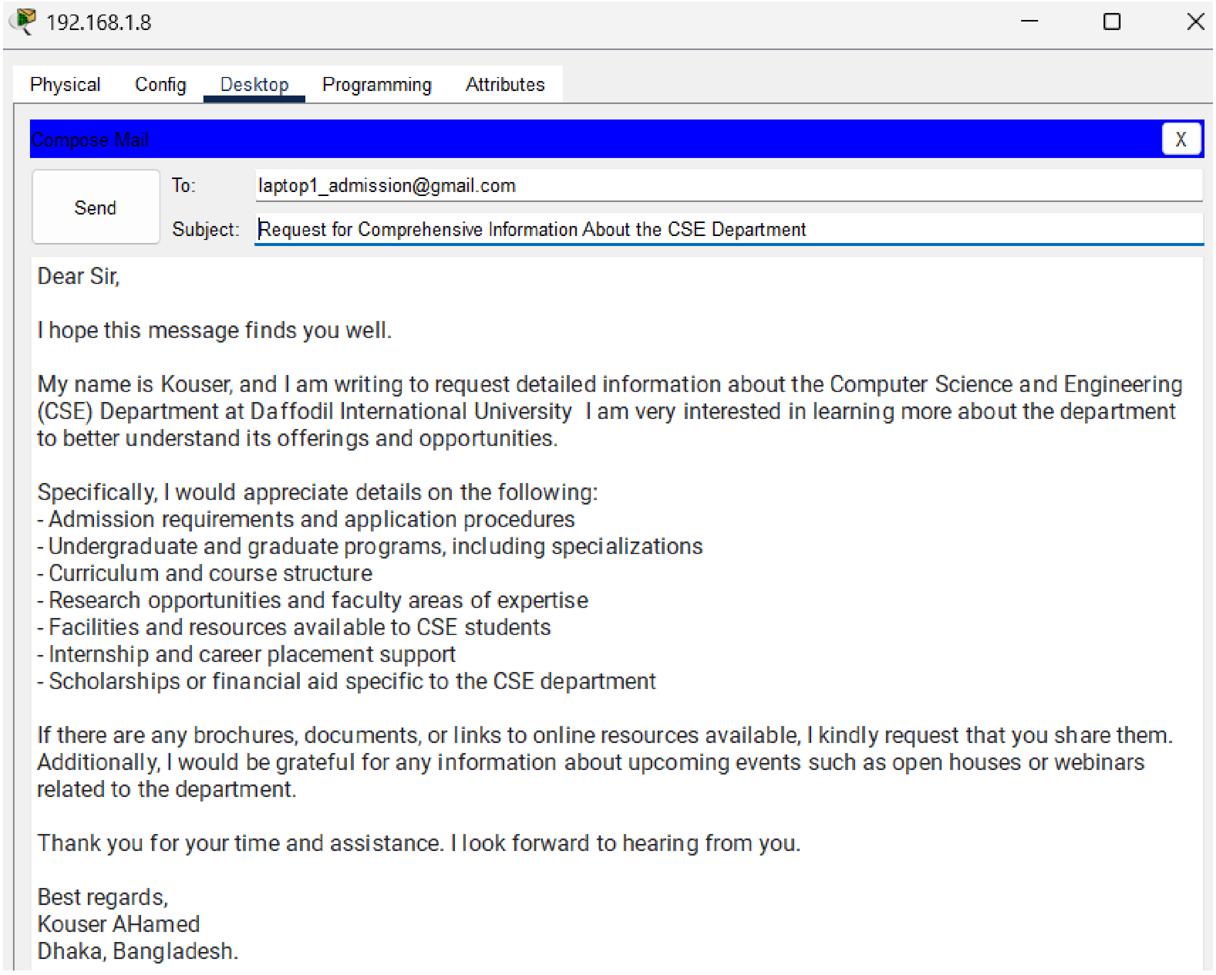


Figure 3.8: Send Email CSE Department To Admission Office

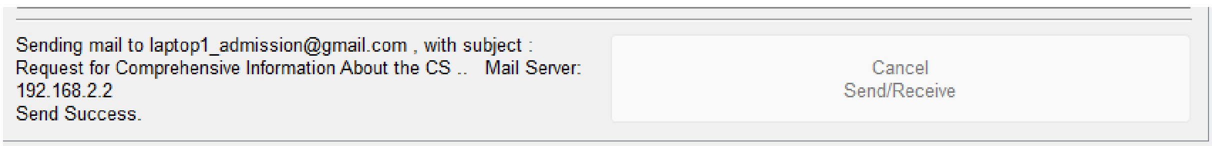


Figure 3.9: Send Email CSE Department To Admission Office

Received Email CSE Department From Admission Office:
Here we can see that the Department of Computer Science and Engineering has sent us an email requesting all the information for the students, so we are opening the email and reading it here. So finally we can see here that we can send messages everywhere and send emails to all our

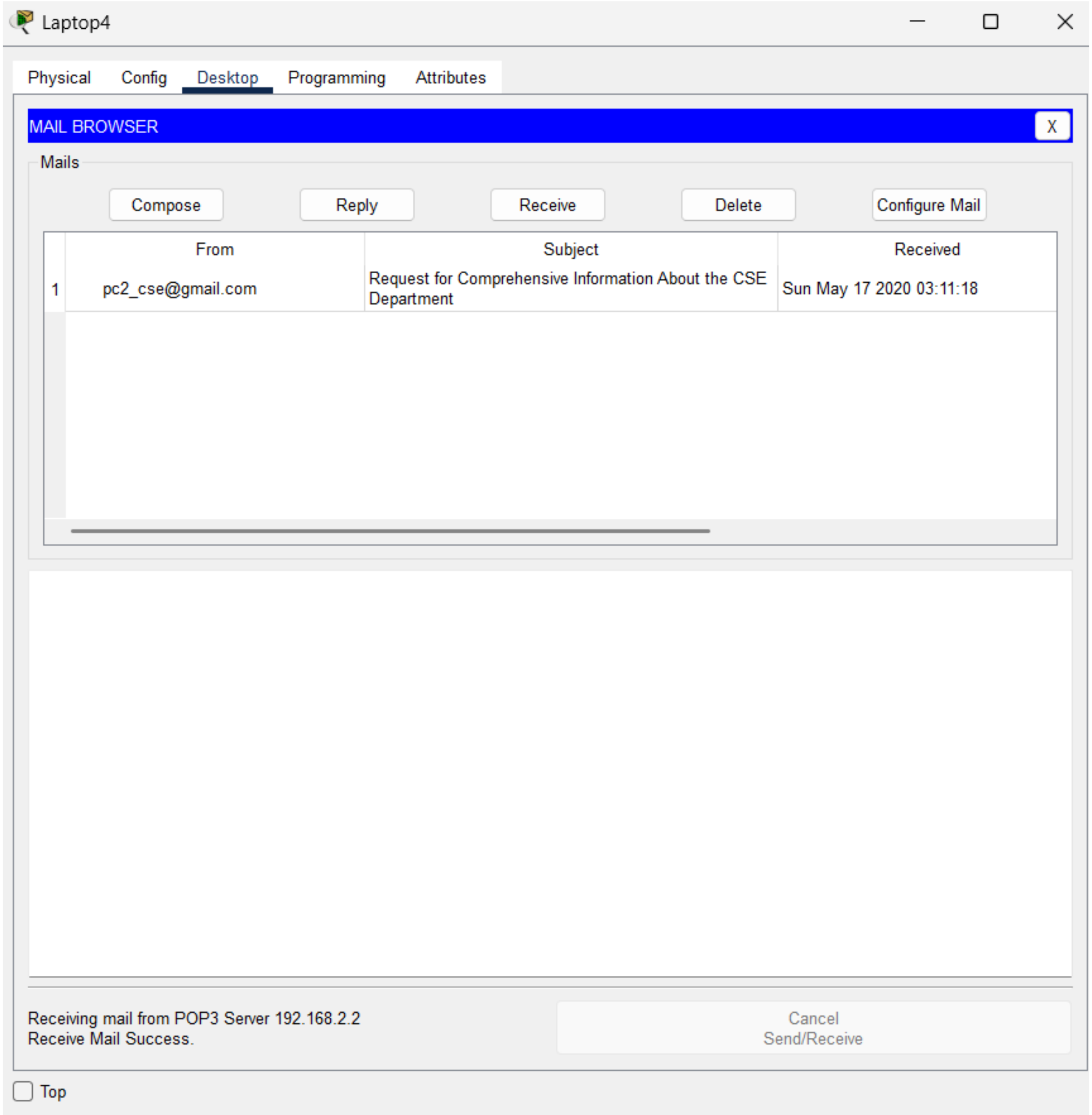
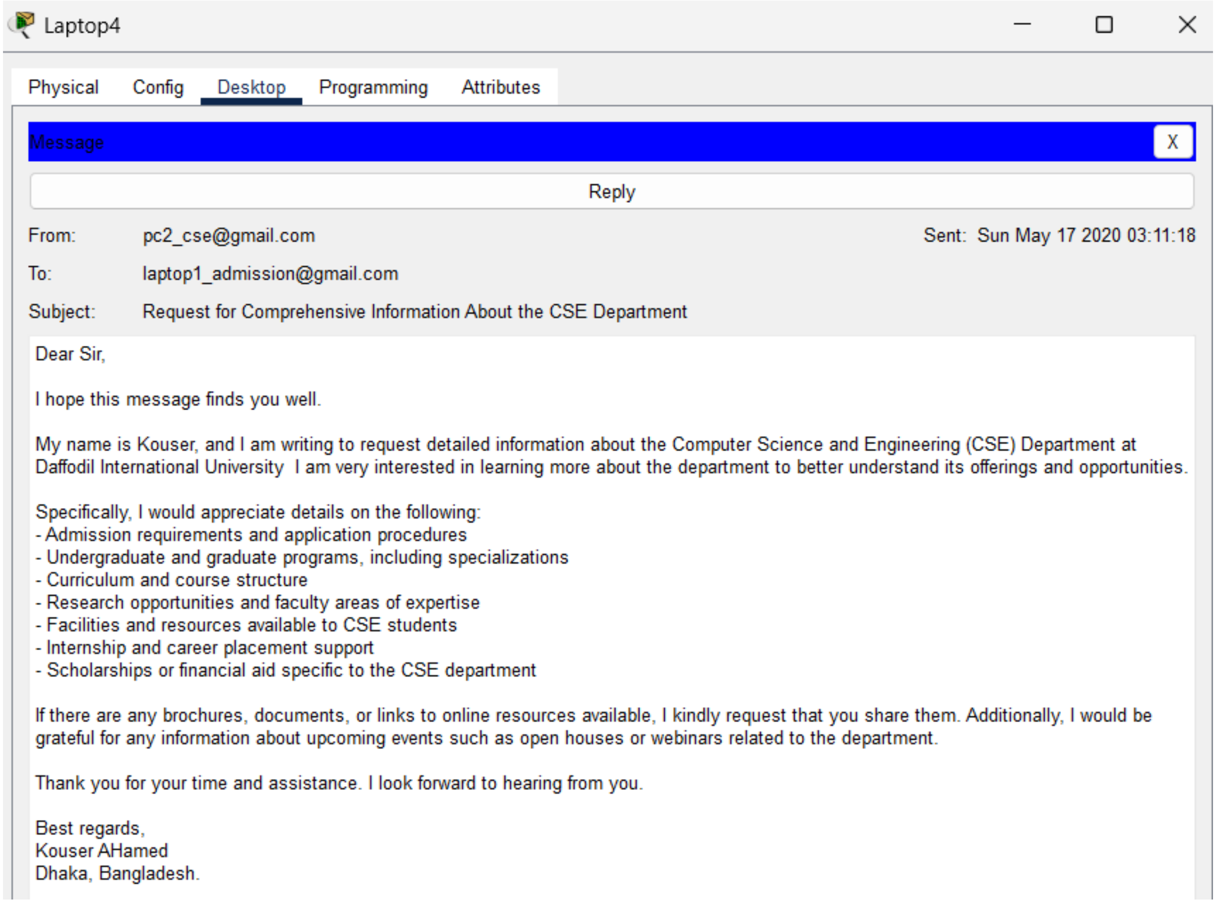


Figure 3.10: Received Email CSE Department From Admission Office

users, so we can finally say that our project is completely functional and efficient.


Laptop4

Physical Config Desktop Programming Attributes

Message

Reply

From: pc2_cse@gmail.com Sent: Sun May 17 2020 03:11:18

To: laptop1_admission@gmail.com

Subject: Request for Comprehensive Information About the CSE Department

Dear Sir,

I hope this message finds you well.

My name is Kouser, and I am writing to request detailed information about the Computer Science and Engineering (CSE) Department at Daffodil International University I am very interested in learning more about the department to better understand its offerings and opportunities.

Specifically, I would appreciate details on the following:
- Admission requirements and application procedures
- Undergraduate and graduate programs, including specializations
- Curriculum and course structure
- Research opportunities and faculty areas of expertise
- Facilities and resources available to CSE students
- Internship and career placement support
- Scholarships or financial aid specific to the CSE department

If there are any brochures, documents, or links to online resources available, I kindly request that you share them. Additionally, I would be grateful for any information about upcoming events such as open houses or webinars related to the department.

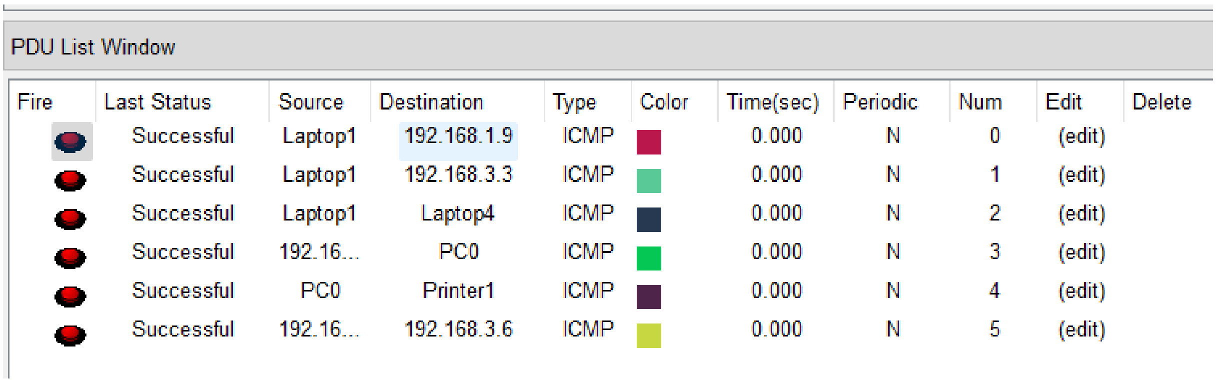
Thank you for your time and assistance. I look forward to hearing from you.

Best regards,
Kouser AHamed
Dhaka, Bangladesh.

Figure 3.11: Received Email CSE Department From Admission Office

Message Send:

We are now checking whether our messages are going from one user to another, so we are sending messages from the playground to the boys' hostel admission office, the CSC department, the CSE department, the IT office, and from the playground to the AB1 building and many other users to see if our messages are being exchanged properly.


PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Laptop1	192.168.1.9	ICMP		0.000	N	0	(edit)	
	Successful	Laptop1	192.168.3.3	ICMP		0.000	N	1	(edit)	
	Successful	Laptop1	Laptop4	ICMP		0.000	N	2	(edit)	
	Successful	192.16...	PC0	ICMP		0.000	N	3	(edit)	
	Successful	PC0	Printer1	ICMP		0.000	N	4	(edit)	
	Successful	192.16...	192.168.3.6	ICMP		0.000	N	5	(edit)	

Figure 3.12: Message Send.

Chapter 4

Engineering Standards and Mapping

4.1 Impact on Society, Environment and Sustainability

4.1.1 Impact on Life

The project improves connectivity and access to educational resources, enhancing learning experiences. With a reliable network, students and faculty can seamlessly share resources, access online content, and conduct collaborative research projects, fostering an environment conducive to learning and innovation.

4.1.2 Impact on Society & Environment

Efficient networks reduce resource wastage and promote collaboration across departments. By enabling better communication, the network supports administrative efficiency, reduces paper usage through digitization, and facilitates e-learning, contributing positively to society and the environment.

4.1.3 Ethical Aspects

The network design ensures data integrity and privacy, adhering to ethical standards in information security. Proper configurations and access controls prevent unauthorized access, maintaining the confidentiality of sensitive academic and administrative data.

4.1.4 Sustainability Plan

The use of simulation tools minimizes hardware costs and environmental impact, fostering sustainability. By avoiding physical infrastructure during testing phases, the project reduces e-waste and emphasizes green technology solutions. This approach can be scaled to support future network expansions with minimal additional environmental burden.

4.2 Project Management and Team Work

The project was completed collaboratively, with team members sharing responsibilities for design, implementation, and testing. Clear communication and task delegation ensured efficient use of time and resources. Agile project management techniques were employed, allowing iterative development and rapid issue resolution. Team discussions and feedback loops further enhanced the project's quality.

4.3 Complex Engineering Problem

4.3.1 Mapping of Program Outcome

The project outcomes are linked to the following Program Outcomes which shows levels of compliance with engineering standards:

Table 4.1: Justification of Program Outcomes

PO's	**Justification**
PO1	Shows the understanding of basic principles of engineering for machine learning and health care use.
PO2	Offers the tools for solving the actual problems of healthcare and guarantees their credibility and effective applicability to tumor classification.
PO3	Creates models of treatment and prevention in the area of public health, exposing real life ideas for early diagnosis of cancer.

4.3.2 Complex Problem Solving

The Project is based on solving critical problems associated with complex campus Networking by fulfilling the below stated requirements:

Table 4.2: Mapping with complex problem solving.

Criteria	Rationale
EP1: Depth of Knowledge	Thinking about the design in-depth as it pertains to having VLANs, route protocols, and security aspects that allow for an efficient network on campus.
EP2: Range of Conflicting Requirements	Striking the balance between security, scalability, and cost. Minimizing hardware costs with simulation tools, while ensuring secure access.
EP3: Depth of Analysis	Network Performance, with in-depth performance testing, examining latency, packet loss, and dynamic routing properties.
EP4: Familiarity of Issues	Solving problems like poor communication between departments and lack of security.
EP5: Applicable Codes	Following best practices and guidelines regarding data security, access control, and ethical use of network resources.
EP6: Stakeholder Involvement	The network design should be developed in collaboration with academic departments and IT staff to ensure that it meets the educational and administrative needs of the institution.
EP7: Interdependence	Bringing engineering and IT solutions together for an integrated, scalable and sustainable campus networking system

4.3.3 Engineering Activities

The project achieves the success through the following key activities:

Table 4.3: Mapping with complex engineering activities.

Criteria	Rationale
EA1: Range of Resources	By using Cisco Packet Tracer and various Python libraries to model the network and analyze the output, cutting down on the usage of expensive hardware.
EA2: Level of Interaction	Work with your IT staff, faculty and students to coordinate a network design that meets user needs.
EA3 & EA4: Innovation and Impact	Recommend future-proofed network structures that allow for extra elements such as IoT products or AI-controlled supervision.
EA5: Familiarity	By using simulation, the environmental impact is minimal, and these simulations can be scaled up, making it a great way to implement eco-friendly practices.

Chapter 5

Conclusion

5.1 Summary

The project successfully simulated a secure and efficient campus network using Cisco Packet Tracer. By employing VLANs and routing protocols, the network achieved robust inter departmental and external communication. The practical application of theoretical concepts provided valuable insights into network design and optimization. Additionally, the project demonstrated the importance of segmentation, security, and scalability in modern campus environments. The successful implementation underscores the role of simulation tools in developing cost-effective and sustainable networking solutions.

5.2 Limitation

However, the work cannot be without some drawbacks:

- Simulation-Based Design: The project simulation, which relies on the Cisco Packet Tracer, may not fully simulate actual real-world conditions, especially hardware constraints or environmental aspects.
- Scalability Constraints: The network simulation may not operate effectively for an increased network activity characterized by too many devices or persons without further optimization.
- Security Limitations: Further, the simulation does not provide for advanced security measures such as scopes with intrusion detection systems even though they are simulated basic security scopes such as VLANs, secure protocols. Secondly, institutional deployment would require purchasing multiple routers, switches, and servers whose cost may be unmanageable by many institutions. Another limitation is that the simulation has not been done on a live network.
- Future Technology Adaptation: Lastly, the network design would need changing or adding new elements to adapt some cutting-edge technology such as 5G networks, IoT, or AI-managed networks.

- Therefore, actual network traffic may vary, making it difficult to understand its effectiveness. Additionally, there is little attention directed to user involvement related to the project, which may contribute to a low utilization of the network.

- The simulation does not consider physical and environmental influences like wireless network interference. The model is based on the restriction of one vendor, Cisco Packet Tracer and further Cisco technologies. Finally, the model does not assess the type of phishing, ransomware, etc.

5.3 Future Work

To overcome these obstacles and make the project even better:

- Real-Time Deployment: Implement the proposed system within networks of an actual university in order to evaluate its performance in real time.

- Enhanced Security: Use of firewalls, intrusion detection systems (IDS), and VPNs to secure sensitive data with advanced security mechanisms.

- Integration of IoT Devices: Network growth Expand the network to accommodate machines to connect the Internet of Things (IoT), including smart sensors and connected classroom equipment in learning and administrative tasks.

- Automation and AI Integration: Standardize processes and allow technology to perform the inner workings.

- Cloud Integration: Extend the campus network to the cloud for data storage, application hosting, and remote access for flexibility and lower on-premises hardware costs.

References

[1] L. Ezema, W. Mbonu, U. Nwogu, and C. Owuamanam. Plan, design and simulation of university network. *International Journal of Advanced Computer Research*, 4(3):834, 2014.

[2] A. H. Ahmed and M. Al-Hamadani. Designing a secure campus network and simulating it using cisco packet tracer. *Indonesian Journal of Electrical Engineering and Computer Science*, 23(1):479–489, 2021.

[3] P. Kornilovitch, R. Bicknell, and J. Yeo. Fully-connected networks with local connections. *Applied Physics A*, 95(4):999–1004, 2009.

[4] R. S. S. AlSarhan. Computer network design for universities in developing countries, 2016.

[5] R. Jiang. A review of network topology. In *4th International Conference on Computer, Mechatronics, Control and Electronic Engineering*, pages 1167–1170. Atlantis Press, 2015.

[6] G. E. Clarke. *CompTIA Network+ Certification Study Guide*. McGraw-Hill, 2009.