Business Network Design

By

Abu Mohammed Mushfiqur Rahman

Student ID: 1621560

Semester: Spring, Year: 2021

Supervisor:
Mohammad Noor Nabi

Senior Lecturer

Department of Computer Science & Engineering

Independent University, Bangladesh

June 17, 2021

Dissertation submitted in partial fulfillment for the degree of Bachelor of Science in Computer Science

Department of Computer Science & Engineering

Independent University, Bangladesh

Attestation

Subject: Approval of the report

This letter certifies that all the information mentioned in this document is true and confidential to the company. The project mentioned here has been successfully done with the involvement of Abu Mohammed Mushfiqur Rahman, 1621560, Bachelors in Computer Science and Engineering, Independent University, Bangladesh (IUB).

I wish him all the best and hope he will lead a successful career in his field.

Internship Supervisor
Md. Monwarul Islam Furat
HR ASSISTANT,
GAOTek Inc.

Signature Date

Name

Acknowledgement

First and foremost, I would like to thank Almighty for giving me the endurance and the ability to work hard. It is my privilege that I had the opportunity to do an internship in the GAOTek Inc. I would like to thank all the people on whom I carry out my internship. I am grateful to my Advisor Mohammad Noor Nabi, Senior Lecturer, Department of CSE, Independent University, Bangladesh (IUB), for his valuable instructions, continuous guidance, constructive criticisms, and thoughtful advice during pursuing this internship and preparation of this report. I would thank my external supervisor, Md. Monwarul Islam Furat, who helped me learn many new different topics on the technology field. And finally, I would like to thank Independent University, Bangladesh for having such a wonderful course which students can learn a lot.

I would also like to thank my colleagues at the office. They were supportive, and they made my internship period more eventful and enjoyable. Without them it was not possible to do the tasks successfully.

Finally, I must acknowledge with due respect, the constant support and patience from my parents.

Letter of Transmittal

June 17, 2021

Mohammad Noor Nabi
Senior Lecturer,
Department of Computer Science & Engineering,
Independent University, Bangladesh,
Dhaka, Bangladesh

Subject: Submission of the internship working report

Dear Sir,
This letter is written to kindly inform you that I, Abu Mohammed Mushfiqur Rahman, have completed my internship program and its report. The Internship was conducted from 4h April 2021 to 4th July 2021. I completed my internship from GAOTek Inc. which is a leading US based supplier of test and measurement equipment for fiber optic, telecommunications, networks, PSTN, CATV, environment, chemical and bio-medical test, and measurement instruments.
The following report is based on my experience and the work I did in the development sector of this company. I was assigned to work as part of the Tech Support team. I tried my best to communicate and learn about the work in the department.
I hope that you will be kind enough to consider any mistakes in preparing this report and accept it.

Sincerely,
Abu Mohammed Mushfiqur Rahman
ID - 1621560

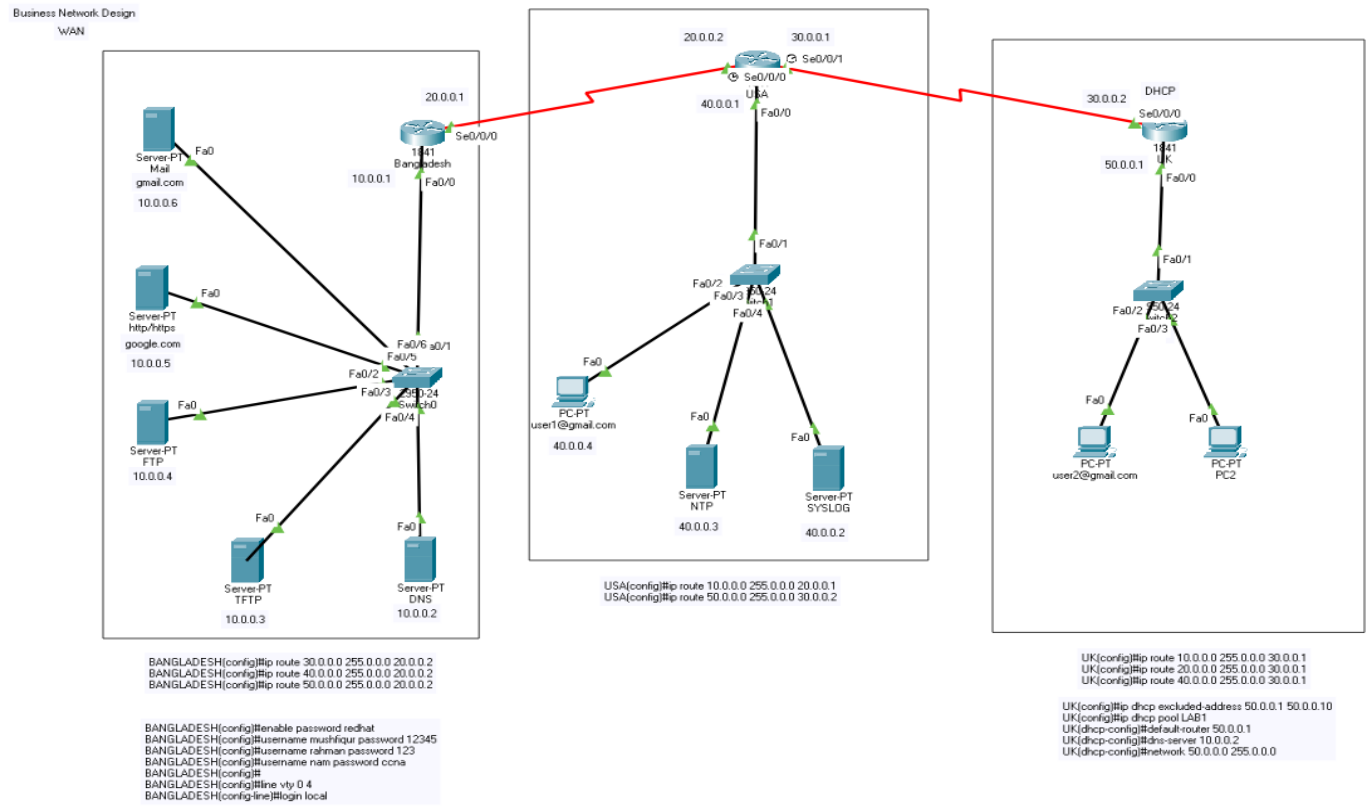
Abstract

The aim of this project is to develop a business network design or enterprise network design for a company like GAOTek Inc. The system will be based on Wide Area Network (WAN) where the various devices used by the company's employees would be all interconnected on a special network made only for the company itself. The main part of this network will consist of various servers, each with their own distinctive functionality to assist the employees on a private WAN network. Since I have completed internship at GAOTek as a Tech Support Intern, I have seen first-hand why such private WAN based networks are beneficial to a company, where everything can be controlled remotely from one country to another. This will provide multi-sited business with secure, reliable communication and data sharing. This project is entirely prepared and simulated using Cisco Packet Tracer.

Contents

List of Figures

Topology



Chapter 1

Introduction

1.1 Overview/Background of the Work

The system is based on Wide Area Network (WAN) where the various devices used by the company's employees are all interconnected on a special network made only for the company itself. The main part of this network consists of various servers, each with their own distinctive functionality to assist the employees on a private WAN network. Since I have completed internship at GAOTek as a Tech Support Intern, I have seen first-hand why such private WAN based networks are beneficial to a company, where everything is controlled remotely from one country to another. For the project, a total of 5 networks has been established to observe the connectivity between 3 countries, all part of a WAN network.

1.2 Objectives

- Send email from one user to another
- To keep a log of events of data transfer
- Maintain time zone
- Keep backup of router data
- Establish web server
- Remote login from one country to another
- Establish DNS
- Initiate DHCP

1.3 Scopes

This system is entirely prepared and simulated using Cisco Packet Tracer under guided timelines. The devices used in this project are routers, switches, cables, servers, and a couple of PCs. The three routers were established as part of networks including Bangladesh network, USA network, and UK network. First, the devices were arranged according to the diagram (refer to List of Figures, page: viii). The IP addresses of all the devices were assigned accordingly. Next, DNS service was added for google.com and gmail.com. By default, TFTP and HTTP/HTTPS servers were turned on, so next FTP server was configured using a username and password. Next, domain name for mail server was set for 2 users. Next, the IP address were assigned accordingly to the routers. After this, the routing was established using static routing method. Next, DHCP was established only for the UK devices. Finally, after the setup phase, the project was moved towards testing, troubleshooting, and analysis phases. This is to notify that due to time limitations, a lot of extra functionalities were scrapped from the project as they were not ready for implementation.

Chapter 2

Literature Review

2.1 Relationship with Undergraduate Studies

This project is directly related to CSE316 Data Communication and Networking where I learned the basics of computer networking and first started learning to use simulation software such as Cisco Packet Tracer, which is used in this project for demonstration. For my optional advance courses, I have taken three courses which are all related to Data Communication. They are: CSE402 Wireless Networking and Mobile Communication, where I learned about mobile and wireless connections and completed related project, CSE403 Network Management, where I learned mostly about network security and completed project on it, and CSE408 Advanced Computer Network, which is based off on advanced networking topics. CSE307 System Analysis and Design was used as framework to complete the project with set goals and timeline. Also, it is to be noted that Data Communication can be tied back to topics Logic, Mathematics, Physics, Circuit, and Algorithm related courses which I have completed in the past on pursuing this degree.

2.2 Related works

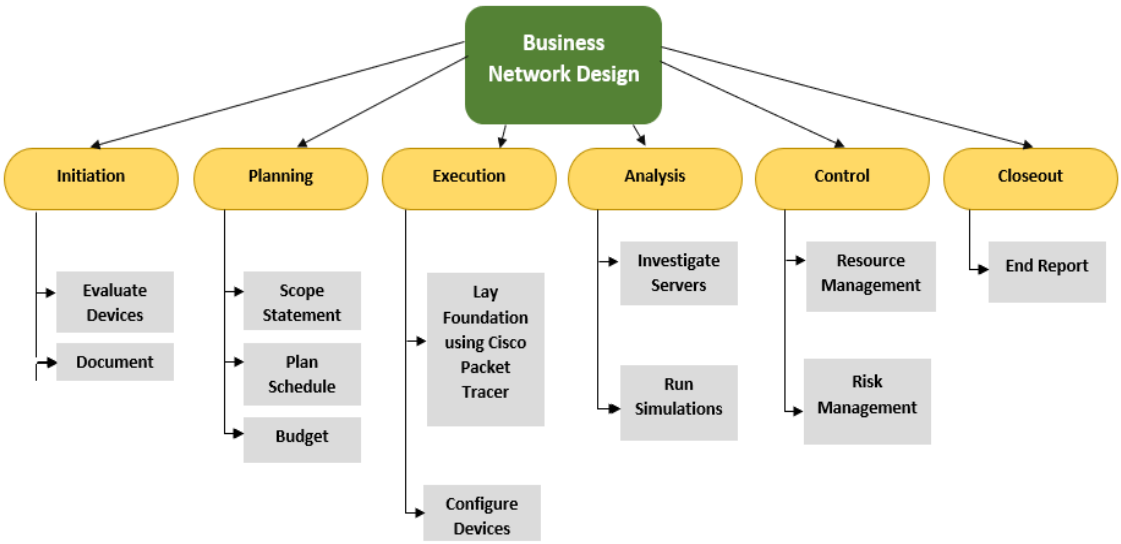
These projects are completed as part of related courses or are in development.

- Static Routing Implementation (CSE402, CSE403, CSE408) (Rahman, 2019)
- 3G and Internet Protocols Integration (in development) (Rahman, 3G and Internet Protocols Integration, 2021)

Chapter 3

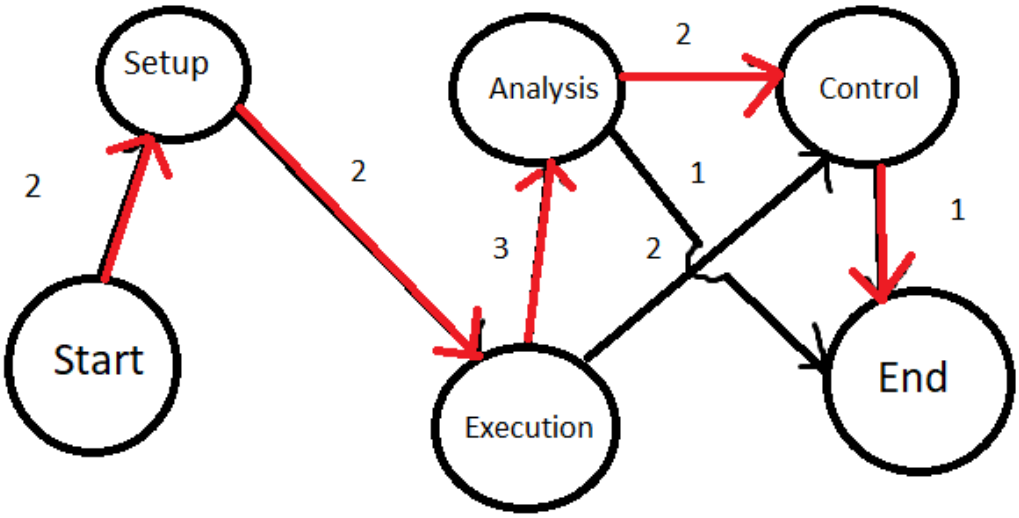
Project Management & Financing

3.1 Work Breakdown Structure



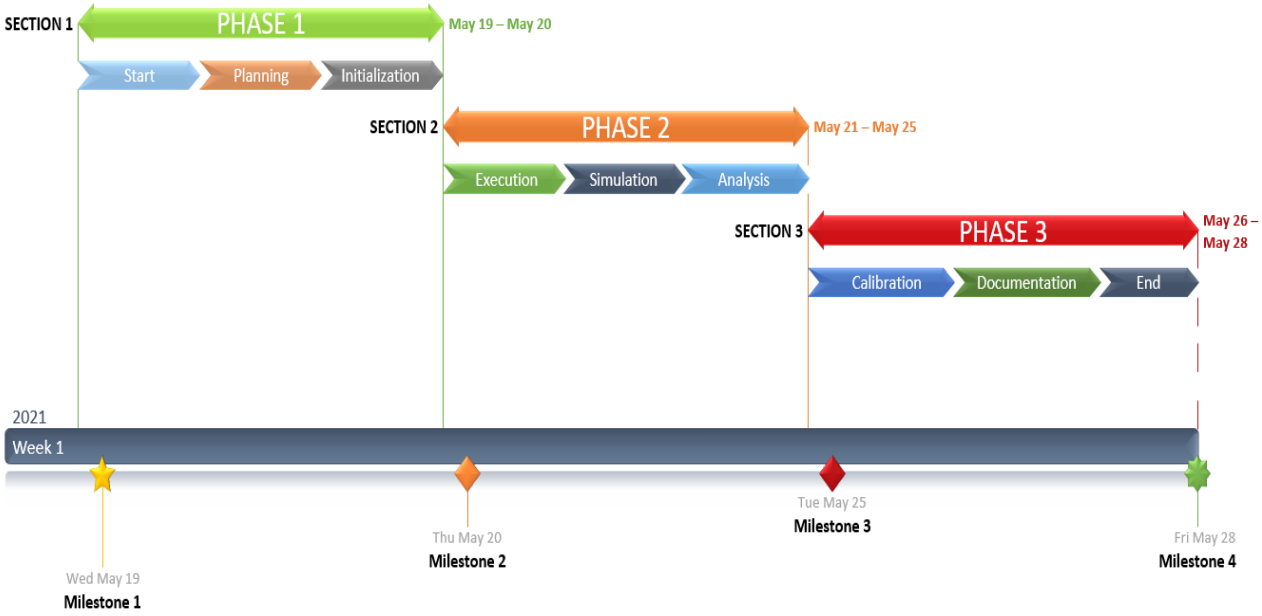
The above figure breaks down the structure for which the project was carried out, initializing with evaluation and documentation for devices used. Next, the planning was carried out in terms of scope, budget, and the schedule of work. After this, the project was executed and then evaluated by running simulations. Anomalies and errors were later calibrated, and report prepared finally after the end of the completion of the project.

3.2 Process/Activity wise Time Distribution



Critical Path =10days

3.3 Gantt Chart



The above figure breaks down the time structure for which the project events were carried out under a day, initializing with planning and documentation for devices to be used in terms of scope, budget, etc. Next 5 days were used for execution and then evaluation by running simulations. In phase 3, under 3 days, anomalies and errors were calibrated and report was prepared finally after the end of the completion of the project.

3.4 Process/Activity wise Resource Allocation

May 19	18:00 – 19:00	Planning and setup of devices
May 20	19:00 – 22:00	Scope outline and schedule
May 21 - 23	18:00 – 22:00	Execution of main tasks
May 24 - 25	18:00 – 22:00	Analysis of data
May 26	18:00 – 22:00	Calibration
May 27 - 28	18:00 – 22:00	Documentation and closure

The above figure shows the simplified version of the time stamp of the task allocation of the project and how it was carried out.

3.5 Estimated Costing

This project had an estimated cost of 50 thousand taka, which in its entirety was due to the cost of the computer in which the project was prepared and simulated. Additionally, this project is entirely prepared and simulated using Cisco Packet Tracer, which is a free networking software.

Chapter 4

Methodology

Before embarking on this project, it was necessary to ensure that the project was authentic enough to be conducted under computer science and engineering perspectives. The methods used in this project is made sure that it follows conventional methodology of science and engineering background as well as repeatable for others to test.

This project is entirely compiled and simulated using the latest version of Cisco Packet Tracer v8. It is a cross-platform visual simulation tool designed by Cisco Systems that allows users to create network topologies and imitate modern computer networks. The software allows users to simulate the configuration of Cisco routers and switches using a simulated command line interface.

The hardware used to simulate this project is listed below:

- Processor: AMD Ryzen 6 core 12 thread processor
- Memory: 16 GB DDR4 3200 MHz
- Storage: 256 M.2 Nvme SSD
- Graphics: Nvidia 6 GB Video Card
- Display: Standard 1080p 75 Hz

Inside the Packet Tracer, the devices used to simulate the project are listed below:

- Routers x3 - device that forwards data packets between computer networks.
- Switches x3 - connects multiple devices to create a network.
- Servers x7 - save and store data and helps in the execution.
- Cables – wires which are used to carry electricity or electronic signals.
- PCs x3 – Personal Computers

The main benefit for a Business Network to succeed, are the servers which are used in this project. They are listed below:

- FTP Server - File Transfer Protocol for data backup of routers
- TFTP Server – Trivial File Transfer Protocol for data backup of routers
- SMTP – System Mail Server to establish sending email capability.
- NTP Server – Network Time Protocol to maintain same time zone everywhere
- Syslog Server – Keeping a log of events stored.
- Telnet – Used for remote login.
- HTTP/HTTPS Server – Hypertext Transfer Protocol/Secure as a web server
- DNS Server – Domain Name Service to find webpages from domain names.
- DHCP Server – Dynamic Host Configuration Protocol to assign IP addresses.

The three routers are situated on 3 separate countries (Bangladesh, USA, and UK) where they are all each connected with switches, servers, and PCs to form a private WAN – Wide Area Network (refer to List of Figures, page: viii). The process of configuring these devices and their main functionalities is explained in the next chapter.

Chapter 5

Body of the Project

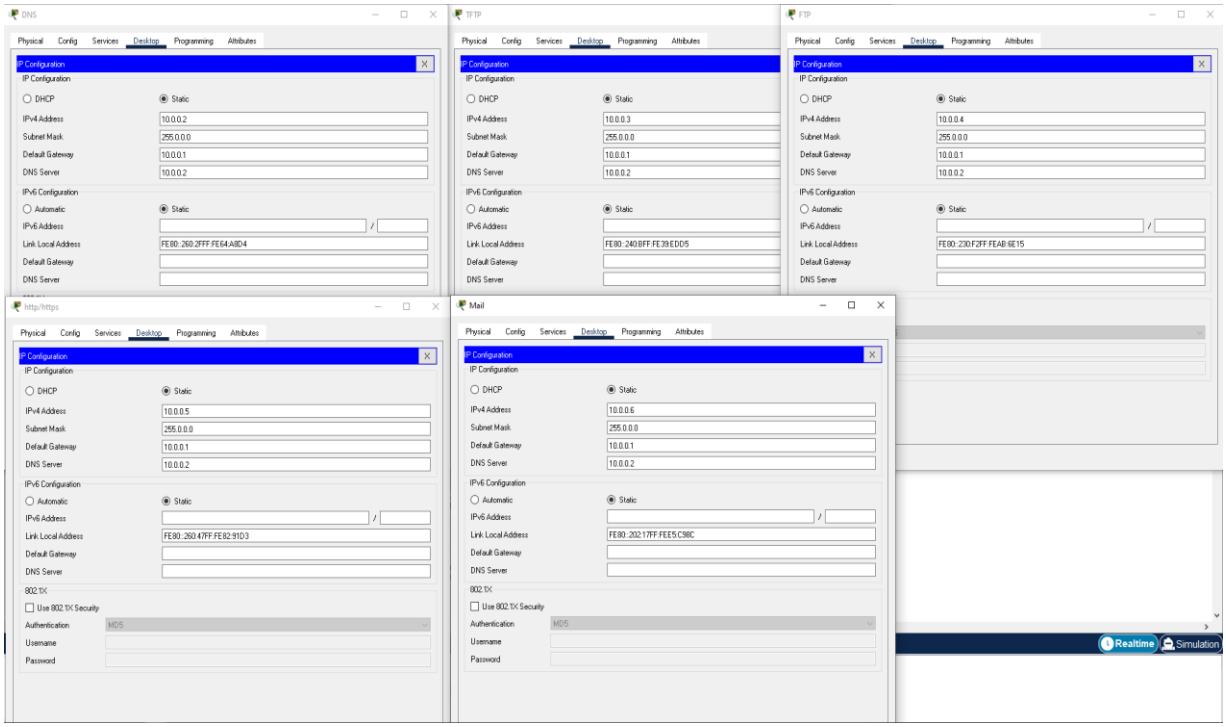
5.1 Work Description

The system is based on Wide Area Network (WAN) where the various devices used by the company's employees are all interconnected on a special network made only for the company itself. The main part of this network consists of various servers, each with their own distinctive functionality to assist the employees on a private WAN network.

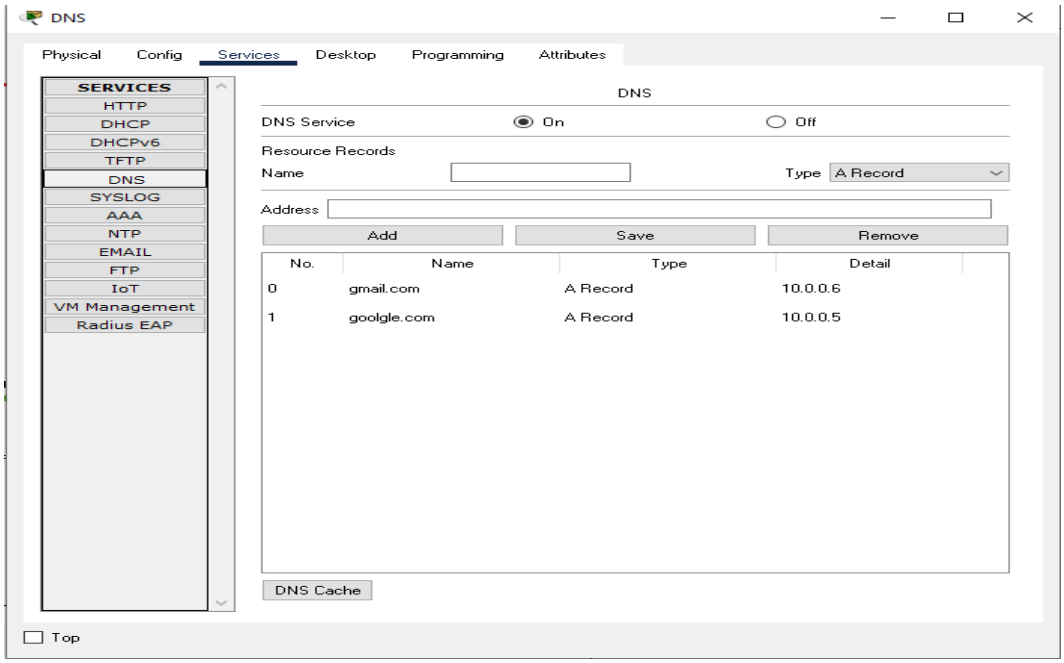
For the project, a total of 5 networks has been established to observe the connectivity between 3 countries, all part of a WAN network. The three routers are situated on 3 separate countries (Bangladesh, USA, and UK) where they are all each connected with switches, servers, and PCs (user1 on USA and user2 on UK) to form a private WAN – Wide Area Network (refer to List of Figures, page: viii) using Serial Cable. Since we have five different networks, the following IP addresses were used for Bangladesh Network. They are: 10.0.0.1, 20.0.0.1, 20.0.0.2, 30.0.0.1, 30.0.0.2, 40.0.0.1 and 50.0.0.1.

Bangladesh Network

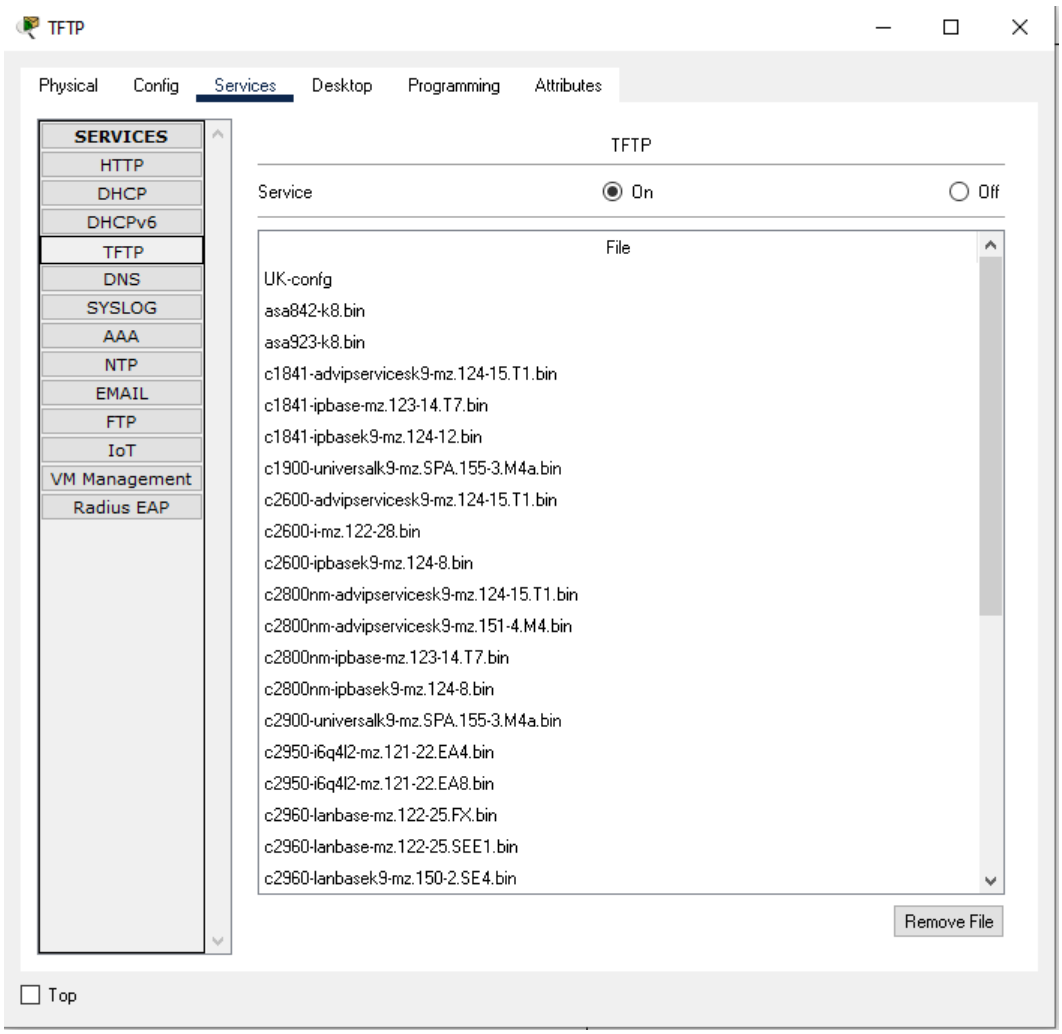
For Bangladesh router, all the devices were configured manually with the following IP addresses. They are: 10.0.0.2 (DNS), 10.0.0.3 (TFTP), 10.0.0.4 (FTP), 10.0.0.5 (HTTP) and 10.0.0.6 (Mail). The following picture shows the configuration.



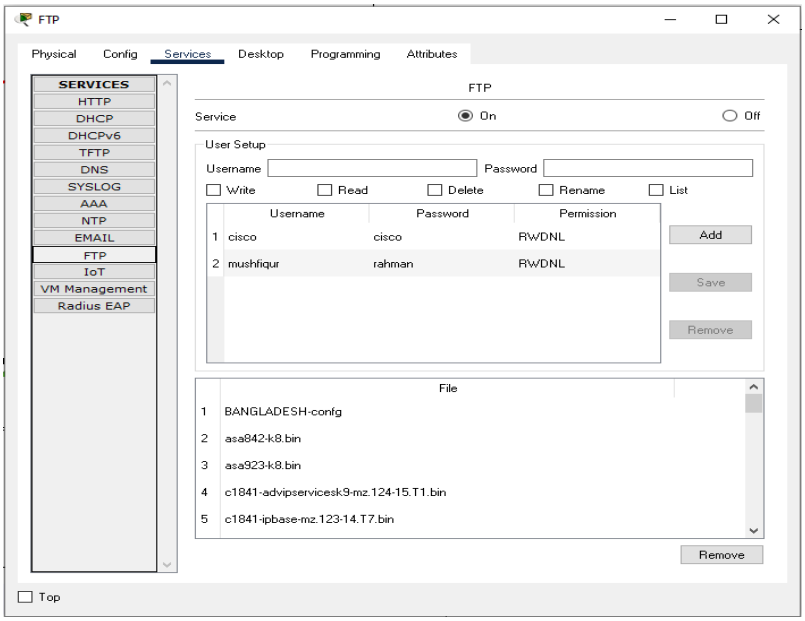
Next, DNS Server is configured. The Domain Name System (DNS) is the phonebook of the Internet. When users type domain names such as ‘google.com’ or ‘nytimes.com’ into web browsers, DNS is responsible for finding the correct IP address for those sites. Browsers then use those addresses to communicate with origin servers or CDN edge servers to access website information. This all happens thanks to DNS servers: machines dedicated to answering DNS queries. For the configuration, Telnet and DHCP Servers are configured on the UK router. The following picture depicts the configuration where google.com and gmail.com were added as domain:



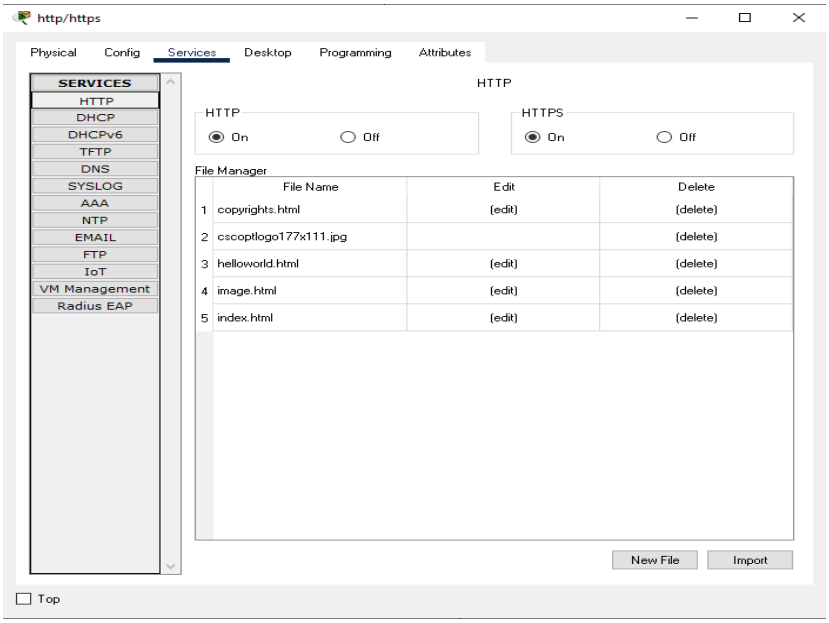
Next, TFTP Server is configured. TFTP Server is used for simple file transfer (typically for boot-loading remote devices). Trivial File Transfer Protocol (TFTP) is a simple protocol for exchanging files between two TCP/IP machines. The TFTP Server can also be used to upload HTML pages onto the HTTP Server or to download log files to a remote PC. Here, by default TFTP Server is turned on which the following picture depicts.



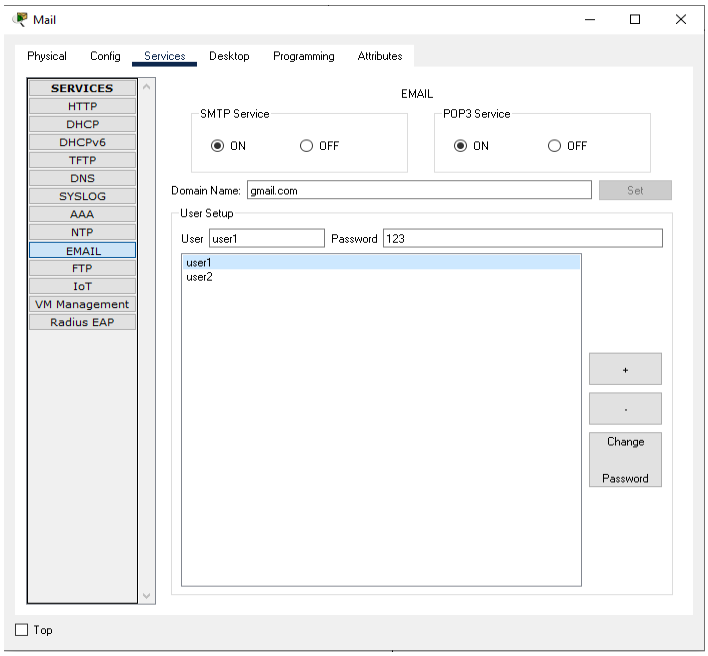
Next, FTP Server is configured by creating a username and password and giving read, write, delete, rename, and list permissions. File transfer protocol (FTP) is a set of rules that computers follow for the transferring of files from one system to another over the internet. It may be used by a business to transfer files from one computer system to another, or websites may use FTP to upload or download files from a website's server. The following picture depicts the configuration:



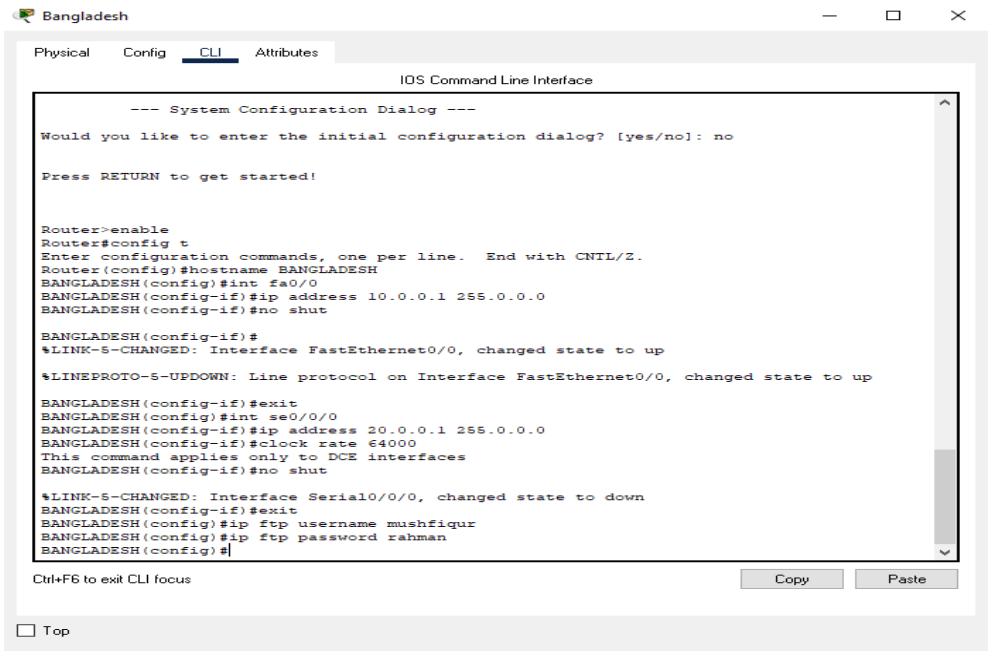
Then, HTTP/HTTPS Servers were configured. This is a web server where underlying hardware accepts requests via HTTP, the network protocol created to distribute web pages, or its secure variant HTTPS. A user agent, commonly a web browser or web crawler, initiates communication by making a request for a specific resource using HTTP, and the server responds with the content of that resource or an error message. The server can also accept, and store resources sent from the user agent if configured to do so. By default, the server is turned on which the following picture depicts:



Next, SMTP or Simple Mail Transfer Protocol Server is configured. It is an internet standard communication protocol for electronic mail transmission. Mail servers and other message transfer agents use SMTP to send and receive mail messages. According to the picture below, domain name was set as ‘gmail.com’ and 2 users were created and given passwords accordingly.



For all these devices to work and communicate with each other on Bangladesh network, routing must be established on the Bangladesh router. The following picture shows the assigning of IP addresses on the interfaces.

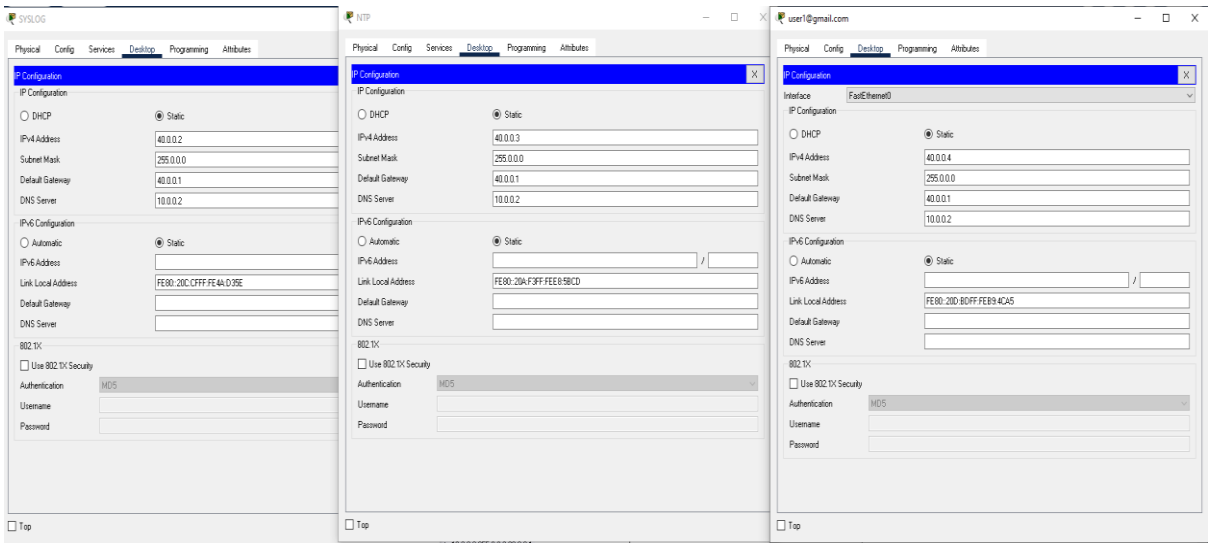


Furthermore, Telnet has been configured on Bangladesh router. Telnet, developed in 1969, is a protocol that provides a command line interface for communication with a remote device or server, sometimes employed for remote management but also for initial device setup like network hardware. Telnet stands for Teletype Network, but it can also be used as a verb; 'to telnet' is to establish a connection using the Telnet protocol. The following picture depicts the code used to configure this:

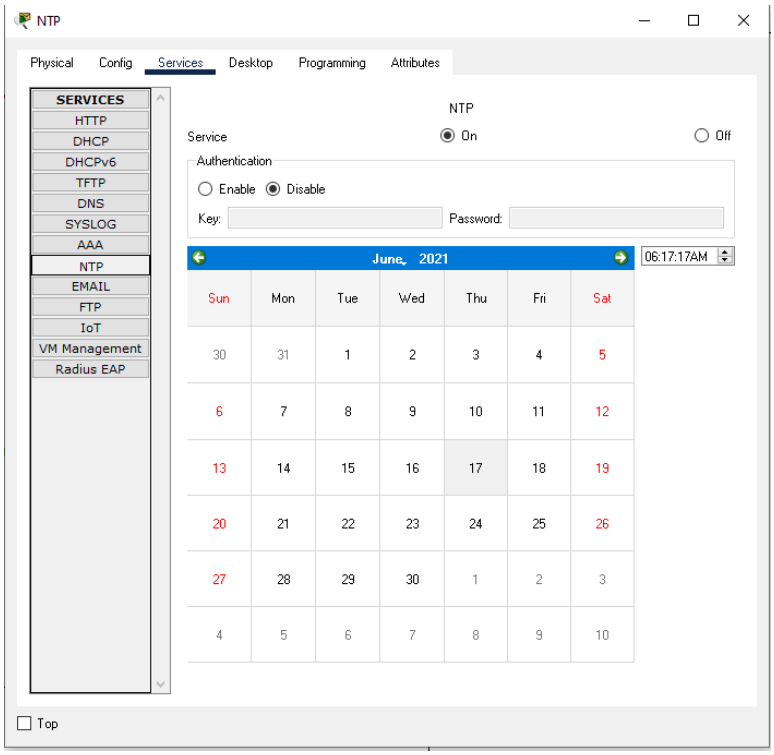
```
BANGLADESH(config)#enable password redhat
BANGLADESH(config)#username mushfiqur password 12345
BANGLADESH(config)#username rahman password 123
BANGLADESH(config)#username nam password ccna
BANGLADESH(config)#
BANGLADESH(config)#line vty 0 4
BANGLADESH(config-line)#login local
```

USA Network

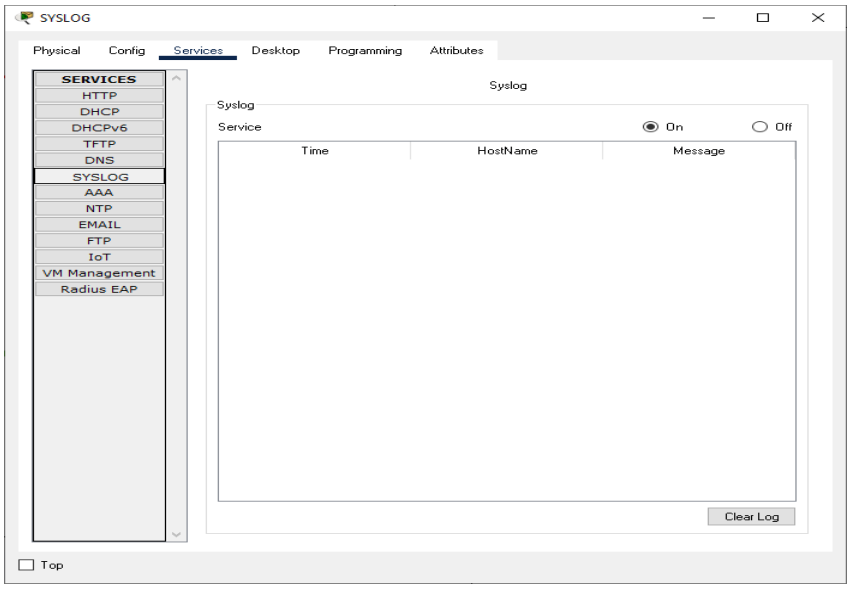
For USA router, all the devices were configured manually with the following IP addresses. They are: 40.0.0.2 (SYSLOG), 40.0.0.3 (NTP), and 10.0.0.4 (user1). The following picture shows the configuration.



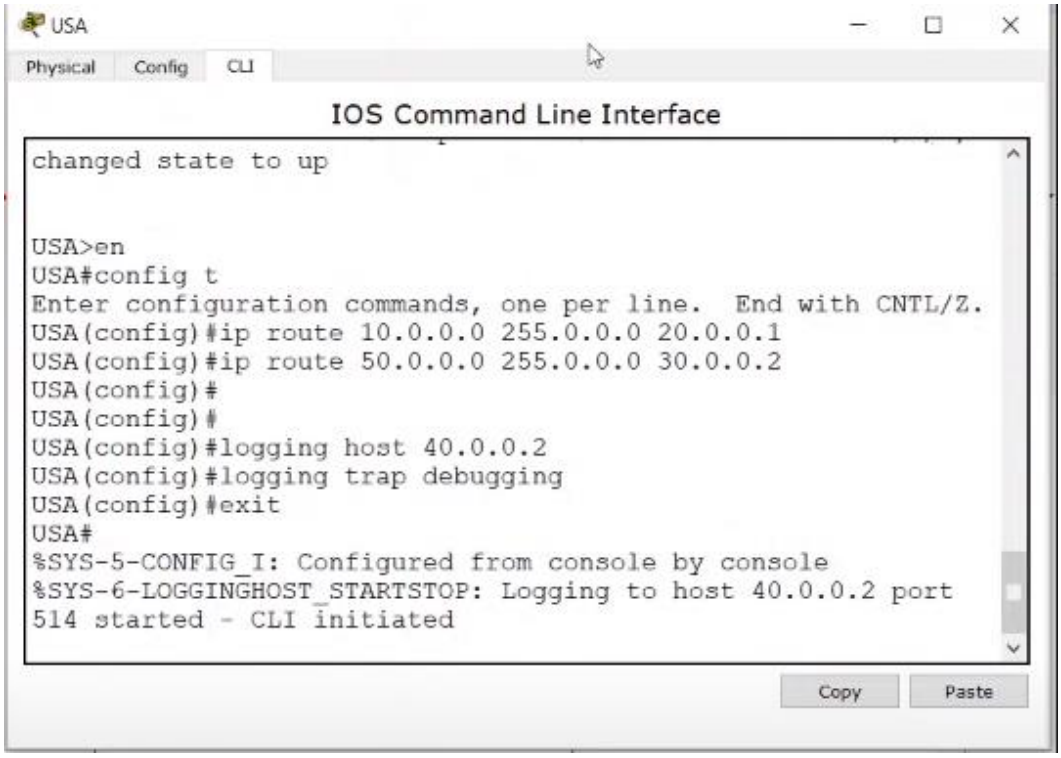
First NTP Server is configured. The Network Time Protocol (NTP) is a networking protocol for clock synchronization between computer systems over packet-switched, variable-latency data networks. It is used here to maintain same time zone on every device. By default, it is disabled. According to the picture below, it needed to be turned on.



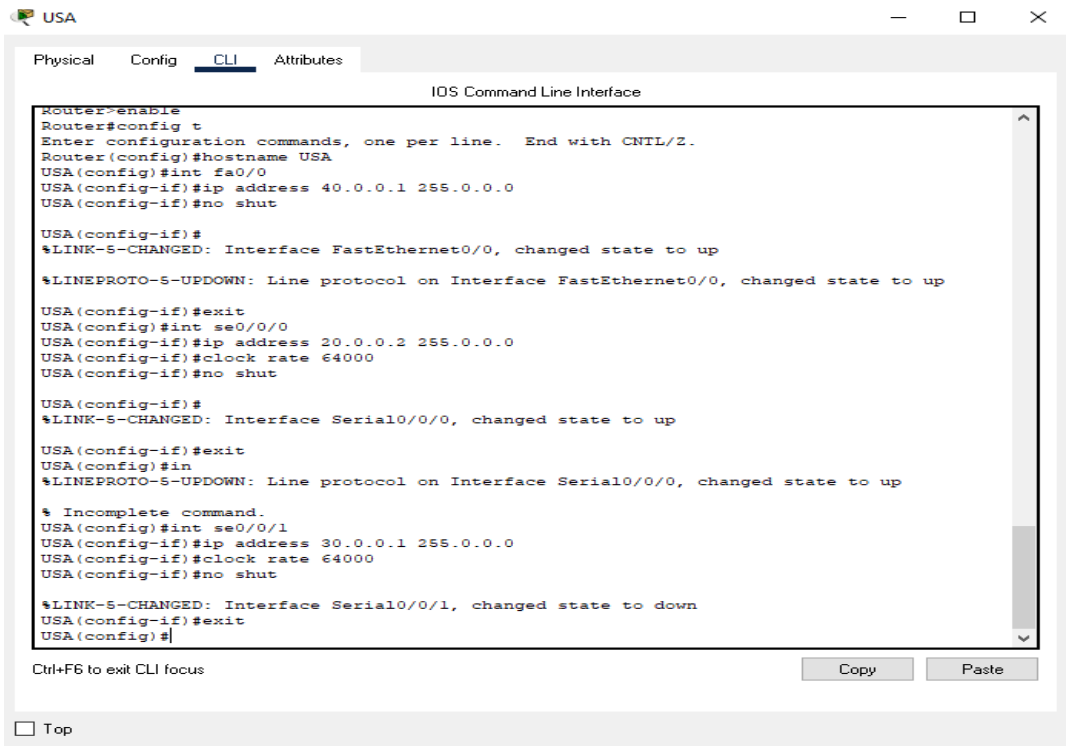
Then, SYSLOG Server is configured. Default it is turned on according to the picture:



In the USA router, putting the following code configures the SYSLOG Server:



IP addresses for the 3 interfaces were assigned. The following picture depicts it:



UK Network

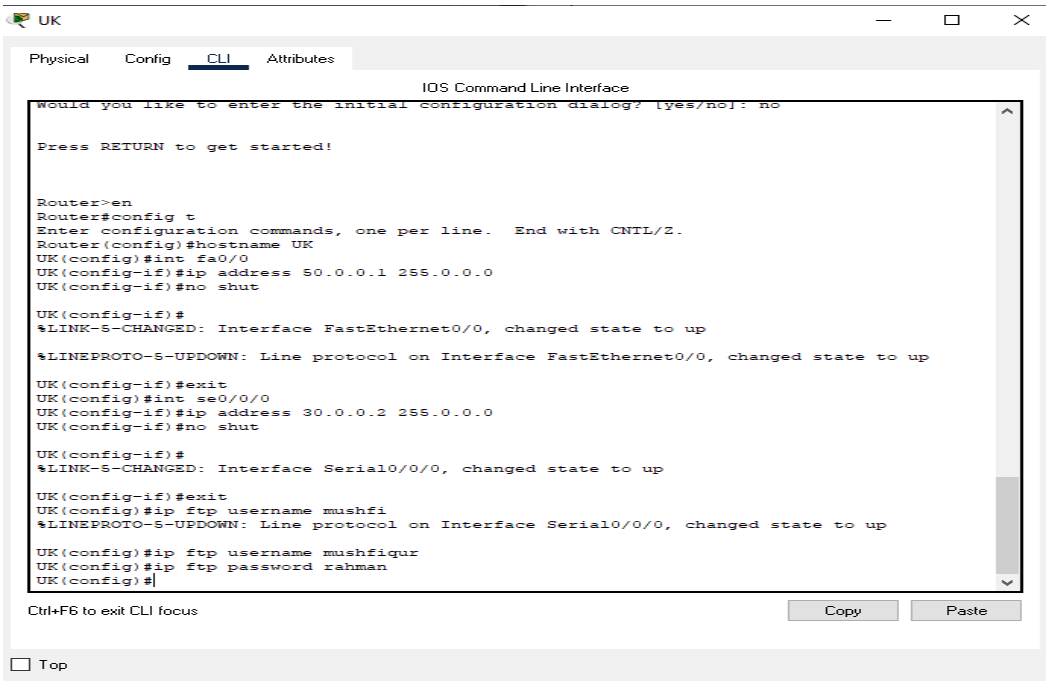
First NTP Server is configured on the UK router. The Network Time Protocol (NTP) is a networking protocol for clock synchronization between computer systems over packet-switched, variable-latency data networks. The following picture depicts the code used for configuration:

Bangladesh (config) # ntp server 40.0.0.3
Bangladesh (config) # exit

DHCP Server has been configured on the UK router. The Dynamic Host Configuration Protocol (DHCP) is a network management protocol used on Internet Protocol (IP) networks for automatically assigning IP addresses and other communication parameters to devices connected to the network using a client–server architecture. The following picture depicts the code used for configuration:

```
UK(config)#ip dhcp excluded-address 50.0.0.1 50.0.0.10
UK(config)#ip dhcp pool LAB1
UK(dhcp-config)#default-router 50.0.0.1
UK(dhcp-config)#dns-server 10.0.0.2
UK(dhcp-config)#network 50.0.0.0 255.0.0.0
```

Next, IP address for 2 interfaces were assigned which the following picture depicts:



Routing

Routing configured in this system is static routing. Static routing is a form of routing that occurs when a router uses a manually configured routing entry, rather than information from dynamic routing traffic. In many cases, static routes are manually configured by a network administrator by adding in entries into a routing table, though this may not always be the case. Unlike dynamic routing, static routes are fixed and do not change if the network is changed or reconfigured. The following pictures show he code for configuring static routing on the network for the 3 routers:

```
BANGLADESH(config)#ip route 30.0.0.0 255.0.0.0 20.0.0.2
BANGLADESH(config)#ip route 40.0.0.0 255.0.0.0 20.0.0.2
BANGLADESH(config)#ip route 50.0.0.0 255.0.0.0 20.0.0.2
```

```
USA(config)#ip route 10.0.0.0 255.0.0.0 20.0.0.1
USA(config)#ip route 50.0.0.0 255.0.0.0 30.0.0.2
```

```
UK(config)#ip route 10.0.0.0 255.0.0.0 30.0.0.1
UK(config)#ip route 20.0.0.0 255.0.0.0 30.0.0.1
UK(config)#ip route 40.0.0.0 255.0.0.0 30.0.0.1
```

5.2 System Analysis

5.2.1 Six Element Analysis

The six elements of the project are listed below:

- Goal - To establish a private WAN business network with multiple functionalities.
- Input – Configuration of routers, servers, switches, and PCs
- Activities – Servers allowing 9 different types of functionalities to take place.
- Output – Simulation of the design using software.
- Outcome – Analysis of the design
- Performance – Control and calibration of the design

5.2.2 Feasibility Analysis

There was a medium familiarity with the technology. I had some prior knowledge in using Cisco Packet Tracer software on previous projects and courses. The software, however, is complicated and contains many components. Therefore, it took some time to learn how to use the software to be able to build the system.

This was a medium size project. Much analysis was needed for a proper implementation. Development of the system was somewhat complex. Much work was required to ensure that the devices interact with each other correctly and that the application has a working and easy to use deployment capability.

The system being developed has good compatibility with the existing systems. Cisco has a history of creating small custom applications to automate and improve its internal systems. This project is in keeping with that development style.

The project appears to have good economic feasibility. Except for the hardware, there was little to no cost. One projected benefit of the system is time savings to employees when using the design.

5.2.3 Problem Solution Analysis

Some of the problems listed below can improved upon further speculation:

- Security - WAN could be vulnerable to cybercriminals looking for potential points of weaknesses. WANs can be exploited by anyone able to cross security layers, anyone able to guess or obtain passwords, and in some cases, by anyone in control of a device with access to the WAN. The obvious solution to this would be to implement SSH (Secure Shell) on routers rather than Telnet, as done on this project.
- Insufficient bandwidth - There will be an upper limit to how much data can be transferred between connections. If pushed against or exceed that limit, traffic will slow down, resulting in delays for everyone involved. The solution would be to by allowing or disallowing certain apps to access data throughout the organization or use methods like traffic shaping to better optimize the flow of that bandwidth.

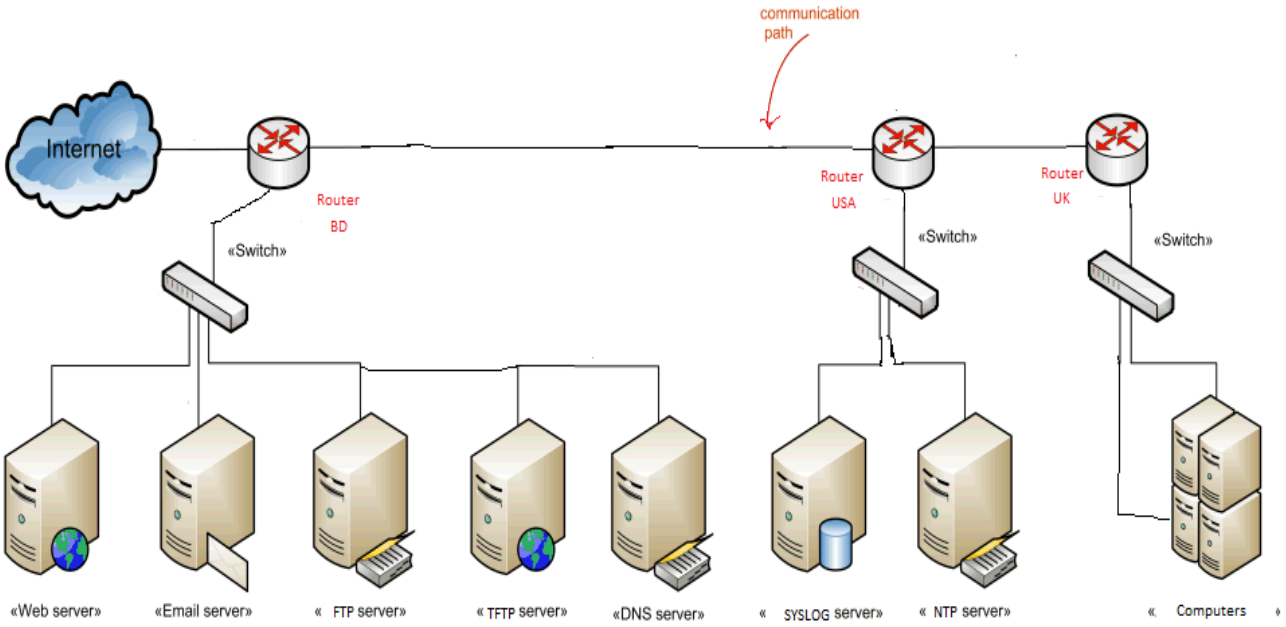
- Bad optimization - For the system to run more smoothly, caching maybe implemented to store data locally to prevent it from needing to load upon subsequent requests. It is a small step, but it could greatly optimize system.

5.2.4 Constraints Analysis

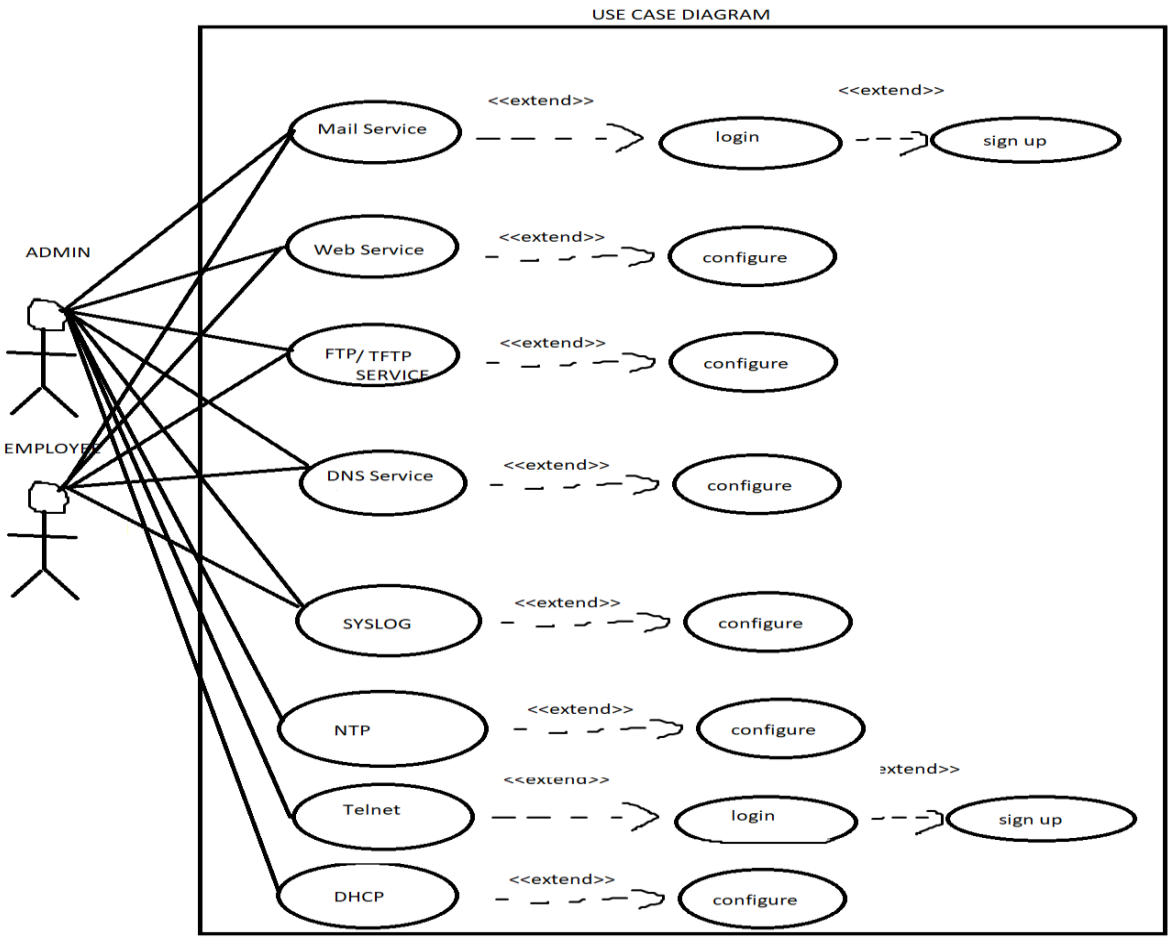
Some of the constraints regarding the project include time constraints. There was just not enough time to add more functionalities (servers) on to this project to make it seem more like a business network than it is currently. Due to this, web servers will not be able to access ecommerce sites, which is the main functionality of a business. Moreover, during the age of pandemics, there was no other way to live demonstrate this process except for using software simulation tools which may not be as reliable. Finally, the cost of hardware used in the project could be bit higher to run smoother simulations. Better core performance on the computer would have sufficed.

5.3 System Design

5.3.1 Rich Picture



5.3.2 UML Diagrams



5.3.3 Functional and Non-Functional Requirements

Functional Requirements	Definition
Storing data	Ability to store router data using FTP and TFTP Server
Mail Service	To establish email service in the network
NTP Service	To maintain same time zone on every device
SYSLOG Service	Ability to keep a log of events on the network
HTTP/HTTPS Web Service	To work as a web portal
DNS Server	To identify addresses and open webpages using domain name
Telnet	For remote login of router configuration

Non - Functional Requirements	Definition
Access Control	Limitation on who can access the data
Limited Platform	Ability to function in windows-based platform
Limited Services	Exclusion of more functions of a WAN network
Security	Lack of firewall

5.4 Product Features

5.4.1 Input

Inside the Packet Tracer, the devices used to simulate the project are listed below:

- Routers x3 - device that forwards data packets between computer networks.
- Switches x3 - connects multiple devices to create a network.
- Servers x7 - save and store data and helps in the execution.
- Cables – wires which are used to carry electricity or electronic signals.
- PCs x3 – Personal Computers

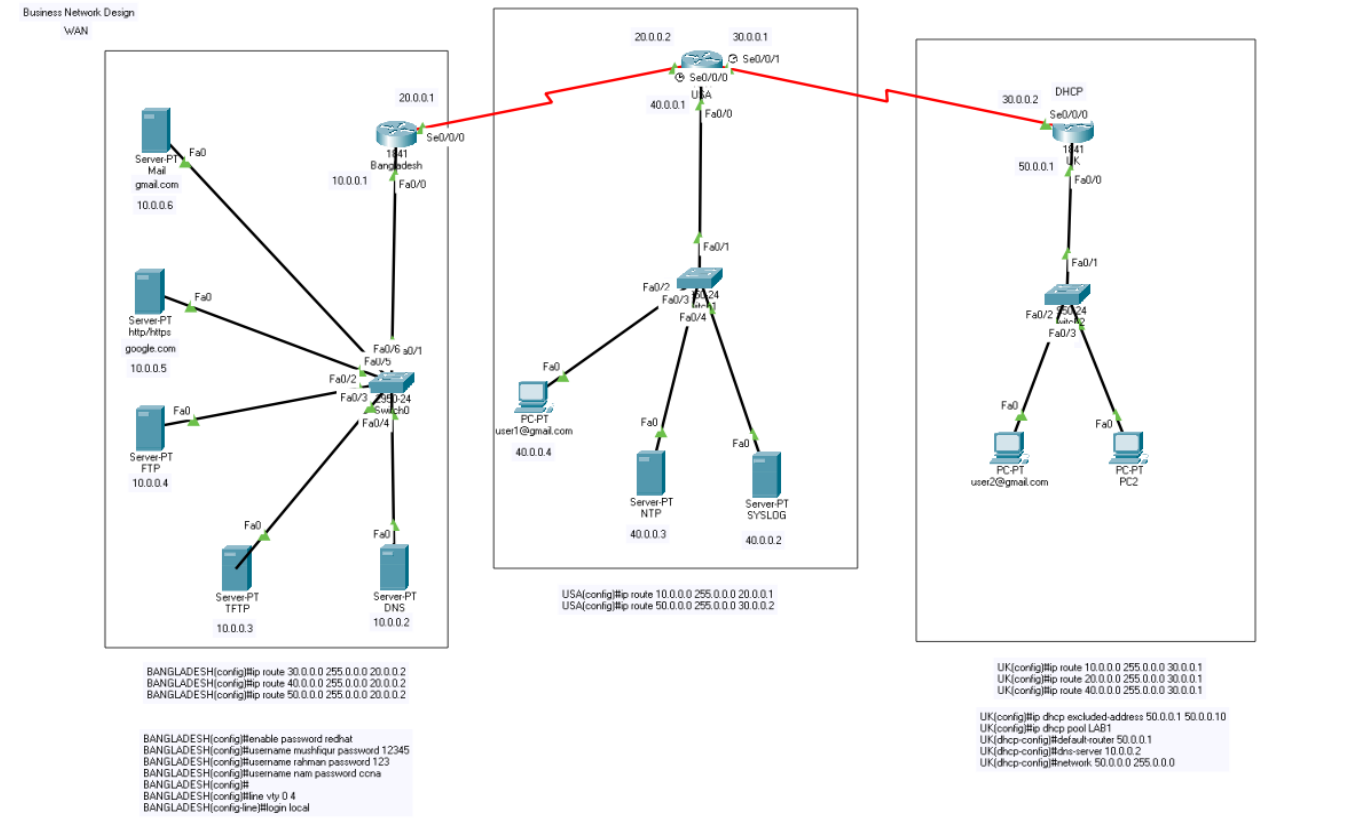
Cables were used to join the devices with each other to form a WAN network. The routers, servers, and switches were configured accordingly as mentioned in the work description with each of the devices with their own set of codes.

5.4.2 Output

The output of this project is a running private WAN network with the following services:

- Keeping data backup of routers
- Ability to send / receive data from computers from one country to another.
- Sending email capability.
- Maintaining same time zone everywhere
- Keeping a log of events stored.
- Remote router login.
- Functional web server
- Finding webpages using domain names.

5.4.3 Architecture

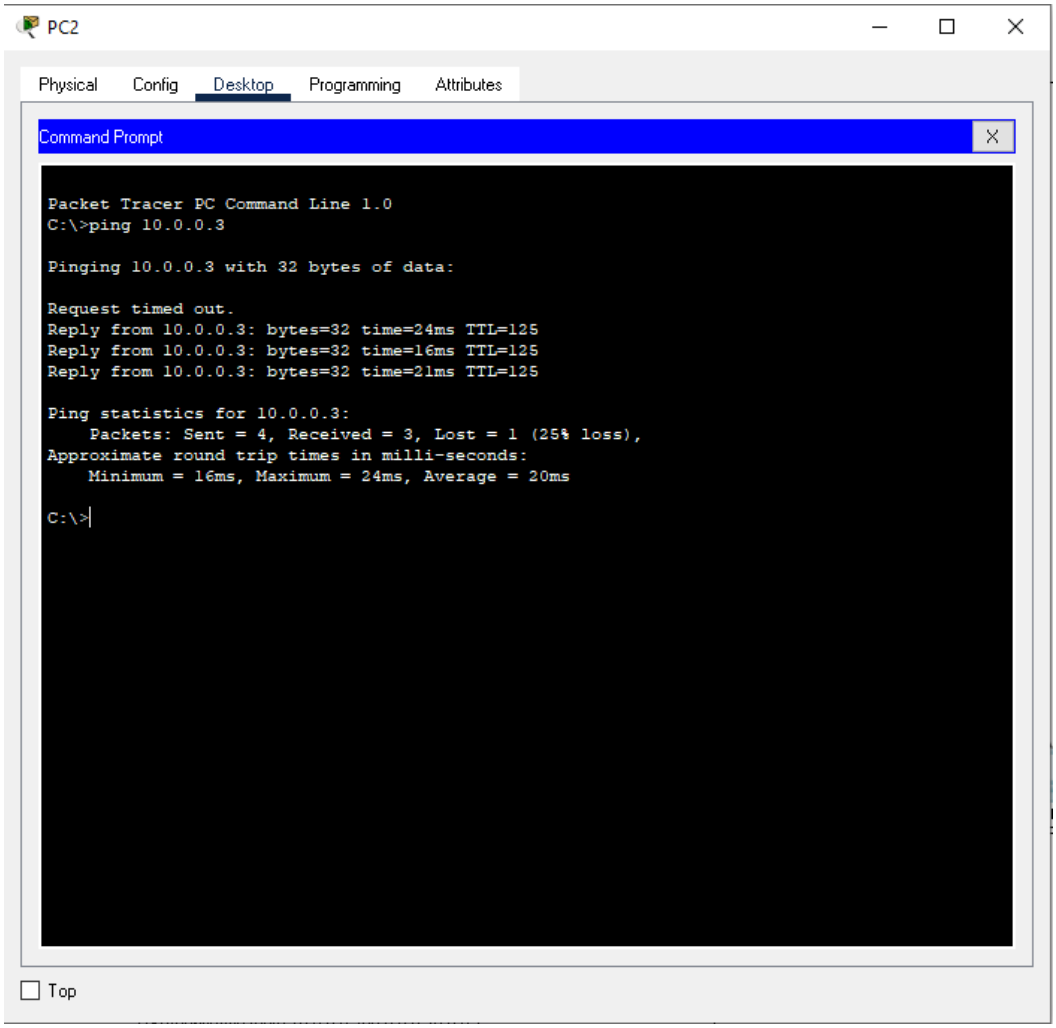


Chapter 6

Results & Analysis

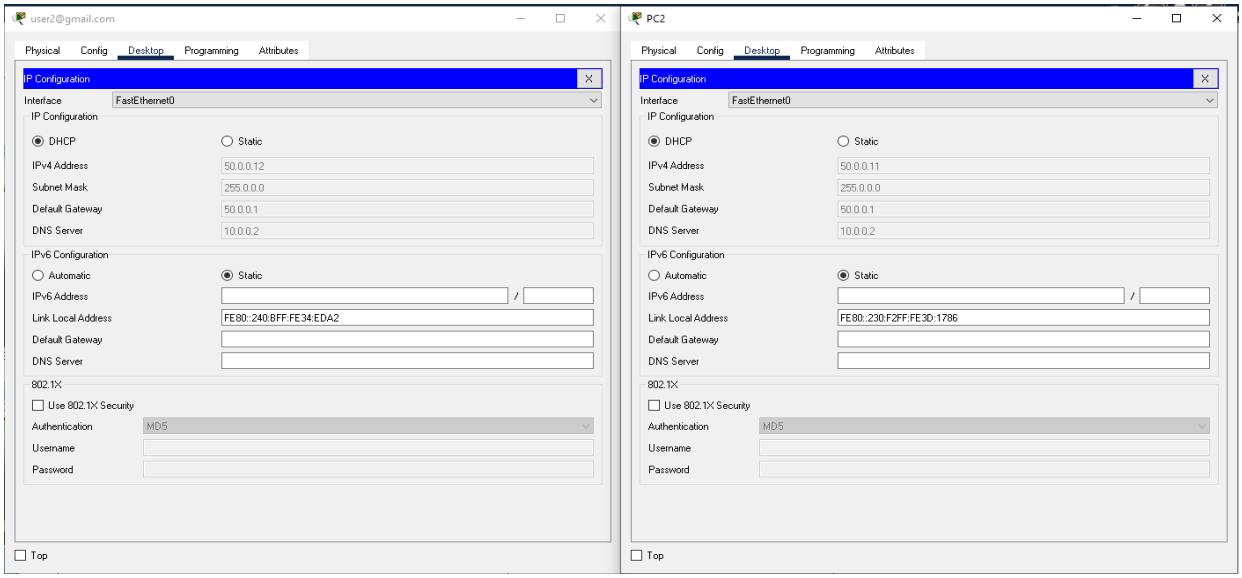
Ping to PC

All the computers of any branch can communicate with each other, that is all the computers are pinging each other, and thus all the branches can now communicate and thus the purpose of the project is achieved. The following picture depicts it:



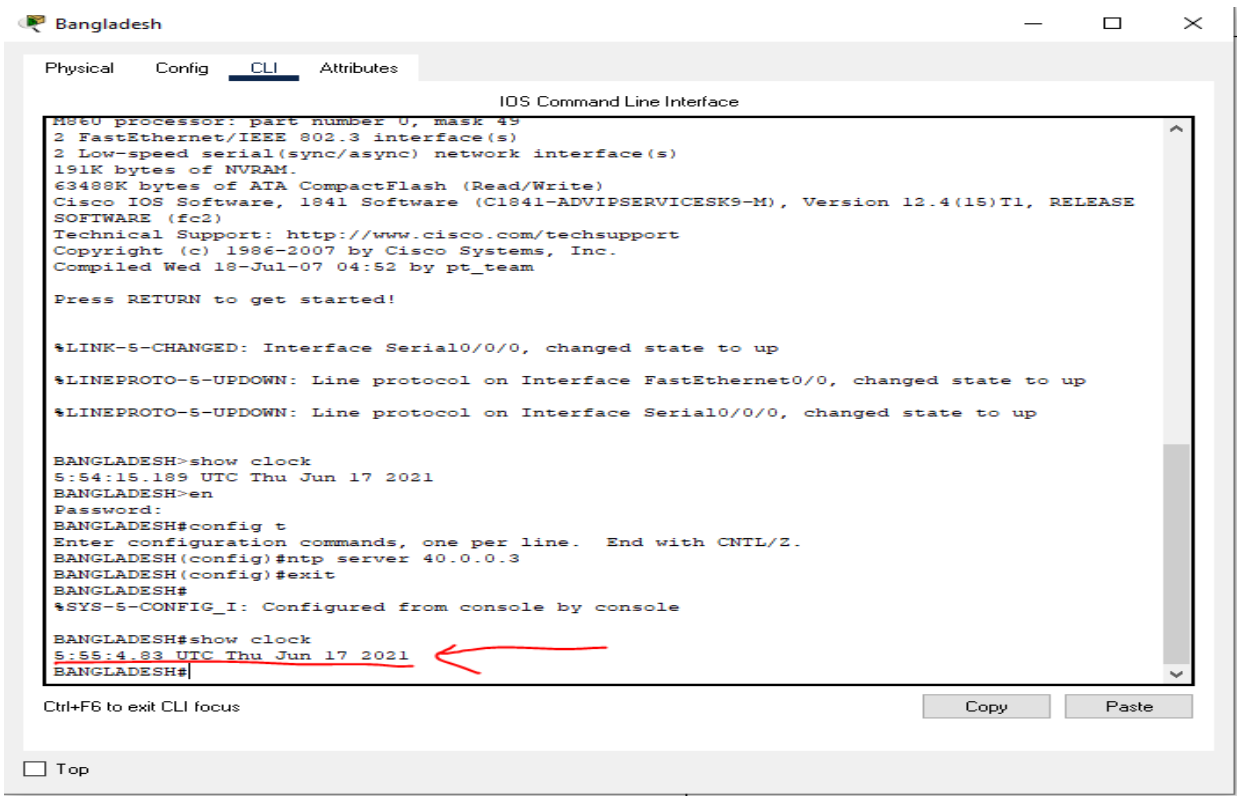
DHCP Testing for UK router

The following picture depicts that all the devices under UK network are taking automatically assigned IP addresses from the DHCP Server:



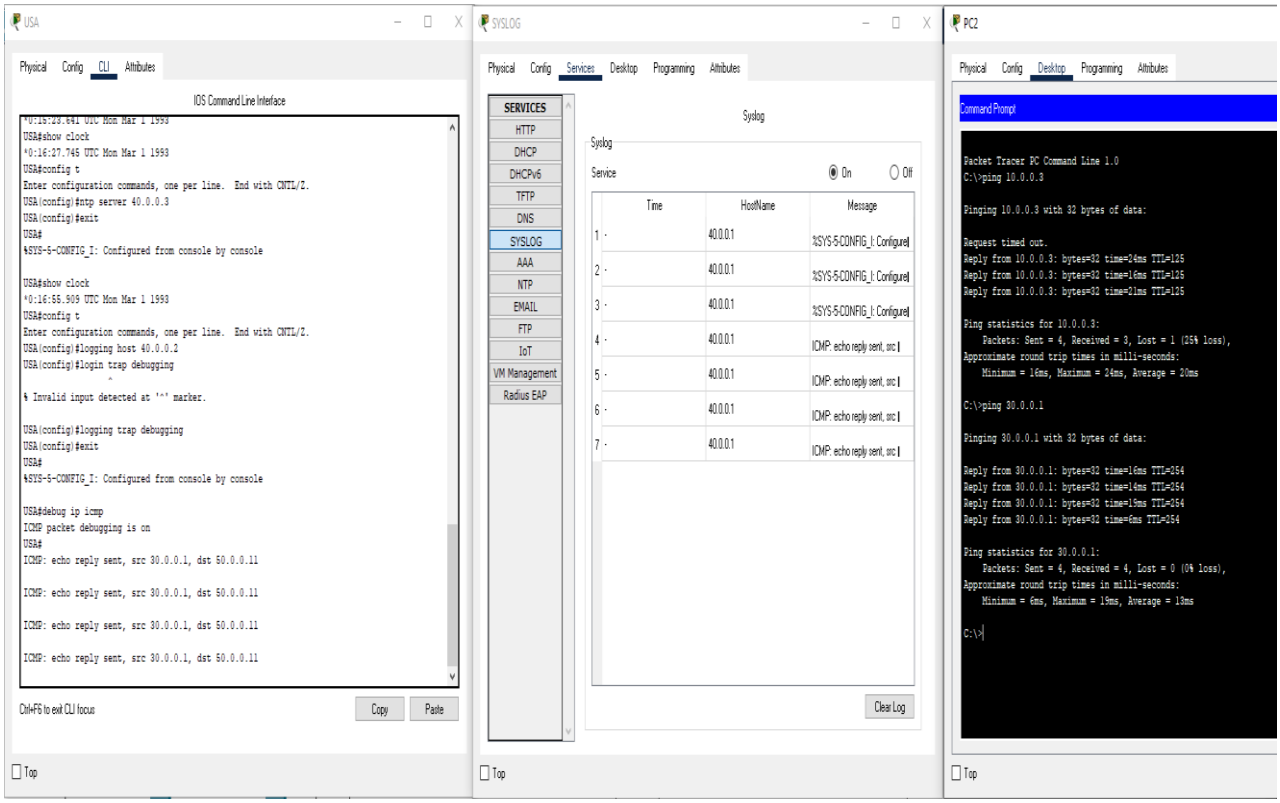
NTP Server Testing for Bangladesh router

The following picture shows that Bangladesh router is showing the correct date and time:



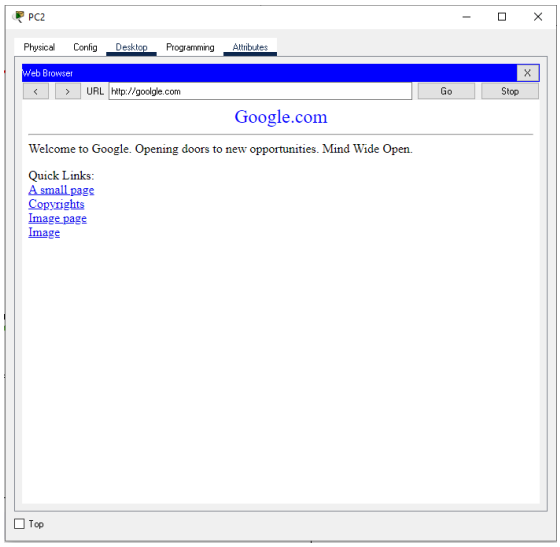
SYSLOG Server Testing

The following picture shows that SYSLOG Server can save log of events from USA router and show which device is pinging to it. In this case, a PC from UK network is pinging the USA network:



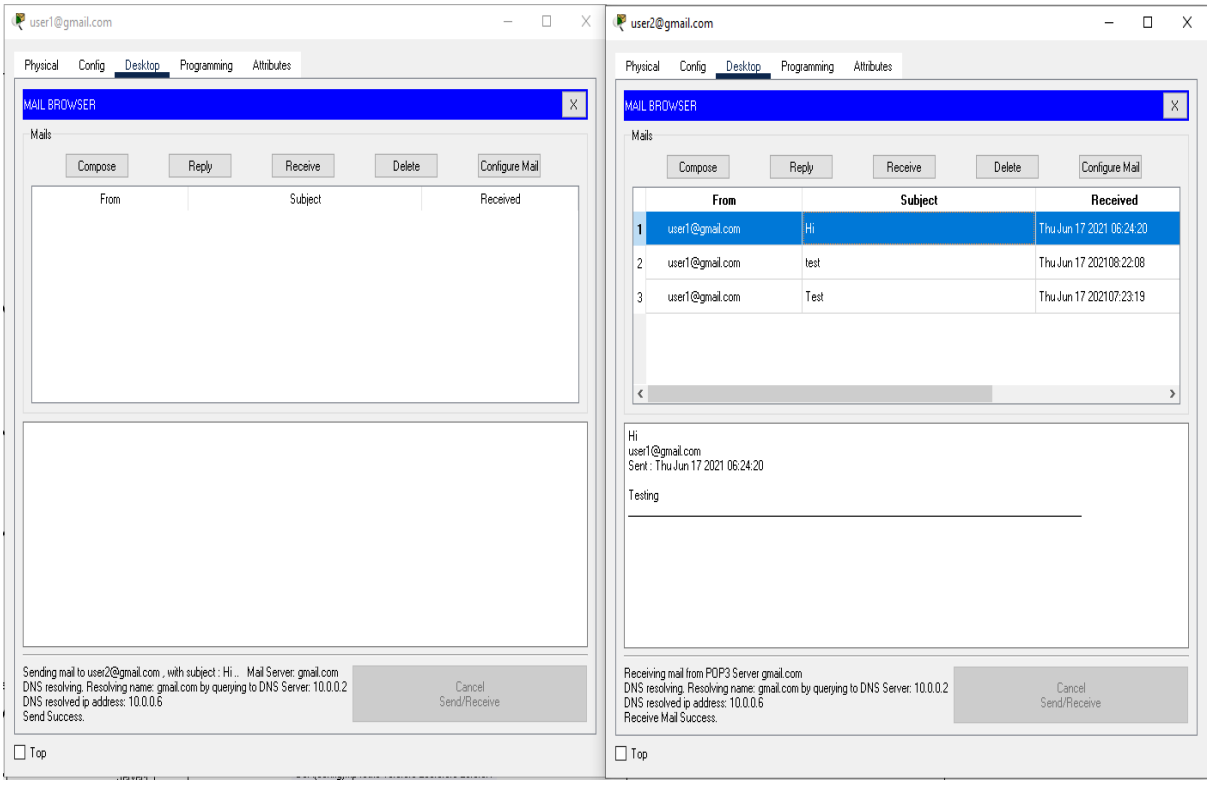
Testing HTTP / HTTPS and DNS Servers

Using the browser from UK PC we can open webpage using domain name ‘google.com’ to open it, which the following picture depicts:



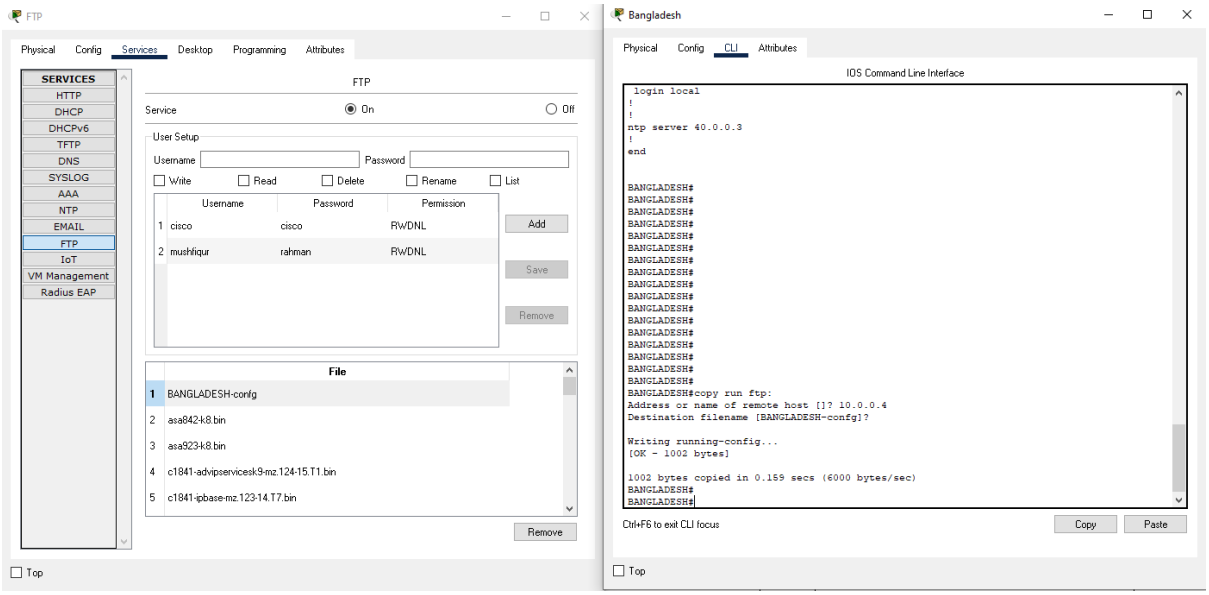
Testing SMTP or Mail Server

The following picture shows that user1 from USA network is able to send email to user2 of UK network which user2 can receive:

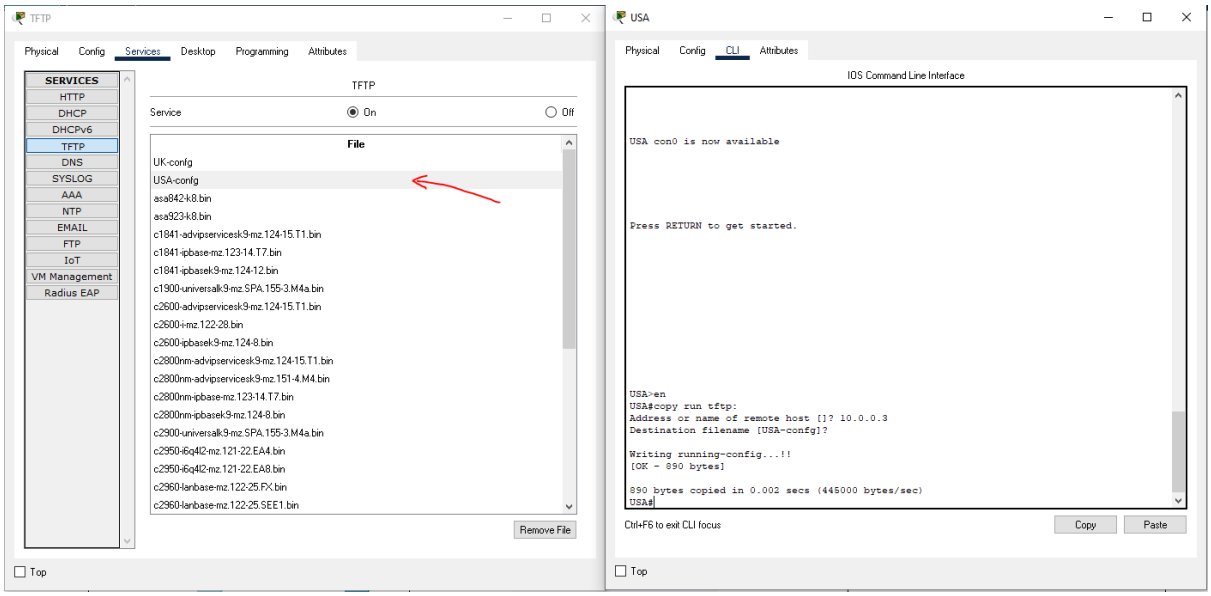


Testing FTP and TFTP Servers

The following picture shows FTP server has taken a backup of data of Bangladesh router:

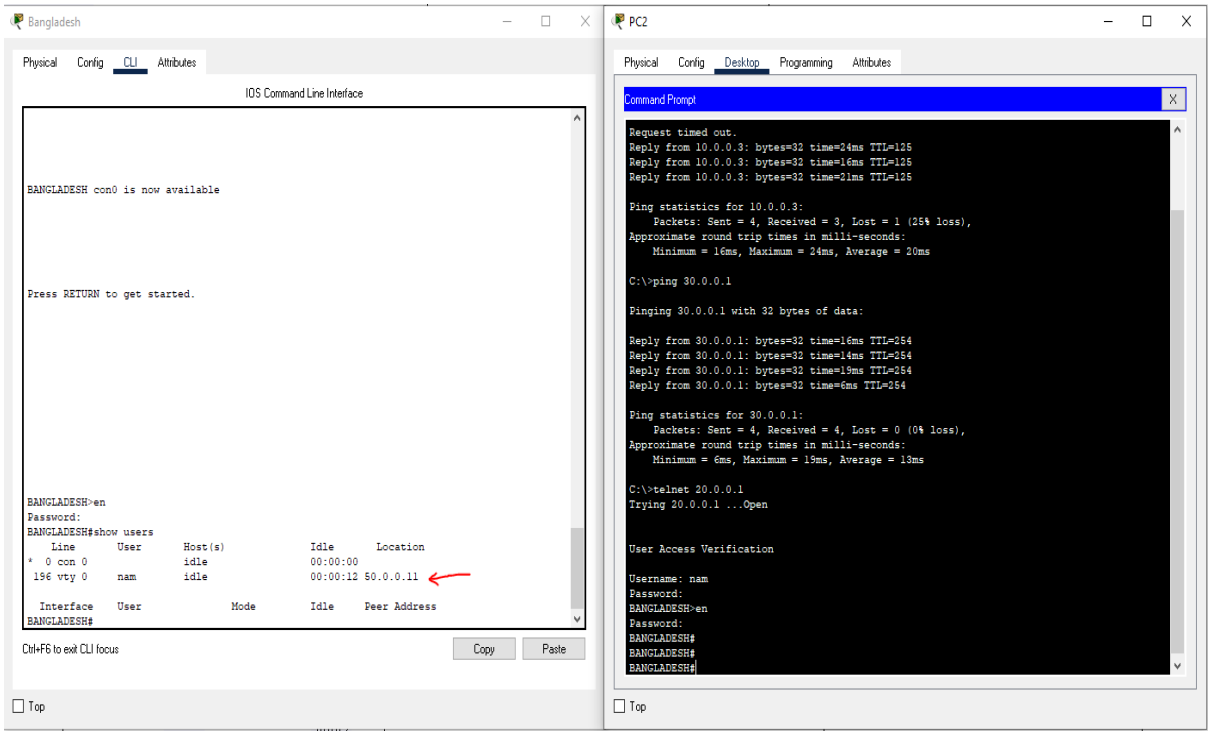


The following picture depicts the case where TFTP server can secure a backup of data of USA router:



Testing Telnet for Remote Login of Router

The following picture depicts how from UK router we can remotely login to Bangladesh router, which has been configured as Telnet, for remote login:



Chapter 7

Project as Engineering Problem Analysis

7.1 Sustainability of the Project/Work

Just as the Internet hierarchy had to adapt to accommodate an increase in players, so has the business network. Early data networks facilitated the basic requirement of communication between terminals and a central mainframe. The need for a simple hierarchy, was readily apparent from this basic requirement. In today's world of peer-to-peer networking, however, the reasons for network hierarchy and its inner workings are subtler, yet just as important for successful network design.

A typical large IP network, whether an ISP or a large corporate intranet, will consist of routers performing several different roles. It is convenient to define three major roles corresponding to each layer in the hierarchy: backbone, distribution, and access.

7.2 Social and Environmental Analysis

Social effects of this project include those that may not seem sensible to achieve the major requirements of the network. These could include a mandated use of standards that are difficult to obtain, to use, or to understand. Thankfully, this has been less common since the demise of OSI. (At one time in the industry, a play on the OSI reference model included a "political" layer above the application layer—the so-called "eighth layer of networking.") Alternatively, it may be constrained to using a certain vendor's equipment because of a prearranged partnership agreement.

7.3 Addressing Ethics and Ethical Issues

When we talk about ethics in computer networking, we talk about security. This project by no means violates their user's personal information. Today, most desktop computers and PCs are networked that is, they can link to other machines, usually to access data and other information held remotely. Such machines may sometimes be connected directly to each other, as part of an office or company computer system. More frequently, however, connected machines are at a considerable distance from each other, typically connected through links to global systems such as the Internet, or World Wide Web (WWW). The networked machine itself may be anything from a powerful company computer with direct Internet connections, to a small hobbyist machine, accessing a bulletin board through telephone and modem. It is important to remember that whatever the type or the location of networked machines, their access to the network, and the network itself, was planned and constructed following deliberate design considerations.

Chapter 8

Future Work & Conclusion

8.1 Future Works

To enhance this project in the future, we can do the same project on IPv6. This project is based on IPv4, so it has limited number of IP addresses. We can use RADIUS server or TACAS+ server authentication which is basically a dedicated servers for collecting username and passwords of routers. We can also implement router for different layer security such as RIP security or OSPF authentication. We can also add firewall for better security to protect all TCP/IP Model layers. We can also implement switch different layer of security such as adding passwords to router, increasing the security of routers like type 7 passwords We can also enhance the network by using MD5 password and service password encryption while adding security protocols. We can also use ACL for packet filtering. We can add null routing for protection from DOS or DDOS attacks. Other than this, we can also distribute servers to different routers, we can add SSH (Secure Shell) which is better for security for remote login than telnet. Furthermore, we can add interface description to router and add banner setting as well.

So, we have seen that for future implementation, this network design can be made much better with enhanced security and added functions. Due to time limitations, it was not meant to be like this for this project.

8.2 Conclusion

To conclude, Business Network Design is a project that aims to simulate the networking operations of a company that uses routers, switches, and servers to form a private WAN network. Since it is based on Wide Area Network (WAN), the various devices used by the company's employees are all interconnected on a special network made only for the company itself. The main part of this network consists of various servers, each with their own distinctive functionality to assist the employees to communicate with each other. The project mainly had three phases which were initialization, simulation, and calibration. Future additions and implementation on this project can vastly improve the security and add more functionality to the project.

Working on this project and doing this internship has been excellent and a very rewarding experience. I got to apply much knowledge of computer science and engineering on this project, especially in terms of networking courses, which helped me to simulate such a business network. GAOTek Inc. is also a company where such networks are structured around similar types of topologies which made my work for this project easier to implement. Not only did I gain practical skills, but I also had the opportunity to meet many fantastic people. This internship has shown and provided me a wonderful opportunity to acquire various technological skills. Though it will take more time to master those skills, at this moment I am confident to apply those in any of my upcoming or current projects.

Bibliography

REFERENCES

Dordal, Lars. [2014] “An Introduction to Computer Networks - Second Edition”
Loyola University of Chicago. Published 2016
(https://open.umn.edu/opentextbooks/textbooks/353)

Gooley, Jason. Yanch, Dana. Schuemann, Dustin. Curran, John. [2020]
“Cisco Software-Defined Wide Area Networks: Designing, Deploying and Securing Your Next Generation WAN with Cisco SD-WAN (Networking Technology) 1st Edition”
Published July 8, 2020
(https://www.amazon.com/Cisco-Software-Defined-Wide-Area-Networks/dp/0136533175)

Lanford, Duncan. [1997] “Ethical Issues in Network System Design”
University of Kent, Canterbury. Published 1997
(https://journal.acs.org.au/index.php/ajis/article/view/367)

Rahman, Abu Mohammed Mushfiqur. [2019] “Static Routing Implementation”
Independent University, Bangladesh. 2019
(https://drive.google.com/file/d/1tzf0w57MGWttJonHmiZ_E6rvoRTgVX2q/view?usp=sharing)

WEBSITES

- www.google.com
- www.cisco.com
- www.scribd.com
- www.wikipedia.org