An Undergraduate Internship on Topic Network Construction at Broad Band Telecom Services

By

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Attestation

This is to certify that I, Sadman Muntasir have completed the report titled "Network Construction for BMD" and submitted it in partial fulfillment of of the requirement for the Degree of Computer Science and Engineering from Independent University, Bangladesh. It has been completed under the guidance of my university supervisor Mr Sheikh Abujar and company supervisor Mr Ajoy Parial who is the Deputy Manager and Engineer at Broad Band Telecom Services. This work has not been submitted as a project to this university previously, neither has it been submitted to any other institution. All the sources of information used in this Project Report has been duly acknowledged in it.

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Acknowledgement

Letter of Transmittal

September 10, 2021
Mr Sheikh Abujar
Lecturer
School of Computer Science and Engineering
Independent University Bangladesh

Subject: Submission of Internship Report

Dear Sir,

It is with a great pleasure that I am presenting the internship report on the project "Network Construction for BMD". Bangladesh Meteorological Department's (BMD) project tender was won by BBTS which involved the network construction in 57 weather forecast offices all over Bangladesh which is being funded by the World Bank. I was involved in this project for the completion of my Bachelors Computer Science and Engineering Degree. I am happy to inform you that I have successfully completed my internship for 12 weeks at Broad Band Telecom Services under the supervision of Mr Ajoy Parial, Deputy Manager.This project gave me an opportunity to apply the theoretical knowledge gain at my University

I am hoping that this report will be interesting, unique and informative. I also hope that this meets your expectations. I have tried my best to avoid my mistakes and deficiencies and hope that this report will satisfy you. I would like to end by thanking you again for helping me and giving me the chance to submit this report to you.

Sincerely,
Sadman Muntasir.

Evaluation Committee

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Signature

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Name

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Supervisor

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Internal Examiner

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External Examiner

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Convener

Abstract

Climate change is a real happening phenomenon and people all around the world should be actively aware. For the people of Bangladesh, it's always important to be provided the accurate weather forecast information and for that Bangladesh Meteorological Department (BMD) has received a donation from the world bank to improve the infrastructure of connectivity of all the 57 offices all over Bangladesh.

[1] Previously in Bangladesh, the BMD offices had a very poor connectivity set up with just a single desktop in every office and the officers were using portable modems as their main source on internet connection. This was a below par situation for such an important aspect for livelihood. As a result, the data used from the BMD's database by TV channels and weather forecast apps were mostly inaccurate.

Now Broad Band Telecom Services has taken the project to construct an efficient and reliable network for BMD where all the offices will have about 8-24 desktops in a LAN setup with dedicated IP addresses for their internet connection of a bandwidth of 100 mbps. This will by far improve the accuracy of data entry of the Climate of Bangladesh.

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Chapter 1

Introduction

1.1 Overview/Background of the Work

Weather forecast is an important aspect of livelihood as it helps determine the future climate expectations. Information of the climate is extremely important for cultivation, fishing, flight information and construction so a lot of people working in these sectors need to have accurate climate information. Bangladesh has 57 weather forecast offices all over the nation under the Bangladesh Meteorological Department (BMD).

The most important work in the BMD offices is of data input into the government's database of climate information through their website. These data from the database are used by different domestic TV channels for broadcasting weather forecasts and also used by international weather forecast websites and application. So having a strong network connection at all times is very important for the quality of data entry into the database.

The current scenario in these office are very poor in terms of the infrastructure of equipment.This has effected the quality of work and compromised the accuracy of weather forecasts. Information about the climate of every country is a concern for the United Nations Environment Programme as global warming is a happening and a immensely concerning phenomenon for which Bangladesh received a funding from the World Bank [2] to improve the infrastructure of the BMD offices all over the nation.

This government tender was won by Broad Band Telecom Services and the project of network construction for BMD was our responsibility. Establishing an efficient and reliable network was the main goal and also giving them a proper IT solution for their work space. This will improve the working environment of the BMD offices and there will the an opportunity for more officers to work efficiently for reliable data input and improving the weather forecasts for Bangladesh.

1.2   Objectives

- **Setup a reliable network**- Our company works with the four layers from the OSI reference model which are the physical layer, data link layer, Network Layer and Transport layer. Our engineers with their knowledge and experience will set up an efficient network connection for BMD which will be perfectly suitable for the ease of work without any connectivity issues.

- **Provide quality networking equipment**- The equipment required for the construction for BMD's network can be acquired from different hardware brands. We will be using the most reliable hardware starting from the fiber optics which can transfer up to 100 GB of data, the switches and routers will be from Cisco and the desktop set up will be of Dell.

- **Setup the best suitable LAN connection**- In an office space, work compatibility is very important and having an organised setup is crucial for work efficiency. We go through a surveying process before the final construction of a network where we try to meet the client's requirements and plan ahead.

- **Provide the desired bandwidth**- BMD has requested a 100mbps of bandwidth in every of their 57 offices so we will make sure that all the 57 office have a reliable BTS point from where the connection will be provided through fiber optics cable.

- **Assure maintenance**- Our company has POP (point of presence) offices which are responsible for network maintenance. We already have POP offices set up in most the areas where the BMD offices are situated and they will always provide assistance in any connection failure.

1.3   Scopes

The possibilities after the complete construction of BMD's network are given below:

- Faster connectivity.

- More data reliability.

- Stable network.

- Improved work efficiency.

- Improved accuracy in weather forecasting.

Chapter 2

Literature Review

2.1 Relationship with Undergraduate Studies

With the help of the knowledge and skills that I gained and learned in various courses here at Independent University, Bangladesh (IUB), helped me participate and work on this project at Techdojo. While, with these courses I had to learn a few more things to align my knowledge at the company. Some of the courses that helped me are given below:

- **CSE316 Data Communication and Computer Networks**- This course was directly related to my field of work. This course has taught me the OSI reference model and how network communication work throughout the seven layers. More topics covered were network categories and topologies, TCP/IP protocol suite, TCP/IP applications, FTP, transport layer protocols, link layer protocols, internetworking devices, routing algorithms, IP addressing, sub netting, network programming, LAN types and technology. Knowledge gained from this course were crucial in the construction of BMD's network.

- **CSE403 Network Management**- This course introduced the techniques and tools for the management of telecommunication systems and computer networks. I've was introduced to the fundamental models that are used in the Internet (SNMP), and telecommunication networks (TMN).

- **CSE316 Cryptography and Network Securities**- Not much of information from this course was needed in my project at BMD but this course introduces the principles and practice of cryptography and its use in network security and understand a variety of generic security threats and vulnerabilities, and identify and analyse particular security problems for a given application.

2.2 Related works

As a well know ISP service provider to corporate client's BBTS as previously had numerous projects and have successfully constructed networks and have maintained all of their clients. The biggest client that BBTS have constructed a network is for Dutch Bangla Bank Limited (DBBL) and they have been availing BBTS's internet connectivity till date. DBBL is one of the biggest banks in Bangladesh and has over 200 branches nationwide including zonal offices and their head office in Motijheel, Dhaka.

DBBL has their own IT division for maintaining the bank's database and also has their own servers so their requirement from BBTS was to construct a secure network with strong firewalls to protect their network by filtering traffic and blocking unauthorised access to the transactions heppening through BBTS's network. Their requirement for the network devices were from Cisco and the optic fiber cable bandwidth has almost 10Gps. The area branches required 10-15 destops having a Vlan connection with a Cisco switch and router in every office. Their required bandwith in every office nationwide was 100mbps which had to be consistent during office hours. Maintenance of the network was also a requirement from DBBL which were to be maintained by our POP office in the area.

BBTS successfully constructed a secure network for DBBL which is helping them with seamless banking transactions and online banking. A total of 25Gbps of bandwith is being provided every month which is generating huge revenue for BBTS. [3]

Chapter 3

Project Management & Financing

3.1 Work Breakdown Structure
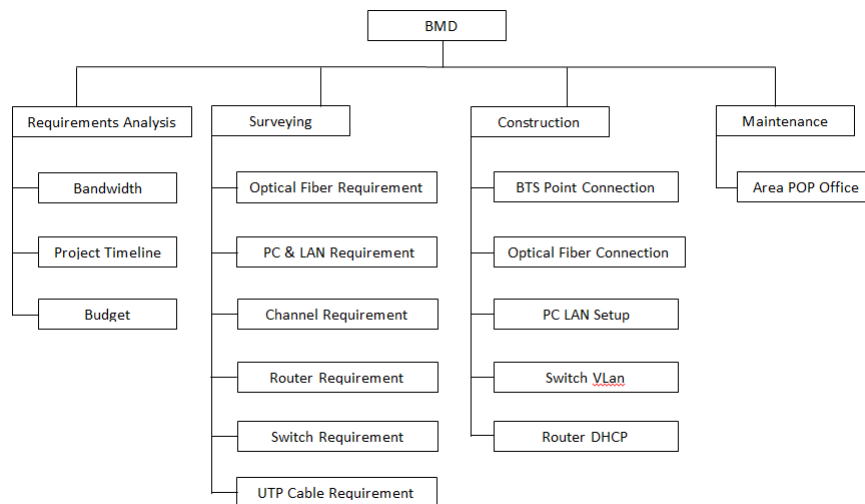
Figure 3.1: Work Breakdown Structure

Work Breakdown Structure (WBS) [4] is the tool that breaks work into smaller tasks to increase productivity and is used to make the work more manageable and approachable. This technique is one of the most important project management documents.

The above diagram shows us the work breakdown structure (WBS) of BMD's Network Construction. Here, we can see four main project phases which are required to complete the project. Those five phases are:

1. Requirement Analysis is the phase where the company understands the client's specific requirements of the project. This phase has three sub-tasks which included the confirmation of the amount of internet bandwidth needed in the BMD offices, the project deadlines and most importantly the budget of the project.

2. Surveying is the initial phase of the projects network construction which has six sub-tasks which include the calculation of the length of Optical Fiber needed, number of PC required for the offices and the LAN setup structure, the channels needed, the router requirement, the switch requirement and finally the number of UTP cables required in each office.

3. Construction of the network buildup process which has five sub-tasks. The first task is to locate an existing BTS point nearest to the office from which the optical fiber will connect to the router being the second task. The third task involves the desktops being in a LAN connection which will be connected to a Cisco switch. The Cisco switch will have VLan configuration setup in the required offices which is the fourth task and the final task would be configuring the routers for the PCs to receive IP through DHCP.

4. Maintenance being the final phase has only one sub-task which is to make sure there are POP or Point of Presence offices present in the area of every BMD office nationwide as these POP office with be involved of the physical maintenance of the network.

The WBS has given us a clear roadmap on how to approach these tasks one at a time. This made the project look more approachable and less complicated.

3.2 Process/Activity wise Time Distribution

Tasks	Days
Requirement Analysis	5
Surveying	20
Construction	60
Maintenance	10
Total	95

Figure 3.2: Process/Activity wise Time Distribution for BMD

The Process/Activity wise Time Distribution shows us a table with the set of tasks that are required to be completed with the amount of time needed to complete each task.

From the table we can see that Requirement Analysis would take around 5 days, Surveying would take around 20 days as there are 57 offices to be surveyed, Construction of the network would take the most amount of time allocated to it which is 60 days and lastly for maintenance the POP offices need about 10 days to be allocated.In total, the project is estimated to be completed by around 95 days which can be said that it would require more than 3 months for its completion.

3.3   Gantt Chart

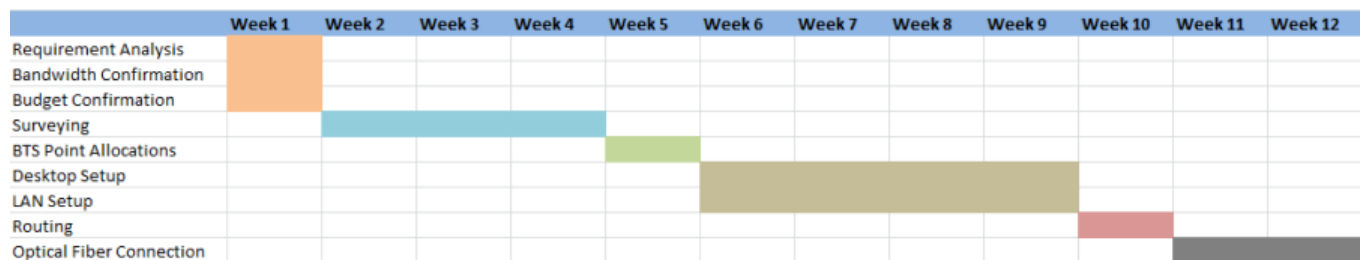|	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Requirement Analysis												
Bandwidth Confirmation												
Budget Confirmation												
Surveying												
BTS Point Allocations												
Desktop Setup												
LAN Setup												
Routing												
Optical Fiber Connection												

Figure 3.3: Gantt Chart for BMD's Project

The above diagram shows us the Gantt Chart of BMD's project. A Gantt Chart is a graphical explanation of a project. From the above chart, we can see how each task along with its sub-tasks took a certain amount of time and how according to that allocated time those tasks were distributed to be completed in that specific time frame.

3.4 Process/Activity wise Resource Allocation

Tasks	Work Percentage
Requirement Analysis	10%
Surveying	25%
Construction	50%
Maintenance	15%
Total	100%

Figure 3.4: Process/Activity wise Resource Allocation for BMD

The Process/Activity wise Resource Distribution shows us a table with the set of tasks that are required to be completed with the amount of work needed to complete each task. The main 5 tasks are:

1. **Requirement Analysis**: The first most important work is to understand the requirements of the client in details and most importantly coming to a feasible budget agreement for the project to proceed forward.

2. **Surveying**:Before starting the construction of the network and the hardware setup in the BMD offices, surveying was done for all the 57 office nationwide and our surveying team noted the equipment required for each specific office.

3. **Construction**: The major work was done in constructing the network as BMD needed new desktop setups in their office with LAN connections and configuration was done for all the routers which had to provide IP to the PCs through dhcp. The switches were mostly non manageable but in few offices there were a good number of desktop setup which had to be in a VLan connection.

4. **Maintenance**: Most of the offices of BMD had our company's POP offices in the area but in a few remote location like Sandwip needed a POP office for maintenance.

3.5 Estimated Costing

Equipment	Unit	Per Unit Cost/Taka	Total Unit Cost/Taka
Desktop	520	45000	23400000
Cisco Router	57	18000	1026000
Cisco Switch	57	8500	484500
Optical Fiber Cable	250000 meters	14	3500000
UTP Cable	8700 meters	30	261000
Channel	10000 meters	12	120000
UPS	520	3500	1820000
Fiber Media Converter	114	1000	114000
Fiber Joint Box	250	100	25000
Mountain Server Rack	57	8000	456000
Summit Bandwidth	5700 mbps	414	2359800
Total			33566300

Figure 3.5: Costing of the project

The above table shows us the list of the equipment required for the complete network construction for BMD. BMD is going through an entire office upgrade and will be hiring employees so desktop installation in every office was a general requirement for work and about 520 desktops were ordered from Dell. The router requirement for every office was from Cisco, model RV160W and most of the office required non manageable switch with a few offices needed VLan connection both from Cisco switches, models SF95-24-AS 24-Port SMB and SG350-28 28-Port. The LAN setup were usually of 8-10 desktops using UTP cables managed with channeling the wires in the office.

Chapter 4

Methodology

The network design methodology we have used in this project is derived from the Cisco PPDIOO methodology [5], which reflects a network's life-cycle. This involves six phases in the construction of a network and this life-cycle approach provides several key benefits which include,

- Lowering the total cost of network ownership

- Increasing network availability

- Improving business agility

- Speeding access to applications and services

The total cost of network ownership is especially important into today's business climate. Lower costs associated with IT expenses are being aggressively assessed by enterprise executives. Network availability has always been a top priority of any enterprise as the number of users availing services increase, the profits increase in parallel. However, network downtime can result in a loss of revenue.Accessibility to network applications and services is critical to a productive environment. As such, the network life-cycle accelerates access to network applications and services.

The six phases of this methodology includes,

- Prepare

- Plan

- Design
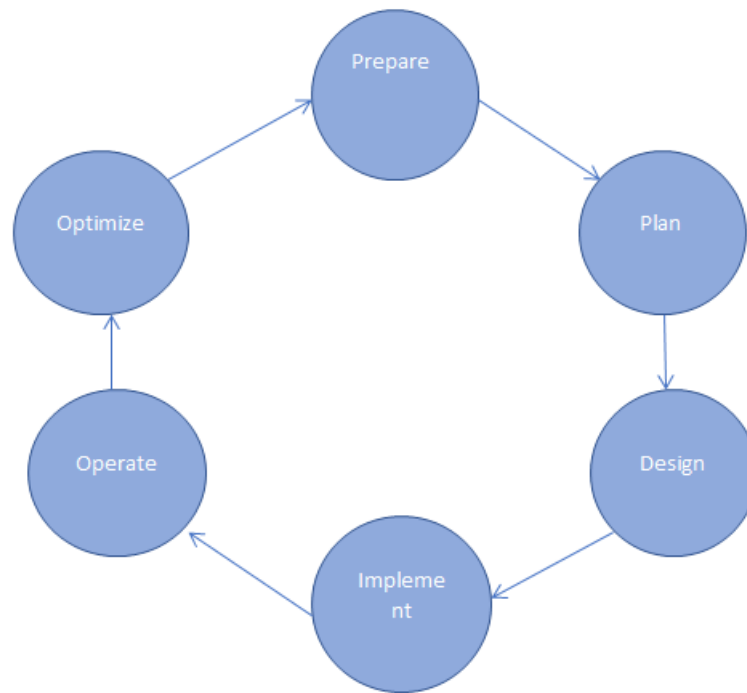
- Implement

- Operate

- Optimize

Figure 4.1: PPDIOO cycle

- Prepare: The Prepare phase involves establishing the client's requirements, developing a network strategy, and proposing a high-level conceptual architecture, identifying technologies that can best support the architecture. Financial justification for the network strategy is established by assessing the client's case for the proposed architecture.

- Plan: This phase involves identifying the network requirements, which are based on the goals for the network, where the network will be installed, who will require which network services, and so forth. The Plan phase also involves assessing the sites where the network will be installed and any existing networks, and performing a gap analysis to determine if the existing system infrastructure, sites, and operational environment can support the proposed system. A project plan helps manage the tasks, responsibilities, critical milestones, and resources required to implement the changes to the network.

- Design: The initial requirements determined in the Plan phase drive our network design specialists' activities. Our specialists design the network according to those initial requirements, incorporating any additional data gathered during network analysis and network audit and through discussion our managers and network users. The network design specification that is produced is a comprehensive detailed design

that meets current business and technical requirements and incorporates specifications to support availability, reliability, security, scalability, and performance. This design specification provides the basis for the implementation activities.

- Implement:Implementation and verification begins after the design has been approved by our clients. The network and any additional components are built according to the design specifications, with the goal of integrating devices without disrupting the existing network or creating points of vulnerability.

- Operate: Operation is the final test of the design's appropriateness. The Operate phase involves maintaining network health through day-to-day operations, which might include maintaining high availability and reducing expenses. The fault detection and correction and performance monitoring that occur in daily operations provide initial data for the network life-cycle's Optimize phase.

- Optimize: The Optimize phase is based on proactive network management, the goal of which is to identify and resolve issues before real problems arise and the organization is affected. Reactive fault detection and troubleshooting are necessary when proactive management cannot predict and mitigate the failures. In the PPDIOO process, the Optimize phase might lead to network redesign if too many network problems or errors arise, if performance does not meet expectations, or if new applications are identified to support organizational and technical requirements.

Chapter 5

Body of the Project

5.1   Work Description

Broad Band Telecom Services in a well know ICT service provider to corporate clients. The company provides a few number of services from which the main revenue generates from providing Internet services and constructing networks. Our project was a tender won by our company which involves the complete network setup for the Bangladesh Meteorological Department(BMD). The project required the digitization of all 57 of their offices with a strong network connectivity.

BMD is a government organisation responsible in working for collecting data of the climate information of this country. With the increasing concerns of global warming, it is important for every country to maintain high data accuracy of the climate which is why the World Bank provided a fund for BMD to improving their technological infrastructure. Our project responsibility was to construct a strong and reliable network for them.

The project requirements included the setup of internet connectivity as well as providing them solutions for office digitization in all of the 57 office nationwide. Our company's agenda in approaching this project included the clear understanding of the client's requirements through surveying every office which was done by our surveying team and then providing them the necessary accordingly. We had three teams working in this project, the system department, the network and support department and finally the construction and maintenance department.

The initial responsibility of the network and support department was surveying all the offices and understanding what the BMD officers needed for their work feasibility. Our surveys consisted of the equipment requirements specific to every office. The information collected by the surveying team are given to the construction team who are responsible

for the physical set up of the network and for maintenance our company has Point Of Presence (POP) offices in most of the areas where the BMD offices are located. These POP office have backup server setups in case of emergency and are also responsible for maintaining connectivity.

Finally, after the network had been physically constructed, the system department were responsible for the routing, switching and bandwidth distribution configuration of the whole BMD's network. This was done from our company's head office which in is Agrabad, Chittagong. The configuration included the IP allocations to every network and the routers in the BMD offices had to configure DHCP for the desktops in LAN connect to receive IP addresses and the configuration of the bandwidth distribution of a 100mbps to every office and the clock speeds of the servers.

5.2 System Analysis

5.2.1 Six Element Analysis

Process	System Roles					
	Human	Non-Computing Hardware	Computing Hardware	Software/System	Database	Network & Communication
Requirement Analysis	1. Business analysts Understands requirements of the client and negotiates the budget allocation for the project.	1. Pen & Paper Stationaries and paper were need by the analysts for taking notes about the requirements.	1. Tablet A softcopy of information is kept for the preparation of a quotation. 2. Printer A hardcopy of the quotation is printed.	1. MS Word This Microsoft office application is used to prepare the quotation of the project.	None	1. Internet A Wi-Fi connected printed uses internet to receive printing information from the tablet.
Surveying	1. Junior Network Engineers. Surveying the offices are performed by the engineers who gather information about the equipment required for the network construction. 2. Interns Us interns are also involved in assisting the surveying process.	1. Pen & Paper Stationaries and paper were need by the analysts for taking notes on the list of equipment needed.	1. Laptop A softcopy of information about the amount of equipment needed are made into an excel sheet. 2. Printer A hardcopy of the excel sheet is printed.	1. MS Excel This Microsoft office application is used to prepare the list of required equipment.	None	1. Internet A Wi-Fi connected printed uses internet to receive printing information from the Laptop.

Figure 5.1: Six Element Analysis

| Network Construction | 1. Electrician
The wiring management of the fibre cables and the LAN cables are done by the electricians.

2. Computer Engineers.
The desktop setup in the offices are managed my our computer engineers.

3. Interns
Assistance for the computer engineers. | 1. Fibre Cable
For the Internet connectivity fibre cables are used to connect the offices with the BTS points.

2. UTP Cable
The desktops in the offices are connected in a LAN setup using the UTP cables.

3. Channels
The UTP cables are covered using Channels. | 1. Desktops
4-8 PC's will be in a LAN connection for the BMD offices use.

2. UPS
In case of load shedding, the UPSs will power the desktops with a back time of about 1h. | 1. Windows
The operating system for all the desktops will be windows 10 which will be a more efficient OS compared to the one being used before. | None | None |
| Routing and Switching configuration | 1. Senior Network Engineers.
The main routing configuration of BMD's network will be managed by the engineers from the system department

2. Junior Network Engineers.

The switching configuration and VLan.

3. Interns

DHCP configuration and assistance. | None | 1. Router
For IP address allocation and bandwidth distribution Cisco routers were configured.

2. Switch
For the PCs to have VLan configuration manageable switches were used.

3. Laptop
The configurations of the routers and the switches were done via laptops. | None | None | 1. Internet
A broad band connection was used for the laptops while router and switch configuring. |

Figure 5.2: Six Element Analysis

5.2.2   Feasibility Analysis

Feasibility Study is the study that helps us to understand certain factors of the project and how those factors would help in the development of the project. For the project to be successful analyzing the factors of feasibility would make it easier to determine the problems that can be faced in the project. The feasibility factors [6] that we analyzed for the network construction for BMD are given below:

• **Operational Feasibility**: In Operational Feasibility sector, the project would be considered successful only if the requirements are fully met for the project and if the operation of the project is successful and is maintained after the complete construction of the network. The project has been successful as all the offices of BMD now are availing our network services with the satisfaction of our work and the fast internet connectivity we are providing has made work more efficient.

• **Technical Feasibility**: For the technical Feasibility, the resources available, both hardware and software with the other required technology are analyzed to understand the development of the project. This is done by keeping the technical feasibility in limelight. With this, the capability of handling these technical hardware are analyzed to see

if it would be efficient and successful in the process of the network construction. The Routers, switches, UTP and Fibre cable were the most important networking hardware of our project and the quality of these products will determine the strength and security of BMD's network. In this project, most of our hardware were of high quality especially the fibre used for the connectivity were 4-core optic fibres and the routers and switches were from Cisco. Other technologies like Telegram and Discord were used to mostly communicate and share the project update with the coworkers. So, it can be said that this project is Technically feasible.

• **Economic Feasibility**: In this analysis, the cost and benefit of the project is analyzed. This sector oversees the cost that was needed in the surveying process, Construction process and configuring. The analyzed data sees if the project is going to be successful in term of economic sector. As this being a big project, the budget negotiation with BMD was handle precisely keeping the companies profitability margins in mind which made the project economically feasible.

• **Scheduling Feasibility**: In this analysis, the timeline of the project was analyzed to make sure that the project would be completed on time. This would make the project successful if the given timeline is followed. The proposed timeline of the completion of the project was of 3 and a half months and our company successfully constructed their network well before the deadlines.

5.2.3 Problem Solution Analysis

The problems that were identified, analyzed and finally a solution was figured to solve those particular problems are mentioned in this section.
The problems that have been identified are given below:

• Poor Internet Connectivity- No fibre connectivity was available in any of the BMD offices. The source of internet connectivity was attained from wireless internet modems with a speed of only 256mbps. This was a below par network connectivity for such an important office work.

• Out dated Computers- The desktop setup was too outdated for the proper utilization of work. The operating system being used in these desktops was windows 7 which is already 12 year old version of windows. The CPU specifications were poor as well for faster data communication.

• Poor power backup- As Bangladesh face power cut and load shedding problems which may cause disruption in working hours. Previously the back-up power option

was really poor as the UPS used in the offices with a back-up time of only 4-5 minutes.

- Work frustration- Due to the lack of technological infrastructure standards it's been difficult for the officer to work efficiently and poor connectivity options added to the frustrations.

- Unreliable weather forecast data- Due to the lack of technological facilities there's a scarcity of employees in the BMD offices which has put an immense pressure on the existing employees and led to work negligence. Thus, the information of weather forecasts of Bangladesh are unreliable.

The solutions to the problems that have been identified are given below:

- Solution for poor Internet Connectivity- The fibre connection to all the offices with a internet bandwidth of a 100mbps will give the users a much smoother and faster working experience. The high quality 4-core fibres used in the network construction will also assist in providing a constant reliable speed.

- Solution for outdated Computers- New desktop setups have been provided in all the offices being in a LAN connection with the latest software system for a better experience for the BMD officers.

- Solution for poor power backup- All the desktops will have back-up power up to 1 hour from the 1 kva online UPSs we were providing.

- Solution for Work frustration- With the overall technological improvement there will be opportunities for employment and with that, the pressure on the existing officers will be redeemed and also the improved work experience.

- Solution for unreliable weather forecast data- With the number of employees increasing in BMD, the overall work efficiency will increase will less negligence in work. The weather data calculation and data entry accuracy will improve thus, the forecasts will be more accurate.

5.2.4   Effect and Constraints Analysis

Our network construction project for BMD will immensely improve the quality of the work these office are involved with. The technological solutions we provided will create employment opportunities to help gather information of such an important concern which is the climate.

BMD is a government organisation which has a database used by different media companies and as well as weather forecast applications to broadcast weather information. This database is also used by international organizations which are working and conducting studies on climate change. So, it is very crucial for our countries Meteorological department to have reliable data in their database [7]. After our company's ICT solutions are implemented, the technological standards of these government office will enhance. Using our company's fibre connection for their internet connectivity will be the major plus point of communication ease as well as efficiency of work.

5.3 System Design

5.3.1 Rich Picture

Rich Picture is a type of diagram that is done during the initial stages of a project. This helps us visualize what would happen in the system. This lets the team come up with an agreed plan on how to built the system. The rich picture of BMD's is given below:
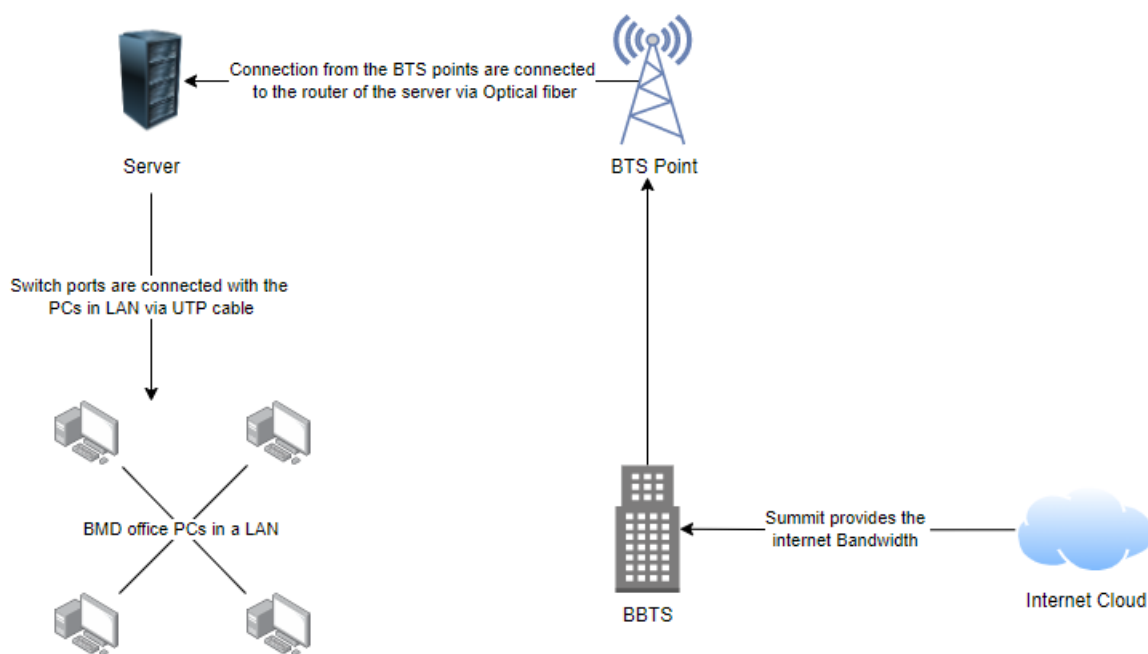

Figure 5.3: Figure of Rich Picture
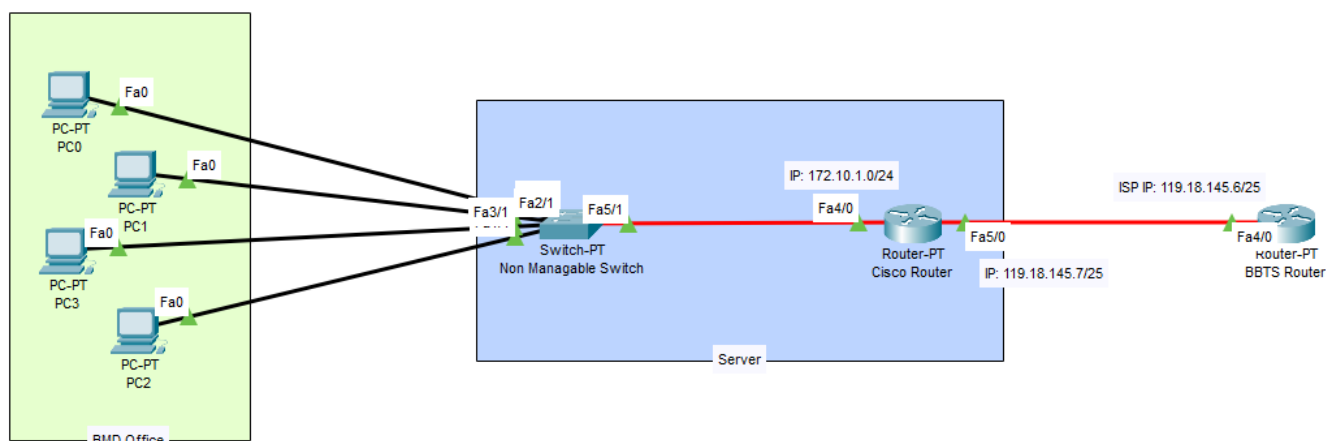
5.3.2 Network Topology

Figure 5.4: Network Topology 1

Most of the office of BMD consists of 4-6 desktops in a LAN connection and will be following the topology shown in figure 5.4. This topology consists of a non manageable switch so VLan is not being configured. The PCs will receive IP from the router through DHPC which will be configured in the routers along with NAT configuration to allow other devices to access the internet.
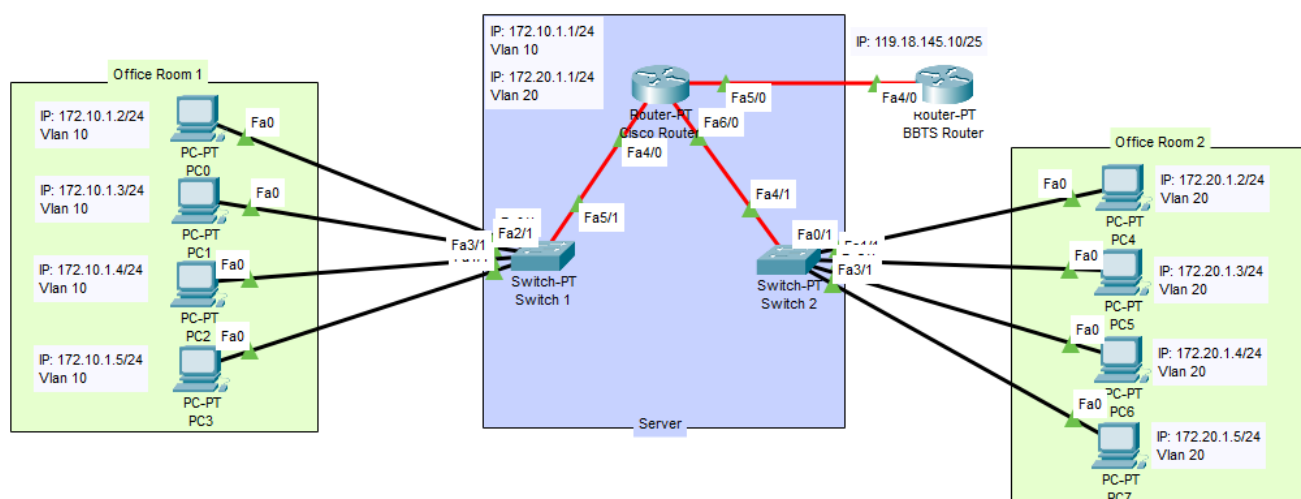

Figure 5.5: Network Topology 2

The divisional offices will have more employees in the BMD's office premises. About 8-10 desktops will have a LAN connectivity as more advanced work will be done here as a result, PCs will require access to each other and for security purpose the PCs will be given

static IPs. The switches will be configured for all the PCs to have their required Vlan and the routing configuration will enable Vlan connectivity along with NAT configuration to allow other devices to access the internet.

5.3.3 Functional and Non-Functional Requirements

Functional Requirement [8] means the functionality that the system must have to be viable. Functional Requirements are beneficial in the process of developing a system. It lets us know about the functionality that we should expect the system to have, errors can be caught at this stage which is cheaper to fix, helps us identify if any functionality is missing or not.

The functional requirements which our project tried to meet are:

- General Functional Requirements: The general functional requirements included the successful data communication through the fibre connectivity, the desktops have a LAN connectivity, switches will have VLAN configuration in required offices.

- Physical Layer Characteristics: Successful data transmission from end to end via the physical medium which is the fibre optic cables.

- Media Access Control Characteristics: Data transmission from the data link layer correctly recognises the MAC addresses of the end devices and successfully sends packets for decryption.

- Logical Link Control Characteristics: During data transmission the synchronization, flow control, and error-checking should be done perfectly so that no packets are dropped during transmission.

- Errors, Failures and Maintenance: For situations of disconnection or failure of data connectivity, troubleshooting will be performed at both user and provider end to reboot the network and POP offices will provide a secondary connection during this period.

A non-functional requirement [9] is a specification that describes the system's operation capabilities and constraints that enhance its functionality. The non-functional requirements that I will be discussing for our project are given below:

- Availability: Network availability is the amount of uptime in a network system over a specific time interval. Uptime refers to the amount of time a network is fully operational. Network availability during the office hours are crucial as office work at BMD has data entry responsibilities and this will be ensured from our headquarters at all times.

- Reliability: The bandwidth speed is reliable as our fibers are of high quality with a 4-core configuration for smooth data transmission and a reliable protocol is a communication protocol that notifies the sender whether or not the delivery of data to intended recipients was successful.

- Recoverability: Network recovery is the process of recovering and resorting normal working operations on a computer network. It enables network administrators to regain and restore operations on a network after going offline, being disconnected, crashing or other events have stopped normal network operations.

- Serviceability: The network maintenance of BMD's network will be maintained by our local POP offices at all times so that any loss of connectivity can be recovered at anytime of the day.

Chapter 6

Project Results

BMD's network construction project that was implemented by Broad Band Telecom Services has made a massive technological infrastructure improvement. In this section, I will be talking about the results and the impact of our project on such an important concern which is the reporting of weather changes and issuing forecasts and warnings according to the change.

This was a networking project with the added responsibilities of handling the technological equipment supplies in order for a complete technological improvement in these government offices. Broad Band Telecom Services according to the requirements carried out the project with the help of the whole networking team have successfully constructed a suitable network as well as a feasible working environment in all the BMD office nationwide. The previous scarcity of employees in this government sector will be fulfilled due to the development in the technological infrastructure. The work of reporting weather information and data entry will be more efficient with the use of BBTS's fibre connection for internet. Internal communication amongst the BMD officers will be much more easier and cost efficient.

In the coming future, there will be an immense improvement in the data collection and reporting of the weather of Bangladesh. As climate change is an international concern, Bangladesh can help with their improved database of the information about the climate of a country with a vast population.The end results of Research studies on the weather of our country will be more accurate and reliable. An important factor of having improved weather reporting is the natural disaster warning will be error-free and people can rely on the channels broadcasting the weather news.

Chapter 7

Project as Engineering Problem Analysis

7.1 Sustainability of the Project/Work

When it comes to the sustainability of the product/work, then various aspects come into the factor. Sustainability of the product refers to the ability of the product being maintained and updated. It is vital to understand the concepts sustainability and to come up with an appropriate sustainability plan so that project failure can be avoided.

The sustainability of the product can be categorized into 3 parts [10]:

a. Community Sustainability: Community sustainability refers to how much the community, i.e., the officers who will be using the network, will support the project to be sustainable. Having to work efficiently with the availability of our internet services and properly utilizing the technological infrastructural will sustain our service.

b. Financial Sustainability: The price at which our company is selling our service of internet bandwidth is not only covering all the cost required to maintain the service but is also creating a profit for the company. This will maintain the financial sustainability of the company will continue to generate profit for the future.

c. Organizational Sustainability: Our company constantly invests in improving our services with the help of the employees pushing towards improving their knowledge and skill about networking which will help in strategically facing unique challenges in this industry and can keep on competing with other companies.

7.2 Social and Environmental Effects and Analysis

Networking is crucial in our everyday lives. Most of the business, corporate offices, Banks, schools and now a days in every home, without Network connections everything is non functional. As network being the foundation of the use of technology, any project of our company has it's effects socially and environmentally. Our Networking project for BMD was an immense upgrade on their technological infrastructure and this will not just help the employees with their ease of work but also will effect the general people of our country as BMD is responsible for the weather reporting of Bangladesh.

a. Social Effect: The social effect of our project will be positive on the employees of BMD. Everyday work will be hassle free and more efficient. Our solution provide easy communication between offices from other regions as well which enhances the opportunity of information sharing with ease. More importantly the improvement of accuracy of weather forecasting will help people who are dependent on the it such as the Airlines and shipping industry. Knowing the accurate information about the weather is very crucial for flights and sailing as people's live depend on it.

b. Environmental Effect: The environmental effects of networking projects are rather negative. The amount of overhead fiber cables being used in this project reaches a length of about 250Km creating visual pollution. Bangladesh has no system of installing underground optic fibre cables which is why electric polls are used and disasters of electric polls catching fire is a common hazard causing air pollution.

7.3 Addressing Ethics and Ethical Issues

As a networking based company focusing on the virtue-ethics is important for the practice of networking. Starting from the equipment supply to the actual bandwidth distribution for networks is a part of our companies ethics. Ethics in business networking [11] is required from all levels in the networking process. It should be practiced in every form of networking, from utilitarian networking, emotional networking, and virtuous networking.

1. Utilitarian Networking: Ethical utilitarian networking is ensuring that your networking is not wasting the client's time, making it to be well thought-out, strategic, and useful. For example, Broad Band Telecom Services were not involved with false advertising about the service and the specifications in a networking meeting with BMD. The company managed to deliver the promised networking equipment and are providing them the actual required bandwidth for all the 57 offices

2. Emotional Networking: Ethical emotional networking helps people see why they need to be ethical in a situation, as opposed to doing something because they know it is a rule. When our clients don't fully understand the issues, they will not be able to make ethical decisions about them, so our responsibility is to explain the consequences so that the other party understands what will happen if an unethical decision is made.

3. Virtuous Networking: Virtuous networking consists of acting in good faith, sharing honest goals, and participating in legitimate activities. It also includes sharing information, knowledge, and resources with reciprocity, as well as exercising a positive ethical influence within the network.

Chapter 8

Lesson Learned

8.1 Problems Faced During This Period

In this section I will be discussing the challenges that I've faced during my 3 month long internship. It was my introductory towards a corporate ISP company and I was given the opportunity to learn and work simultaneously in a networking project which our company was constructing for the Bangladesh Meteorological Department.

Adjusting to Corporate Culture: The culture in any corporate office environment is not defined, in fact it takes to learn and adapt toward the cumulative behavior of the employees. Being exposed in such an environment made it difficult for me to adjust in to the learning and working phase of the company. The learning phase in my internship was not entirely about networking and data communication but also involved self-educating myself in dealing with the different types of people from different departments.

Requirement Analysis of Equipment: Installing technological equipment in every BMD office was a general requirement demanded during the project negotiations. Other than our networking devices, complete desktop setups were to be build and as for these type of projects which require bulk amount of equipment, it is better to be sure specifically about the requirements of individual offices. Complications occurred when the designated officers from different BMD offices had requirements which contradicted the demands meet at the project meetings which slowed down the network construction process of this project.

Routing Configuration: The prime engineering in a networking project is the system configuration to ensure data transmission is successfully occurring from end to end. BBTS works with Cisco routers for the routing of their networks and this was the responsibility of the system department. But for the BMD project, engineers from the system

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department weren't physically involved during the configuration of the routers as it was being managed by the engineers from the support department, at times with the correct configuration the PCs weren't receiving any Internet through the static IP addresses.

8.2   Solution Of Those Problems

I, with the help of my supervisor and engineers involved in the BMD's project overcame the problems that were faced during the internship period. My internship experience was a simultaneous transition of learning and working. My supervisor initially introduced and educated me with the basics of network engineering along with the type of commercial work being implemented in this sector of the business made sure that I was familiar with BBTS's field of work. This helped me overcome the obstacles and problems faced during the construction of BMD's network.

Adjusting to Corporate Culture: The seniors and co-workers and mostly my supervisor at BBTS were genuinely helpful which gave me the confidence to open up and contribute more to the processes of the project. The seniors at the company helped me understand the concepts of networking and how an ISP functions in managing networks which in return helped me understand more clearly and give more effort in the project. Their motivation encouraged me to ask questions and get out of my comfort zone and gradually adapt to the corporate culture in this firm.

Requirement Analysis of Equipment: Before working on the equipment installation and fitting LAN connections, our team conducted a survey for every office of BMD. The survey involved us, the interns along with a junior network engineer to understand the infrastructure of the BMD offices and the requirement of the way the officers wanted the setup of the desktops to be. I was involved in the surveying of four BMD office in the Chittagong district and the offices of the other districts were surveyed by the teams of that region. This helped in understanding quantity of equipment needed for this project.

Routing Configuration: The only way routing configuration problems were solved was by the advice given to me by my supervisor. Which was to acquire more knowledge about Cisco routers and network configuration by learning from the CCNA course and then relating the theories with the work in the system department. This actually helped in the learning process and usually the engineers do not allow interns to be involved in the configuration of routers and switches but my supervisor had the confidence in me and gave me minor responsibilities of configuring in order to gain experience.

Chapter 9

Future Work & Conclusion

9.1 Future Works

Computer Networks field has a vast field of commercial work and having the experience of working in a Network based company was an important learning factor about the functions of work. Working as an intern in Broad Band Telecom Services has given me aspiration towards building a career as a network engineer. In Bangladesh, there are different fields of work related to networking in Banking, in ISP companies similar to BBTS, telecommunication companies such as Grameenphone etc. The basics of networking can be truly be learned working in an ISP. Although there is no requirement of the use of higher level network architecture and analysis, the root work of how a network is established and how the service is being provided can be learned. In BBTS, I was not only learning and working in the network construction project for BMD but was also being prepared for the opportunity of employment not just for the company, but also for future work in different areas as a professional [12] such as:

Network Specialist: The daily activity of a network specialist consists of overseeing groups of PCs that work with each other, while guaranteeing that customers have the right networks based on their business needs. A network specialist is in charge of ensuring that the network works effectively. This may include collecting information on the network's performance, keeping up on network security and fixing issues as they emerge.

Network Analyst: A network analyst is responsible for the installation and maintenance of a network within an organization. Many network analysts discover that they turn out to be associated with both the business side and technical side of an organization. A network analyst is required to design, plan, analyze and provide technical help for data communication networks or group of networks in the organization.

Network Solutions Architect: The network solutions architect defines current and future standards for networking and telecommunication infrastructure. The ideal candidate has experience with firewalls, understanding of Linux/Unix configurations, knowledge of VLANs, VSANS, and Hypervisors, and familiarity with the internet routing and connectivity and configuration of wireless access points.

Network Security Specialist: A network security specialist provides support to the computer networks by detecting, preventing, and resolving threats to the computer networks. A person in this position also analyzes security risks and develops security measures to address the threats. Secondary duties may include installing computer security software, developing and testing software deployment tools, creating documentation for users and conducting security audits.

Cloud Networking Architect: A cloud networking architect works closely with customers by assisting them with the deployment of infrastructure that meets their technical and business needs. The candidate must have deep knowledge of cloud technologies, experience in migrating networks to the cloud, capability to solve network related issues, ability to troubleshoot and effective communication skills, both verbally and in writing.

9.2 Conclusion

My internship at Broad Band Telecom Services was an effective learning experience for me. Although it was a tough time during this pandemic I was committed towards attending office hours. This internship had given me the chance to get a glimpse of what the networking experience would be like in an ISP. I had also adapted to the culture of corporate life.

This internship had given me the chance to learn the roots of networking and how all seven layers in the OSI model were involved in the construction of any network. I've also learned a lot from my supervisor who have helped me navigate and understand what was required of me and understand how to make the work easier by giving me advice. A suggestion from my supervisor was to start online classes for the Cisco Certified Network Associate which immensely helped me understand the work of our BMD project thoroughly. In this field, practical knowledge about the networking devices are also very important as for establishing a connection a lot of networking components are needed.

During my internship period, I initially learned about the functionalities of the seven layers of the OSI model from a practical point of view and then gradually learning about how a network is constructed and what networking equipment are needed in order to

establish a network. Having to gain knowledge about the equipment was very important as the different functionalities of wires, routers and switches effected the quality of the connection. Routing and switching is a major networking engineering factor in an ISP and I've learning about Cisco routers and switches. I've learned routing configurations such as NAT, DHCP, OSPF,SSH, TELNET and IP address allocations and the switing configuration included the PCs in VLan.

Finally, I would like to thank my supervisor from university who guided me in creating my internship report and to my supervisor from Broad Band Telecom Services who introduced me to the practical work of network engineering by helping me in the project of BMD showed me the path to strive for best outcome. Their advice helped me navigate through the internship and helped me be a part of a government project being constructed by our company and from which would help a lot of people working in environmental department. Their guidance and motivation have given me the confidence to work in the field of networking as a network engineer and strive for triumph when it comes to future project work.

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