Redesigning the Existing Network of ip-Link Network

Md. Tanvir Ashrafee

ID# 19103067

A Practicum in the Partial Fulfillment of the Requirements

for the Award of Bachelor of Computer Science and Engineering (BCSE)

Department of Computer Science and Engineering
College of Engineering and Technology
IUBAT–International University of Business Agriculture and Technology

Fall 2023

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The practicum has been examined and approved,

_____

Prof. Dr. Utpal Kanti Das
Chairman

_____

Shahinur Alam
Co-supervisor, Coordinator and Assistant Professor

_____

Supervisor Name
Supervisor and Designation of the Supervisor

Department of Computer Science and Engineering
College of Engineering and Technology
IUBAT–International University of Business Agriculture and Technology

Fall 2023

Letter of Transmittal

17 October 2024

The Chair

Practicum Defense Committee

Department of Computer Science and Engineering

IUBAT–International University of Business Agriculture and Technology

4 Embankment Drive Road, Sector 10, Uttara Model Town

Dhaka 1230, Bangladesh.

Subject: Letter of Transmittal.

Dear Sir,

I am writing to submit my practicum report entitled "Redesigning the Existing Network of ip-Link Network" which I have completed as a part of the Bachelor of Computer Science and Engineering (BCSE) program's requirement at IUBAT – International University of Business Agriculture and Technology.

The purpose of this practicum was to apply my theoretical knowledge in a real-world situation. For almost three months, I worked hard with ip-Link Network's Support Department, and prepared the report by providing the best of my ability. Now I am looking forward to get your thoughtful feedback on this practicum report. I hope that my report will be useful to you and that it will contribute to the development of network industry. If you kindly go through this report and evaluate my performance, I will be grateful to you.

Yours sincerely,

_____

Md. Tanvir Ashrafee
ID# 19103067

Organization Certificate

Place your organization-certificate image here.

Student's Declaration

I am Md. Tanvir Ashrafee, ID: 19103067, a student of Department of Computer Science and Engineering, IUBAT. The practicum report titled as "Redesigning the Existing Network of ip-Link Network" has been prepared for the partial fulfillment of Bachelor of Computer Science and Engineering (BCSE) Program, Department of Computer Science and Engineering, IUBAT. I am declaring that my practicum report has been fully prepared by me and not appeared in any other places before. The sources of topic-related information included in this study are dully cited in the reference section.

_____

Md. Tanvir Ashrafee
ID# 19103067

Supervisor's Certification

This is to certify that Md. Tanvir Ashrafee, ID: 19103067 students of Department of Computer Science and Engineering, IUBAT, completed the practicum report titled as "Redesigning the Existing Network of ip-Link Network" has been prepared for the partial fulfillment of Bachelor of Computer Science and Engineering (BCSE) program, IUBAT. The report was written under my supervision. Based on my knowledge and according to his declaration, this report was created by him.

The contents of the report have not been submitted anywhere. He is no prepared to submit the report. I wish him the best of luck in his future undertakings.

_____

Dr. Md. Hasibur Rashid Chayon

Supervisor and Associate Professor

Department of Computer Science and Engineering

IUBAT–International University of Business Agriculture and Technology

Abstract

Computer networking and the Internet are becoming increasingly significant in all sectors of society, from the home to the workplace. One of the top local Internet service providers in Uttara, The IP-Link Network offers Internet access to customers who succeed in all spheres of business and promotes socioeconomic development. It took a lot of effort in the customer service department and throughout the IP Link Network, Uttara networking system to create this practicum report, "Redesigning the Existing Network of ip-Link Network." This practicum activity's main goals are to examine and learn about the IP-Link network as it currently exists, to address any current shortcomings, and to make some recommendations for improvements that could boost the network's efficiency. The Open System Interconnection (OSI) model, IP addressing, and the Transmission Control Protocol/Internet Protocol (TCP/IP) suite are all carefully studied in order to accomplish this goal. Next, the current network infrastructure of the IP-Link network—which comprises network devices, wired and wireless communication, routing protocols, tools for network monitoring, and tools for network security—is examined. Although the current network performs fairly well overall, the demands for constant expansion are causing limitations. Only a few changes are suggested for the suggested network. The IP-Link network performs better overall as a result of these changes. With the help of the well-known packet tracer program "CISCO Packet Tracer" version 8.2.0, the performance of the suggested and current networks was displayed. The results of the simulation and comparative study show, that the proposed network can significantly improve the IP-Link network performance compared to existing network of IP-Link Network.

Acknowledgments

To begin, I would like to express my appreciation to Allah, the Merciful and Grateful, for giving me the strength to finish the practicum report on time. I am very happy to take this opportunity to thank a few people who have assisted, encouraged, guided, and supported me throughout my practicum program. I would like to express my gratitude to the late Vice-Chancellor of IUBAT – International University of Business Agriculture, and Technology, professor Dr. Md. Alimullah Miyan, for allowing me to study at this university, which is the country's most beautiful and well-known non-government university. I would like to express my gratitude and respect to our current vice chancellor Dr. Abdur Rab, IUBAT.

I would like to express my appreciation to Prof. Dr. Utpal Kanti Das, Chairman of the Department of Computer Science and Engineering at IUBAT for allowing me to study there and enabling me to envision a bright future in the modern technological field.

I would Like to Express my gratitude to Shahinur Alam and Md. Rashedul Islam, who server as the Coordinator of the Department of Computer Science and Engineering at IUBAT. They deserver special recognition for the unwavering support and direction provided throughout my BCSE degree program.

I would Like to express gratitude to my supervisor Dr. Md. Hasibur Rashid Chayon, for giving me the chance to write such a practicum report and for offering me the invaluable guidance and support at any time and in any circumstance. I was able to complete this report professionally and correctly only under his supervision.

I would like to express my appreciation to my organizational supervisor. I have received excellent instruction in learning about the organizational networking and monitoring system from Md. Jahirul Islam, Chief Executive Officer, ip-Link Network, Uttara.

I would like to express my appreciation to all of the faculty members for their consistent encouragement and support throughout my BCSE degree program.

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Chapter 1

Introduction

As the modern world changes, computer networks become more and more important to everyone. The Internet is the most well-known computer network. It offers a vast array of resources and services. These days, it is difficult to envision a world without the Internet. This practicum report was written following the internship program at IP Link Network (Local ISP), Bangladesh, in the Customer Support Department. This is a neighborhood Internet service provider in Uttara, Bangladesh that offers Internet access. The primary objectives of this practicum activity are to study and learn the existing network of IP-Link network in a hands-on manner, to address the current limitation of it and to suggest some modification for enhancing the network performance of IP-Link network. To achieve this goal, overview of data communication and networking including IP addressing, the Open System Interconnection (OSI) model, and the Transmission Control Protocol/Internet Protocol (TCP/IP) protocol suite are studied thoroughly. Then the IP-Link network's existing network is studied that includes network devices, wire and wireless communication, routing protocols, network monitoring tools, and network security tools. The existing network's overall performance is quite good but limitations are occurring due to the continuous expansion demands. Therefore, a number of limitations of the existing network has been addressed. In the proposed network, there are few modifications are suggested. These modifications not only overcome the addressed limitation but also improve the overall performance of the IP-Link network. The well-known packet tracer software version 8.2.0 of 'CISCO Packet Tracer' was utilized to demonstrate the performance of the proposed existing networks. The results of the simulation and comparative study shows that the proposed network can significantly improve the IP-Link network performance. During the internship, practical experience was gained in troubleshooting network issues, configuring routers and switches, and optimizing bandwidth. The importance of network monitoring tools like MRTG and security protocols was also explored to ensure network reliability. Proposed improvements include enhanced routing protocols and better load balancing to handle increasing demand. These changes aim to enhance overall network efficiency and security for IP-Link Network.

1.1 Objectives of BCSE Program

The significant objective of the Bachelor of Computer Science and Engineering (BCSE) program is to make students for their profession in production, academic community and administration by evolving them in the required practical skills and mutual expertise. The extensive goal is to distribute students with the new analytical structure and practical competence that is needed to encounter the contemporary evolving trades. A detailed theoretical understandings and ideas strengthening the complete computing methods are provided to the students by the BCSE program. This allows the students to examine and determine the technical matters with the software, hardware and networking methods now-a-days. The BCSE program is underneath of the College of Engineering and Technology (CEAT). The program has 146 credit hours. A BCSE student performs as an internee with his/her appropriate organization after completing all the requisite courses in the BCSE program.

IUBAT–International University of Business Agriculture and Technology contributes a significant force on the necessity of technical task circumstances in the BCSE program. A Practicum, called as deployment of task is a graduate extent course in an especial study area. It provides technical understanding to the students of a formerly or simultaneously learned approaches in software, hardware and computer networking strategies. The procedure of practicum has been completed under a company which takes after an internship program. In the practicum program, a student can take part which consists of twelve weeks duration. One of the faculties of the department supervises the practicum program.

1.2 Source of the Report

This practicum report has been developed as an essential segment of the internship program of IUBAT. This internship has been completed under the IP Link Network which is an ISP company. The company has observed their duty with the internship accessory. The respectable faculty members Prof. Dr. Utpal Kanti Das, Chairman; Shahinur Alam, Coordinator and Assistant professor; and Supervisor Dr. Hasibur Rashid Chayon, Associate Professor, Department of Computer Science and Engineering, IUBAT are the persons who are responsible for the gracious deliberation and supervise the practicum program

academically from the institution. The your-organization-name has given a chance to perform the internship program with them and contributed the essential information for making this practicum report.

1.3 Methodologies

There are several methods are applied to complete this practicum work and develop this report. Primary and secondary sources that are utilized in this work are given below:

1.3.1 Primary Sources.

The steps of primary sources are given below:

- Primary data is gathered from Dr. Hasibur Rashid Chayon, the supervisor of our institute.
- Md. Jahirul Islam Kamal, the CEO and supervisor of our office.

1.3.2 Secondary Sources.

The steps secondary sources are given below:

- Secondary data gathered from the Internet.
- Informal conversation with the employees.
- Sources include websites and books

1.4 Objectives

The objectives of this practicum are:

- To understand how to infrastructure operate.
- To understand the fundamental idea of security.
- To be aware of the monitoring and maintenance of the network.
- To suggest some changes in the existing network that is needed.
- To improve the performance of the network.

Chapter 2

Organizational Overview

IP-Link Network has emerged as a prominent and auspicious Internet service provider (ISP) in the Uttara Area since its establishment in 2010. The business is becoming more and more known for providing distinctive Internet solutions and quick, dependable Internet connections to both valued individual and business clients.

A massive fiber optic network is part of the high-performance network infrastructure backbone that IP Link Network has constructed. Over time, this network has changed to fulfill the objective of providing services to customers in various important locations throughout Uttara. At the most affordable prices, IP Link Network is always prepared to provide sincere services and benefits.

2.1 Mission

In order to improve productivity and quality of life, offering a broad range of Internet and information technology services to people and businesses at a fair price while utilizing the newest technology.

2.2 Vision

Become the biggest provider of information technology (IT) services in Bangladesh with the best local connectivity and broadband Internet standards, all the while aiming to maintain our remarkably high standards of customer care.

2.3 Organization Services

There are multiple departments within IP Link Network that function as the primary departments of the company. These are described in more detail below.:

- Customer Services:

  Customer service representatives converse with customers to provide information and address concerns regarding goods and services. They also assist in solving problems and deal with them. Customer service representatives usually obtain information via phone calls, emails, or in-person meetings. 24 hours a day, 7 days a week, free customer support is provided by IP Link Network.

- Technical Support: Customers can always get assistance from a sizable technical support team consisting of more than six individuals. Services for IP Link Networks are offered in a particular region of Uttara as well as outside of it. Consequently, issues arise constantly. In order to resolve these problems and give clients the assistance they need, IP-Link Network's technical support staff is essential.

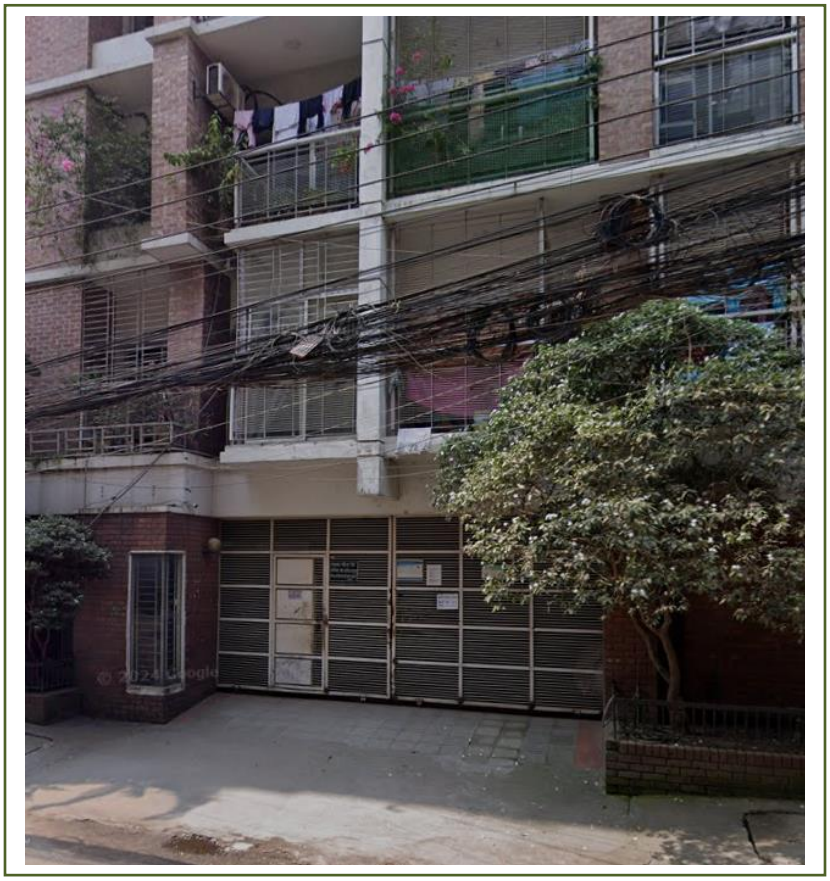


Figure 2.1 Location of ip-Link Network

2.4 Address of Office

Ip-Link Network

House: 73/C, Road- 12/b, Sector -10, Uttara Dhaka, Bangladesh

Phone: 01710534647

Email: iplinkisp@gmail.com

Chapter 3

Existing Network of ip-Link Network

Understanding the existing network infrastructure is a critical step in identifying areas for improvement and ensuring that any proposed enhancements align with the current operational framework. Ip-Link Network, as a leading Internet Service Provider in Bangladesh, relies heavily on a robust and efficient network to deliver seamless connectivity and high-quality service to its clients. The existing network serves as the backbone for a wide array of services and functions, from data transmission to network management and customer support. In this section, we will delve into the specifics of ip-Link network's current office network configuration. This comprehensive overview will encompass the network's architecture, key components, and operational protocols. By examining the current setup, we can better understand its capabilities, limitations, and potential points of failure. This analysis will provide a foundation for proposing targeted improvements aimed at enhancing network performance, reliability, and security.

Through a detailed exploration of the existing network, including its topology, hardware, and software components, as well as its current management practices, we can pinpoint the critical areas that require attention. This will enable us to tailor our recommendations to address the unique challenges faced by ip-Link Network and ensure that the network continues to support the company's growth and operational excellence.

3.1 Existing Network Structure

ip-Link Network, a prominent internet service provider in Uttara and the nearby area, has established comprehensive network infrastructure to support its operation. It is not as big as other ISP company and still its able to give their client the satisfactory services. This section provides an overview of the current network setup, detailing the hierarchical structure, departmental connections, and inter-office linkages.

As shown in Figure 3.1, at the heart of the network lies the Core Router, which is very important and doing very powerful work. It is positioned such a way that it can be accessed by the office employee for checking and troubleshooting purpose. At first the Internet directly comes and connects with the two port of the core switch. Because it has a backup line for safety. Then one line goes to the switch where the NOC department and their servers are aligned together in same area. From here all the routing and troubleshooting happens.

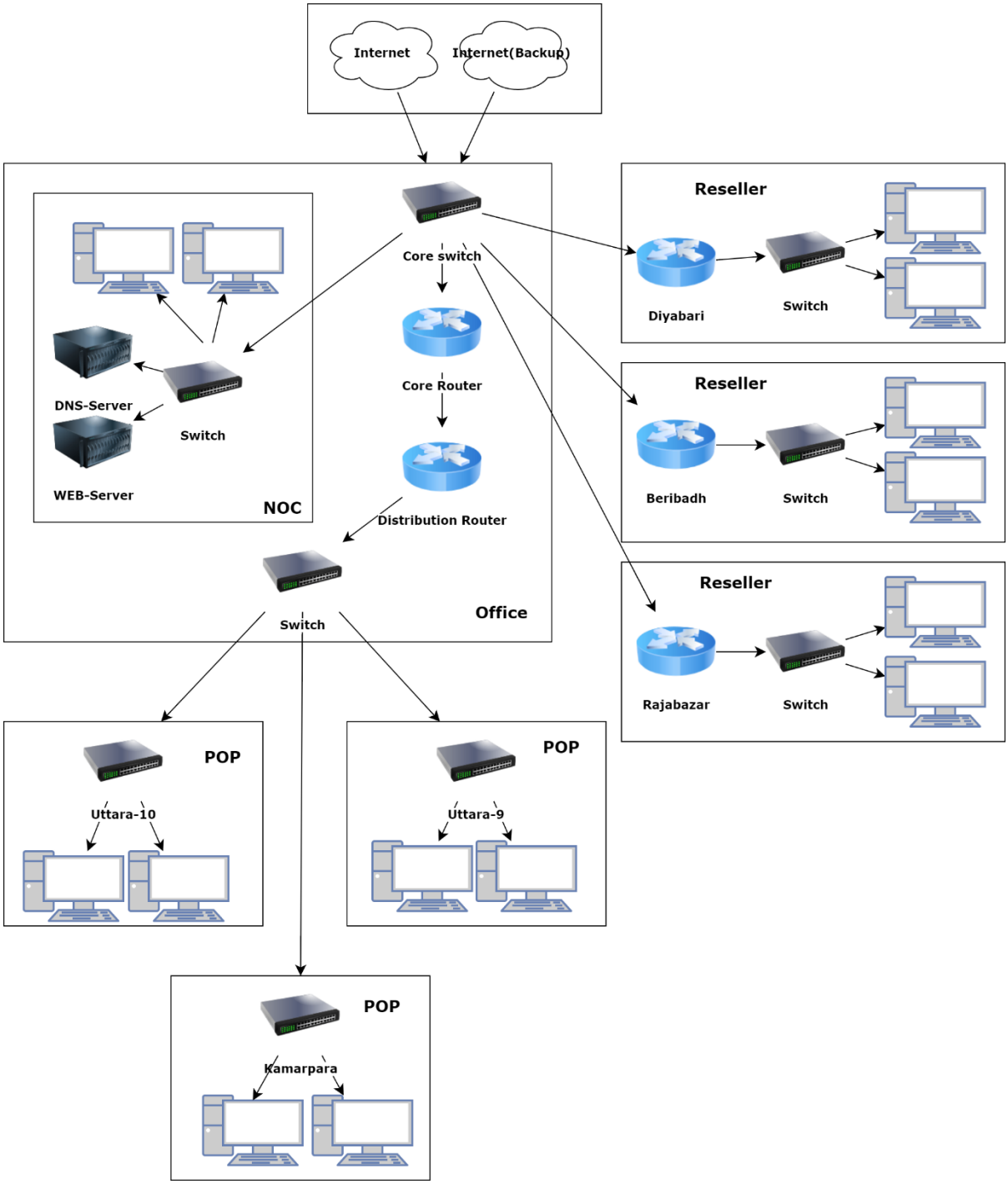


Figure 3.1: Existing Model of the ip-Link Network

From the core router the network goes to the distribution router where the network gets divided for the area wise POP (Point of Presence). And from the core switch three more line gets to the three resellers.

3.2 Communication Channels

The cable infrastructure of ip-Link Network is critical component of the overall network, ensuring a structured and organized network layout also reliable and high-speed data transmission across various levels and locations. This section provides a detailed explanation of the cabling setup used within the network, highlighting its role in maintaining network performances and connectivity.

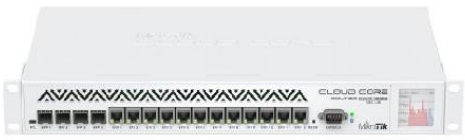
Figure 3.2: Optical Fiber Cable (Left) and Fast Ethernet Cable (Right)

The Core Router serves as the central hub of the network, and all primary connections originate from this point. The cabling used in these connections is designed to support the high bandwidth and reliability requirements of the network. All the internal connection has been done with optical fiber cable for fast low latency data transfer and rj45 cable is used where speed is not first priority. These connections ensure that data is transmitted efficiently between the Core Router and the Distributed Routers, facilitating smooth communication across different departments. The core router is also connected with distribution router for fast and reliable distribution which core router is unable to do for long term. Each reseller connection is also done via optical fiber cable due to its long range data transmission with low latency data transfer and secure connection without any other router or OLT in between the connection.

3.3 Network Infrastructure

The devices used in ip-Link Networks are briefly described below. Table 3.1 is showing the devices ip-Link Networks use.

Table 3.1 List of Devices used by ip-Link Networks

Device Name and Figure	**Key Features**
Richerlink RL8004EL OLT 	PON Ports:4 (up to 64 ONUs each) Uplink ports: 4 GE Combo Pon Standard: GPON Price: 86000-130000 BDT
MikroTik CCR1072-1G-8S+ 	CPU: 72-core Tiera CPU, 1GHz Ports: 1 Gigabit Ethernet, 8 SFP+ (10Gbps) RAM: 16 GB DDR3 Throughput: Up to 80 Gbps Price: 145000-200000 BDT
Cisco SF350-48P-K9-EU 48-Port 10/100 Managed PoE Network Switch 	Ports: 48 x 10/100 Mbps Ethernet ports (PoE) PoE Budget: 370 W Management: Web-based management, CLI, SNMP Layer: Layer 2 Price: BDT 60,000 - BDT 85,000
MikroTik CCR1036-12G-4S-EM 	CPU: 36-core Tilera CPU, 1.2 GHz Ports: 12 Gigabit Ethernet, 4 SFP (1 Gbps) RAM: 16 GB ECC DDR3 Throughput: Up to 16 Gbps Price: BDT 120,000 - BDT 170,000

3.4 Routing Protocols

Routing protocols are essential for directing data packets across the network efficiently and securely. ip-Link Networks employs a combination of static and dynamic routing protocols to manage both internal and external network communications. This section provides an in-depth analysis of the routing protocols used within the company's network infrastructure. There are mainly two types of routing protocol in networking-1) Static Routing and 2) Dynamic Routing. In ip-Link network all the main routing is done with static routing protocol.

Statice Routing: Within the office, ip-Link Network utilizes routing protocol for all the connection. Static routing involves manually configuring the routing table with predefined path for data packets. This method chosen for its simplicity and control, allowing the network administrators to precisely dictate the path the data takes through the network. Because static has one good side is its simple and easy to but when the network will get bigger it will not be easy to do.

3.5 Servers Provided by ip-Link Network

ip-Link Network offers multiple facility such as shared FTP server, own WEB server and DNS server. Each server type plays a specific role in ensuring smooth and efficient network functionality. Below is brief explanation of each server type:

HTTP (Hypertext Transfer Protocol) Server: This HTTP server is basically a web server, which handles web traffic by hosting websites and serving web pages to users. It processes HTTP requests from clients (Via web Browser) and responds with the appropriate web content, enabling users to access websites an online application.

DNS (Domain Name System) Server: DNS servers translate human-readable domain names (e.g., www.example.com) into IP addresses (e.g., 192.0.2.1) that computers use to identify each other on the network. This service is crucial for the functioning of the internet, enabling users to access websites using easy-to-remember names instead of numerical IP addresses.

FTP (File Transfer Protocol) Server: FTP servers facilitate the transfer of files between clients and servers over a network. They support uploading and downloading of

files, making them useful for sharing large files and managing website content. FTP servers can be accessed using FTP clients or through web browsers with FTP support.

3.6 Monitoring Tools and Ticketing Services

ip-Link have different types of users and software to monitor your network. We primarily use Winbox software to monitor, configure, and manage our network. The following describes the Winbox software workspaces and their functions. Figure 4.3 shows the Child menu in Winbox Software.

3.6.1 Winbox

Winbox is a GUI tool for configuring MikroTik RouterOS devices, allowing users to manage settings easily. It connects to routers via IP or MAC address, simplifying access to advanced features.

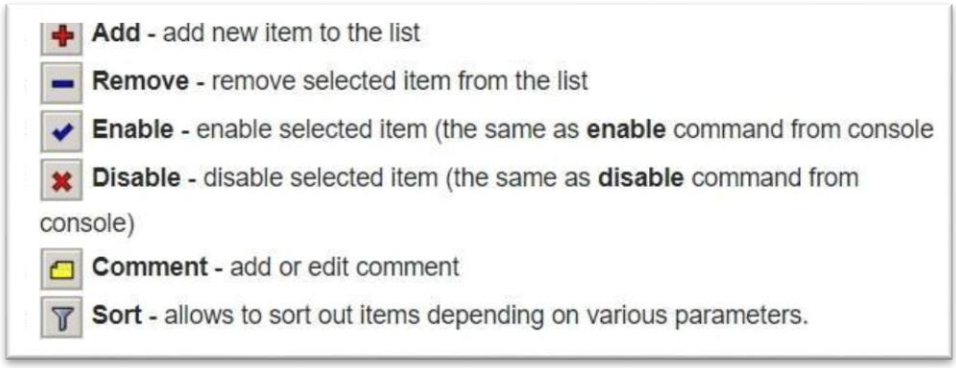


Figure 3.3 Child Menu in Winbox software

As shown in Figure 3.3, it provides it is the menu where every action can be seen. Like add, remove, enable, disable etc.

3.6.2 Interface List:

This menu contains information about all interface lists available on your router. There are three predefined lists: all (Includes all interfaces), none (Includes no interfaces), and dynamic (includes dynamic interfaces). You can also create additional interface lists. and dynamic (includes dynamic interfaces). You can also create additional interface lists.

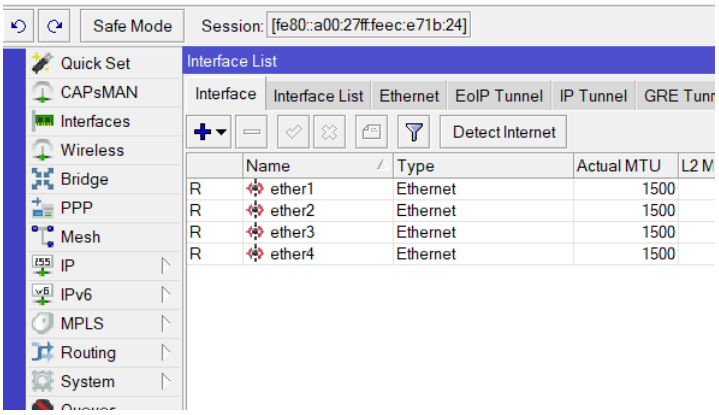


Figure 3.4 Interface list in Winbox Software.

3.6.3 PPP list

This menu contains information about the individual client lists available on your router. Client interact availability must be guaranteed from this list. All active connections are displayed in the list of active connections.

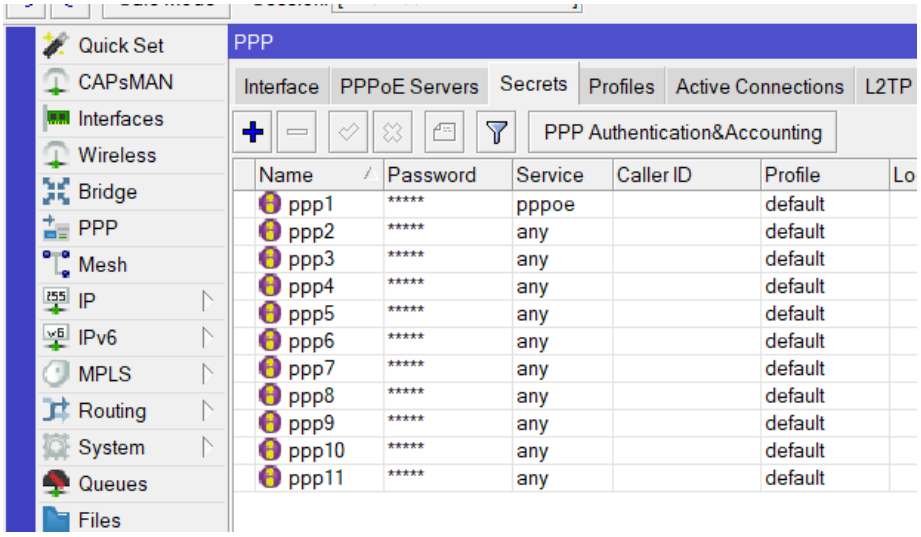


Figure 3.5 PPP List in Winbox Software.

3.6.4 MRTG Graph

Network Network traffic can be observed using a tool called Multi Router Traffic Graph (MRTG). In contrast, MRTG is not just utilized for traffic management. You can use MRTG to monitor an external program gathering data as well as any SNMP variable you can specify. This gives the user a graphical representation of the network's traffic load over time. Create a

graph showing the amount of network traffic over time. MRTG is a Perl script that works with NetWare, Windows, Linux, UNIX, and Mac OS X. This open source program is used to gauge network traffic load and track network traffic. Figure 3.6 shows the ip-Link networks daily, weekly, monthly, and yearly traffic loads.

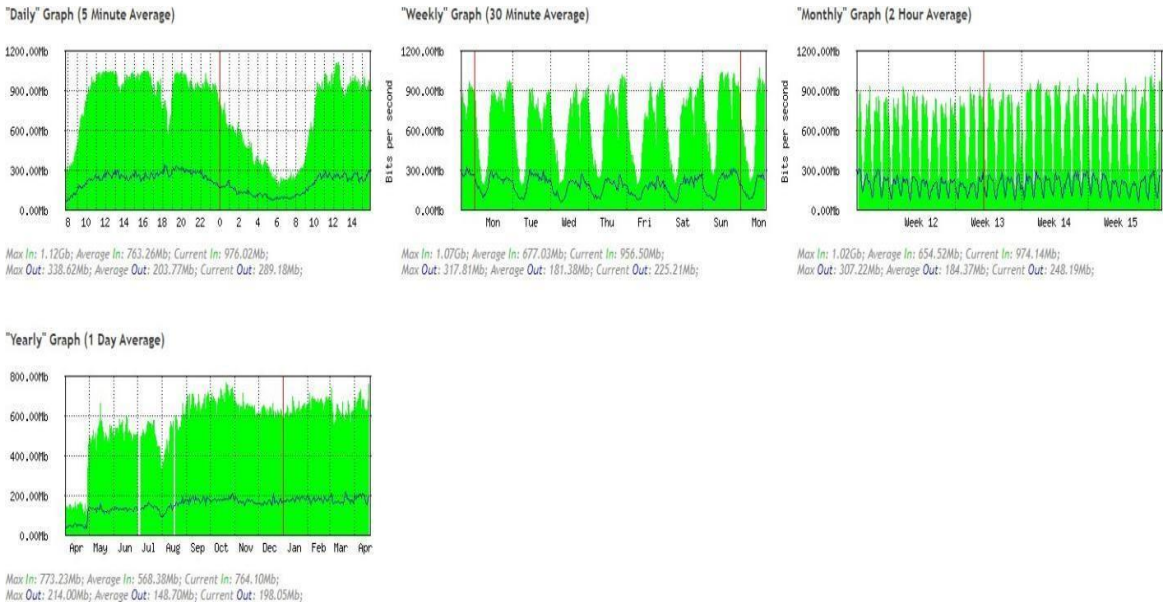


Figure 3.6 MRTG graph.

3.7 Security Tools and Software

The MikroTik Firewall is the security measure that IP-Link Network has opted to use. They use WinBox to handle complaints and manage customer support. IP-Link Network uses the PRTG monitoring tool to keep track on devices, particularly the Optical Network Terminal (ONU) and some Media Converters.

3.7.1 Winbox Software

The software program Winbox, created by MikroTik, offers a graphical user interface (GUI) for controlling and setting up MikroTik routers. It offers a simple interface with a number of tools and capabilities to make managing MikroTik devices easier. The win box software's user interface is depicted in (Figure 3.7).

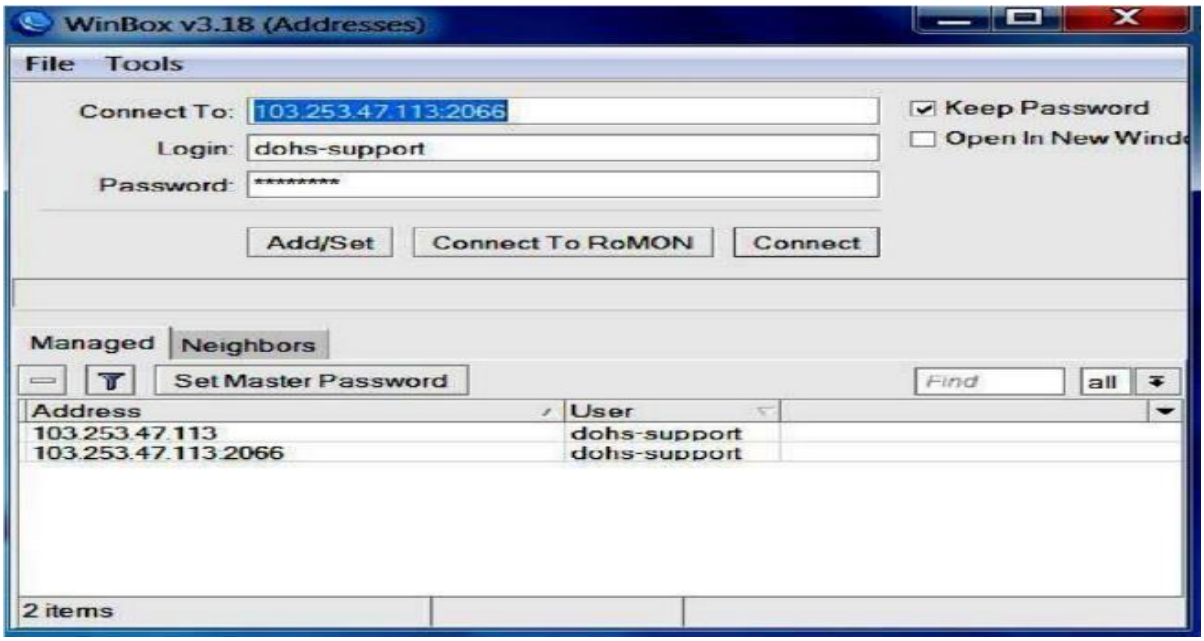


Figure 3.7 Interface of Winbox Software

3.8 Cost Estimation of Existing Network

In the table 3.2 below, the cost of the existing network of ip-Link Network is given.

Device Name	Cost	Quantity	Total
Core Router MikroTik Cloud Core Router 1072-1G8S	339,000	1	460000
Core Switch MikroTik (CCR1009–8G–IS-1S+)	45000	1	52000
Cisco SF350-48P-K9-EU 48-Port 10/100 Managed PoE Network Switch	60500	1	65500
Distribution MikroTik	158500	1	170500

CCR1036-12G-4S-EM Cloud Core Industrial Grade 12 Port Gigabit Ethernet			
Richerlink RL8004EL 4 port EPON OLT	45000	1	45000
Total			793000

3.9 Limitation of Existing Network

IP Link Network has limitations even though it provides customers with essential services. We noticed certain limitations that made it challenging to keep the network up to date and run it effectively. These limitations include:

- If the core router fails, then the whole network will be paralyzed and without a functional core router immediately the solution cannot be happened.
- There are no own FTP server so the speed will be limited for their main connection.
- There is no mail server for communication easily.
- There are no DHCP server for automatically ip routing, so every user needs to be set up their ip address manually.
- There are no security features in the noc department so the outsider can come and use their device as hacking device.

Chapter 4

Proposed Network

The current network was described in detail in the previous chapter. Some of the existing network's limitations are also addressed. A few changes to the existing network have been proposed in this chapter.

4.1 Proposed Network Diagram

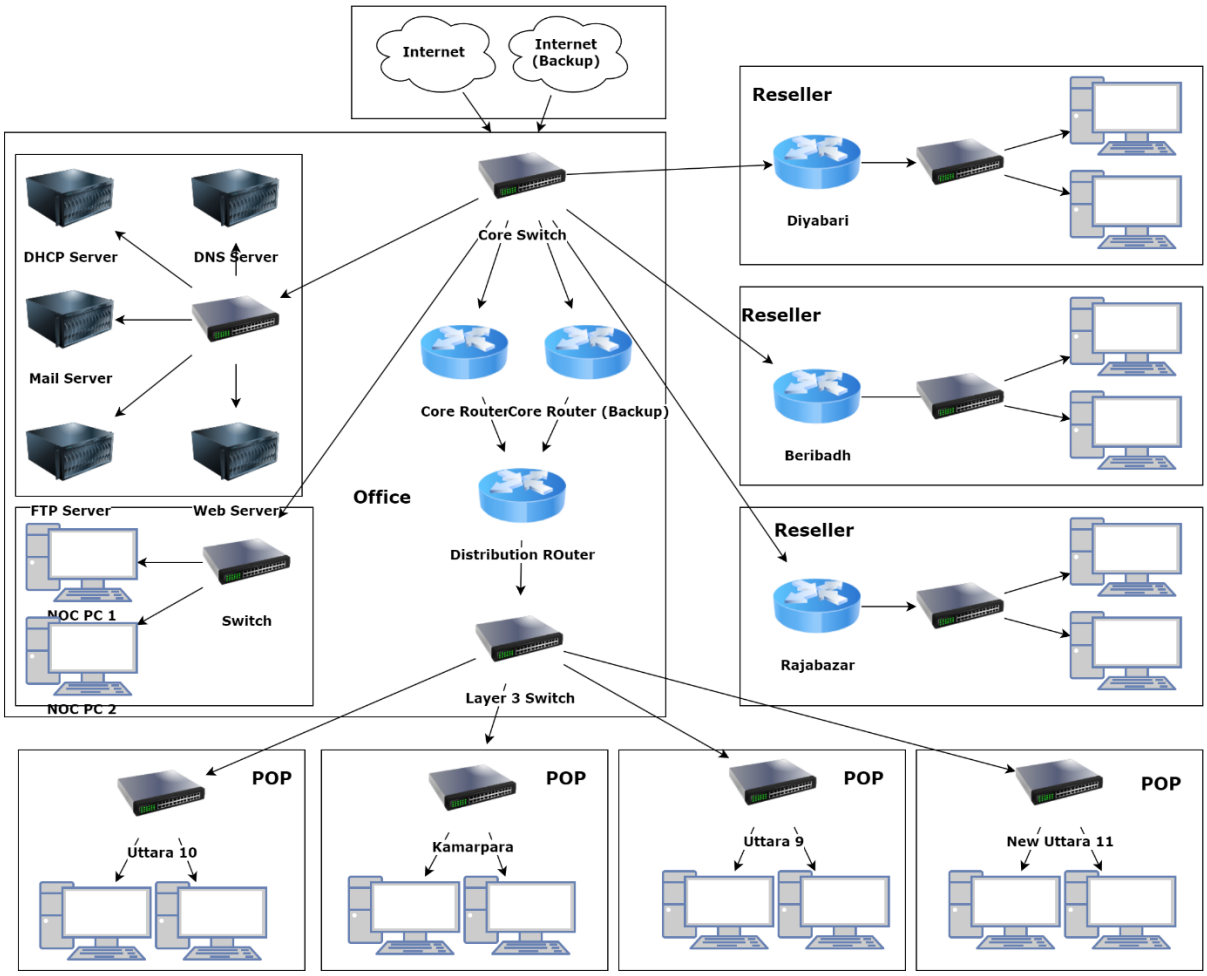


Figure 4.1 Proposed Network diagram for ip-Link Network

The proposed network's goal is to facilitate quick and easy connections and communication. The IP Link Network has undergone the following modifications. In this figure u can see that two router is being used. One is used for main data transfer and one is there for backup if somehow the main core router becomes faulty or does not work properly then immediately the data can transfer through the backup core router. The speed also will be

the same because the core router (backup) is as powerful as the main core router. this is very much needed. Because the core router is a heavy-duty router whose performance and data transferring protocol is incomparable with daily router we see at home. That the reason we used same router as core router. So whatever the time is needed to repair the core router or buy a new one that time the user can use the same speed as before without any problem. Providing each customer with a seamless connection is the primary goal. The internet is such a thing that after years of good service, an issue arises and your internet is cut off for two to three days. Your user will become irritated during that period and may decide to switch to a different Internet service provider (ISP).

4.2 Features of proposed network

The proposed network includes a number of elements that would improve the system's security and performance. They are:

- An extra core router for using as a backup core router.
- HSRP redundancy protocol used for using the backup core router when needed.
- Port security is added to improve the security of the noc department.
- Using mail server for better communication.
- Installing Own FTP server for fast downloading for the user.
- Using DHCP server for automated IP addressing.
- OSPF routing is used instead of static

Let’s Discuss about the features below:

4.2.1 Failsafe Mechanism for core router redundancy

In ip-Link network they have used only one core router just for the data transferring and data handling but suppose this router gets disturbed by third party or it automatically shutoff during the operation then the whole system will be turn off and to find out the problem it needs time and time is money. Every minute matters in the ISP industry. Many people are more concerned with 100% uptime than they are with extremely fast internet. It implies that there can never be a brief outage of the internet. Because they occasionally perform

important tasks like working in offices or hospitals where everyone is connected to the internet with the clients. In those situations, uptime is crucial. I therefore made an effort to improve the situation by installing a new router that was either as close to or as fast as the core router.

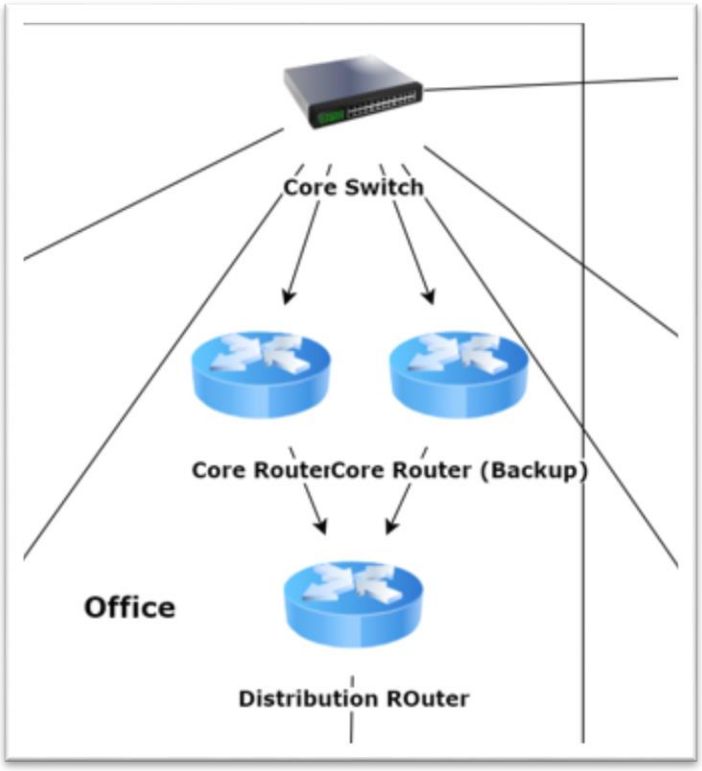


Figure 4.2 Proposed Networks Backup core router usage

4.2.2 HSRP Protocol Used for Network Redundancy and Failover

I set up HSRP (Hot Standby Router Protocol) on two core routers for the IP-Link network company to guarantee high availability and smooth redundancy. By sharing a virtual IP, HSRP enables automatic failover, whereby the standby router takes over without causing any service interruptions in the event that the active router fails. In order to keep our core

network infrastructure stable and operational, this configuration improves network reliability, minimizes downtime, and guarantees constant connectivity for end devices.

4.2.3 Port security implementation

In order to improve network security by preventing unauthorized devices from connecting to the network, I installed port security on the two PCs in the NOC department. I can limit the number of MAC addresses that can be linked to each port by turning on port security, making sure that only authorized devices can use those PCs to connect to the network. In a NOC environment, where stringent control over network devices is necessary to safeguard sensitive data and preserve operational integrity, this averts possible threats like MAC address spoofing or unauthorized access.

4.2.4 Mail server implementation

To guarantee safe and effective email communication, I set up a mail server at the IP-Link network company. This internal server improves performance and dependability while strengthening data security and email traffic control. It lessens dependency on outside services, which is necessary to protect privacy.

4.2.5 Implementing own FTP server

To guarantee safe and effective file transfers, I set up our own FTP server at the IP-Link network company. This configuration removes the need for third-party services while improving data security and giving users more control over file access.

4.2.6 Implementing DHCP server

To automate IP address management and expedite device connectivity, I set up our own DHCP server at the IP-Link network company. This configuration increases control over IP address allocation, decreases configuration errors, and boosts network efficiency.

4.2.7 Using OSPF routing instead of static

In the IP-Link network company, I replaced static routing with OSPF (Open Shortest Path First) routing to improve network scalability and flexibility. In response to network changes, OSPF automatically updates routing tables, guaranteeing effective routing and the best

possible routes for data flow. Compared to static routing, this dynamic approach lowers the possibility of human error and makes management simpler as the network expands or changes.

4.3 Cost Estimation of Proposed Network

Device Model	Price (BDT)	Quantity	Cose (BDT)
MikroTik CCR1072-1G-8S+ (Core router)	3,40,000	1	3,40,000
TP-Link T2600G-28TS (Layer switch)	60,000	1	60,000
Dell PowerEdge T340(Server)	60,000	1	60,000
Others	20,000	N/A	20000
Total			4,80,000 BDT

Chapter 5

Performance Evaluation

To determine its efficacy and pinpoint areas for development, network infrastructure performance evaluation is crucial. When comparing the current IP-Link network with the suggested upgraded version, notable advantages become apparent. Key metrics like scalability, security, speed, and dependability are the focus of the evaluation. Single points of failure, poor cabling, a lack of sophisticated management and security features, and other functional limitations characterize the current network. The suggested architecture, on the other hand, resolves these problems by utilizing Layer 3 devices, redundancy, and contemporary cabling techniques. It also prioritizes thorough security and management procedures, which improve the overall resilience and efficiency of the network. The goal of this upgrade is to make sure the network can efficiently accommodate future growth and organizational needs.

A thorough performance comparison of the suggested and existing networks will be provided in this section, emphasizing how the suggested improvements have the potential to produce notable gains. We can better grasp the possible advantages and defend the investment in modernizing the network infrastructure by looking at the effects of these changes. The intention is to show that the suggested network not only fixes current problems but also offers a strong basis for expansion and technical development in the future.

5.1 Simulation Environment

The network simulation tool Cisco Packet Tracer 8.2.2, created by Cisco Systems, is frequently used for network design, configuration, and troubleshooting in a virtual setting. It is a very useful tool for both professional and educational settings. Cisco Packet Tracer 8.2.2 is used in the context of IP-Link Networks to simulate and visualize both the current and suggested network architectures. An interactive platform is offered by this potent tool to illustrate different network configurations and evaluate their effectiveness. IP-Link Network is capable of demonstrating the possible effects of suggested upgrades and modifications with the help of Cisco Packet Tracer. This promotes improved decision-making and guarantees that the network architecture satisfies organizational requirements while continuing to be scalable for expansion. It improves the capacity to develop effective and efficient network solutions overall.

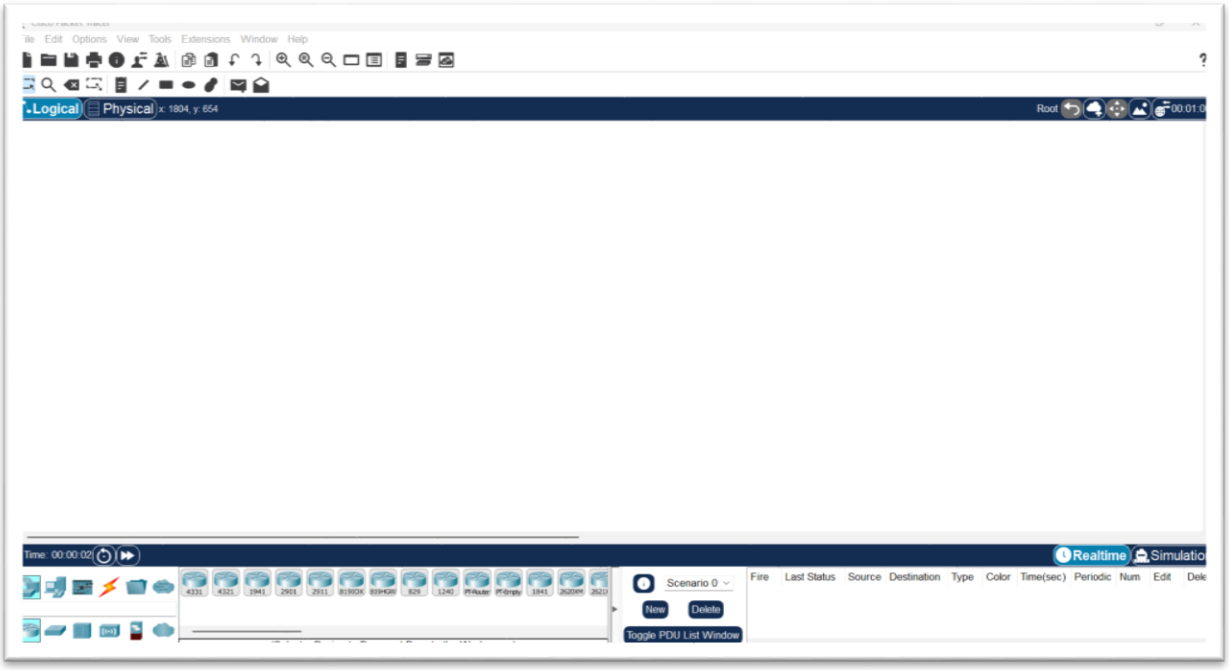


Figure 5.1 Overview of Cisco Packet Tracer 8.2.2

The current IP-Link Network has been designed in Cisco Packet Tracer 8.2.2 to provide an interactive and visual representation of its infrastructure. This model includes core and distribution routers, switches, and the cabling layout, offering a comprehensive view of the network's configuration. The simulation effectively illustrates the network's vulnerabilities, such as single points of failure and lack of redundancy. Additionally, the upgraded network architecture is modeled in Packet Tracer, highlighting key improvements and new features.5.2 Testing Results of Proposed Features.

In the following section, the testing results for the proposed features of ip-Link Networks are discussed. The efficiency and improvement that the proposed features bring will be clear as well.

5.2.1 Connectivity Test of Redundant Paths

Figure 5.2 shows the connectivity test of redundant path of one point to another point.

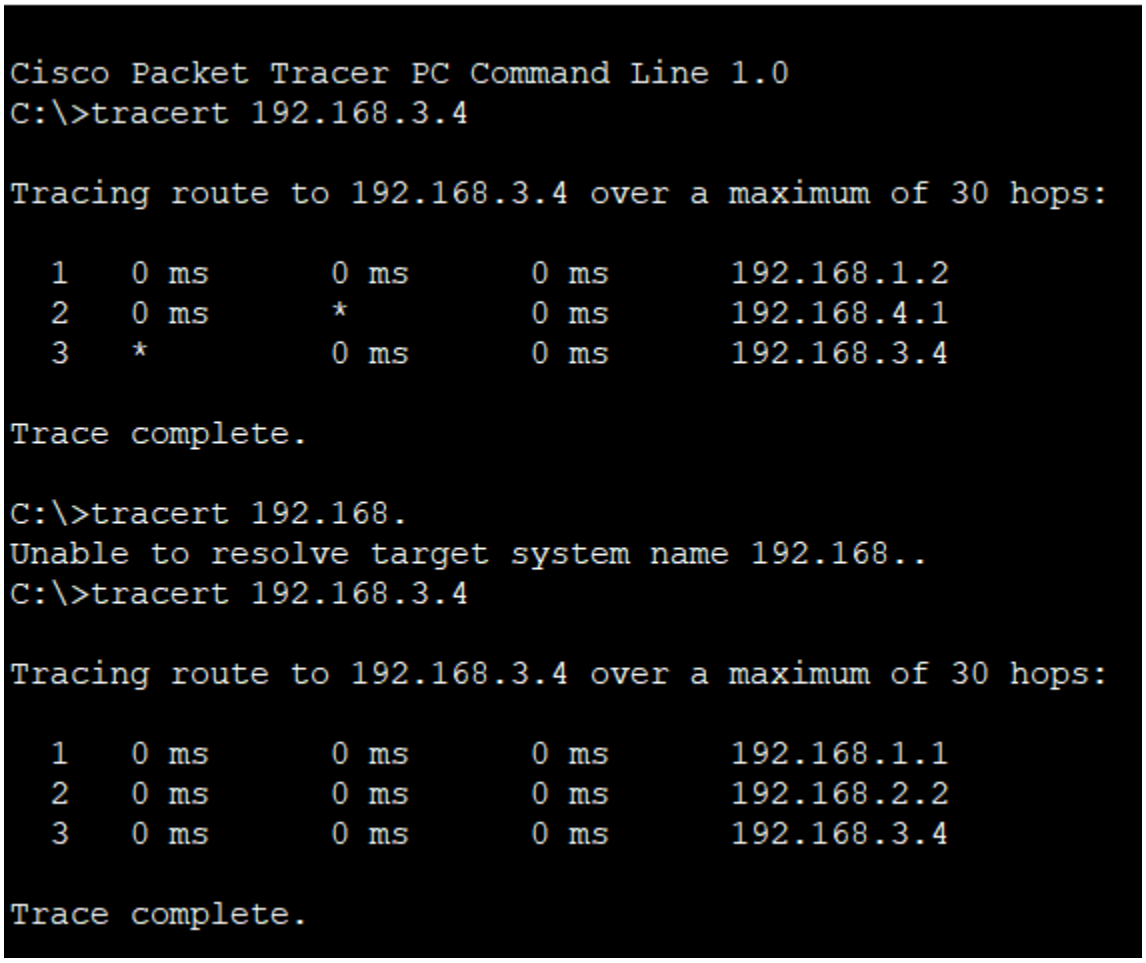


Figure 5.2 Connectivity of Redundant Paths

Here, to reach the desired destination, a primary path has been used (192.168.1.2) at first. If anyhow the primary gets down, secondary path (192.168.1.1) will be being used as alternative path.

5.2.2 FTP server file transfer

Figure 5.4 shows the FTP file transfer from one pc to another pc. Only admin will be able to use the writing features such as write, rename and delete. And the user can only download the file to his/her pc.

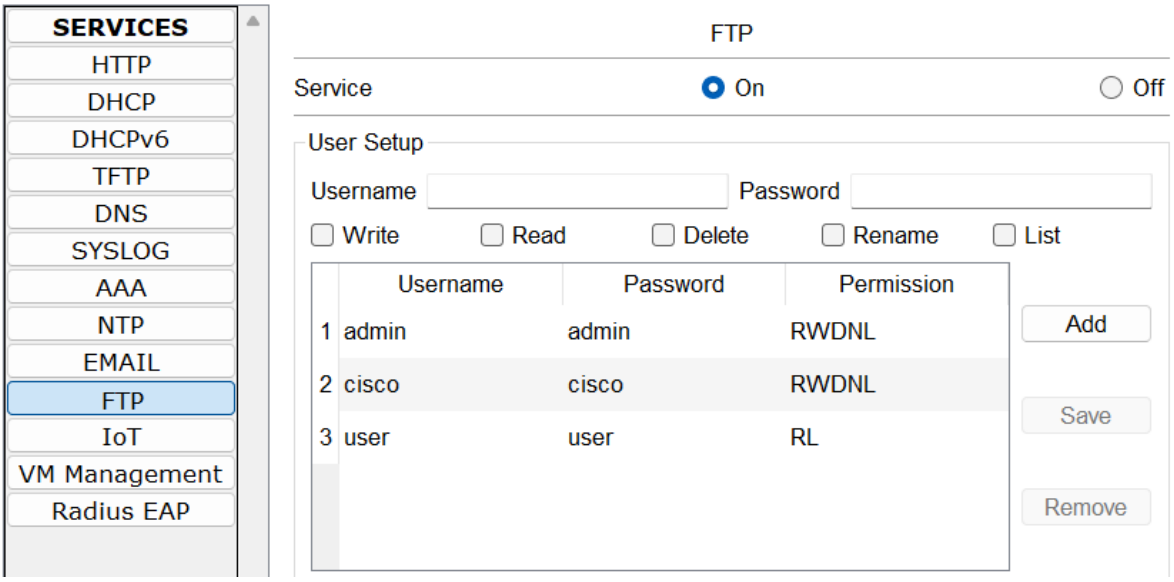


Figure 5.3 FTP configuration.

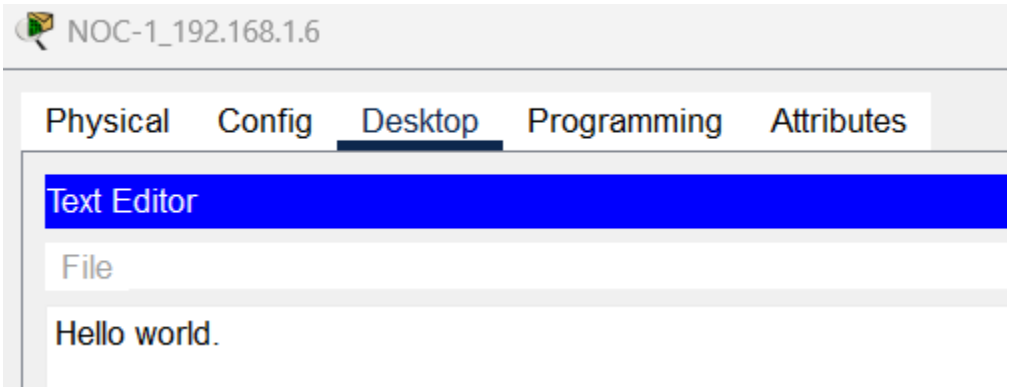


Figure 5.4 Admin creating a file.

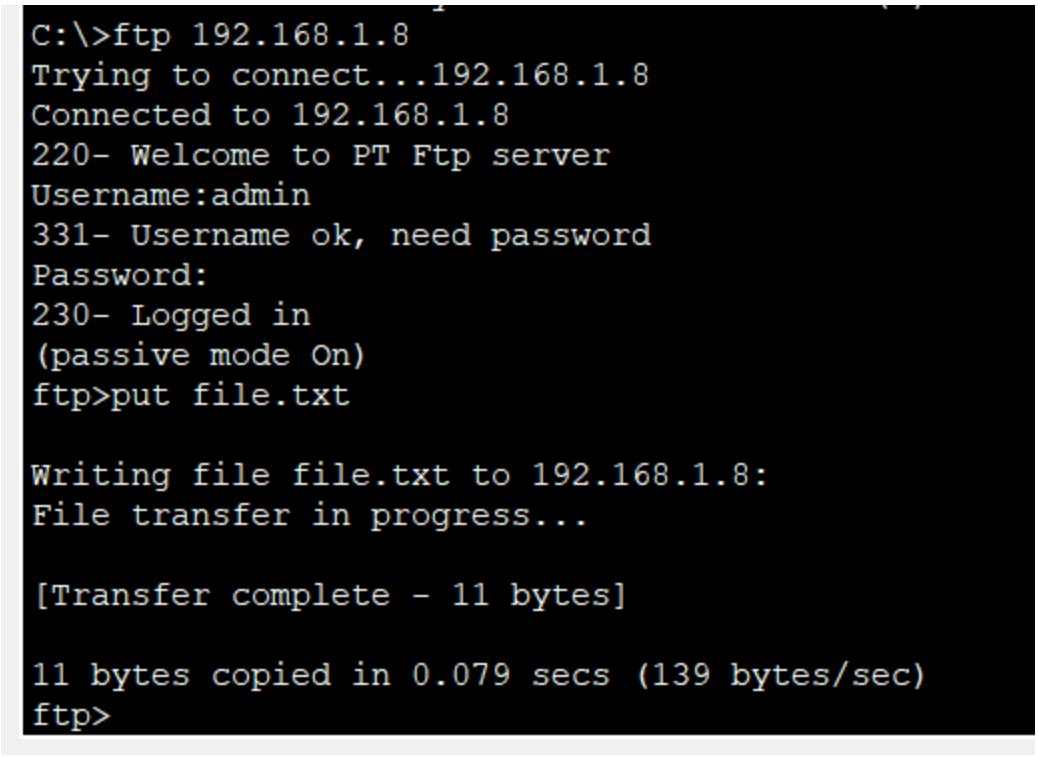


Figure 5.5 Admin uploading a file.

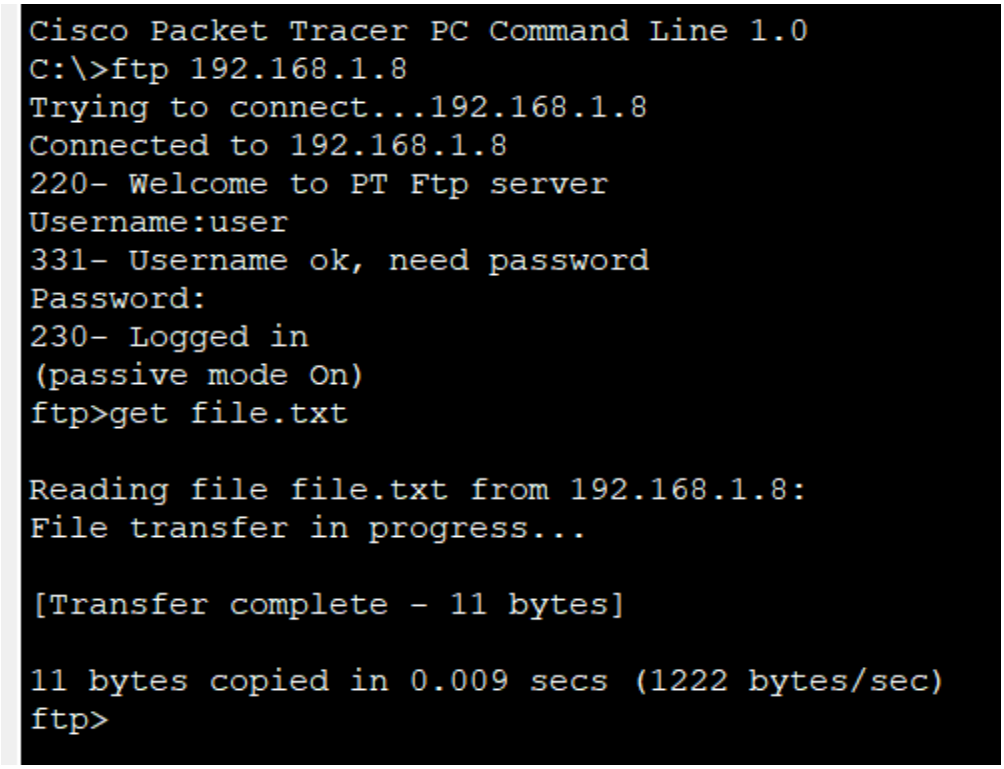


Figure 5.6 User downloading the file.

So, you can see that here at Figure 5.5 the admin uploaded a file using command prompt and the user downloaded the file in Figure 5.6. So, the FTP server is properly working.

5.2.3 Mail server implementation

In the mail server the two users should be able to send and read messages from both sides.

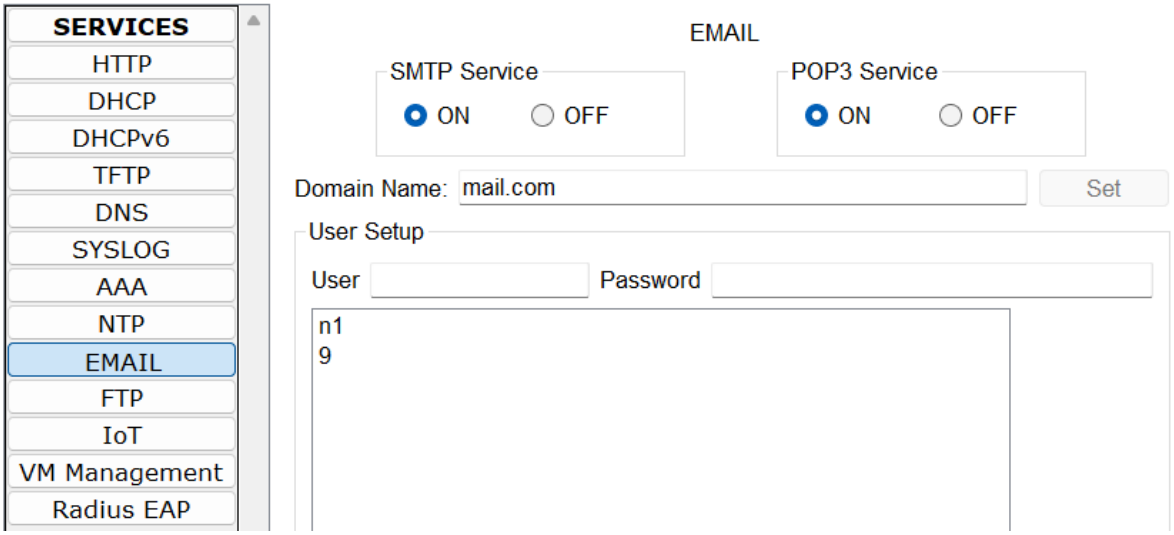


Figure 5.7 Email server configuration

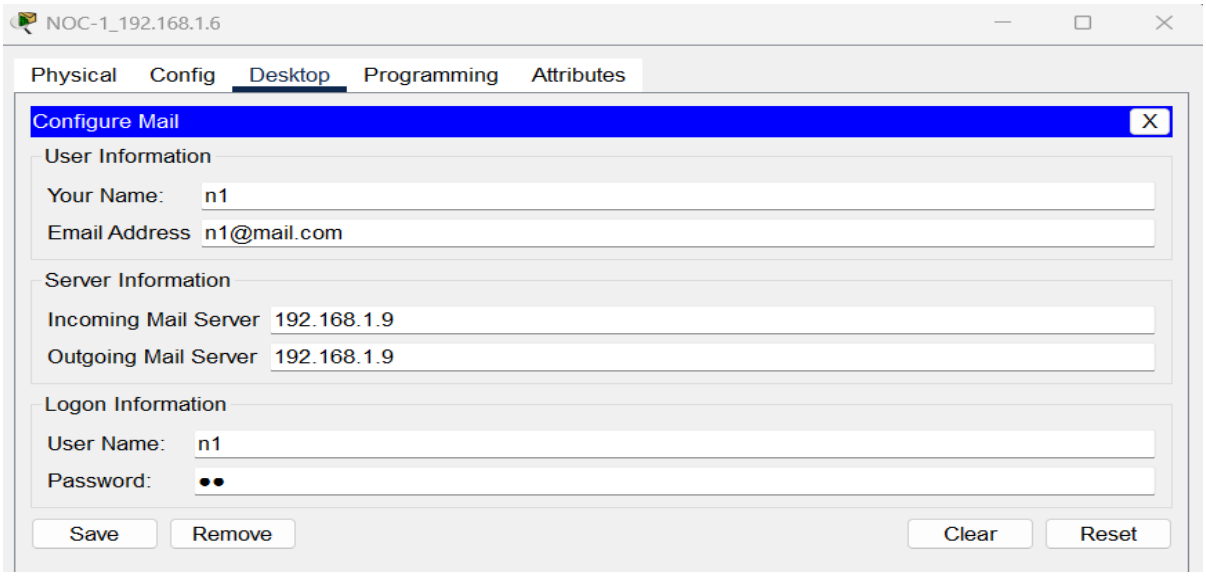


Figure 5.8 Email configuration in users' side.

Figure 5.9 User-9 sending mail to user n1

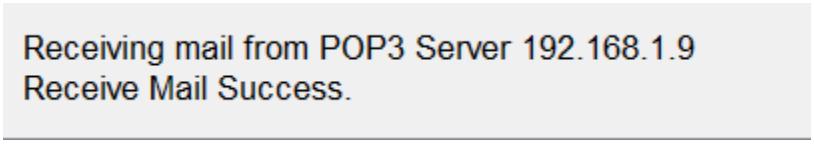


Figure 5.10 User n1 Receive message successfully from user 9

So, Mail sending and receiving are functioning perfectly on both ends, allowing for smooth and uninterrupted communication. Users can easily send and receive messages without any delays or issues.

5.2.4 DHCP server implementation

In this configuration the DHCP server should be able to send ip address so that statically they do not need to get ip address.

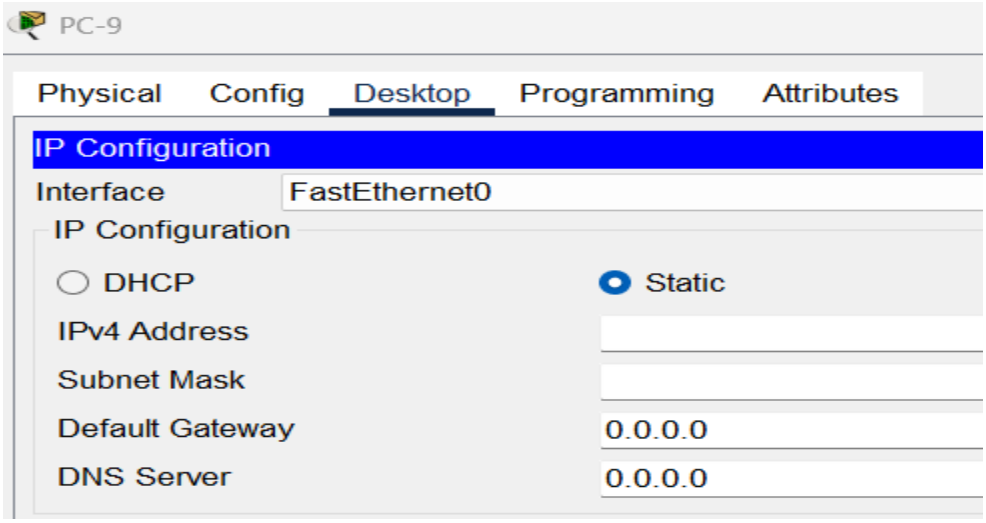


Figure 5.11 User does not have any ip address.

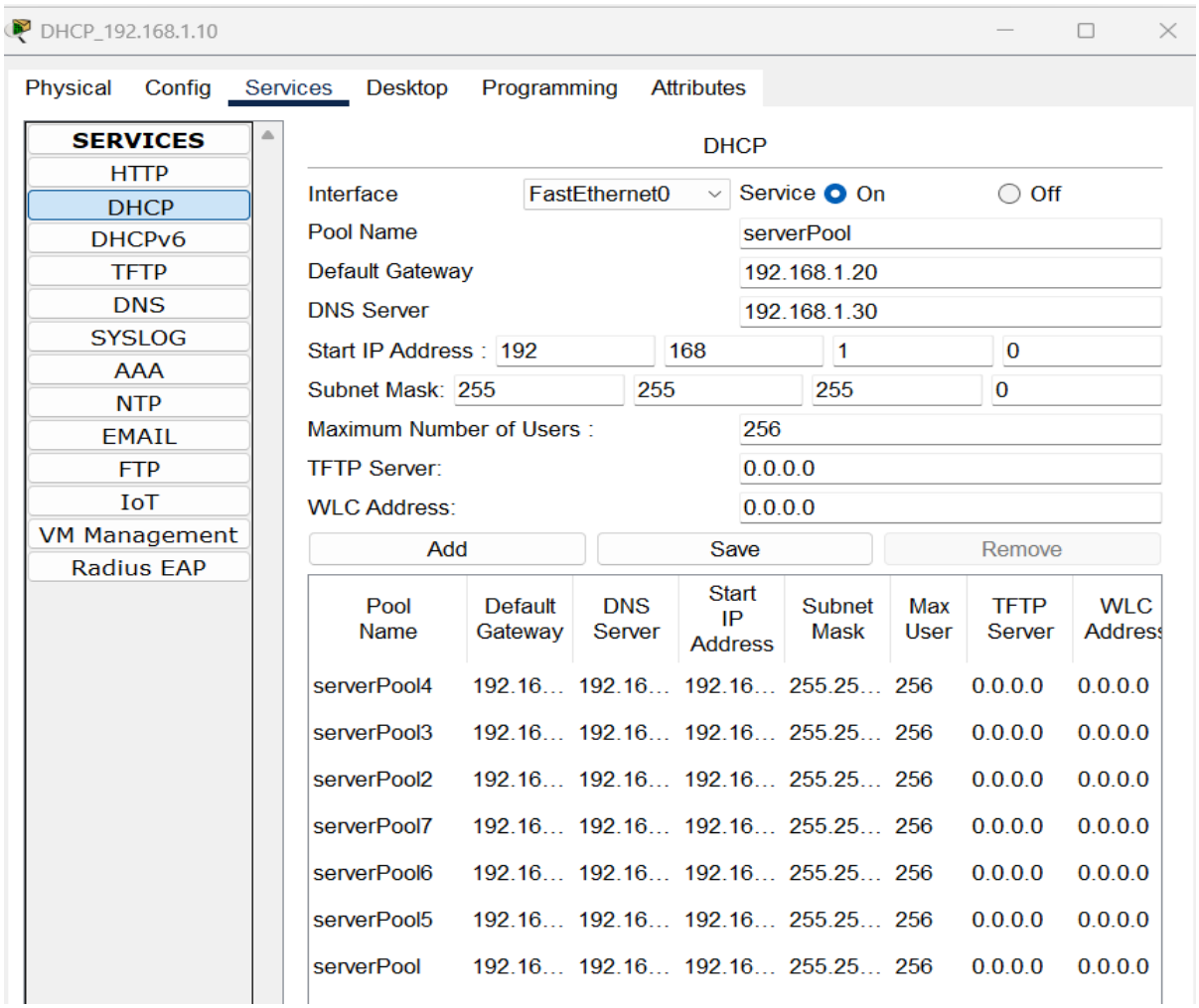


Figure 5.12 DHCP Server configuration

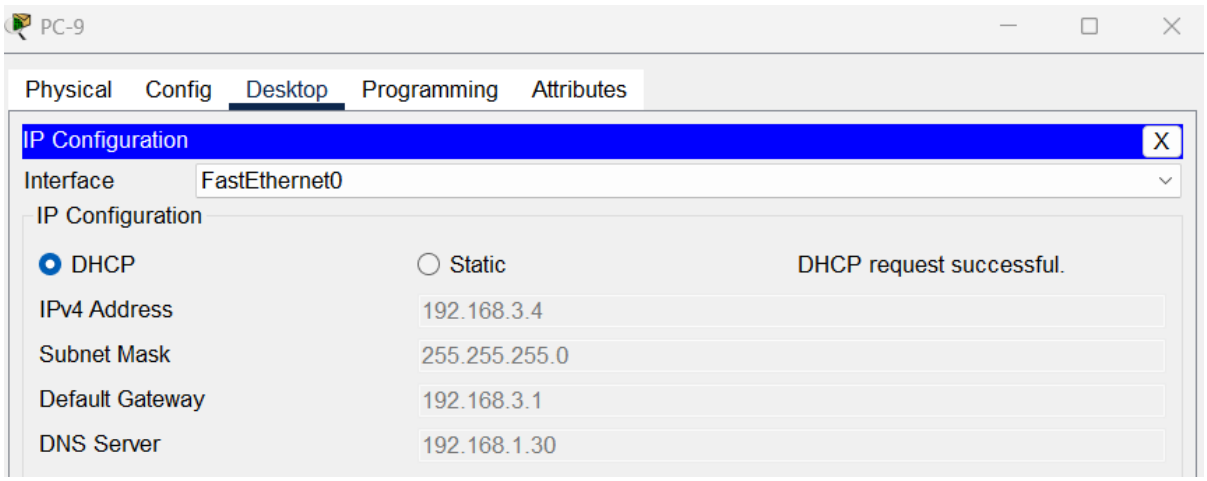


Figure 5.13 User getting IP address automatically

Here you can see that before DHCP they did not have any ip address. And after clicking the DHCP button they got the ip. So, the DHCP working properly.

5.2.5 Port Security implementation

In port security I used the restrict protocol so if someone comes and try to unplug the port of NOC department and try to put their device on the network it will not allow that hacker to do so.

184	Tue Oct 15 01:56:55 2024	Switch0	Switch(config)#	interface fastEthernet 0/2
185	Tue Oct 15 01:57:29 2024	Switch0	Switch(config-if)#	switchport mode access
186	Tue Oct 15 01:57:49 2024	Switch0	Switch(config-if)#	no switchport port-security mac-address sticky
187	Tue Oct 15 01:58:32 2024	Switch0	Switch(config-if)#	switchport port-security mac-address sticky
188	Tue Oct 15 01:58:34 2024	Switch0	Switch(config-if)#	ex
189	Tue Oct 15 01:58:41 2024	Switch0	Switch(config)#	interface fastEthernet 0/3
190	Tue Oct 15 01:58:45 2024	Switch0	Switch(config-if)#	no sh
191	Tue Oct 15 01:58:57 2024	Switch0	Switch(config-if)#	switchport mode access
192	Tue Oct 15 01:59:11 2024	Switch0	Switch(config-if)#	switchport port-security mac-address sticky
193	Tue Oct 15 01:59:23 2024	Switch0	Switch(config-if)#	switchport port-security maximum 1
194	Tue Oct 15 01:59:51 2024	Switch0	Switch(config-if)#	switchport port-security viOLATIOn shutdown

Figure 5.14 Port security configuration command

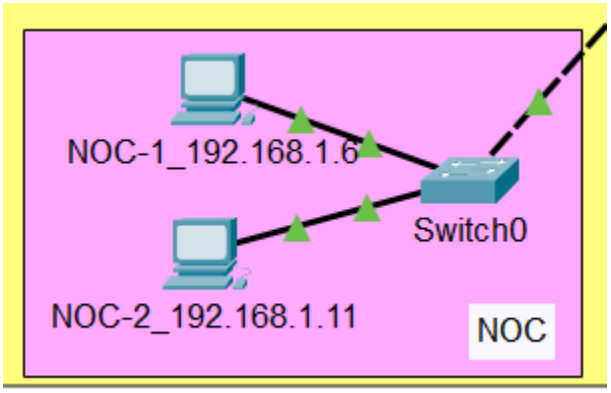


Figure 5.15 NOC departments two pc

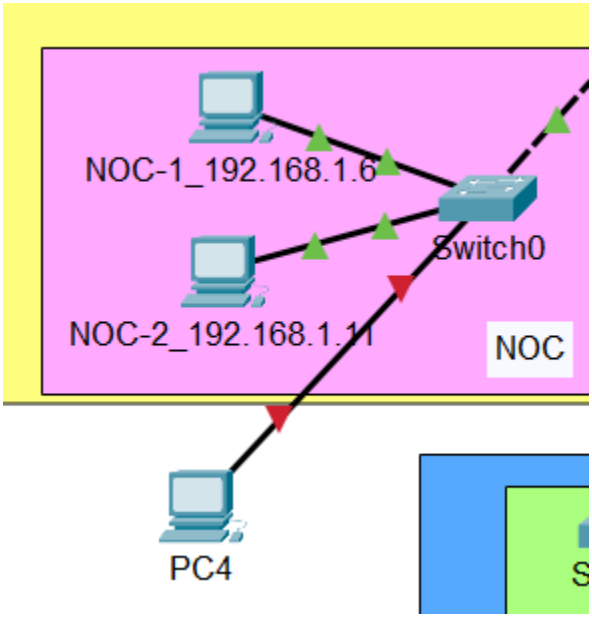


Fig: 5.16 Third person cannot access the network.

Here you saw that the third person came but could not use the network because in port security the mac address is locked with the previous users pc. And the others port is being turned off for the safety.

5.2.6 OSPF Routing

OSPF routing is a highly optimized routing protocol that significantly improves network efficiency compared to static routing methods. While static routing relies on manually configured paths, OSPF dynamically determines the best routes based on current network conditions, making it far superior in terms of adaptability and performance. Known as Open Shortest Path First, OSPF uses a link-state algorithm to maintain a comprehensive view of the network topology, allowing routers to make informed decisions about data transmission paths.

In the figure below, we will examine some code implemented on the network router that demonstrates how OSPF configurations can be applied. This code highlights the ease of integration and the robust features OSPF offers, showcasing its advantages over traditional

static routing methods. With OSPF, networks can achieve greater reliability and quicker convergence, leading to enhanced overall performance.

Router3	Router(config-if)#	ex	exit
Router3	Router(config)#	router 4	router
Router3	Router(config)#	router ospf	router ospf
Router3	Router(config)#	router ospf 4	router ospf 4
Router3	Router(config-router)#	network 192.168.1.0 0.0.0.255 area 0	network 192.168.1.0 0.0.0.255 area 0
Router3	Router(config-router)#	network 192.168.5.0 0.0.0.255 area 0	network 192.168.5.0 0.0.0.255 area 0
Router4	Router(config-if)#	ex	exit
Router4	Router(config)#	router ospf	router ospf
Router4	Router(config)#	router ospf 5	router ospf 5
Router4	Router(config-router)#	network 192.168.1.0 0.0.0.255 area 0	network 192.168.1.0 0.0.0.255 area 0
Router4	Router(config-router)#	network 192.168.6.0 0.0.0.255 area 0	network 192.168.6.0 0.0.0.255 area 0
Router5	Router(config-if)#	ex	exit
Router5	Router(config)#	router ospf 6	router ospf 6
Router5	Router(config-router)#	network 192.168.1.0 0.0.0.255 area 0	network 192.168.1.0 0.0.0.255 area 0
Router5	Router(config-router)#	network 192.168.7.0 0.0.0.255 area 0	network 192.168.7.0 0.0.0.255 area 0

Figure 5.17 Some parts of the OSPF routing.

In image form the routing protocol viewing is hard. But the OSPF routing protocol is working fully.

5.2.7 Web server implementation

In the existing network there was a web server but it was not functional properly. Si improved its speed and functionality.

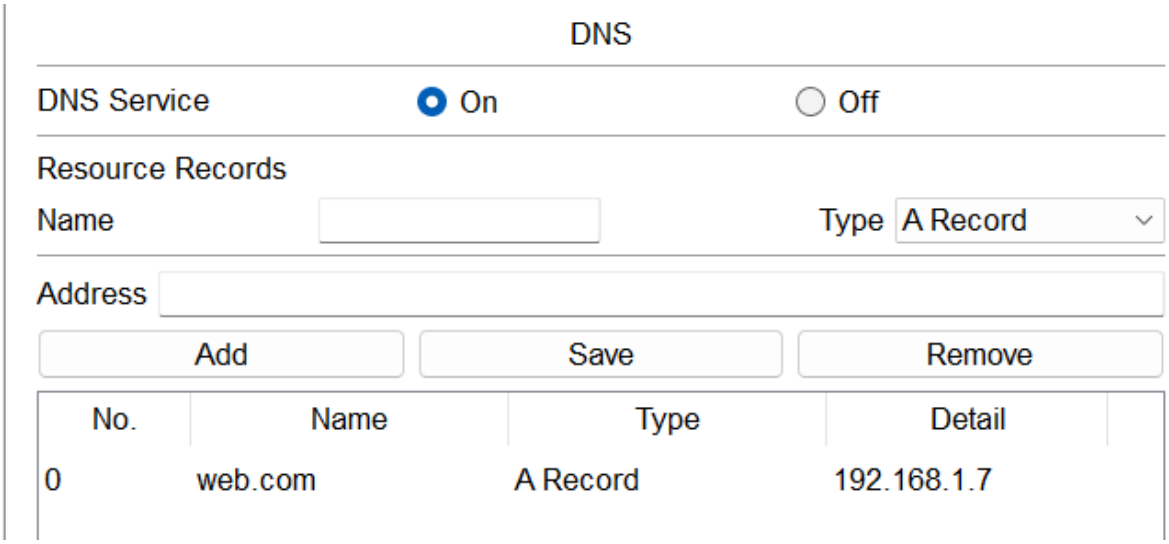


Figure 5.18 DNS configuration for Web server.

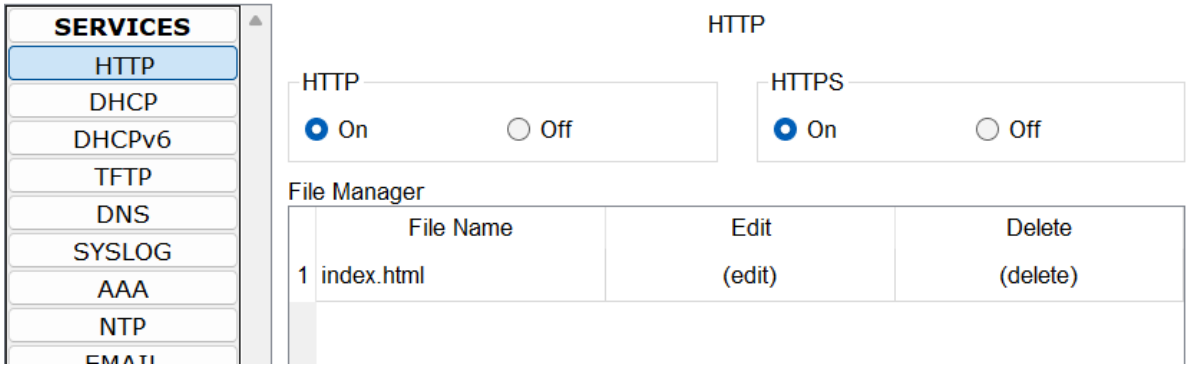


Figure 5.19 Web server configuration for demonstration.

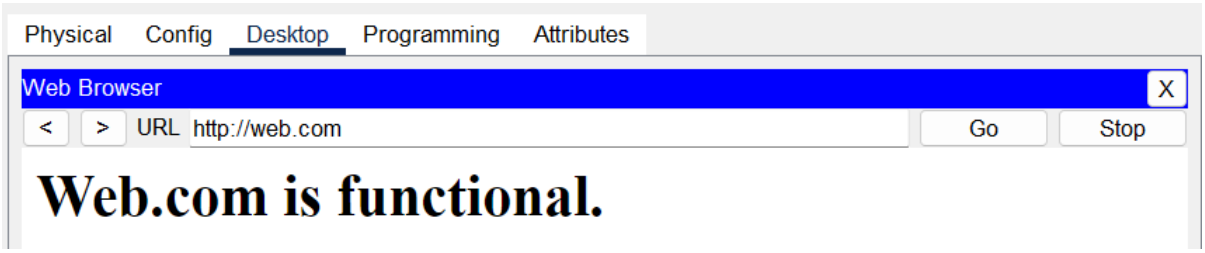


Figure 5.20 Webpage working properly.

5.3 Comparison Between Existing and Proposed Network

After the discussion, it is clear that the proposed network is more secure and efficient than the previous existing network of the ip-Link Network. Table 5.1 shows the comparison between the existing and proposed network

Table 5.1 Comparison Between existing and Proposed Network

Feature	Existing Network	Proposed Network
Redundancy	No redundancy	Core router redundancy
Routing Protocol	Static Routing Protocol	OSPF (Open Shortest Path First) Routing protocol
Network Operation Center (NOC) Security	Network Operation Center (NOC) is not secured	Network Operation Center (NOC) is secured.
Port Security	No port security	Port security available (Restriction Mode)
Mail Server	NO mail server	Mail Server Available
Performance	Performance is poor	Performance improved for extra router and security
Scalability	Limited by current design	Enhanced Scalability due to OSPF and layer 3 devices.

The main distinctions between ip-Link Networks current and suggested network architectures are highlighted in this comparison table, along with how the suggested improvements will solve the present constraints and greatly boost network security, dependability, and performance.

Chapter 6

Conclusion

The ip-Link Network's network architecture has been redesigned and assessed, identifying key areas for improvement. The current network has several shortcomings, despite its effectiveness, such as a single point of failure, incorrect cabling, no redundancy, and insufficient security. The performance, scalability, and dependability of the network are jeopardized by these issues, which may impact the operational efficacy and service quality of the company.

The proposed network architecture addresses these limitations comprehensively. By introducing redundancy at critical points such as core router, changing the switch with layer three switch, the proposed network has multiple server that was absent in the existing network, the new design aims to enhance network robustness and efficiency. Additionally, using the fast FTP server for quick file transfers and downloads, as well as setting up port security in NOC (Network Operation Center). Comparative analysis using Cisco Packet Tracer 8.2.2 simulations underscores the benefits of these enhancements. The proposed network demonstrates superior performance, increased reliability, and enhanced security compared to the existing setup. The transition from static to OSPF for routing further optimizes network scalability and convergence times.

In conclusion, the proposed network architecture provides a resilient, efficient, and secure foundation for IP-Link Network. These improvements not only address the company's current challenges, such as scalability, reliability, and security, but also position IP-Link Network for future growth and technological advancements. By enhancing network performance and optimizing resources, the company will be well-equipped to handle increasing customer demands and the evolving digital landscape.

In summary, we gained practical network management experience and knowledge about the expansion of IP-Link Network from this report. It demonstrates how critical it is to continuously innovate and adjust to changing consumer demands and technological advancements. We're hoping that these efforts will help the organization.

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