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An Undergraduate Internship Report
on
Enterprise Business Network Designing

By

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Student ID: **1730371**

Summer, 2022

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Independent University, Bangladesh

September 14, 2022

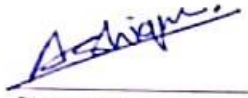
Dissertation submitted in partial fulfillment for the degree of Bachelor of Science in Computer Science

Department of Computer Science & Engineering

Independent University, Bangladesh

Attestation

This is to certify that Ashiqur Rahman Anik (1730371) fulfilled the requirements for the degree of Computer Science Engineering from Independent University, Bangladesh(IUB) by finishing the report "Enterprise Business Network Designing". The work was supervised by Ms. Sabrina Alam internally and Mr. Rajiul Hasan externally. I further certify that my work is authentic and has never before been submitted to this or any other organization. Every reference source used to endorse this report has been properly acknowledged.



Signature

14-09-22

Date

Ashiqur Rahman Anik

Name

Acknowledgement

I would like to take this chance to thank everyone for their support throughout the course. Throughout the internship, I am appreciative of their encouraging advice, constructive criticism, and helpful suggestions. I value their honesty and openness in sharing their opinions on various lesson topics. I am grateful for the support of Ms. Sabina Alam, my professor and the internship supervisor, as well as Independent University of Bangladesh (IUB) for giving me this opportunity. My external supervisor, Mr. Rajiul Hasan, deserves a lot of praise for giving me the help and encouragement I needed to finish my internship. Furthermore, I would like to express my sincere gratitude to my Omega Exim Limited coworkers for their time and consideration in helping me explore the internship. I'd also like to thank my mother, my late father, and my sisters for always being there for me and giving me the mental strength as well as assistance I need in challenging times.

Letter of Transmittal

Date: September 14, 2022

Sabrina Alam

Lecturer

School of Engineering, Technology & Sciences

Independent University Bangladesh.

Subject: Submission of Internship Report, Summer 2022.

Dear Mam,

It is with great pleasure that I offer my internship report for Omega Exim LTD. In my report, I've put an attempt to highlight my efforts, accomplishments, and internship experiences. Each product on display was generated with the utmost honesty and transparency.

I spent three months as an intern at Omega Exim LTD, where I gained practical experience and a better understanding of the various features and operational procedures of the Business. This study looks closely at both business activities and office environments. I have backup of all the project work I did during my internship periods as a record of my efforts.

I sincerely wish and hope that you will find the content engaging and that it will meet the expectations. I've tried my hardest to avoid any faults, and I hope my report will live up to your expectations.

I'd also want to thank you for giving me the opportunity to submit my report.

Sincerely,

Ashiqur Rahman Anik

ID: 1730371

Evaluation Committee

.....

Signature

Sabrina Alam.....

Name

SABRINA ALAM.....

Supervisor

Mohammad Motiur Rahman

Signature

Mohammad Motiur Rahman

Name

Asif.....

Internal Examiner

Md. Asif Bin Khaled.....

Signature

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Name

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External Examiner

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Convener

Dr. Mahady Hasan
Head, Department of CSE
School of Engineering & Computer Science
Independent University, Bangladesh (IUB)

Abstract

Omega Exim Limited (OEL) is a leading one-stop IT solution provider, leveraging leading technologies to drive real business results for clients.

Since its inception OEL plays a leading role building a bridge between the IT solution seekers and IT solution providers. We aim to serve our customers with highest satisfaction, integrity and best practices offering an enriched array of IT product, services and solutions. Enterprise Network is the term for the ICT framework that underpins every business. All users and systems on a local area network (LAN) are connected to data center and cloud applications through an enterprise network, which also gives access to network data and analytics. An enterprise network is made up of physical and virtual networks and protocols. The enterprise network infrastructure is a company's backbone and must support both current and future applications, databases, and business objectives. It also needs to be adaptable and accessible. The Enterprise Network is comparable to the internet, with the exception that it is restricted to the confines of a single particular organization.

We've also discussed some of the technological issues and worries that came up during the design and implementation process in this report. One of our key long-term objectives for the system is to enable the organization to implement its own hybrid cloud system in the future. As a result, staff members from all branches will have remote access to central resources.

Contents

Attestation 2

Acknowledgement 3

Letter of Transmittal 4

Evaluation Committee 5

Abstract 6

1 **Introduction** 11
- 1.1 Overview/Background of the Work 11
- 1.2 Objectives 11
- 1.3 Scopes 12

2 **Literature Review** 14
- 2.1 Relationship with Undergraduate Studies 14
- 2.2 Related works 15

3 Project Management & Financing 15
- 3.1 Work Breakdown Structure 15
- 3.2 Process/Activity wise Time Distribution 17
- 3.3 Gantt Chart 17
- 3.4 Process/Activity wise Resource Allocation 22
- 3.5 Estimated Costing 23

4 Methodology 25

5 Body of the Project 28
- 5.1 Work Description 28
- 5.2 Requirement Analysis 29
- 5.3 System Analysis 31
  - 5.3.1 Six Element Analysis 31
  - 5.3.2 Feasibility Analysis 32
  - 5.3.3 Problem Solution Analysis 33
  - 5.3.4 Effect and Constraints Analysis 34

5.4 System Design 36
5.5 Implementation 38
5.6 Testing 40

6 **Results & Analysis** 42

7 **Project as Engineering Problem Analysis** 42
7.1 Sustainability of the Project/Work 42
7.2 Social and Environmental Effects and Analysis..... 43
7.3 Addressing Ethics and Ethical Issues..... 44

8 **Lesson Learned** 45
8.1 Problems Faced During this Period 45
8.2 Solution of those Problems 45

9 **Future Work & Conclusion** 46
9.1 Future Works 46
9.2 Conclusion 46

Bibliography 47

Consent From..... 48

List of Figures

Figure 3.1: Work Breakdown Structure chart for High Level Network Designing

Figure 3.2: Gantt Chart for ABC Company Network Design Project

Figure 3.3: Gantt Chart for ABC Company Network Design Project

Figure 3.4: Gantt Chart for ABC Company Network Design Project

Figure 3.5: Gantt Chart for ABC Company Network Design Project

Figure 4.1: The Cisco PPDIOO Network Lifecycle

Figure 5.1: Core Network Deployment Diagram

Figure 5.2: Network Architecture Diagram

Figure 5.3: Branch-1 Router Configuration

Figure 5.4: Branch-2 Router Configuration

Figure 5.5: Branch-3 Router Configuration

Figure 5.6: Branch-4 Router Configuration

Figure 5.7: Branch-5 Router Configuration

List of Tables

Table 3.1: Time Distribution Chart

Table 3.2: Estimated cost for deployment of the ABC Company Network

Table 5.1: Six Element Analysis

Chapter 1

Introduction

1.1 Overview/Background of the Work

An appropriate Enterprise business network design is important for business owners. Due to technical flaws, networks are generally more vulnerable to viruses and spyware. It's just as critical to have high-quality routing systems and hardware as it is to have up-to-date software designed to mitigate these risks. Setting up a computer network in a corporate context is significantly different from setting up a network at home or in a domestic setting. Complexity and security challenges abound in business network design. The network can be developed, designed, deployed, managed, and configured to meet specific commercial and technical objectives.

In order to connect all users and systems on a local area network (LAN) to data centers and cloud applications and to provide access to network data, a business network is made up of physical and virtual networks and protocols.

Local Area Networks(LAN), Wide Area Networks(WAN), and Cloud Networks are all common types of networks use in businesses.

1.2 Objectives

Every business needs its own networking solution for the purposes of production, consumer, logistics, management, and other work tasks. The proper network design can be very beneficial to organizations.

which includes a few of the below

1. The primary objective of the computer network **is resource sharing.** The intention is to make all software, data, and hardware accessible to all network users.
2. The second objective is to provide the **high Reliability**.
3. Companies can connect to apps and data that are controlled and guarded by internal and perimeter firewalls that are installed on-site, **assuring the security of the data.**

1.3 Scopes

This project's main objective is to design an Enterprise business network backbone with modern internetworking devices. The scopes include, but not limited to, the following

a) **Internetworking Devices:** An internetworking device is a widely-used term for any hardware within networks that connect different network resources. Examples include dedicated servers, firewall, Access point(AP) switches, and routers. Such devices are produced by several different vendors.
b) **Local Area Network:** A local area network (LAN) is a collection of devices connected together in one physical location, such as a building, office, or home. A LAN can be small or large, ranging from a home network with one user to an enterprise network with thousands of users and devices in an office or school. A full enterprise business network is made up of several connected LANs (and/or WANs).
c) **Segments:** A single network divided or confined by a switch or other multiple network device is known as a segment.

d) **Microsoft Visio:** Microsoft Visio is one of the most famous diagram mapping tools on the market. Microsoft Visio apart from the crowd is its extensive templates. Users can design a new network much more easily by creating templates for network hardware and data center configurations. Microsoft Visio has the bandwidth to handle both a network and a corporation's worth of hardware.

e) **VMware:** VMware allows businesses to run multiple application and operating system workloads on the one server. thus enabling better resource management. By creating a virtual machine that behaves exactly like an actual computer – VMware also allows everything running on that virtual machine to run in its own window.

f) **Enterprise campus network and remote sites:** Rollout of IP telephony across the enterprise, which may require a redesign of virtual LANs (VLANs), quality of service (QoS), and so on across the LAN, WAN, data center (DC), and remote-access edge.

g) **Optimize enterprise edge availability:** Add redundant link for remote access, which might require redesign of the WAN module and remote site designs and configurations such as overlay tunnels.

Chapter 2

Literature Review

2.1 Relationship with Undergraduate Studies

CSE-403: Network Management. This course involves applying concepts for network management. This course introduces various attempts to standardize the way in which network and network equipment are managed. The course also covers network concepts in planning and designing a functioning network.

CSE-406: Cryptography and Network Security. This course involves Basics of Security and Cryptography, Trust and Security, Various Security Issues, Classical Encryption Techniques, Block Ciphers and Data Encryption Standard, Advanced Encryption Standard, Contemporary Symmetric Ciphers, Modes of Operation, Symmetric Encryption, Public Key Cryptography (PKC), Key Management and other PKCs, Hash and MAC Overview, Firewall.

CSE 316: Data Communication & Networking. In This Course the concepts taught is Basic concepts, categories of networks, network topologies, OSI model and TCP/IP protocol suite, TCP/IP applications, FTP, SMTP, HTTP and WWW, transport layer protocols, Internetworking devices, repeaters, bridges and routers, routing algorithms, IP addressing, sub netting, domain name systems, Network programming: Client-Server programming, socket programming, data link control protocols, LAN types and technology, MAC protocols, high speed LANs and Gigabit Ethernet, Wireless LANs, MAN, Circuit switching and Packet switching, ISDN, Frame Relay and ATM, SONET/SDH. Spectrum and bandwidth, Digital Transmission, encoding, modulations and demodulations, multiplexing: FDM, TDM and WDM,

interfaces and modems, transmission media, fiber optic and wireless media, error detection techniques.

2.2 Related Works

Establishing an effective, efficient, reliable, and robust network backbone is one of the most crucial requirements for any Business. The entire Business will come to a grinding halt without it. They operate in the background, are managed by another party, and when they malfunction, they hamper user productivity. Network theorists appear to have assumed that network engineers implement the proper techniques to ensure networks are dependable, serve all business requirements in computing, and advance business goals due to how closely connected network infrastructure and enterprise needs appear to be. They may be developed and modified with little interaction from users, programmers, or business strategists. Business networks are very difficult to develop, design, and maintain. Fewer people are interested in and inclined to keep studying and designing larger business solutions because of their size and difficulty.

Chapter 3

Project Management Plan and Financing

3.1 Work Breakdown Structure

A project's hierarchy of project tasks is listed in a work breakdown structure (WBS). The WBS divides a project's structure into workable objectives. To meet the goals of the project, each goal is assigned a task, or set of tasks, that can be further broken down into subtasks. It is useful to use a work breakdown structure (WBS)

as part of project lifecycle management because it divides large, complex projects into smaller, easier-to-manage tasks that can be assigned to individuals or teams. A brief overview of the WBS that will be used for this project is shown in the following figure.

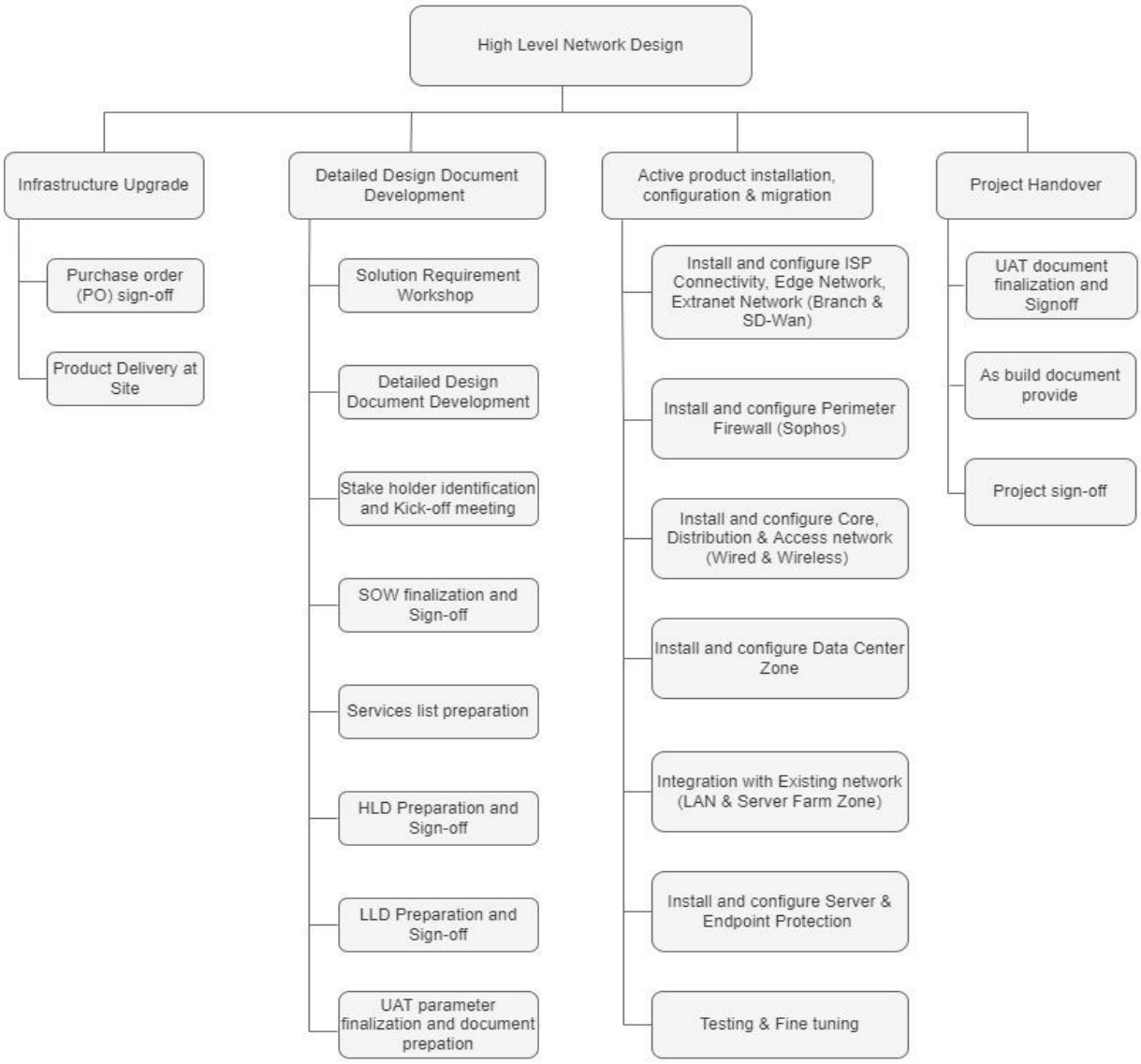


Figure 3.1: Work Breakdown Structure (WBS) chart for High Level Network Designing

3.2 Process-Wise Time Distribution

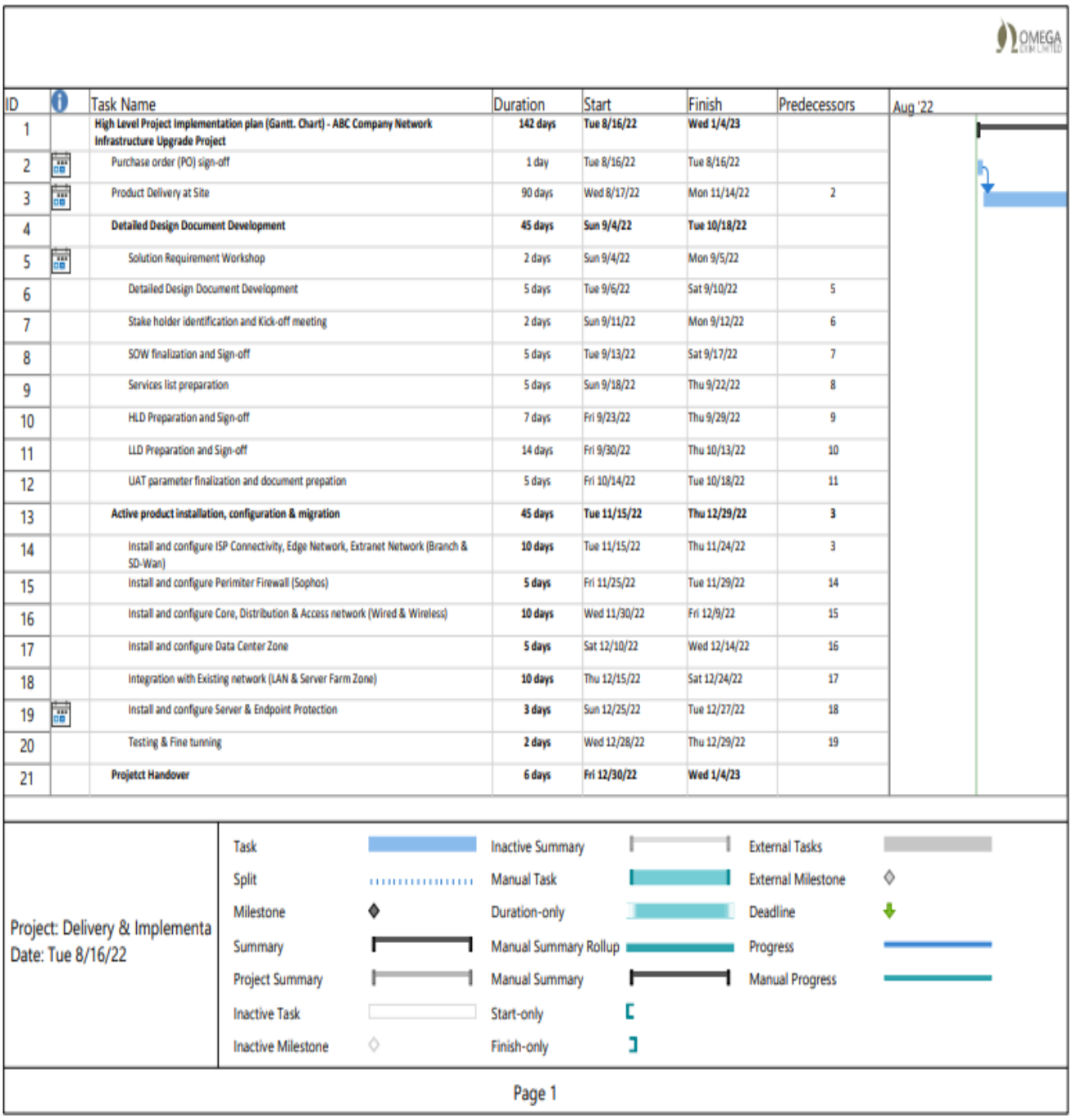
The time required for completing each task shown in the WBS chart above is approximately represented by the following table.

Task Name	Duration	Start	Finish
Purchase order (PO) sign-off	1 day	Tue 8/16/22	Tue 8/16/22
Product Delivery at Site	90 days	Wed 8/17/22	Mon 11/14/22
Detailed Design Document Development	45 days	Sun 9/4/22	Tue 10/18/22
Active product installation, configuration & migration	45 days	Tue 11/15/22	Thu 12/29/22
Project Handover	6 days	Fri 12/30/22	Wed 1/4/23

Table 3.1: Time Distribution Chart

3.3 Gantt Chart

Project team frequently makes use of Gantt charts. It is one of the most well-liked and useful ways to depict activities, tasks, or events against by the time allotted for those activities, tasks, or events. A list of the activities may be found on the left side of the chart, and an appropriate time scale can be found on the left.



ID	Task Name	Duration	Start	Finish	Predecessors
1	**High Level Project Implementation plan (Gantt. Chart) - ABC Company Network Infrastructure Upgrade Project**	**142 days**	**Tue 8/16/22**	**Wed 1/4/23**	
2	Purchase order (PO) sign-off	1 day	Tue 8/16/22	Tue 8/16/22	
3	Product Delivery at Site	90 days	Wed 8/17/22	Mon 11/14/22	2
4	**Detailed Design Document Development**	**45 days**	**Sun 9/4/22**	**Tue 10/18/22**	
5	Solution Requirement Workshop	2 days	Sun 9/4/22	Mon 9/5/22	
6	Detailed Design Document Development	5 days	Tue 9/6/22	Sat 9/10/22	5
7	Stake holder identification and Kick-off meeting	2 days	Sun 9/11/22	Mon 9/12/22	6
8	SOW finalization and Sign-off	5 days	Tue 9/13/22	Sat 9/17/22	7
9	Services list preparation	5 days	Sun 9/18/22	Thu 9/22/22	8
10	HLD Preparation and Sign-off	7 days	Fri 9/23/22	Thu 9/29/22	9
11	LLD Preparation and Sign-off	14 days	Fri 9/30/22	Thu 10/13/22	10
12	UAT parameter finalization and document prepation	5 days	Fri 10/14/22	Tue 10/18/22	11
13	**Active product installation, configuration & migration**	**45 days**	**Tue 11/15/22**	**Thu 12/29/22**	**3**
14	Install and configure ISP Connectivity, Edge Network, Extranet Network (Branch & SD-Wan)	**10 days**	Tue 11/15/22	Thu 11/24/22	3
15	Install and configure Perimiter Firewall (Sophos)	**5 days**	Fri 11/25/22	Tue 11/29/22	14
16	Install and configure Core, Distribution & Access network (Wired & Wireless)	**10 days**	Wed 11/30/22	Fri 12/9/22	15
17	Install and configure Data Center Zone	**5 days**	Sat 12/10/22	Wed 12/14/22	16
18	Integration with Existing network (LAN & Server Farm Zone)	**10 days**	Thu 12/15/22	Sat 12/24/22	17
19	Install and configure Server & Endpoint Protection	**3 days**	Sun 12/25/22	Tue 12/27/22	18
20	Testing & Fine tunning	**2 days**	Wed 12/28/22	Thu 12/29/22	19
21	**Projetct Handover**	**6 days**	**Fri 12/30/22**	**Wed 1/4/23**	

Figure 3.2: Gantt Chart for ABC Company Network Design Project

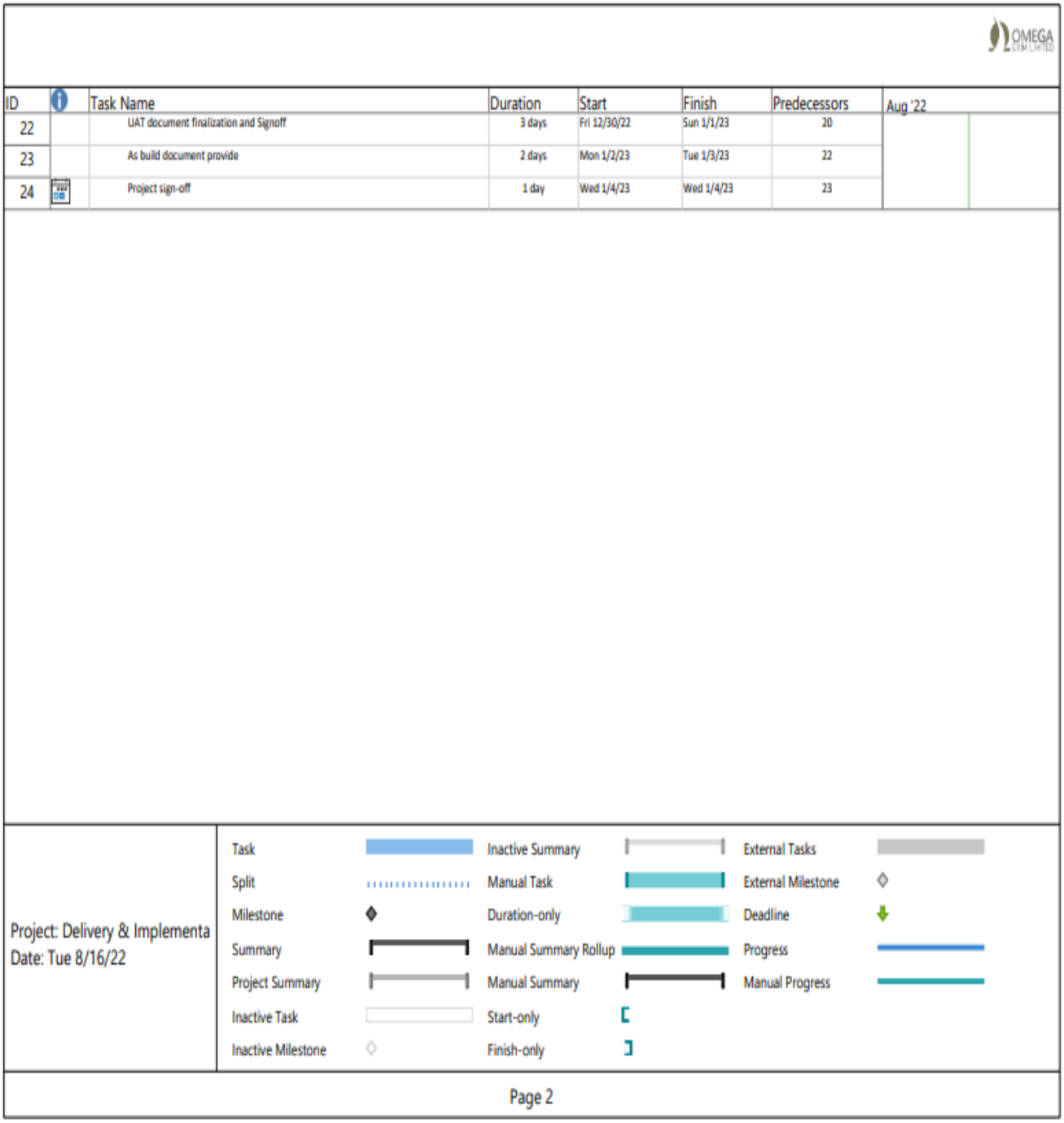


Figure 3.3: Gantt Chart for ABC Company Network Design Project

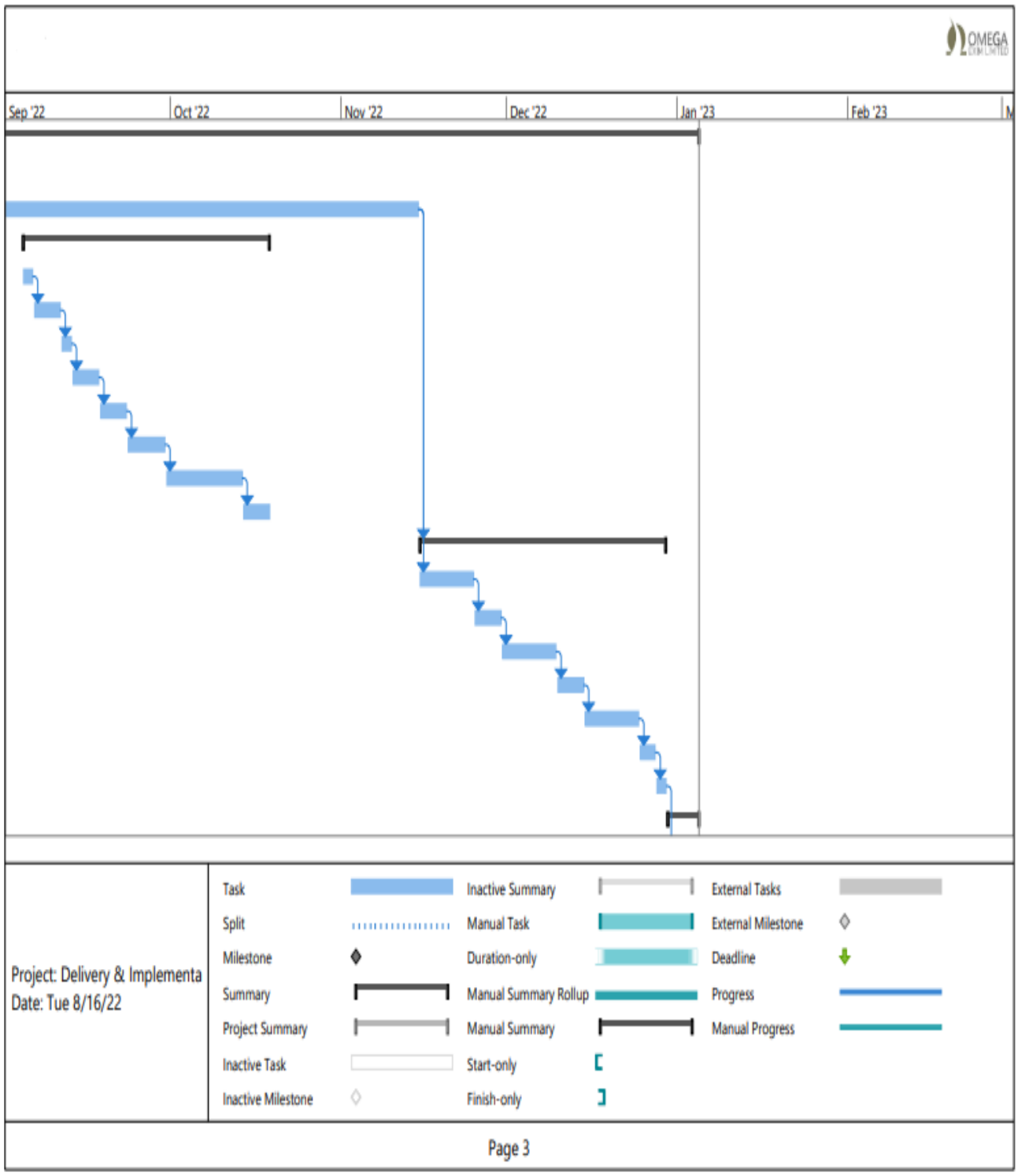


Figure 3.4: Gantt Chart for ABC Company Network Design Project

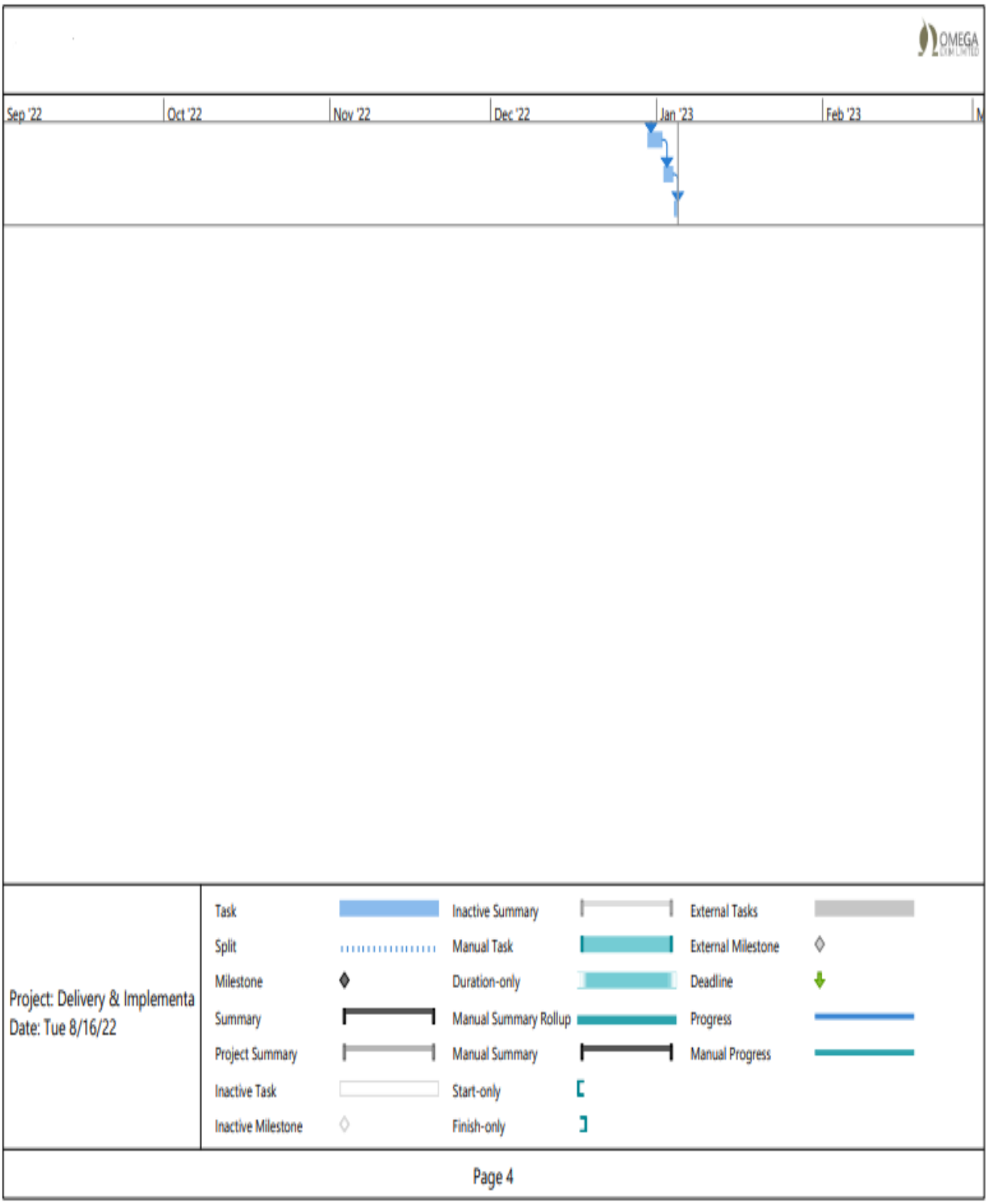


Figure 3.5: Gantt Chart for ABC Company Network Design Project

3.4 Process-Wise Resource Allocation

For any business, having a reliable network infrastructure is essential. As a result, one of the top-level management's main tasks is to make sure that their business organization has the best communication channels that best suit the requirements of the company. The departments working under the organization are this project's primary concern, and segments to that are the employees working under each department.

Purchase order (PO) sign-off: The project started at this stage. At this stage customer finalized project purchase order by signing the PO.

Detailed Design Document Development: The main priority is to schedule solution requirement workshop with the organization's top managers and members of their IT team to learn more about the initiatives they intend to implement for their company. Gathering information on needs and organizational requirements will also help with conducting informal interviews with the employees. It will be essential to assign priorities to each requirement based on the requirements that have been gathered from the various significant sources. This will greatly aid in creating abstract designs when visiting the actual site. By this time, we need to prepared SOW (Scope of Work), HLD (High Level Design) for the project and post-sales team will prepare a LLD (Low Level Design). The installation of required networking tools is the next step, which will take up a significant amount of time.

Active product installation, configuration & migration: Physical devices are assembled after the final design has been approved, and they are then arranged in accordance with the design. The physical consoles for each of these

internetworking devices must then be used to physically configure each one; however, the configuration process will resemble virtual design. To ensure the network's effectiveness and working mechanism, it will then be given a longer period of time to operate in a supervised environment. Firstly, post team Install and configure ISP Connectivity, Edge Network, Extranet Network (Branch & SD-Wan). After That Install and configure Perimeter Firewall (Sophos) and Install and configure Core, Distribution & Access network (Wired & Wireless) and configure Data Center Zone. Integration with Existing network (LAN & Server Farm Zone) also take a long period of time. Lastly Install and configure Server & Endpoint Protection team will Test all the installation and configuration before handover the project. The network will finally go live and be thoroughly tested in a live environment.

Project Handover: UAT document finalization and Signoff- Finally, the project is launched live and made operational.

3.5 Estimated Costing

It has been calculated how much it will cost to deploy and maintain this project.

Component (Cisco)	Model	Quantity	Price(BDT)
WAN Switch	C9300L-24T-4G-E	2	1,303,463
Meraki SD-WAN UTM for Regional Branch	MX100-HW	2	453,943
Meraki MX100 Advanced Security License	LIC-MX100-SEC-5YR	1	1,142,849
Core Router- ABC Co. Head Office	ASR1001-X	2	10,827,804
Core Switch- ABC Co. Head Office	N9K-C93180YC-EX	2	6,811,117
Server Farm Firewall- ABC Co. Head Office	FPR2130-FTD-HA-BUN	2	8,954,324
Server Farm Switch- ABC Co. Head Office	N9K-C93180YC-EX	2	6,957,488

Access Switch Type 1 (Non PoE)- ABC Co. Head Office	C9200L-24T-4X-E	5	1,944,061
Access Switch Type 1 (PoE)- ABC Co. Head Office	C9200L-24P-4X-E	5	2,264,359
10G SFP Module for Access Switch	SFP-10G-SR=	12	590,531
Meraki Access Point	MR46-HW	50	4,022,229
Meraki Power Injector	MA-INJ-5-UK	25	586,183
Meraki MR Enterprise License	LIC-ENT-5YR	50	996,364
Branch Firewall for Mirsharai and Spare	MX250-HW	2	908,328
Power Cord for Meraki MX Firewall	MA-PWR-CORD-UK	4	61,149
Meraki MX250 Advanced Security License	LIC-MX250-SEC-5YR	1	1,853,499
Branch Firewall - ABC Co.	MX84-HW	4	515,173
Power Cord for Meraki MX Firewall	MA-PWR-CORD-UK	4	14,922
Meraki MX84 Advanced Security License	LIC-MX84-SEC-5YR	3	797,091
Nasirabad Regional Branch Router + Baro Aulia Branch Router	ISR4331-SEC/K9	8	3,309,007
Regional Branch Router	MX68CW-HW-WW	14	1,315,073
Enterprise License and Support for Regional Branch Router	LIC-MX68CW-SEC-5YR	12	1,673,893
Power Cord for Meraki MX Firewall	MA-PWR-CORD-UK	16	30,797

Component (Sophos)	**Model**	**Quantity**	**Price(BDT)**
Next Generation Firewall	XG4ETCHEUK	2	2,938,344
Next Generation Firewall	XF4E3CSES	1	5,223,337
Next Generation Firewall	ITFZTCHXF	8	682,210

Support for 2nd HW need to include if purchased 2 HW and 1 License	X-EPUPG4500	1	1,226,979
Endpoint Protection	CIXE-CU	1200	4,317,580
Endpoint Protection	SVRCIXE	5	104,776
Total without VAT			71,826,879

Table 3.2: Estimated cost for deployment of the ABC Company Network

Chapter 4

4.1 Methodology

4.1.1 Network Design Methodology

The CISCO-PPDIOO (Prepare, Plan, Design, Implement, Operate, Optimize) methodology was used as the framework for the design process for the network used in this project. To structure the project of designing and maintaining a network, Cisco divided PPDIOO into phases. To structure the project of designing and maintaining a network, Cisco divided PPDIOO into phases. Following are descriptions of the PPDIOO steps and how they relate to the network design methodology.

Step-1 Prepare: In this stage, business needs are initially assessed, and a conceptual architecture is defined. The Prepare phase includes creating business requirements, creating a preliminary network design plan, recommending a few suitable concept architectures, and identifying technologies that work best with the architecture. The network method's budgetary justification is provided by the business case for the proposed design.

Step -2 Plan: At this point, we translate business needs into technical requirements. We translate the customer requirements from the prepare phase into technical requirements in the PPDIOO plan phase. The creation of a document that designers can understand is our aim here. This document must clearly explain how the network should operate. The technical specifications must be understood by the designers, who should not be required to interpret them. The Plan phase also involves performing a gap analysis to determine whether the current system architecture, sites, and operating environment can support the new system, as well as looking at the geographic areas where the network will be established and any pre-deployed networks on those areas. The project plan should comply to the criteria for scope, cost, and resources set forth in the initial business requirements.

Step-3 Design: The network design team creates precise network specifications in this scenario. The main aspects specified in the Plan phase serve as a guide for the network design experts' actions. These specialists construct the network based on those initial criteria, taking into account any additional data discovered through network analysis and consulting with management and users. The resulting network design specification is a precise, thorough design that satisfies present technological and business requirements and includes requirements for performance, availability, reliability, security, and scalability. As briefly mentioned below, every other phase influences design choices, and the Design phase is closely related to all of them.

- Based on the needs identified during the Prepare and Plan phases, the network design is created.

- The Install phase also includes the initial testing of the design on the actual network.

- Depending on network analysis and any emerging problems, the Operate and Optimize phases will ultimately decide whether or not the design is suitable. It might be necessary to reconfigure the network if any problems are found.

Step-4 Implement: The design is put into action by network engineers by installing and configuring devices after the customer approves it. In order to add new devices without disrupting the current network or adding security flaws, the network and any additional components are set up in line with the design criteria.

Step-5 Operate: A network will need to perform some operations, depending on the size of the network and the needs of the customers. The effectiveness of a design is ultimately determined by how it performs. Maintaining increasing service in day-to-day operations, such as ensuring high availability and cutting costs, is a priority during the Operate phase.

Step-6 Optimize: Error detection, correction, and performance monitoring provide essential operational data for the network lifecycles optimize phase. The goal of the Optimize phase is to find and fix errors before they turn into major issues by concentrating on dynamic network management. The need for susceptible fault detection and troubleshooting arises when entrepreneurial management fails to anticipate and minimize failures.

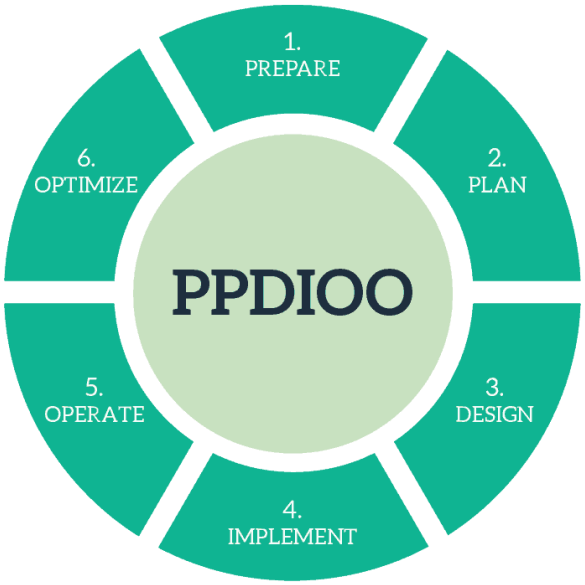


Figure 4.1: The Cisco PPDIOO Network Lifecycle

Chapter 5

Body of the Project

5.1 Work Description

All users and structures on a local area network (LAN) are connected by both physical and virtual networks and protocols through a network system, which also gives access to network data and analytics. The company network infrastructure is a company's core and must support both current and future applications, databases, and business objectives. It also needs to be adaptable and accessible. The Network Infrastructure is similar to the Internet, but it is restricted to the confines of a single particular organization. The Visual Studio software will be used to design the network, with a focus on making the backbone system simple to use and providing uninterrupted network connectivity for the organization's staff.

Employees from various departments and branch may access the central storage server with their permission and in accordance with their usage policies. The access points and endpoints are completely under the control of the IT management team. The IT team will be able to add as many features as they desire in the future when it comes to the design's basic customizability. It will be carefully considered during the implementation and testing phases to minimize energy consumption while maximizing use cases on the servers. Daily maintenance and monitoring of the core network will allow for quick troubleshooting of any issues that may arise. The network administrator and network managers will regularly ensure proper maintenance to keep the network operating smoothly for the convenience of its users.

I was tasked as an intern with designing the core network as well as regional branch networks.

5.2 Requirement Analysis

Rich Picture

A rich picture is a representation created after carefully considering, identifying, and characterizing a circumstance. By utilizing images, text boxes, symbols, and icons, a rich image can help to spark discussion and reach a broad, shared understanding of a subject. In contrast to software engineering, there is no standard model for creating a rich picture in the networking industry. Instead, it is comparable to a diagram of a network architecture.

Functional Requirements: Functional requirements compose the foundation of any system design because they define system and technology functions. Specifically, functional requirements identify what these technologies or systems will deliver to the business from a technological point of view.

- Ability to establish separation between internal staff and visitor traffic (both wired and wireless), in accordance with the organization's standard security policy.
- support for adding new remote sites to the network without requiring any redesign
- The central server must be located outside the access layer.
- All associations and departments must be able to access the storage server simultaneously, and it must be available to them.
- The IT department must be given authentication privileges and be given only limited administrative access to the servers and network components.

Non-Functional Requirements:

- After the project is completed, the post team need minimum 6 days' to handover the project and signing off.
- All employees must be able to complete their tasks effectively, uninterruptedly, and with the fewest possible connectivity-related obstacles.

- This network structure needs to be expandable for future growth, just like any other backbone network.
- The program needs to be stable and dependable.

5.3 System Analysis

5.3.1 Six Element Analysis

Process	**Tasks**					
	Human	**Hardware (Non-computing)**	**Hardware (computing)**	**Software**	**Remarks**	**Networking Segment**
Project Plan (With Stack Holders)	Yes	Pen, Papers	Laptop	Microsoft Project	Kickoff with all stack holder of the project	Yes
Infrastructure Readiness	Yes	N/A	N/A	N/A	Data center - Cooling, Redundant Power, Space for device mounting, Fire System	Yes
Device Power on Self-test	Yes	N/A	Laptop/ Desktop	Putty	Checking system power and boot up	Yes
Basic Configuration	Yes	N/A	Laptop/ Desktop	Putty	devices basic configuration MGT, Interface Ip etc.	Yes
Detail Configuration	Yes	N/A	Laptop/ Desktop	Putty	Accordingly, to the design	Yes

HQ Network Testing	Yes	N/A	Laptop/ Desktop	Putty	Checking reachability along the HQ Network including User PC, Internet, Phone, Fax , Printer	Intranet & Internet
Branch Network Testing	Yes	N/A	Laptop/ Desktop	Putty	Checking reachability along the HQ Network including User PC, Internet, Phone, Fax , Printer	Intranet & Internet
HQ TO Brach Network Reachability Checking with Security	Yes	N/A	Laptop/ Desktop	Putty	Checking reachability with HQ & branch over VPN	Intranet
Completion	Yes	N/A	Laptop/ Desktop	Putty	Project Completion	Intranet

Table 5.1: Six Element Analysis

5.3.2 Feasibility Analysis

A significant aspect from the preliminary analysis was that the suggested method is effective. An organized review was conducted to determine the best approach for achieving the performance standards. A feasibility analysis is both necessary and wise if you want to evaluate the project's viability as rapidly as possible. It involves conducting an initial analysis of the project and determining whether the

proposed architecture will be advantageous to the company. If a design flaw is discovered early on in the testing process, it is possible to save yourself days or months of work, significant money, and professional embarrassment. Three categories—technical, operational, and economic—are used to categorize faithfulness.

1.Technical Feasibility: Technical viability is implied for both the required hardware and software. Before assessing technical feasibility, we should first determine whether the required devices and tools can store the company's important data in a sufficient amount of time. This technical feasibility study determines whether the project's infrastructure and technological capabilities are sufficient. A feasibility study also considers the technical knowledge of the technical team, the applicability of existing technology, the ease of management and adaptation of the selected technology, and other factors. Specific project feasibility was taken into consideration.

2.Operational Feasibility: The new structure and network design are assumed to be sufficient for the business' needs and meet operational requirements.

3.Economic Feasibility: Building a company network backbone for any business or organization requires a significant initial investment. However, it must be remembered that no unnecessary costs are included. The suggested architecture offers a fantastic balance between performance and cost.

5.3.3 Problem Solution Analysis

Numerous problems cropped up throughout the project's development, but they were all quickly resolved. A list of some of the issues is provided below.

- A significant problem during project implementation was the lack of available networking devices in the market. We had to push back our timeline even further because of this problem.
- These commercial products are not only expensive but also tend to be difficult to install,

  configure, administer, and maintain. Also the solution is expensive.
- The project's handling of the constantly changing needs of the business was one of the most challenging parts. The management was having trouble with the project plan because they were considering different implementing features.
- It was difficult to find everyone avail all time. There was also other project they were working. As a result, it was challenging to get in touch with any engineers, especially as an intern.

5.2.4 Effect and Constraint Analysis

The extent of adaptability an organization possesses when creating a solution is a limit imposed. Financial constraints, operational issues, deadlines, and any other restrictions that hamper productivity are all cases of limitations. A high-level policy or limited investment resources that place restrictions on the project team's ability to develop a platform throughout the production cycle. Here is a list of some restrictions and their results.

Time: Time restrictions also limit an organization's ability to provide a product. Time and money are linked together. Budgetary constraints had an impact on the

planning process, so each step had to be completed as soon as possible to meet the deadline.

Budget: One of a company's most important major limitations is its budget. Due to Dollar Rate Constantly changing on the local market, Because of that some product's pricing was constantly increasing and that was a major challenge in project budget segment.

Location: One of the challenging types of constraints is location because it can introduce restrictions that have an indirect impact on the design. For instance, a remote site might be sited in a location with no fiber infrastructure and only wireless connectivity available. From a high-level architectural point of view, this might not be a serious issue.

Infrastructure equipment: A good example here is that of legacy network devices. If a business has no plan to replace these devices, this can introduce limitations to the design, especially if new features or protocols not supported by these legacy platforms are required to optimize the design.

Staff expertise: Sometimes network designers might propose the best design with the latest technologies in the market, which can help reduce the business's total cost of ownership. This can be an issue, however, if the staff of this company has no expertise in these technologies used to operate and maintain the network.

■ **Train the staff on these new technologies:** This will be associated with a risk, because as a result of the staff's lack of experience, they may take a longer time to fix any issue that might occur, and at the same time, data center downtime can cost the business a large amount of money.

5.4 System Design

5.4.1 UML Diagrams

UML standard has no separate kind of diagrams to describe network architecture and provides no specific elements related to the networking. Deployment diagrams could be used for this purpose usually with some extra networking stereotypes. Network architecture diagram will usually show networking nodes and communication paths between them.

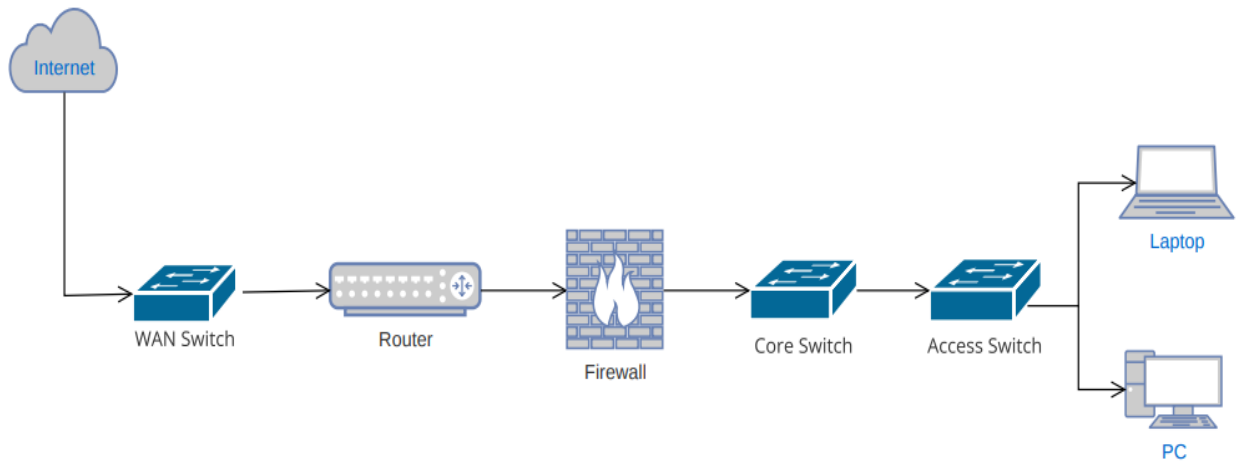


Figure 5.1: Core Network Deployment Diagram

5.4.2 Architecture

A network diagram is a visual representation of a network's architecture. Various symbols and line connections are used to represent the network's topology. It's the most effective method for explaining how a network is organized because the visual illustration makes connections clear to the audience.

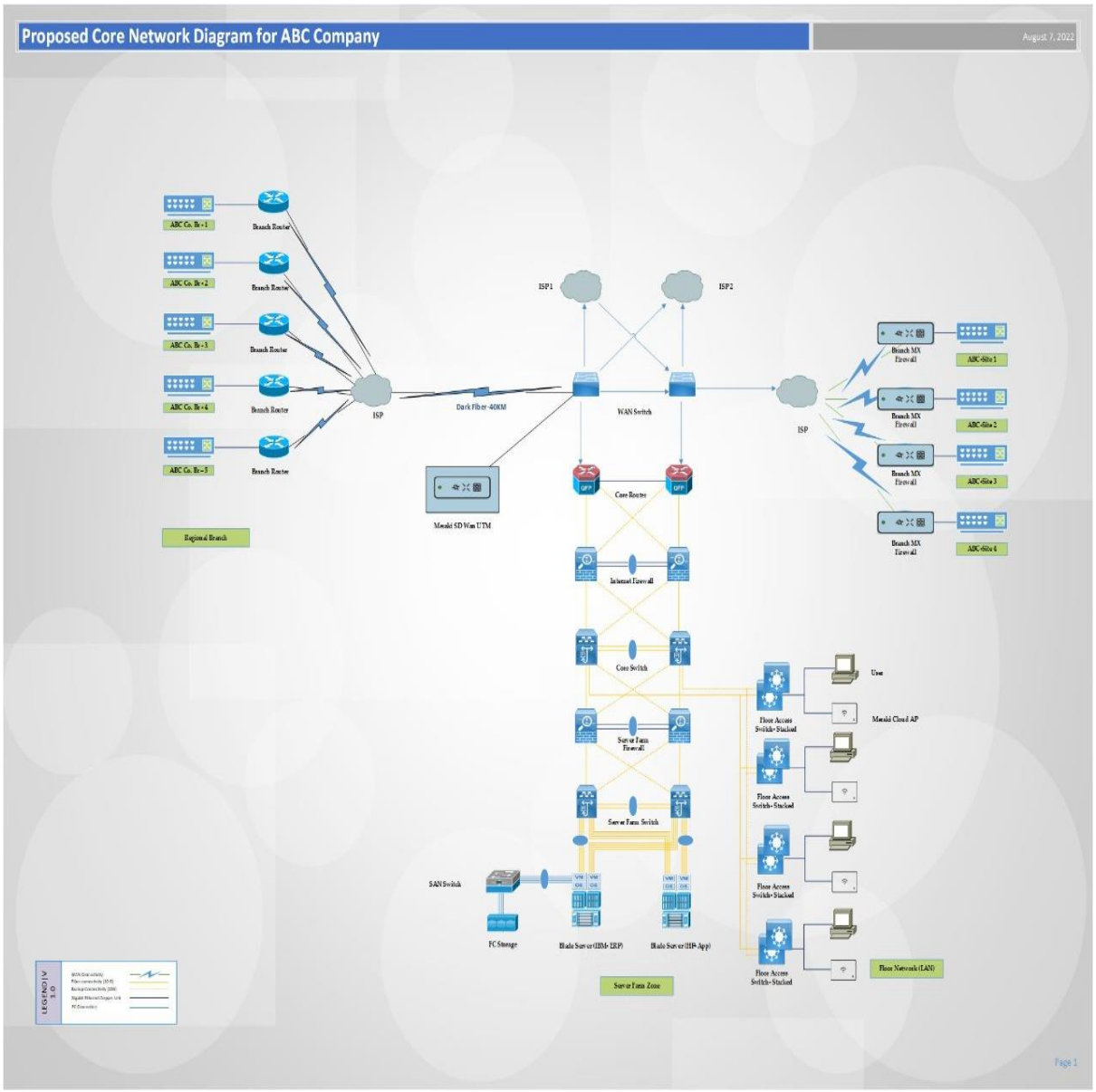


Figure 5.2: Network Architecture Diagram

5.5 Implementation

5.5.1 Branch Router Configuration

Branch-01 Router Configuration:

```
Router>en
Router#conf
Router#configure t
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#hostname Br-01
Br-01(config)#int
Br-01(config)#interface g
Br-01(config)#interface gigabitEthernet 0/0
Br-01(config-if)#ip address 180.4.11.33 255.255.255.252
Br-01(config-if)#no shutdown

Br-01(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up
```

Figure 5.3: Branch-1 Router Configuration

Branch-02 Router Configuration:

```
Router>en
Router#conf
Router#configure t
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#hostname Br-02
Br-02(config)#
Br-02(config)#int
Br-02(config)#interface ga
Br-02(config)#interface g
Br-02(config)#interface gigabitEthernet 0/0
Br-02(config-if)#ip address 180.4.169.37 255.255.255.252
Br-02(config-if)#no shutdown

Br-02(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up
```

Figure 5.4: Branch-2 Router Configuration

Branch-03 Router Configuration:

```
Router>en
Router>enable
Router#conf
Router#configure t
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#hostname Br-03
Br-03(config)#
Br-03(config)#int
Br-03(config)#interface g
Br-03(config)#interface gigabitEthernet 0/1
Br-03(config-if)#ip address 104.11.180.41 255.255.255.252
Br-03(config-if)#no shutdown

Br-03(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
```

Figure 5.5: Branch-3 Router Configuration

Branch-04 Router Configuration:

```
Router>en
Router#conf
Router#configure t
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#hostname Br-04
Br-04(config)#int
Br-04(config)#interface g
Br-04(config)#interface gigabitEthernet 0/0
Br-04(config-if)#ip address 11.104.220.45 255.255.255.252
Br-04(config-if)#no shutdown

Br-04(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
```

Figure 5.6: Branch-4 Router Configuration

Branch-05 Router Configuration:

```
Router>en
Router#conf
Router#configure t
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#hostname Br-05
Br-05(config)#int
Br-05(config)#interface g
Br-05(config)#interface gigabitEthernet 0/1
Br-05(config-if)#ip address 114.16.226.49 255.255.255.252
Br-05(config-if)#no shutdown

Br-05(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
```

Figure 5.7: Branch-5 Router Configuration

5.6 Testing

Network testing is an investigation conducted to provide stakeholders with information about the quality of the product or service under test. The network test has been extensively used as one of the test formats and will continue to be a significant test format due to the increasing use of computer networks. Security has, however, drawn more attention as a result of the network test system's continuous growth. A network test system that includes security features has been developed and put into use. Network testing should be run ad-hoc after a configuration change to validate that everything went well, as well as permanently, via active network monitoring, to detect network problems as soon as they happen.

Network testing use cases

Here are some instances where, in the first case, we would like to verify our implementation and design presumptions following a configuration change.

- **Site turn-up:** When a new remote site or WAN link is put in place, we can use a program like iPerf to make sure we get the bandwidth we ask for from our carrier and ping to make sure there aren't any packet losses in the circuit. iperf-equipped single-board computers are another option. another important thing to test in a new site, is testing what's the maximum MTU (Maximum Transmission Unit) allowed.
- **Routing policy change:** The more complex the network, the more likely it is that a change in routing policy will have unanticipated effects on the routing table. We can verify in real-time that a routing policy change is modifying the routing table as expected by relying on distributed monitoring agents that run continuous ping and traceroute tests in a full-mesh fashion.
- **Firewall rules updates:** Whether a new firewall ruleset should be blocking or allowing specific traffic, it is always best practice to ensure that it is successfully implemented. Use a port scanner like nmap or run a TCP-based ping test from the unprotected to the protected network to confirm that a firewall update was successful.
- **Quality of Service (QoS):** Testing is crucial to ensure that, in the end, the network is classifying, marking, and queuing traffic as intended because there are so many dependencies and small details that could go wrong.
- **Network speed tests:** When estimating the end-user experience, measuring throughput, such as download and upload speeds to the Internet, is crucial.

There are both free and paid tools available to measure network speed, including the previously stated iperf.

Chapter 6

6.1 Result Analysis

In order to design a network that adds value to the company and is consistent with its goals and objectives, the experienced team with whom I worked on the project adopted a disciplined approach. In fact, the system was successfully implemented after an extensive testing phase that focused on the needs, goals, and objectives of the business. The implementation has also been done in a way that their IT team can always build business-driven network architecture using the particular, making it simpler to choose the appropriate hardware platforms, technological features, and protocols to implement the overview of the research design at a later time. The core network is therefore more flexible to changing technological or business needs. Additionally, the server systems are kept flexible to allow the developers to implement their tasks as soon as it is finished and subsequently deploy through the server farms while considering a variety of constraints, design flaws, and principles as well as the various requirements.

Chapter 7

Project as Engineering Problem Analysis

7.1 Sustainability of the Project/Work

Sustainability is a method of conducting business that balances the environmental, social, and economic aspects of project-based work to meet the requirements of

the current primary stakeholder without risking the future generations. In light of our dynamic world, project sustainability is more important than ever. To ensure that project outcomes, results, and benefits are sustained throughout their life cycles, including during their production, disposal, and decommissioning, individual and organizational responsibility is necessary. Sustainability should be incorporated into the project's design from the beginning because it cannot be compromised or disregarded if it is treated as a key requirement. This undertaking is not an exception. Throughout the design process, it was strictly enforced that no redundant devices or devices that would use more power without producing any more output were selected as design elements. Less energy consumption by the servers while maximizing use cases was given a lot of thought during the implementation and testing phases.

Daily upkeep and monitoring of the core network will allow for quick troubleshooting of any issues that may arise. The network administrator will regularly make sure that the network is properly maintained to keep users as comfortable as possible.

The team will also redesign, upgrade, and modify any core network design components to make them more reliable and robust to meet changing organizational needs in the future.

7.2 Social & Environmental Effects and Analysis

Social Effects: In this fast-paced digital world, we are all aware of the devastation that a slow network can inflict on and within a person. Employees can complete

assigned tasks with a solid design without having to worry about the complex network and computer mechanisms that support them.

Environmental Effects: Environmental sustainability is now a business requirement. Across all sectors and activities, environmental opportunities and risks are now posing a challenge to business strategy and operating models. Decisions about environmental strategy, as part of a broader sustainability agenda, are increasingly determining a company's prospects in the super competitive market of today. The company where I completed my internship is very concerned about that, and that has been clear from the beginning of this project thanks to their strict guidelines to prioritize social and environmental impact.

7.3 Addressing Ethics & Ethical Issues

In today's world, technology is all around us. Data is one of the most essential components of any company or organization. One of the most crucial elements of any company or organization is data. As technology has advanced, hacking, cybercrime, and data theft have all dramatically increased. When working on the design and implementation of networks for any organization, there are many unspoken norms and moral guidelines that must be followed. Therefore, it is essential to strictly consider all of the attack vectors when designing.

Today's desktop computers and PCs are typically networked, allowing users to connect to other devices to access data and other information that may be stored on those devices. These devices may be directly connected to one another as part of a computer network in a workplace or corporation. In contrast side, connected machines are typically connected to global networks like the Internet or the World Wide Web(WWW), which are typically linked over considerable distances. The

actual networked server computer could be anything, from a robust business computer with direct Internet access to a tiny home computer with a phone and modem for browsing a message board. Therefore, it was essential to design and construct the network with intentional design considerations in mind, regardless of how difficult they were to put into practice.

Chapter 8

Lesson Learned

8.1 Problems Faced During Internship

We always run into problems when we try something for the first time. I, too, encountered a variety of brand-new challenges during my internship. To begin of, I found it to be an incredibly difficult task to balance six days of office work with a new daily routine. It's your duty as a new employee to discover the preferred communication and working methods of your immediate workmates so that you can fit in with their existing dynamic, and this was really challenging. Since I am a continuous and diligent person who takes my work very seriously, my internship was no different. The lack of communication between the different teams was one of the major challenges I encountered during my internship.

8.2 Solution to Those Problems

Through reflection and self-awareness, this internship has allowed me to identify my abilities and flaws. I collaborated with a diverse group of individuals during my internship, representing a range of viewpoints and mentalities. I've improved my ability to express my thoughts and opinions to my peer group. Despite the fact that I was just starting out and communication with my superiors was challenging, my

mangers and authorities were on my side. They provided me with the time and space I needed to grow professionally by taking note of my mistakes. To interact face-to-face with a variety of employees, including very knowledgeable supervisors, in order to gather requirements, was an amazing experience for me. I have personally witnessed the amount of work required to construct an enterprise network from the ground up and then deploy it. Last but not least, overcoming a variety of challenges has taught me a lot and made me appreciate leadership more.

Chapter 9

Future Works & Conclusion

9.1 Future Works

The business has plans to switch to the cloud in the near future. Thus, has taken steps to enhance this currently reside design in order to deploy a private cloud. We have realized the value of working remotely using the Internet as a result of the COVID-19-related global crisis. The business is open to implementing a home-office working plan for the convenience of the staff and to inspire them to complete tasks more quickly in order to meet organizational goals. In this context, the company's honorable director hopes to transition to a hybrid-cloud system shortly after.

9.2 Conclusion

It was a privilege and an amazing experience to work as an intern at Omega Exim Limited with such outstanding coworkers. Throughout my internship, I picked up knowledge and valuable experience in a variety of professional fields related to network design. Despite their busy schedules, my director, supervisor, and workmates were very supportive in helping me adjust to the new workplace. In

order to solve problems and get past personal obstacles during my internship, I was able to collaborate with my more experienced coworkers. Fortunately, I was able to participate in a number of meetings with senior management where we discussed the company's objectives, needs, and requirements as well as the cost and schedule of the project. Additionally, I was able to gain knowledge about enterprise business management and teamwork through this internship. I would like to express my appreciation to everyone who helped make my internship a success.

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An Undergraduate Internship Report
on
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By

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Student ID: **1730371**

Summer, 2022

Consent Form

The student modified the internship final report as per the recommendations made by his/her academic supervisor and/or panel members during final viva, and the department can use this version for archiving.

Sabrina Alam

(Signature of the Supervisor)

Ms. Sabrina Alam

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