

An Analytical Study of Technical Support and Network Operations: Internship Experience at Bangladesh Online (BOL)

by

Tivana Akter Ridi (221014072)

Internship report (CSE4099) submitted in partial fulfillment of the requirements for the degree of

Bachelor of Science in Computer Science and Engineering

Under the supervision of

Dr. Muhammad Golam Kibria, SMIEEE

Professor & Head (Academic)

Wardha Anjum

Deputy Manager (Industry)



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

UNIVERSITY OF LIBERAL ARTS BANGLADESH

SPRING 2026

© *Tivana Akter Ridi*
All rights reserved

DECLARATION

Internship Title	An Analytical Study of Technical Support and Network Operations: Internship Experience at Bangladesh Online (BOL)
Author	<i>Tivana Akter Ridi</i>
Student ID	221014072
Supervisor (Academic)	Dr. Muhammad Golam Kibria, SMIEEE
Supervisor (Industry)	Wardha Anjum

I declare that this internship report entitled *An Analytical Study of Technical Support and Network Operations: Internship Experience at Bangladesh Online (BOL)* is the result of my own work except as cited in the references. The internship report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Tivana Akter Ridi
221014072

Department of Computer Science and Engineering
University of Liberal Arts Bangladesh

Date: April 21, 2026



Department of Computer Science and Engineering
University of Liberal Arts Bangladesh
Mohammadpur, Dhaka - 1207

CERTIFICATE

This is to certify that the internship report entitled **An Analytical Study of Technical Support and Network Operations: Internship Experience at Bangladesh Online (BOL)** , submitted by **Tivana Akter Ridi** (Student ID: 221014072) is a undergraduate student of the **Department of Computer Science and Engineering** has been examined. Upon recommendation by the examination committee, we hereby accord our approval of it as the presented work and submitted report fulfill the requirements for its acceptance in partial fulfillment for the degree of *Bachelor of Science in Computer Science and Engineering*.

Dr. Muhammad Golam Kibria, SMIEEE
Professor & Head (Academic)
University of Liberal Arts Bangladesh

Wardha Anjum
Deputy Manager (Industry)
Bangladesh Online

Place: Dhaka
Date: April 21, 2026

ACKNOWLEDGEMENTS

I would like to express my deep and sincere gratitude to my supervisor, *Wardha Anjum*, for giving me the opportunity to conduct this internship and providing invaluable guidance throughout this work. Her dynamism, vision, sincerity and motivation have deeply inspired me. She has taught me the methodology to carry out the work and to present the works as clearly as possible. It was a great privilege and honor to work and study under her guidance. Also, I would like to thank the other employees of *Bangladesh Online* for their help and cooperation during my practice time.

I am greatly indebted to our honorable teachers of the Department of Computer Science and Engineering at the University of Liberal Arts Bangladesh who taught me during the course of our study. Without any doubt, their teaching and guidance have completely transformed us to the persons that we are today.

I am extremely thankful to my parents for their unconditional love, endless prayers and caring, and immense sacrifices for educating and preparing me for the future. I would like to say thanks to my friends and relatives for their kind support and care.

Finally, I would like to thank all the people who have supported me to complete the Internship directly or indirectly.

Tivana Akter Ridi

University of Liberal Arts Bangladesh

Date: April 21, 2026

*I envisioned it, pursued it
with my best efforts, and
achieved it—owing every
success to my parents and my
little sister.*

– Tivana Akter Ridi

EXECUTIVE SUMMARY

The internship at Bangladesh Online (BOL) offered me the opportunity to move beyond theoretical classroom learning and gain exposure to real-world network operations. One of the main objectives of this internship was to observe the operational practices of a professional IT service provider and understand how different services are delivered to clients. Bangladesh Online is among the oldest and most well-established IT solution providers in Bangladesh and currently functions as the IT division of BEXIMCO. The organization provides a broad range of services, including dedicated internet connectivity, Wi-Fi and LAN solutions, managed IT services, email solutions, cloud services, HR support for corporate clients, web hosting and SSL services, data backup solutions, IP telephony, and various other ICT-related services.

As an intern in the Technical Support Department, my role was to gain knowledge about the services managed by the Tech Support team and to understand their operational workflows. These services included both remote and on-site technical support for resolving client issues, email security solutions using Barracuda, data backup services powered by Acronis, as well as platforms such as Carbonio and Outlook, along with web hosting, SSL certificate management, and related support activities. My responsibilities were primarily focused on learning how these services are implemented and maintained, rather than directly handling them.

A key part of the internship involved accompanying senior engineers during remote troubleshooting sessions. This experience allowed me to observe real-world technical challenges, identify their root causes, and develop an understanding of professional behavior and communication etiquette when interacting with clients in a corporate environment.

Overall, the internship provided valuable exposure to ISP operations and IT service management, while significantly enhancing my technical knowledge, communication abilities, and overall professional competence.

Keywords: Bangladesh Online, Networking, ISP Operations, Remote Support, Router Configuration.

Contents

1	Introduction	1
1.1	Introduction	1
1.2	Objective of the internship report	2
2	Background	3
2.1	Overview of Bangladesh Online (BOL)	3
2.2	Mission of Bangladesh Online (BOL)	4
2.3	Vision of Bangladesh Online (BOL)	5
2.4	Purpose of the Internship	5
3	Scope of Work	7
3.1	Summary on Internship Activities	7
3.2	Technical Support and Network Operations	8
3.3	Professional and Operational Learning	8
4	Internship Activities	10
4.1	Introduction of the Organization	10
4.2	Work Accomplishment	11
4.3	Challenges Faced	13
5	Analysis and Findings	15
5.1	Learning and Development	15
5.1.1	Bangladesh Internet Demography	15
5.1.2	Fundamentals Of Optical Fiber:	16
5.1.3	Cloud Computing & Its Fundamentals	17
5.1.4	OSI (Open System Interconnection)	17
5.1.5	Secure Socket Layer(SSL)	18

5.1.6	Routing protocols	19
5.1.7	Modulation & Multiplexing	20
5.1.8	MultiProtocol Label Switching(MPLS)	21
5.1.9	LAN and WAN	22
5.1.10	Domain Name System (DNS)	23
5.1.11	Basic Network Troubleshooting	25
5.1.12	Router Configuration	26
5.1.13	Network Architecture and Connectivity Overview	28
5.1.14	Linux Operating System	29
5.1.15	Cryptography	32
5.1.16	Cybersecurity Fundamentals	33
5.2	Tools and Technologies	36
5.2.1	Network Monitoring Tools	36
5.2.2	Network Documentation and Design Tool	37
5.2.3	Support Learning and Practical Experience	39
5.3	User Guideline	39
5.4	Impact of the Internship	40
5.5	Socio-Economic Impact of ISP's in Bangladesh	41
6	Conclusion , Limitation & Recommendation	43
6.1	Conclusion	43
6.2	Limitations	44
6.3	Recommendations	44
	References	46

List of Figures

2.1	Bangladesh OnLine (BOL) Logo	3
2.2	BOL Services Overview	4
5.1	Secure Socket Layer (SSL)	19
5.2	MPLS Header	22
5.3	DNS Lookup Process	24
5.4	Basic Connectivity(Dual Optic Fiber Connectivity)	28
5.5	chmod example	31
5.6	Cryptography Block Diagram	33
5.7	Nagios Logo	36
5.8	Cacti Logo	37
5.9	Whatsup Gold Logo	37
5.10	Allot Logo	37
5.11	Visio Logo	38
6.1	Offer Letter	45

List of Tables

5.1	Tools and Technologies Used During Internship	38
-----	---	----

Chapter 1

Introduction

This chapter presents a concise description of the internship report, starting with the definition of Internet Service Providers (ISPs), the necessity of IT service organizations in modern infrastructure, and an overview of the objectives of the internship in Bangladesh Online (BOL).

1.1 Introduction

In today's digital landscape, reliable network connectivity combined with high-quality IT services plays a vital role in economic development. As the use of IT services such as the internet, cloud computing, and email continues to grow, organizations are becoming increasingly dependent on these technologies to support their daily operations. Recent advancements in networking, cybersecurity, and cloud computing have significantly transformed the way IT services are delivered [1].

In this rapidly evolving environment, Internet Service Providers (ISPs) and managed IT service organizations serve as key enablers, ensuring seamless internet connectivity, secure data transmission, and scalable solutions for clients [2]. Achieving this requires a robust network infrastructure, supported by proactive and responsive technical support capabilities.

Bangladesh Online (BOL) is recognized as one of the oldest and most well-established IT solution providers in Bangladesh and currently functions as the IT division of **BEXIMCO**. The organization delivers a diverse range of services, including dedicated internet connectivity, Wi-Fi and LAN solutions, managed IT services, email solutions, cloud computing services, HR support for corporate

clients, web hosting and SSL services, data backup solutions, IP telephony, and various other ICT-related services [3].

This report presents the knowledge and learning experiences gained during the internship at Bangladesh Online, with a particular focus on technical support, service delivery, and troubleshooting activities. The purpose of this study is to evaluate how theoretical concepts are applied in practical scenarios and to understand how IT support services contribute to maintaining efficiency and ensuring security.

1.2 Objective of the internship report

The objectives of this internship report are outlined as follows:

- **Understanding ISP and IT Service Operations:** Gain clear and practical insight into the operational processes and service delivery mechanisms of ISP and IT service providers.
- **Observation and Learning Work Procedures:** Understand the roles, responsibilities, and workflows of the Technical Support Department in handling client issues.
- **Learning Networking and Support Technologies:** Improve the understanding of network concepts, configuration of network devices, network monitoring tools, and related services such as email systems, security solutions, and data backup services.
- **Gaining Experience in Real-World Troubleshooting:** Observe and assist senior engineers in identifying and resolving networking issues faced by clients during support activities.
- **Familiarizing with Professional and Corporate Work Culture:** Develop an understanding of communication practices, client management, teamwork, and professional behavior within an organizational environment.

Chapter 2

Background

This chapter provides an overview of Bangladesh Online (BOL), including details about its organizational role, service offerings, and operational environment. It also highlights the position of Bangladesh Online (BOL) within the broader context of the information technology and data communication sector in Bangladesh. This background information helps in developing a clear understanding of the professional environment in which the internship was conducted.

2.1 Overview of Bangladesh Online (BOL)

Bangladesh Online (BOL) is recognized as one of the prominent IT service providers in Bangladesh, specializing in data communication and managed IT services. Over time, the organization has built a strong reputation for delivering reliable and secure technological solutions to its enterprise and corporate clients. Currently, BOL operates as the **IT division of BEXIMCO** [4], supporting large-scale business operations through its digital infrastructure and services.



Figure 2.1: Bangladesh OnLine (BOL) Logo

In addition to internet connectivity, BOL offers a wide range of services. These include dedicated internet access, point-to-point(P2P) and MPLS (MultiProtocol Label Switching) connectivity, Wi-Fi and LAN solutions, managed IT services, enterprise email solutions, cloud services, web hosting and SSL certification, data backup solutions, IP telephony, and IT security services [3]. Such services are essential in today's business environment, where organizations depend heavily on secure networks, uninterrupted connectivity, and efficient information flow to carry out their daily operations.



Figure 2.2: BOL Services Overview

The company places strong emphasis on service reliability, technical efficiency, and customer-oriented support. As a technology-driven service provider, BOL continuously adapts to address evolving client requirements and advancements in technology. This dynamic and professional work environment offered a valuable platform for internship learning, particularly in developing practical knowledge of network operations, technical support procedures, and service delivery within an ISP and managed IT service organization.

2.2 Mission of Bangladesh Online (BOL)

Bangladesh Online (BOL) has a mission to make sure that every activity it engages in positively impacts the society. The organization also has a guiding principle that

it must add value to its business operations but also to the community. Bangladesh Online (BOL) also values the responsibility of all stakeholders it interacts with such as its employees, customers and to the wider population. This principle is regarded as a key to providing high-quality services to everyone [3].

2.3 Vision of Bangladesh Online (BOL)

Bangladesh Online (BOL) has a vision to be a major provider of internet services, software solutions and system integration services. The organization would strive to ensure that the customers it serves excel in the market by ensuring that the organization knows clearly what the customers need and how to respond to that. By working in close partnership with clients, BOL aims at providing one-stop solutions that are faster, cheaper and scalable to ensure that they have a competitive edge in the area of electronic communication [3].

2.4 Purpose of the Internship

The internship at Bangladesh Online (BOL) was designed in such a way that an intern who is completely new to this field can gain hands-on experience by working in a practical environment along with skilled engineers, as well as to understand the working procedures of technical support services in an internet services and technology-based organization. This internship had immense opportunities to leave the conventional classroom and put into practice the theoretical knowledge that had been attained in academic life into practical issues concerning networking, support services or systems [3].

The other notable aim of the internship was to gain a elementary knowledge of networking and support related duties that are typically performed in the workplace. In order to facilitate this learning process, I paid attention to the configuration procedures of various networking equipment like TP-Link routers, MikroTik routers and access points. I was also introduced to the basics of using network monitoring tools like Nagios, Cacti, Allot and WhatsUp Gold to see how the health and quality of services on a network are monitored in practice.

It also assisted in the development of various professional skills like communication skills, team work, management of time and solving problems which will be

of great help in both day to day life and the corporate life. This internship gave an insight into how organizations handle information systems to deliver easy services to their customers through being closely associated with experienced engineers. It is an excellent learning field to one who is planning to venture in information technology and networking as a career field [1].

Chapter 3

Scope of Work

This chapter provides a description of the particular tasks, projects and duties that I performed during my internship experience at Bangladesh online (BOL). It emphasizes the on-the-job experience in various fields, the types of activities done, skills learned, and knowledge gained by being actively engaged in the actual networking processes.

3.1 Summary on Internship Activities

The internship experience of Bangladesh Online (BOL) was primarily an orientation into technical support operations, and network service management. The program was created with the purpose to introduce the interns to the operation working process of the Internet Service Provider company and the organization managed IT services to the operational process. The internship experience was also relevant as I worked under the tutelage of the seasoned engineers which enabled me to observe professional activities as well as engage in physical support projects alongside senior engineers.

The internship scope involved in-office technical assignments and customer service at the field level. This enabled me to have a balanced understanding on how network services are designed, implemented, managed and maintained. The internship also assisted me in understanding processes of service response, customer support process and how teams collaborate to provide unending connectivity and service delivery.

3.2 Technical Support and Network Operations

A significant portion of the internship was to be able to learn the theoretical component and make it work. It also entailed familiarizing myself with the routine activities of the team in terms of networks and systems. The concept was to come up with a rudimentary knowledge regarding the concepts of enterprise level networking and Internet Service Provider. Some of the major areas of participation were:

- **Network Device Configuration:** Training and support by other senior engineers enabled me to learn how to set up various networking devices, including: TP Link router, MikroTik, and wireless access points. This setup consists of simple router configuration with dynamic and static IP, NAT, routing, port forwarding and simple troubleshooting procedures.
- **Network Monitoring Tools Use:** Acquired practical experience of the functioning of a monitoring system of an enterprise network. I was familiarized with various monitoring networking tools applied in the work of ISPs, including *Nagios*, *Cacti*, *Allot NetXplorer*, *Whatsup Gold* and many others. The tools are applied in tracking the network conditions, bandwidth, delay properties and service availability.
- **Troubleshooting Support:** The senior engineers taught me the basic troubleshooting processes when doing remote support. The troubleshooting was performed so that to determine and fix the common networking problems such as slow internet browsing, packet loss and wireless signal interference. This helped me to develop my problem-solving and diagnostic skills.

3.3 Professional and Operational Learning

Apart from technical tasks, this internship included knowledge of the professional practices of an IT service-providing company. This included:

- Monitored the interactions between professionals and their clients during the process of communication, service requests and proper protocols of escalating support.

- Discovered that professional communication and coordination of technical teams are the keys to customer satisfaction.
- Developed knowledge of the service-level expectations, response priorities and discipline in the operation that is anticipated in a professional service delivery of an IT service environment.
- Participated in a number of in-house training programs that the organization organized, which involved concepts and practical information on the topic of networking.
- Enhanced understanding of theory related to the basics of networking, the basics of network security, and following safe practices for a network.

Chapter 4

Internship Activities

4.1 Introduction of the Organization

Bangladesh online (BOL) is among the earliest Internet Service Providers (ISPs) and information technology service organizations in Bangladesh and has been proudly offering its services in the booming environment of data communications and information technology in Bangladesh over the years. This company was established in the late 1990s with the aim of offering steady internet services and other IT-related services in Bangladesh, which has yet to reach the first phase of internet penetration. BOL has played its significant role in shaping the digital communications and business connectivity in Bangladesh [3] [5].

Initially, Bangladesh Online concentrated on giving internet, web hosting, and networking services. Later on, the organization expanded its services and started providing business internet solutions, data communication solutions, and managed IT solutions [1].

In 2009, this company was taken over by one of the biggest companies in the private sector in Bangladesh the Bangladesh Export Import Company Ltd (BEXIMCO), which marked a turning point to Bangladesh Online (BOL). After the acquisition, BOL was operating as the IT Division of BEXIMCO and was providing world-class IT and networking solutions to their respective group of companies and corporate bodies outside of it as well [4]

As part of BEXIMCO's IT Division, BOL greatly expanded its technical capabilities. This organization started to provide services beyond internet service such as point to point connectivity, Wi-Fi and LAN services, managed IT services, enterprise email services, cloud services, web hosting and ssl certification, and data backup

services, ip telephony, and IT security services. Organizations, which simply depend on the security of their networks, their constant connectivity, and flow of information, are core to such services in this contemporary world, and they cannot operate their daily businesses without it [2].

Currently, Bangladesh Online (BOL) is involved in providing trusted technology services to a wide range of corporate clients. The sheer experience of the organization and the later inclusion into the BEXIMCO Group has guaranteed that indeed BOL is a stable element in the creation of the information technology landscape in Bangladesh

4.2 Work Accomplishment

This section will be a reflection of the work achievement over the entire internship period. My main responsibility was to learn and visualize the process and techniques of work and seek clarification in case of necessity. During my internship in the Tech Support Department of Bangladesh Online, I had to deal with a few professional responsibilities:

Weeks 1–3: Orientation and Fundamental Networking Concept

At the beginning stage of the internship at Bangladesh Online (BOL), I was assigned to understand the grooming and corporate etiquette, service overview of the company, and the infrastructure. Key accomplishments at this phase include:

- Participated in orientation sessions on corporate grooming, work discipline, and professional communication.
- Learned about BOL's service offerings, which included internet connectivity, managed IT services, as well as customer service operations [6].
- Analyzed customer service processes, involving ticket creation, issue reporting, and escalations of support.
- Achieved a foundational comprehension of WAN and LAN ideas and how internet provider backbone networks facilitate business network connectivity [7].

Weeks 4-6: Network Devices, Monitoring Systems, Remote Support

In the second phase, the internship program prioritized more on hands-on experience related to network devices, network monitoring tools, and related theories. Key accomplishments are:

- Attained knowledge of basic router setups, such as IP addressing, DHCP (Dynamic Host Configuration Protocol) addressing, NAT, and basic troubleshooting methods [7].
- Learned and configured network device setup, such as TP-Link, wireless access point, and MikroTik routers with the help of experts.
- Learned the working and the checking processes of enterprise network monitoring solutions like Nagios, Cacti, Allot, and WhatsUp Gold.
- Learned about the ways in which monitoring tools are utilized to analyze bandwidth consumption, availability and network performance.
- Learned the foundational knowledge of DNS concepts, such as DNS resolution or DNS lookup, and DNS record types.
- Went to field support at client premises with senior engineers to solve the issues the clients were facing.
- Got familiar with Wi-Fi and LAN surveys to identify and solve different issues like coverage, signal interference etc. [8].

Weeks 7-12: ISP Operations, Security, and Infrastructure Services

The final stage included ISP operations, infrastructure, and security awareness. Major achievements in this phase include:

- Attained knowledge about data center basics and redundancy concepts applied in the ISP field [8].
- Gained insight into the connectivity of the ISP's network and the traffic flow in the ISP's backbone network.
- Studied Linux system administration, including topics such as basic system use, security, and access control [9].

- Developed an understanding of cybersecurity basics such as cryptography, network security, application security, vulnerability assessment and penetration testing basic theory, and secure networking.
- Gained knowledge and practical examples regarding enterprise email services, email bounce-back problems, and email delivery issues.
- Witnessed how secure email gateways work and how they help secure an organization from spam and phishing threats.
- Attained knowledge in backup services, cloud backup services, and on-premise backup solutions using Acronis, Seafile, etc. [10]
- Gained knowledge about the radio link setup and tuning from senior engineers [11].
- Have continued to visit customer premises to observe troubleshooting, maintenance, and service optimizations.
- Completed documentation and report writing tasks based on learning and technical exposure.

4.3 Challenges Faced

During my internship period in Bangladesh Online (BOL), I experienced some difficulties in adapting to the professional technical environment, that was quite different from what I had to deal with in academic life . The internship involved actual networking, customer servicing, and experience at the real-world technical level for which I had to adjust and learn continuously for fulfilling the responsibilities.

- The first challenge involved continuous learning to apply academic knowledge to perform ISP operations. The knowledge of network services, network monitoring and providing field support to clients were more complicated than theoretical knowledge. Most of the operations involved making fast decisions under the guidance of senior engineers.

- Another big challenge that I faced was working with the MikroTik routers. I had never worked with a MikroTik router before coming to this internship. It took time to learn the GUI and configuration setup in the MikroTik router. It was tough for me to learn different concepts like routing, NAT, and port forwarding as compared to the simple routers that I had experience with.
- I also experienced challenges in transportation. Most of the time I had to leave my home in the morning to visit clients and come back home as late as 9:00 PM while my working hours ended at 6:00 PM. This was due to the long distances I had to cover in a day, and it was challenging for me to be energetic all the time.
- Furthermore, knowledge about the usage of enterprise monitoring tools and dashboards, like bandwidth graphs, was a challenge because of their complexity and real-time nature.

To overcome these issues, I often consulted senior engineers in my organization, attended training sessions within my company, and followed technical guides. Over time, my skills improved through observation, practice, and learning. Even in a challenging environment with difficulties in transport and technical issues, maintaining a positive attitude helped me turn these issues into learning experiences. In conclusion, dealing with and overcoming all these challenges has significantly enhanced my technical abilities, flexibility, time management, and preparedness for further technical assignments in networks and IT support.

Chapter 5

Analysis and Findings

5.1 Learning and Development

My internship with Bangladesh online (BOL) was a good learning experience that enabled me to connect my theoretical knowledge with the real technical work experiences. I also attended various training programs, observed the work of other engineers and got practical experience of networks, security, and system operations.

5.1.1 Bangladesh Internet Demography

Bangladesh's internet connectivity starts at the international level and includes three major internet gateways: submarine fiber-optic cable, international terrestrial cable via India, and satellite-based connections, including SpaceX Starlink.

Submarine Cable: The country receives most of the internet traffic in the world by the submarine cable lines such as SEA-ME-WE 4 and SEA-ME-WE 5 that land at Cox's Bazar and Kuakata. These connections are handled by Bangladesh Submarine Cable Company Limited (BSCCL) which receives, amplifies, monitors and converts international optical signals into terrestrial fiber signals. International Internet Gateways (IIG's) also facilitate entry of bandwidth in that they provide redundancy as well as minimized reliance on a single route. Data is then transmitted via the Nationwide Telecommunication Transmission Network (NTTN) and creates a high capacity fiber backbone in the major cities. On the very basic level, traffic flows across routers, switches, Internet Exchange points (IXPs), and Bangladesh Internet Exchange, where routing, load balancing, latency optimization and local traffic exchange take place. Lastly, Internet Service Providers (ISPs) and mobile operators

such as Grameenphone and Airtel Bangladesh buy the bandwidth and provide it to the end users through FTTH, Ethernet, Wi-Fi, and cellular networks (4G/5G). The last-mile connection—through fiber cables, routers, and mobile towers—converts this bandwidth into usable signals, enabling end users to access websites, cloud services, video streaming, and real-time communication.

International Terrestrial Cable (ITC): In Bangladesh, ITC offers cross-border fiber connection to India as a backup of the submarine cables. The entry point of bandwidth is International Internet Gateways (IIGs) followed by entry into the NTTN backbone, through core routers and switches, and load balancing and routing by Bangladesh Internet Exchange. Lastly, it is provided to users by ISPs and mobile operators via fiber, Wi-Fi, and cellular network.

Satellite (Starlink): SpaceX offers Starlink which provides satellite internet in Bangladesh, with data being sent by the low earth-orbit satellites straight to user terminals. Routers then convert the signal to access the internet, providing the ability to use the internet without depending on BSCCL, IIG or NTTN, particularly in remote locations.

5.1.2 Fundamentals Of Optical Fiber:

Fiber optics refers to technology of transmitting data as light pulses along a glass or plastic strand or fiber .it is used for Long distance communication and for high performance data network .It is capable of transmitting over longer distances and high bandwidth than a electric cable . It is a major component of Modern telecommunication.

Main Components of Optical Fiber :

Core : The main part from where the main data will be transmitted & Central tube of optical fiber which is hair-thin size made of optically transparent dielectric Medium. It carried the pulses Transmitter to receiver. Core diameter is in between 5 μm to 100 μm (micrometer).

Cladding : It is the Outer optical material of core . It has lower reflecting index than the core. It helps to keep the light pulses within the core central tube.

Buffer Coating : It is a plastic Coating of outer part of cladding which protect the fiber optic cables core part made of a silicon rubber. After Coating the whole optical fiber the diameter became 250-300 μm (micrometer).

5.1.3 Cloud Computing & Its Fundamentals

Cloud computing is a technology that enables users to save their data and run applications without the use of local devices or physical hardware, but through the internet. Cloud computing vendors such as Amazon Web Services and Google Cloud take care of all the computing and storage on remote data center servers.

Service Models:

IaaS (Infrastructure as a Service): Offers virtual servers, storage, and networking; the user controls OS and applications (e.g., Amazon EC2). PaaS (Platform as a Service): Offers development and deployment platforms without hardware management (e.g., Google App Engine, Heroku) SaaS (Software as a Service): Provides software as a service, ready to use, without installation (e.g., Gmail, Microsoft Excel).

Cloud Computing Lifecycle:

Define Requirements: Establish problem, user needs, performance, and security objectives.

Define Hardware: Provider controls servers, CPU, RAM, and networking data centers.

Define Storage: Procure scalable and secure data storage including back-up.

Define Security: Provide security through monitoring, authentication, and encryption.

Deployment: Implement tools to deploy, configure, and start cloud applications.

Testing: Check performance, security and reliability prior to full utilization.

Analytics: Track usage, performance and ensure optimization and improvement.

5.1.4 OSI (Open System Interconnection)

The OSI (Open Systems Interconnection) model is a theoretical seven-layered model developed by the ISO to standardize network functionalities, enabling different systems to interact. It breaks down network data transmission into logical, stacked layers—between physical cables to application interfaces—to help in troubleshooting, design and interoperability between network technologies.

7 layers Of OSI Model:

1. Physical Layer: Bits or raw binary data is transmitted on physical, electrical or optical medium.
2. Data Link Layer: Handles the node-to-node transfer, framing bits and managing access to the physical medium (e.g., Ethernet, MAC addresses).
3. Network Layer: Decides how the data is going to be carried (routing) and does the logical addressing (IP addresses).
4. Transport Layer: End-to-end communication and flow control and error correction (e.g., TCP, UDP).
5. Session Layer: Controls sessions (connections) between computers, creating, keeping and ending connections.
6. Presentation Layer: Formats, encrypts and compresses the data so that it can be read by the receiving application layer.
7. Application Layer: Interacts directly with software applications (e.g. browsers, email clients) to start network services (e.g. HTTP, FTP, SMTP).

5.1.5 Secure Socket Layer(SSL)

Secure Socket Layer (SSL) is a popular security protocol which provides a secure connection between a client (a web browser) and a server to transmit data safely over the internet. It offers three key security capabilities such as encryption, where sensitive information such as passwords and credit card details is not intercepted; authentication where the identity of the server is verified using digital certificates; and data integrity where the sender and receiver do not alter the information they transfer in the course of communication. SSL is based on a mechanism known as the SSL handshake, in which the client and the server exchange information, check the certificate of the server and create encryption keys by using the cryptography of public key and private key. After the process of a handshake an encrypted session is formed and all information is sent in encrypted form. Whereas much of the secure communication protocol in use today, Transport Layer Security (TLS), has supplanted the older and somewhat less secure protocol, SSL, the term still tends to be used interchangeably with this kind of secure communication .

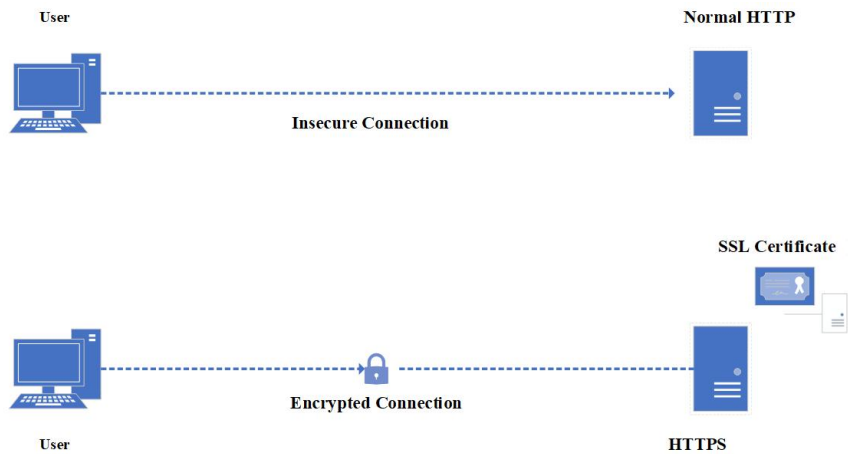


Figure 5.1: Secure Socket Layer (SSL)

5.1.6 Routing protocols

Routing protocols refer to a collection of guidelines and algorithms that routers follow in order to calculate the most effective path that data should follow in their journey through a network between a source and a destination. These protocols help routers to exchange information between themselves, distribute network information and update routing tables dynamically or manually to provide efficient and accurate data delivery.

Static Routing : One technique in which routes are configured into a routing table of a router by hand is known as static routing. These paths are not automatically updated and have to be updated by hand in case there is a change in the network topology. The simplest form of routing is called static routing; it is secure, requires few resources and is appropriate to small or stable networks, but lacks flexibility and scalability to larger dynamic networks.

Dynamic Routing: Dynamic routing is a routing technique that uses routing protocols which dynamically find network paths and update routing tables in accordance with current network conditions. This scheme is flexible and scalable compared with the static routing, because it reacts to fluctuations like link failures or congestion. Popular dynamic routing protocols are RIP, OSPF and EIGRP.

- **RIP (Routing Information Protocol):** RIP is a distance-vector routing protocol whose metric is hop count, and has a maximum of 15 hops. It is easy and

simple to set up but not as fast in converging and not as applicable to large networks.

- **OSPF (Open Shortest Path First):** OSPF is a routing protocol that calculates the shortest route depending on network topology algorithms. It has quick convergence, enhanced scalability, and effective routing, which renders it appropriate in large and complicated networks.
- **EIGRP (Enhanced Interior Gateway Routing Protocol):** EIGRP is a hybrid routing protocol which is a combination of distance-vector and link-state protocols. It offers rapid convergence, bandwidth efficiency, and multiple metrics like bandwidth and delay, making it very efficient, particularly in enterprise networks.
- **BGP (Border Gateway Protocol):** BGP is a path-vector routing protocol of exchanging routing information between networks, called Autonomous Systems (AS) in the internet. It guarantees dependable and scalable routing of extensive and intricate networks.
 1. **EBGP (External BGP):** EBGP is employed in the inter-AS routing. It aids in the exchange of routing information within the internet and also finds the optimal path according to their policies and path attributes.
 2. **IBGP (Internal BGP):** The same Autonomous System utilizes IBGP to exchange routing information between routers. It makes sure that there is consistency in routing decisions within one network and it collaborates with EBGP when communicating with the outside.

5.1.7 Modulation & Multiplexing

Modulation refers to the act of altering a high frequency carrier signal so that it can be used to transmit information over a means of communication effectively. In communications, the original information signal (voice, data, or video) is often of low frequency, and cannot be effectively transmitted over long distances, so it is modulated on top of a higher-frequency carrier wave. This mix changes some of the characteristics of the carrier signal, including its amplitude, frequency or phase, leading to various forms of modulation such as Amplitude Modulation (AM),

Frequency Modulation (FM) and Phase Modulation (PM). Modulation enhances signal strength, minimizes interference, and enables enhanced transmission over long distances using several mediums such as air or optical fiber.

Multiplexing refers to a communication system where more than one signal is transmitted through a single communication channel, and as a result, the bandwidth of that communication channel will be utilized more effectively, and the cost of transmission will be minimized. Here a multiplexer is used to combine several input signals into a single composite signal at the sender side and a demultiplexer is used to separate the signals back to individual signals at the receiver side. In optical communication, Wavelength Division Multiplexing (WDM) is often used to perform multiplexing, with multiple signals sent via different wavelengths of light over the same fiber. Other variants such as Coarse WDM (CWDM) have a wider wavelength separation over shorter distances and are cheaper, whereas Dense WDM (DWDM) has a narrower wavelength separation in order to provide greater data capacity over longer distances. Such systems are commonly paired with devices such as Erbium-Doped Fiber Amplifiers (EDFA) to amplify optical signals without converting them to electrical signals.

5.1.8 MultiProtocol Label Switching(MPLS)

Multiprotocol Label Switching (MPLS) is a high-performance forwarding technique used to establish efficient and scalable long-distance network connections. It forwards packets along a predetermined path called a Label Switched Path (LSP), rather than relying on traditional hop-by-hop IP routing decisions at every router. In MPLS, routers forward packets based on short labels instead of performing complex routing table lookups for each packet. As a result, packets belonging to the same flow typically follow the same predefined path through the network. MPLS is often described as operating at “Layer 2.5” of the OSI model because it sits between the Data Link Layer (Layer 2) and the Network Layer (Layer 3), combining features of both layers.

MPLS Header :

The MPLS header is 32 bits long and is inserted between the Data Link Layer (Layer 2) and the Network Layer (Layer 3), which is why MPLS is often referred to as a Layer 2.5 technology. The MPLS header consists of the following fields:

- **20-bit Label** – This is the main identifier used by routers to make forwarding decisions.
- **3-bit Traffic Class (Experimental or EXP bits)** – Used for Quality of Service (QoS) and traffic prioritization.
- **1-bit Bottom of Stack (BoS)** – Indicates whether this label is the last label in the stack (1 = last label, 0 = more labels follow).
- **8-bit Time to Live (TTL)** – Used to prevent routing loops. The TTL value is decremented by 1 at each hop, similar to the IP TTL field.

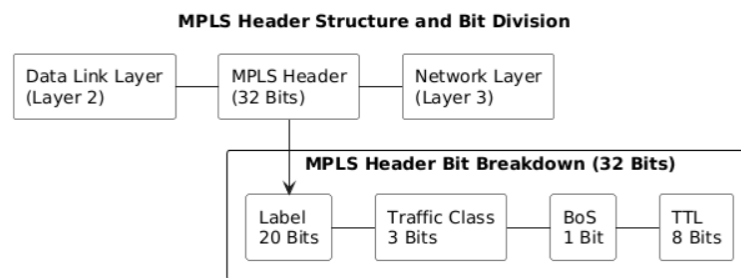


Figure 5.2: MPLS Header

5.1.9 LAN and WAN

Throughout the internship period, I have gained theoretical knowledge about the principles of Local Area Network (LAN) and Wide Area Network (WAN), which is the basic foundation of network connectivity. LAN is a type of network that is geographically limited to a small area such as an office, a building, or even a campus. LAN helps various devices such as computers, printers, servers, etc. to communicate faster, with low latency through Ethernet or Wi-Fi.

WAN covers a much larger geographical area than LAN. It is used for interconnecting multiple LANs together over cities or geographical areas or even countries. WANs use the facilities of fiber-optic cables and leased lines offered by the service providers. The major difference between LANs and WANs is that WANs suffer from high latency and an increased complexity of routing and reliability.

The knowledge of the LAN and WAN difference helped me to understand how business networks are organized and how Internet Service Providers are able to provide connectivity to businesses. The LAN deals with communication that occurs within a firm, while the Wide Area Network is the communication link that connects different networks and finally the global internet. Such knowledge has significant importance in designing and maintaining network systems in a business firm or ISP.

5.1.10 Domain Name System (DNS)

Domain Name System (DNS) is used to translate domain names to IP addresses. Without DNS servers, we had to remember IP addresses for all websites and access the websites using the IP addresses that would be almost impossible for the end users to remember specific IP addresses for websites. They store different records for different purposes like for websites they store A,AAAA records, for email MX records, etc. They cache answers to speed up repeated queries. DNS works through two main types of servers:

1. **Recursive DNS Servers (Resolvers):** When the users type a domain name in browser, the device sends a query to a recursive DNS server. Then the server checks if it has cached the IP address, and sends the response back to the browser. If the IP address is not cached, then it forwards the query to Authoritative DNS servers.
2. **Authoritative DNS Servers:** The Authoritative DNS Servers are divided into 3 parts and they work in hierarchical order to resolve domain names to IP addresses. The hierarchical order is Root Name Servers → Top Level Domain (TLD) Servers → Authoritative Domain Server.

DNS Lookup Process

Let's look at an example of the DNS Lookup process for accessing *www.google.com*

- **Query Initiation** – When the user types *www.google.com*, the browser sends a request to the Recursive Resolver.

- **Recursive Resolver** – The server checks if the IP is cached. If the IP is found on the cache, it sends the response back. If not found, it forwards the query to Authoritative DNS servers.
- **Root Name Server** – After getting the query from the Recursive Resolver, it tells the resolver which TLD server to ask to get the IP address.
- **TLD Name Server** – It points the resolver to the Authoritative Name Server for the specific domain (ns1.google.com, ns2.google.com etc.).
- **Authoritative Name Server** – This server stores the IP address for the domain names. It provides the exact IP address for www.google.com.
- **Resolution Complete** – After the lookup process or resolution is completed, the Recursive server returns the IP to the user's browser, which connects to the website.

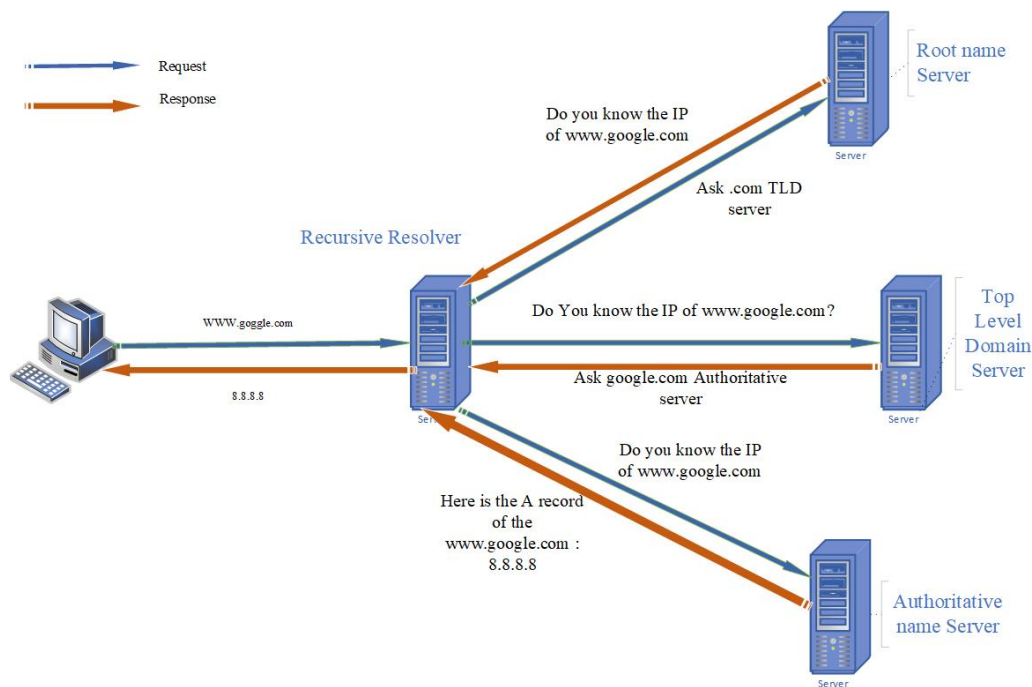


Figure 5.3: DNS Lookup Process

Types of DNS Records

DNS servers maintain a database of records that are similar to a set of directions on how to access certain resources:

- **A record** – This translates domain names into IPV4 addresses.
- **AAAA record** – This translates domain names into IPV6 addresses.
- **MX record** – Directs emails to the correct mail server.
- **CNAME record** – Points one domain to another domain (alias).
- **PTR Record** - This translates an IP address back to a domain name (reverse lookup)
- **TXT Record (General Text Data)** - Commonly used for verification, SPF, etc.
- **SPF(Sender policy Framework:** It is a type of DNS TXT records that list all the servers authorized to send email from a particular domain.This prevents email spoofing,protect from fake email sending .
- **DKIM (DomainKeys Identified mail:)** It is a method of email Authentication that helps to prevent spammer and other malicious parties from impersonating a legitimate domain. DKIM includes digital signature schemes based on public key cryptography to authenticate where an email come from.
- **DMARC (Domain-based Message Authentication, Reporting & Conformance:)** DMARC is also a method of authenticating email messages that tells the receiver email server what to do if SPF and DKIM fails to prevent attacks. It provides a report to the domain owner.

5.1.11 Basic Network Troubleshooting

Network Troubleshooting is performed to diagnose whether there were any problems in the system, analyze the problems and finally fix the problems so that there is no problem in communication and accessing the services. In my internship time, I was taught the systematic steps involved in problem-solving rather than a hunch. This systematic process is useful in identifying the problem in a simple and expeditious manner.

The most recurring problems encountered in a real network include low internet speed, loss of packets, improper configuration of the devices, DNS resolution,

abnormality in link connection. The engineers take several standard and specific steps to trouble shoot the said issues.

Common Troubleshooting Tools and Techniques

- **Ping** – Ping is generally used to check the connectivity of a networking device. It verifies the availability or accessibility of the destination host and also measures RTT (Round Trip Time) which refers to the time that it takes a packet to go to the receiver and back to the sender. This RTT is used to measure the latency. Ping can also be utilized to identify packet loss, link problems etc. we use the command *ping 192.168.1.1*.
- **Traceroute (Tracert):** Traceroute is a command which is used to show the path taken by the data between the source and destination devices. It shows other details besides the path, like the length of each hop, and points of delays or failures when the data is being transported. we use the command *tracert 192.168.1.1* .
- **IP Configuration Checking** -To check the IP address, subnet mask, default gateway, and default DNS server settings to identify any misconfigurations that can cause communication failure we can use the command *IPCONFIG* .
- **DNS Testing** - Sometimes we just find ourselves unable to access any sites. This may happen due to DNS problems, i.e., when the DNS server is not functioning or it is unable to convert domain names to IP addresses. We can either troubleshoot this problem with the help of the *NSLOOKUP* command or not with DNS server properly configured.
- **Network Monitoring Systems** Network dashboard tools can be utilized to monitor bandwidth usage, availability of devices, latency, and error rates. They help to identify unusual trends even before complaints are raised by the users.

5.1.12 Router Configuration

The router configuration is a core component of network management, as routers determine the flow of data in and out of the local networks and the internet. My

internship experience enabled me to have a practical experience in configuring both TP-Link and MikroTik routers. This was also among the crucial learning areas to me, particularly since I had no previous experience with MikroTik devices when I started the internship.

TP-Link Router Setup

The TP-Link router will have a higher chance of being selected in the small business or client set-ups or SOHO (Small Office/Home Office) networks. I managed to receive the basic procedures to configure this router and set regular access to the Internet:

- **IP Set-up (static) :** To ensure the reliable connection of internet, I enabled it with the static IP addresses.
- **DNS Configuration :** I added the DNS server manually by typing in the server so that the computers within the network can be able to resolve their domain names.
- **Remote Management Setup :** Enabled remote management to allow the accessibility of the router to the external administrators who are yet not in the local network.
- **item Simple Connectivity Tests :** Testing of the Internet connection availability when the configuration process has been completed.

MikroTik Router Set-up

MikroTik routers are more reputable in bigger networks and service providers as they possess greater functionality and versatility. At first, I was new to the interface of the MikroTik device but once I had a practical experience, I knew the configuration and command sequence. The larger tasks that I have achieved were:

- **WAN Configuration as a DHCP Client** - This setup will configure the WAN port in a way that will allow it to get its IP address through the upstream networks, and use it as a DHCP client.
- **Static IP Address Allocation** - This is the allocation of IPs to interfaces through manual segmentation of the internal network.

- **DHCP Server Set-up** - This will involve setting up a DHCP server that is to be used to allocate IP addresses, gateways and DNS information to clients automatically.
- **Network Address Translation (NAT)** - Source NAT is used to enable the use of the internal IP addresses on the internal network to access the Internet.
- **DNS** - To configure the interface with DNS servers and DNS forwarding.
- **Default Route Configuration** - It is the process of configuring default routes, which direct the outgoing traffic to the internet gateway.

These experiences contributed to enhancing my knowledge in routing, IP address, and traffic on a business network. My experience with the equipment offered by MikroTik has been especially helpful in assisting me to develop my baseline in networking and my level of confidence when dealing with equipment of professional quality.

5.1.13 Network Architecture and Connectivity Overview

The diagram below shows the high level internet connectivity architecture of Bangladesh online (BOL) to provide internet services to the end users. BOL is fed with upstream bandwidth by a series of International Internet Gateways (IIGs) that provide it with providers like Summit, SkyTel, Apple, and BTTB that access global internet routes via submarine cable networks.

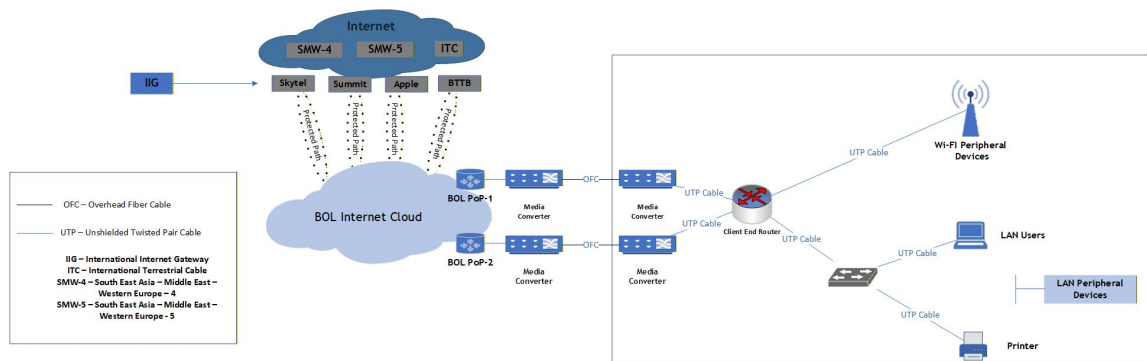


Figure 5.4: Basic Connectivity(Dual Optic Fiber Connectivity)

In order to provide high availability and redundancy, several paths between the IIGs and the BOL core network are kept protected. The combined traffic gets into the BOL Internet Cloud and is dispersed via numerous Points of Presence (PoPs). The PoPs are linked to the client premises via the Optical Fiber Cable (OFC) in order to provide a connection.

Media converters at the customer end convert fiber to copper (UTP) connections that end at the edge router of the client. The local area network (LAN) is then extended to wired and wireless devices like PCs, printers, and Wi-Fi-enabled devices of the user. This architecture provides dependable service delivery, traffic flow, and scalability of enterprise and residential customers.

5.1.14 Linux Operating System

Linux is an operating system that has characteristics such as being multi-user, open-source, and kernel-based, and it has attributes associated with it like being stable, secure, and highly trusted. Linux is preferred to be used in professional IT setups like BOL due to the fact that it can be used after very long durations without interruption and also possesses strong resource control capabilities in the operating system. I also found that Linux follows the notion that everything in the system is treated like a file [12].

Linux Directory Structure

In order to navigate such a system successfully, locate vital files, and use such a system effectively, one must know how to use the Linux directory structure effectively.

- **/:** The root or initial point for the whole file system
- **/etc:** Holds the system and network configurations
- **/var/log:** This directory holds system and service log messages for troubleshooting purposes
- **/home:** Contains the files and folders that belong to users
- **/root:** The home directory for the root user
- **/bin** and **/usr/bin:** These directories store some of the most frequently used

- **/dev**: Denotes hardware devices as files

It gave me the details needed to identify where in the system the network interface configurations, service logs, and system configuration are [12].

Linux Command Line Interface (CLI)

One of the largest parts of my learning process was to learn to use Command Line Interface (CLI), because CLI is widely used among network and system administrators. Command Line Interface makes it possible to control faster and remotely compared to other interfaces. I was trained to execute simple commands that are usually used in technical assistance software [13].

A. Navigation and Directory Management

- **pwd**: (Print Working Directory) It displays the path of the current directory in order for the user to locate himself or herself within the system.
- **cd**: This command is utilized in navigating from directory to directory within the operating system.
- **mkdir**: Used to create a new directory or a folder.

B. File Management and Operations

- **ls**: Used for displaying list of files and directories. In my cases, `ls -la` was often used.
- **cp**: Copy files or directories from one place to another.
- **mv**: Used to rename files or move them to other directories.
- **rm**: Deletes files or directories. The `rm -rf` command must be used with extreme caution.
- **cat**: Allows viewing the content of a file directly from the command line.
- **touch**: Used to create a new empty file or update timestamps.

C. Searching and Filtering (The “Grep” Power)

- **grep**: Used to search specific data such as IP addresses within large files like server logs.

- **find**: Used for searching files based on name, size, or date.
- **Pipe (—)**: Used to combine multiple commands, such as `ls | grep config`.

User and Permissions Management

Security is a crucial aspect in every organization. Therefore, my mission was to learn how to control who can view or modify vital documents.

User Management

The use of `sudo useradd` and `sudo passwd` provides the ability to create and secure users.

Permissions (chmod)

A file or directory has three permission sets: Owner, Group, and Others.

- Numerical Method: **4 = Read**, **2 = Write**, **1 = Execute**
- **chmod 777**: Full access for everyone (very insecure).
- **chmod 755**: Full access for owner, read and execute for others.
- **chmod 644**: Read-write for owner, read-only for others.

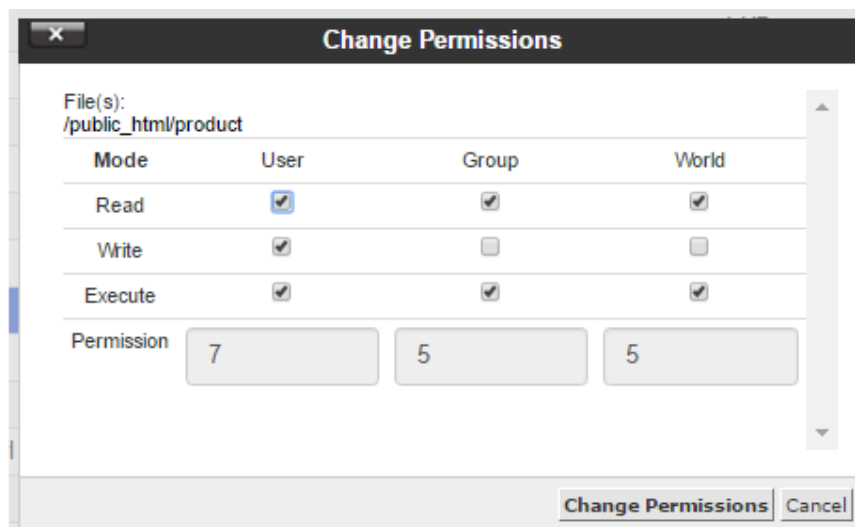


Figure 5.5: chmod example

Ownership (chown)

Learning how to use the command `chown` taught me how to modify ownership of files, which is common during the installation of new web services [13].

Linux Networking Basics

Because BOL provides ISP services, Linux networking commands are an important learning point. To check connections and troubleshoot problems within a network using Linux, the following commands are used:

- **ip addr** or **ifconfig**: Used to verify IP configurations
- **ping**: Used to verify network connectivity
- **netstat**: Used to check ports and processes
- **traceroute**: Used to trace the route taken by packets

These commands are used by engineers to identify link failure, route failure, and service availability [13].

5.1.15 Cryptography

Cryptography is the art of ensuring the safety of information by encrypting it so that the information is only read by the people who are supposed to have access. It is a major feature of computing and networking, and it provides confidentiality, integrity, data authentication, and non-repudiation [14].

Essential Concepts of Cryptography

Encryption and Decryption: Encryption refers to the mechanism of transforming readable information (plaintext) into an unreadable (ciphertext) form with the help of an algorithm and a key. The process of decryption is the opposite, which means that ciphertext is turned into plaintext using the identical key. This is to make sure information is not legible to unauthorized parties [15].

Cryptographic Keys: A cryptographic key is a value, which is applied in an encryption algorithm to encrypt information and decrypt it. Privacy of the cryptographic key is very critical in the security of encrypted data. Symmetric cryptography involves the encryption and decryption of a key which is the same in both encryption and decryption whereas asymmetric cryptography encrypts with a public key and decrypts with a private key [15].

Hash: Hashing is an irreversible process that creates a fixed-size hash of input data. Contrary to encryption, hashing is irreversible. It is typically applied in password protection, assuring data integrity, and unauthorized tampering detection. Any modification of the initial data ends up with a totally different hash of the original data [14].

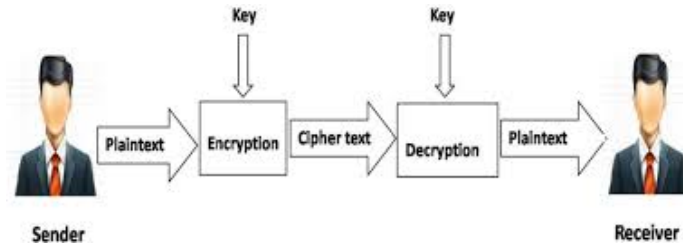


Figure 5.6: Cryptography Block Diagram

Importance of Cryptography: Cryptography is crucial in the security of digital systems in day to day activities. It has been used to secure connections to websites (HTTPS), password storage, and to secure online transactions as well as to provide secure communication over insecure channels such as the internet. Secure online banking, email communication, cloud storage, and authentication mechanisms are supported by cryptography [14, 15].

5.1.16 Cybersecurity Fundamentals

Cyber security is the discipline that aims at providing security of computer systems, networks, applications, and digital data from unauthorized access, misuse, disruption, or destruction. In contemporary companies like Internet Service Providers (ISPs) and cyberspace, cybersecurity is a key element in providing assurance. data integrity, continuous operations and service reliability [1].

Core Concepts of Cybersecurity

Cybersecurity rests on the CIA Triad that outlines three crucial. security principles [2]:

Confidentiality: Ensures that sensitive information like customer data, authentication credentials, and system configurations are confidential and can be accessible only to authorized users.

Integrity: Deals with the accuracy and reliability of information by deterring unauthorized alteration of data at storage or transmission.

Availability: Provides that systems, networks, and data are available to necessary, authorized users.

All three principles should be applied in a balanced manner since a weakness in one of them. area may undermine the security of the system in general.

Network Security

Network security is concerned with protecting communication channels and network infrastructure from threats. Since ISPs manage large-scale and distributed networks, network security is a vital component of their operations [2]. Key learning areas included:

- **Firewalls:** Used to monitor and filter incoming and outgoing traffic based on predefined security rules to prevent unauthorized access.
- **Access Control Mechanisms:** Restrict network access based on user roles and authentication policies.
- **Antivirus and Anti-malware Solutions:** Detect and remove malicious software before it spreads across the network.
- **Network Monitoring:** Continuous monitoring helps identify abnormal traffic patterns, potential intrusions, and service disruptions.

These practices highlighted the importance of layered security and proactive monitoring in reducing network-based threats.

Application Security

Application security is concerned with security of software applications. that attackers can take advantage of. I got to know that a network can be secure and yet not used properly. Systems can be vulnerable to cyberattacks through application configuration exposure [1] Systems can be vulnerable to cyberattacks through exposure to application configuration. Important concepts included:

- **Secure Configuration:** Turning off unneeded services and features to reduce the attack surface.
- **Authentication and Authorization Controls:** Making sure that users are authenticated and authorized. authenticated and accessed depending on assigned roles.

- **Data Leakage Protection:** It is the prevention of unauthorized access to Vulkanize app data with adequate policies and controls.

These measures are essential for protecting web portals, email systems, and internal applications.

Vulnerability Assessment

Vulnerability assessment is an organized procedure that is designed to detect vulnerabilities in systems, networks, or applications the attackers are not allowed to exploit them first [1]. Key learning points included:

- Find outdated software and configuration problems.
- Automated vulnerability assessment tools scanning systems.
- Organizing vulnerabilities according to the level of seriousness and possible effect.

This process helps organizations prioritize security improvements effectively.

Penetration Testing

Penetration testing is an ethical effort to exploit vulnerabilities in a controlled environment to assess the effectiveness of the current security controls [2]. At the beginner level, I learnt that:

- Penetration testing is performed with due approval.
- It is a simulation of real world attack scenarios.
- The use of findings to enhance defense and security policies.

This approach helps validate whether security mechanisms function as intended.

Continuous Security Practices and Awareness

Among the most important lessons of the internship was that cybersecurity is an. continuous, not a one-time arrangement. The cyber threats are dynamic, and as a result, they keep on changing. updating of the system, monitoring, training employees and reviewing of policies all necessary [1]. I also discovered that awareness of the users is paramount, since even powerful technical. phishing, use of weak passwords, or unprotected browsing can be used to compromise controls. practices.

5.2 Tools and Technologies

Through my internship experience with Bangladesh Online (BOL), I learnt on the job and the experience of multiple professional tools and technologies that are commonly used in the Internet. Managed IT service organizations and Service Providers (ISPs). These tools play a essential part of performance monitoring and fault detection of a network, bandwidth network documentation, and management. The collaboration with these platforms assisted me know how big enterprise and ISP networks are tracked and maintained efficiently.

5.2.1 Network Monitoring Tools

Network monitoring is a crucial aspect of ensuring the stability and reliability of internet services. The functional purpose of was taught during the internship. various monitoring systems of the technical support team.

Nagios: Nagios is an open-source monitoring system that is employed to monitor the availability of. network services and servers. I got to know how it identifies failures in the system and transmits. notifications on outages of services, which allows monitoring in advance and responding faster. to network issues [16].



Figure 5.7: Nagios Logo

Cacti: Cacti is a monitoring instrument of the performance based on SNMP to monitor data of the network. display it graphically. It is primarily applied to examine bandwidth consumption, traffic flow. and long-term performance trends. The graphic charts assist the engineers to determine. uncharacteristic traffic patterns and capacity problems.



Figure 5.8: Cacti Logo

WhatsUp Gold: WhatsUp Gold is a network monitoring service and device that is real time. I noted how it can be used to monitor device uptime, visualize network topology, and create. alerts, which is a centralized and efficient network management.



Figure 5.9: Whatsup Gold Logo

Allot: ISPs use allot to monitor traffic and control bandwidth. Through training, I learned how Allot can detect the various kinds of application traffic and helps control bandwidth usage to maintain fair usage and service quality for customers.

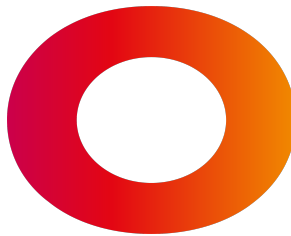


Figure 5.10: Allot Logo

5.2.2 Network Documentation and Design Tool

Microsoft Visio: Network diagrams are designed using Microsoft Visio, which graphically depicts networks. architecture. I was taught the importance of effective

documentation to assist engineers in getting knowledge. location, connection and flow of data and the way it facilitates good performance. troubleshooting and planning [2].



Figure 5.11: Visio Logo

Table 5.1: Tools and Technologies Used During Internship

Tool Name	Description
Nagios	Used to monitor servers, network devices, and services. It generates alerts when systems or services become unavailable.
Cacti	Network monitoring and graphing tool based on SNMP, used to visualize bandwidth usage, traffic patterns, and performance trends over time.
WhatsUp Gold	Network management tool that provides real-time visibility of network devices, uptime monitoring, topology mapping, and alerting.
Allot	Traffic analysis and bandwidth management tool used by ISPs to identify application-level traffic and ensure quality of service (QoS).
Microsoft Visio	Diagramming tool used for creating network diagrams to document network layout, device placement, and data flow.

5.2.3 Support Learning and Practical Experience

My hands-on learning experience in Bangladesh Online (BOL) during my internship program provided me with different operational technical support experiences. These possibilities enabled me to put into practice networking concepts in real-world ISP settings as well as enhance my analytical thinking skills and professional communication skills.

Some of the internet speed-related problems with which I had to deal with due to CPU usages, bandwidth usages and through bandwidth monitoring usages, I observed how bandwidth usages can result in slowing down internet speed even when the network infrastructures are well set up. The experience supported my knowledge about traffic analysis, the ideas of fair use, and the necessity of appropriate guidance to the client.

In addition, I learned how to distinguish between problems that were caused by the ISP network or the client-side network based on the systematic technical analysis. I also got practical knowledge in troubleshooting router misconfigurations and related to wireless frequencies, especially the difference in performance of 2.4 GHz and 5 GHz wireless networks.

5.3 User Guideline

In my internship with Bangladesh Online (BOL), I was able to use several professional tools to monitor and manage the activities of the network instead of using a software application. Therefore, the user guide will focus on generic procedures to be used when utilizing tools in network operations.

It is also recommended that anybody accessing a monitoring and management system should have proper login credentials and access to provide them with security because most of the ISP systems are role-based and they do not allow any unauthorized access to log in. Users are not to log in using unsecured networks and share logins.

In the case of such tools as Nagios, Cacti, and WhatsUp Gold, it is paramount to make sure that their users check the state of network components and servers on a regular basis with the help of the dashboard that the tools offer them. The alerts, warnings, and critical notifications should be verified immediately since these

inform about the potential service disruptions or down situation. Users should be aware of the meanings of alert colors and critical levels to give priority to tasks appropriately when handling alerts.

When dealing with Cacti, one should pay attention to the performance reports which contribute to the analysis of bandwidth usage. Graphs can give an understanding of abnormal traffic patterns and capacity planning of the network. It is recommended to carry out historical comparison of performance degradation by the users.

In the case of WhatsUp Gold, the suggested options are to use the provided real-time monitoring and topology map to monitor network availability and connection status. This will enable the users to readily identify which specific device or connection can be the source of the network issue.

When communicating with the services offered by Allot it is advised to be familiar with general concepts of classifying and controlling bandwidth. Application-level communications should be analyzed judiciously using the software and the usage policies should be handled responsibly.

Microsoft Visio may be used as a tool in creating and updating network diagrams as part of network documentation. Users must make sure that the network diagrams reflect the real network topology of the devices, links and IP addresses.

Generally, system change operations will involve standard operational procedures obliging users to escalate issues to senior engineers when there is need.

5.4 Impact of the Internship

My experience as an intern at Bangladesh Online (BOL) was valuable in terms of gaining skills and in helping the organization to achieve its organizational objectives. I actively participated in helping the organization with the operations of ISP tools and systems.

I assisted in the network monitoring activities, which ensured that the services were available all the time by analyzing the alerts, monitoring the trends of traffic, and reporting early in advance the possible problems that might develop into major service disruptions. This directly underpinned the mission of BOL to provide continuous internet services to its customers.

Hands-on experience with bandwidth management and traffic analysis software like Allot and Cacti helped me understand better how ISPs achieve service quality and implement fair usage. This is in line with the goal of the organization which is to ensure that network performance in the various segments of customers is optimized.

Moreover, I worked on network diagram design and documentation with Microsoft Visio which enhanced the precision of network structure representation. Documentation of the systems is crucial in the work of the engineers when troubleshooting, upgrading, and even planning of an expansion of the long-term infrastructure at BOL.

Personally, the internship reinforced my networking, monitoring systems, and cybersecurity awareness skills. It also helped me increase my confidence in working with professional-level tools and get a better idea of how ISP-level operations work, which will be vital in my future career in networking and cybersecurity.

5.5 Socio-Economic Impact of ISP's in Bangladesh

Internet Service Providers (ISPs) are also important in the socio-economic development of Bangladesh since they can provide extensive access to digital connectivity, information and communication services. Socially, ISPs play a great role in closing the digital divide through the extension of internet to cities and rural regions. This enhanced interconnectedness promotes education enhancement via e-learning systems, health care service provision via telemedicine and communication and cooperation via social networks and electronic communication platforms. Consequently, people and societies become more informed and this fosters digital literacy, sharing of knowledge and a general increase in the quality of life.

From an economic perspective, ISPs are a key enabler of digital transformation and business development in the country. Fast and stable internet connectivity helps the development of e-commerce, freelancing, distant work, and online entrepreneurship, creating new job sources and sources of income. In addition, the organizations in different industries largely rely on stable internet connectivity to conduct business activities efficiently such as communication, cloud computing, data management and delivery of online services. This improves productivity, operational efficiency and global competitiveness. Moreover, the growth of ISP

infrastructure is also a contributor to the development of the IT and telecommunications sector, which draws investment and creates innovations. In general, ISP's become one of the key sources of social inclusion and economic progress in Bangladesh.

Chapter 6

Conclusion , Limitation & Recommendation

This chapter is a general overview of the internship experience with Bangladesh Online (BOL) and more specifically the key findings that have been obtained in the light of the hands-on learning experience in terms of the technical support and networking operations.

Moreover, the limitations, which were encountered at the internship period, are also discussed in this chapter. Specifically, operational and access limitations which affected the level of exposure throughout the internship program are also discussed. Also, constructive recommendations are available on how to enhance the program.

6.1 Conclusion

The internship experience at Bangladesh Online (BOL) was a priceless learning experience as it helped me fill the gap between theoretical knowledge and practical ISP operations. Being actively engaged in network monitoring, routing, cyber-security concepts, and technical support practices gave me a clear insight into how professional ISPs operate and ensure the provision of reliable internet services.

Application of industry standard tools like Nagios, Cacti, WhatsUp Gold, Allot, and network design software was very helpful to my technical skill set. The observed and helped support cases did not only help me enhance my analytical and troubleshooting skills, but also taught me to be a more effective team player and communicator. Generally, the internship helped me to gain insights into networking

and cybersecurity, as well as preparing me to take on career opportunities in the IT and network-related domains in the future.

6.2 Limitations

Despite the fact that the internship has been a very good learning experience, a number of constraints were faced in the process of the training.

One of the significant challenges was transportation. Whereas permanent workers were given transportation facilities, the same could not be said about interns. This forced me to get out of the house early in the morning and to get out late in the night and this was physically exerting.

The other limitation was the limited access to important systems and settings in the technical support department. I did not have access to production environments because of security policies and the need of confidentiality. These restrictions were needed to safeguard client infrastructure; however, they constrained my practical exposure to technical advanced operations.

Also, lack of time and information about confidentiality did not allow participating in high-level troubleshooting and decision-making.

6.3 Recommendations

On the basis of my internship experience, following recommendations are suggested:

The organization can think about offering transport facilities to some extent to the interns to enhance comfort, safety and productivity.

It would be of great help to interns to be able to access a supervised lab or testing environment. This would enable interns to train configurations and troubleshooting methods without interfering with production systems in real-time, and thus improving hands-on learning.

Appendix



Figure 6.1: Offer Letter

References

- [1] K. C. Laudon and J. P. Laudon, *Management Information Systems: Managing the Digital Firm*, 16th ed. Pearson Education, 2020.
- [2] A. S. Tanenbaum and D. J. Wetherall, *Computer Networks*, 5th ed. Pearson Education, 2011.
- [3] Bangladesh Online Ltd., “Products and services overview,” 2024, internal Company Documentation.
- [4] BEXIMCO Group, “Information technology,” <https://www.beximcoltd.com/information-technology>, 2024, accessed: Jan. 2025.
- [5] Bangladesh Online Ltd., “About bangladesh online,” <https://www.bol-online.com/about>, 2024, accessed: Jan. 2025.
- [6] W. Stallings, *Network Security Essentials: Applications and Standards*, 6th ed. Pearson, 2017.
- [7] J. F. Kurose and K. W. Ross, *Computer Networking: A Top-Down Approach*, 7th ed. Pearson, 2017.
- [8] T. Hicks, *Designing Large Scale LANs*. O’Reilly Media, 2000.
- [9] National Institute of Standards and Technology, “Computer security incident handling guide,” NIST Special Publication 800-61 Rev. 2, 2012.
- [10] Acronis International GmbH, “Cybersecurity and data protection solutions,” <https://www.acronis.com/en/>, 2024, accessed: Jan. 2025.
- [11] Kualitek Communications, “Internet connection through radiolink,” <https://kualitek.com/en/internet-radiolink/>, 2020, accessed: Jan. 2025.

- [12] Linux Documentation Project, "Linux filesystem hierarchy standard," https://refspecs.linuxfoundation.org/FHS_3.0/fhs-3.0.pdf, 2015, accessed: Jan. 2025.
- [13] Red Hat, Inc., "Introduction to linux system administration," https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/, 2024, accessed: Jan. 2025.
- [14] D. R. Stinson, "Cryptography: Theory and practice," CRC Press, 2006, accessed: Jan. 2025.
- [15] W. Stallings, "Cryptography and network security: Principles and practice," Pearson Education, 2017, accessed: Jan. 2025.
- [16] Nagios Enterprises, "Nagios core documentation," 2023, available online.

ORIGINALITY REPORT

11%

SIMILARITY INDEX

8%

INTERNET SOURCES

5%

PUBLICATIONS

8%

STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to University of Liberal Arts Bangladesh Student Paper	4%
2	Submitted to Doncaster College Student Paper	<1%
3	Richard Fox, Wei Hao. "Internet Infrastructure - Networking, Web Services, and Cloud Computing", CRC Press, 2017 Publication	<1%
4	Submitted to Purdue University Student Paper	<1%
5	Submitted to NCC Education Student Paper	<1%
6	Submitted to Emirates Aviation College, Aerospace & Academic Studies Student Paper	<1%
7	Submitted to Westford School of Management Student Paper	<1%
8	www.coursehero.com Internet Source	<1%
9	www.ranna.com.tr Internet Source	<1%
10	patents.justia.com Internet Source	<1%

11	Submitted to Liverpool John Moores University Student Paper	<1 %
12	Submitted to Hanzehogeschool Groningen Student Paper	<1 %
13	Submitted to University of Luton Student Paper	<1 %
14	download.zyxel.com Internet Source	<1 %
15	ms.codes Internet Source	<1 %
16	www.scalahosting.com Internet Source	<1 %
17	Submitted to Central Queensland University Student Paper	<1 %
18	David Both. "Using and Administering Linux: Volume 1", Springer Science and Business Media LLC, 2020 Publication	<1 %
19	Submitted to Golden Gate University Student Paper	<1 %
20	Submitted to University of Sydney Student Paper	<1 %
21	evidhya.com Internet Source	<1 %
22	hostingnewsdaily.com Internet Source	<1 %
23	Submitted to University of Ulster Student Paper	<1 %
24	inscricao.faculdadeitop.edu.br Internet Source	<1 %

25	www.fastercapital.com Internet Source	<1 %
26	www.safaribooksonline.com Internet Source	<1 %
27	Submitted to Manipal University Jaipur Online Student Paper	<1 %
28	Robert M. Koretsky. "Raspberry Pi 5 System Administration Basics", CRC Press, 2025 Publication	<1 %
29	idoc.pub Internet Source	<1 %
30	Submitted to Colorado Technical University Online Student Paper	<1 %
31	blog.acer.com Internet Source	<1 %
32	catalog.depaul.edu Internet Source	<1 %
33	GS Jha. "Securing the Enterprise", Springer Science and Business Media LLC, 2025 Publication	<1 %
34	Submitted to Hong Kong University of Science and Technology Student Paper	<1 %
35	eoxs.com Internet Source	<1 %
36	www.powtoon.com Internet Source	<1 %
37	Submitted to Manipal University Student Paper	<1 %
38	Matthew N. O. Sadiku. "Optical and Wireless Communications - Next Generation	<1 %

Networks", CRC Press, 2018

Publication

39	n-eye.capcom.com.hk Internet Source	<1 %
40	theycybersecguru.com Internet Source	<1 %
41	Submitted to University of Manouba Student Paper	<1 %
42	dokumen.pub Internet Source	<1 %
43	ipj.dreamhosters.com Internet Source	<1 %
44	ireeder.ahu.edu.jo Internet Source	<1 %
45	msbtenotesbooks.wordpress.com Internet Source	<1 %
46	noexperiencenecessarybook.com Internet Source	<1 %
47	pub.deadnet.se Internet Source	<1 %
48	thenucleargeeks.com Internet Source	<1 %
49	vdoc.pub Internet Source	<1 %
50	Submitted to Arab Open University Student Paper	<1 %
51	Patricia A. Morreale, Kornel Terplan. "CRC Handbook of Modern Telecommunications", CRC Press, 2019 Publication	<1 %

52 Vldas Leonas, Sorin Toma. "Cyber Insecurity - Examining the Past, Defining the Future", CRC Press, 2025
Publication <1 %

53 archive.org
Internet Source <1 %

54 de Oliveira, Vasco Mota. "ABC Unified Communications: Integration with Microsoft Teams.", Universidade do Minho (Portugal)
Publication <1 %

55 git.kjodle.net
Internet Source <1 %

56 m.moam.info
Internet Source <1 %

57 www.indianamedicaid.com
Internet Source <1 %

58 www.worldscientificnews.com
Internet Source <1 %

59 Udo W. Pooch, Denis Machuel, John McCahn. "Telecommunications and Networking", CRC Press, 2018
Publication <1 %

Exclude quotes Off

Exclude matches Off

Exclude bibliography On