National Apprentice & Industrial Training Authority

Report on Industrial Training

At

Sri Lanka Telecom PLC

Kurunegala

Wayamba University of Sri Lanka

Kuliyapitiya

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PREFACE

In the B.Sc. in Applied Science program at Wayamba University of Sri Lanka, industrial training plays a vital role in bridging the gap between theoretical learning and real-world application. The Faculty of Applied Sciences equips undergraduates with essential work experience, bridging the gap between academic theory and professional practice. Through strong collaborations with industry partners and organizations, students gain practical skills, adapt to workplace environments, strengthen their problem-solving abilities, and build confidence to excel in their future careers. This approach fosters a holistic development, enabling students to seamlessly transition from academic settings to real-world challenges.

I had the privilege of completing my industrial training at Sri Lanka Telecom PLC from 27.05.2024 to 26.11.2024, fulfilling a key requirement of my academic program. During this period, I worked as a trainee in various departments, including the Rehabilitation Unit, ADSL Section, and Planning Section, among others. My training provided hands-on exposure to cutting-edge telecommunication technologies, such as MSAN systems, LTE/GSM architecture, and optical fiber systems.

This experience enriched my technical expertise, particularly in troubleshooting, system configuration, and network maintenance, while offering valuable insights into customer connectivity needs and operational efficiency. Additionally, the opportunity to engage with experienced professionals strengthened my problem-solving abilities, teamwork skills, and overall professional demeanor, making this training an indispensable part of my educational journey.

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LIST OF ABBREVIATIONS

- IPTV Internet Protocol Television
- CEO Chief Executive Officer
- GM General Manager
- DGM Deputy General Manager
- PSM Provincial Sales Manager
- OPMC Outside Plant Maintain Center
- RTOM Regional Telecom Office Manager
- SEAE Senior Executive Assistant Engineer
- PSTN Public Switched Telephone Network
- SAE Senior Assistant Manager
- AE Assistant Engineer
- ADSL Asymmetric Digital Subscriber line
- CDMA Code Division Multiple Access
- MDF Main Distribution Frame
- MSAN Multi-Service Access Node
- FTTX Fiber to the X
- DSL Digital Subscriber Line
- VDSL Very High Bit rate Digital Subscriber Line
- ODF Optical Distribution Frame

- DP Distribution Point
- AON Active Optical Network
- PON Passive Optical Network
- OLT Optical Line terminal
- STB Set Top Box
- OTDR Optical Time Domain Reflector
- OPM Optical Power Meter
- ONT Optical Network Terminal
- SLBN Sri Lanka Back born Network

- CEA Carrier Ethernet Network
- MPLS Multi-Protocol Label Switching
- VOIP Voice over IP
- BTS Base Transfer Station
- BBU Base Band Unit
- RRU Remote Radio Unit
- RAN Radio Access Network

CHAPTER 01

1.1 Introduction

1.1.1 Introduction of Sri Lanka Telecom

Sri Lanka Telecom (SLT) is a leading provider of telecommunications and digital services in Sri Lanka, established in 1991. With a rich history, SLT has embraced technological advancements to deliver innovative solutions, including landline telephony, broadband internet, mobile services, and digital solutions. With extensive network infrastructure, including fiber optic cables, mobile towers, and data centers, SLT enable seamless connectivity and empowers businesses in the digital age. Its commitment to reliability, affordability, and customer satisfaction has earned the trust and loyalty of millions of Sri Lankans.

SLT, a leading telecommunication company in Sri Lanka, offers a range of value-added services including IPTV, cloud computing, cyber security, and enterprise solutions. Its strategic partnerships with global technology providers and focus on research and development enable it to stay ahead of the curve, offering innovative solutions that drive economic growth. As Sri Lanka embraces digital transformation, SLT remains committed to providing reliable, high-speed connectivity and digital solutions that enrich lives and drive progress.

Figure 1. 1: SLT Logo

1.2 Vision and Mission

1.2.1 Vision of SLT

All Sri Lankans seamlessly connected with world-class information, communication and entertainment services.

1.2.2 Mission of SLT

Your trusted and proven partner for innovative and exciting communication experiences delivered with passion, quality and commitment.

1.3 Company Background/History

Sri Lanka Telecom (SLT) is the leading telecommunications service provider in Sri Lanka. Established in 1858, it has a rich history that traces back to the early days of telecommunication in the country.

Early History

- 1858: The first telegraph line was established, connecting Colombo and Galle.
- 1900: The first telephone exchange was introduced in Colombo, marking the beginning of telephone services in Sri Lanka.

Establishment of SLT

- 1991: Sri Lanka Telecom was officially formed as a public limited company, evolving from the government's Department of Telecommunications.
- 1997: SLT was partially privatized, with the government retaining a significant stake. This move aimed to improve efficiency and services.

Growth and Development

- 1990s-2000s: SLT expanded its services to include mobile telecommunications, internet services, and broadband. The introduction of ADSL in 2003 marked a significant development in broadband services.
- 2002: SLT launched its mobile subsidiary, Mobitel, which has since become one of the prominent mobile service providers in the country.

Recent Developments

- 2010s: SLT focused on enhancing its infrastructure, investing in fiber optic technology to improve internet speeds and coverage.
- 2019: SLT launched 5G trials, preparing for the next generation of mobile communication.

Current Status

Today, Sri Lanka Telecom offers a range of services, including fixed-line, mobile, broadband, and enterprise solutions. It plays a crucial role in the telecommunications landscape of Sri Lanka, contributing to the country's digital transformation.

1.3 Organizational management structures and reporting procedures

1.3.1 Organization Structure of Sri Lanka Telecom

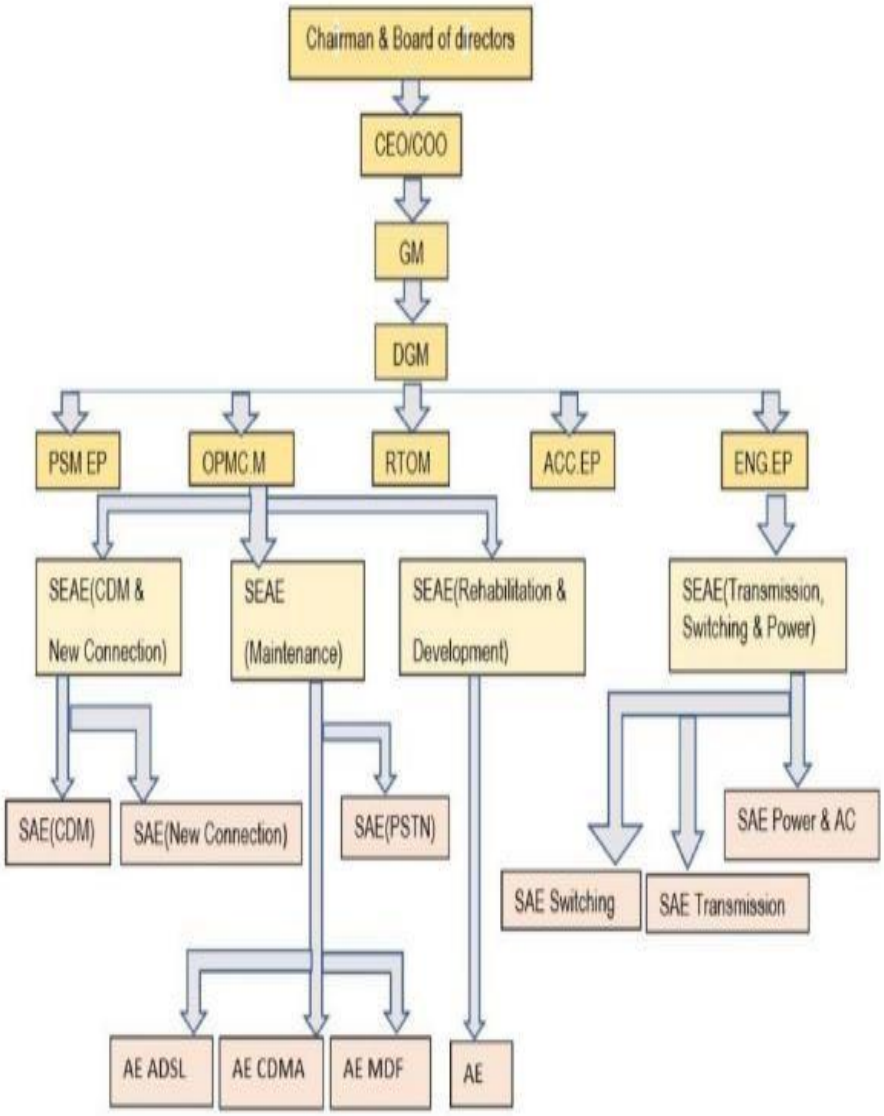


Figure 1. 2: Organization structure

1.4 Work progress monitoring techniques

1.4.1 Services offered by SLT

1.4.1.1 Principal lines of business

While undertaking the innovations, the SLT Group provides different services and several ICT solutions to its many customers. Among them are fixed telephones and mobiles fixed broadband and data and voice services Internet protocol television.

That encompasses Internet Protocol Television (IPTV) cloud solutions, hosting & networking solutions. The direction management of the organization can be described as follows: The main source of SLT's strategic management can be mainly identified from the following strategic business unit.

- Fixed ICT operations
- Mobile ICT operations
- Other segment operations

The largest line is fixed and mobile industries of ICT operation which on average contribute 98% of total income, 98% of total assets and 97% of total capital expenditure in the year 2020 of SLT Group.

1.4.1.2 Secondary lines of business

The scope of SLT as it embarked on its transformation from an ICT serving company to a digital services company has not only broadened into the offering of products and services that utilize on its core competencies, specialized capabilities, and resources. IPTV networks and production of similar content. ICT infrastructure and system integrator serviceTertiary educational services as external organization/delivery system. Healthcare channeling solution into a digital service provider, SLT has expanded beyond ICT services to deliver products and services that utilize its core strengths, expertise, and assets. SLT offers the following services through its subsidiaries:

- IPTV services and content creation facilities
- Human Resources solutions
- ICT infrastructure and system integrator solutions
- Digital marketing solutions
- Tertiary educational services
- Healthcare channeling platform
- Submarine cable maintenance
- Software solution

1.4.1.3 SLT Customer packages

SLT offers numerous sorts of Packages to the clients. They bring new technologies to enhance satisfaction of the customers. Besides this they offer 24 hours customer service for reduces the inconvenience of telecommunication.

1. Megaline

2. Broadband

3. Peo TV

4. IDD

1.5 Administrative practices and stakeholder interaction

1.5.1 Management Style

1.5.1.1 EPF (Employee Provident Fund)

All employees in SLT employee provident fund belong to the Sri Lanka Telecom limited to which they pay 15% part payment for basic salary and allowances. All employees of subsidiaries of the Group are members of EPF to which the respective subsidiaries contributes 12% total emoluments of such employees.

1.5.1.2 Recruitment

For open positions, SLT typically requests applications via print media, such newspapers.

The personnel will be chosen among the applications based on the job requirements.

1.5.1.3 Leaves

Each employee of the company and the employees own the company and in SLT any number of employees can apply leave for Private Business or for other Genuine reason upto [Thirty-five (35)] DAYS from the joining in the company only. Fishery 35 schedule included 7 casual days and 14 sick days in a year apart from above mentioned 14 days casual leave.

1.6 Safety Practices

- Always utilize the right instruments, machinery, or procedures for the job.

- A well-thought-out first aid reaction has a company.
- Wearing safety equipment is required when performing tasks.
- Risky equipment, such as a fiber spicing machine, can be used by experts.

1.6.1 Safety Rules - Working with Fiber Optical Cables.

1. Able to prevent food and drinks from entering the work area. Ingesting fiber particles can result in internal bleeding.
2. Use disposable aprons to lessen the fiber content of clothes. After being on clothing, fiber shards may end up in food, drink, or other consumables.
3. Wear safety goggles with side shields and protective gloves at all times.
4. Treat splinters produced of fiber optics the same way would splinters made of glass.
5. Refrain from looking directly at fiber cable ends until you are positive there is no light source there.
6. When utilizing an optical tracer or continuity checker (visual light source) to check for visible light, examine the fiber at an angle and at least six inches away from eyes.
7. To make it simpler to find fiber remnants, work on a dark surface.
8. Only operate in areas with good ventilation.
9. Keep in mind that positioning fiber optic cable termination and splicing work locations right close to or beneath air conditioning or heating outlets may produce excessive loss measurement because the dust and dirt on the polished connectors can damage them.
10. People who wear contact lenses shouldn't handle their lenses until they've given their hands a thorough wash.
11. Wait to touch your eyes after cleaning your hands sufficiently before handling fiber optic systems.
12. Make sure that nothing combustible is anywhere near the curing ovens.
13. Store all chopped fiber particles in a container with a property label for disposal.
14. In a fiber optic area, avoid sitting on benches or knelt down.
15. Refrain from using fingers to handle fiber fragments.
16. Refrain from using hands to handle fiber fragments. Apply a light brush.
17. After finishing, make sure workspace is spotless.
18. Avoid handling fiber shards with your hands.

19. Clean your hands with soap both before and after handling fiber optic cables.

CHAPTER 02

2.1 TRAINING EXPERIENCE

I was trained as an apprentice at Sri Lanka Telecom from 27.05.2024 to 26.11.2024. During this period, I worked in 7 departments and they are listed below.

Table **2**. 1 Training shedule

Section	Period	
	From	To
Maintenance	27.05.2024	30.06.2024
Switching	01.07.2024	15.07.2024
Transmission	16.07.2024	31.07.2024
Rehabilitation	01.08.2024	31.08.2024
ADSL	01.09.2024	30.09.2024
Planning	01.10.2024	31.10.2024
New Connection	01.11.2024	26.11.2024

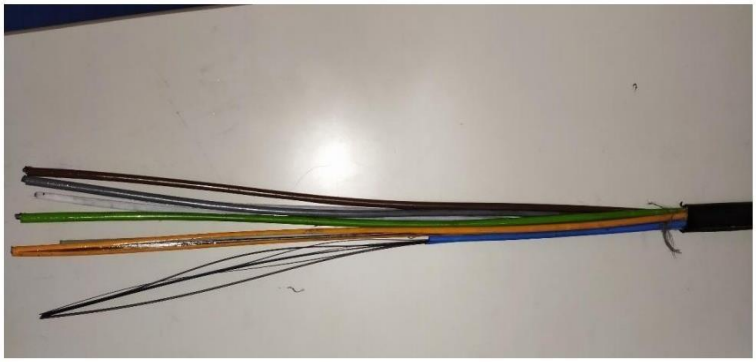
2.1 Involvement in Projects

2.1.1 Fiber Optic Cable

Optic fibers are well understood for transmitting communicated signals through a thin strand of Plastic or Glass core. The Technological advantage is: Indeed, one fabric of the optical fibers can transmits more communication signals than contrasted copper cables over a larger distance. Use of fiber optics in any other field apart from communication includes; Visual inspection; Sensors; Signs and lights. However it provides a heavy focus on data communization applications comprising of Interconnect, cable TV, telephony, LANs, Control & Industrial, Intrusion & Alarm sensors and Closed Circuit Video surveillance and other. Some of these applications have been taken up to the next higher level by this technology. It is identified on CCTV and seen in more than ½ of the cable television distributing systems, the large computer network trunks, over ¾ of all the long distance telephone services, ½ or more of the local telephone consumer services. In a fact optic fibers

can transmit more data in less time and at a much greater distance than any other communication channel. Here, the prescripts of fiber optics are enumerated.

- No electromagnetic radiation interference
- Faster data speed
- Lower weight
- Longer distances
- Smaller size
- Electrical isolation



Blue	
Orange	
Green	
Brown	
Slate	
White	
Red	
Black	
Yellow	
Violet	
Rose	
Aqua	

Figure 2. 1: Fiber optic cable colour code

2.1.2 FTTX (Fiber to the X)

FTTX is an optical Network architecture in which the fiber deployment extends to the customer premises. Fiber to the home (FTTH) implying fiber right to the home up to an internal fiber optic terminal Fiber to the Building (FTTB) which means there is no fiber in a home at all there are Fiber to the Cabinet (FTTC) where supply fiber optic cable up to cabinetried all the way to the customer premises. Customer premise “X” can either be:

- Fiber to the home (FTTH) which actually means “into the home” to internal fiber optic terminal
- Fiber to the Building (FTTB) which does not imply any fiber actually inside a home
- Fiber to the Cabinet (FTTC) which is supply fiber optic cable up to cabinet

Generally, SLT offers Fiber optic connection with speed of 100Mbps and from the connection PEO TV, Telephone, Internet service can be offer with more quality and bigger bandwidth.

2.1.3 OLT (Optical Line Terminal)

A network information system can be broadly divided into two central mean, an active optical network (AON) and passive optical network (PON).

Among these, in the case of AON the optical fiber cable is directly connected to an end-uses equipment like home or office. This data is not reproduced on any other site. But in PON system splitters are used to supply a number of Points from a specific Point while in a WDM system a number of Points supply a number of locations. However, this network must be understood this is used today primarily for FTTH (fiber to the home) markets essentially.

To state the facts even if the sizes comparing the PON network OLT, it was revealed that the values are rather considerable. It is can connected to many PON networks, and of course it each of them can support up to 32 different lines in the AP. An OLT is most commonly located in the service providers central office or data center: It is the end point of a PON substituting and interfaced with ONTs in a customer premises. This OLT that is in charge of control of physically the point of interface of network of service providers and place of customer in addition to the flow of all the date, voice and video services through the fiber optics structure.

Figure 2. 2: OLT

2.1.4 ODF (Optical Distribution Frame)

To provide the cable connection among the communication facilities an optical distribution frame (ODF) is installed. It provides the possibilities to network fiber splicing, Fiber terminating, fiber optic adaptor and connection of different fiber optic connections in this single package. It can also house as a protective device to enable the organization shield

itself from the occurrence as well. As for the functional aspects it is actually quite the opposite, however since ODF's can do everything they can be of very varied size and parameters.

Depending on the structure ODFs are of three categories.

01. Wall Mount ODF

02. Floor Mount ODF

03. Rack Mount ODF

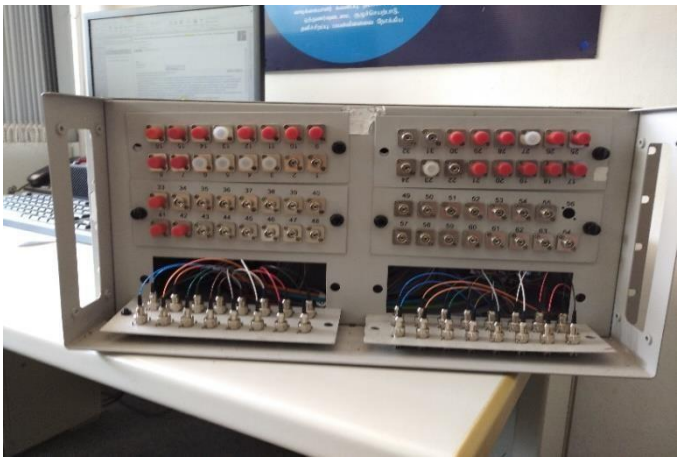


Figure 2. 3: ODF

2.1.5 Fiber Distribution Point (FDP)

A crucial component of contemporary fiber optic networks is Fiber Distribution Point.

They offer the tools to deliver optical fiber lines to specific clients' in different places. The type of splitter utilize is an FDP determines how many dispersed optical cable cables are needed. One fiber optic cable for instance, can be split in to eight dispersed optical cables using 1 to 8 splitter.

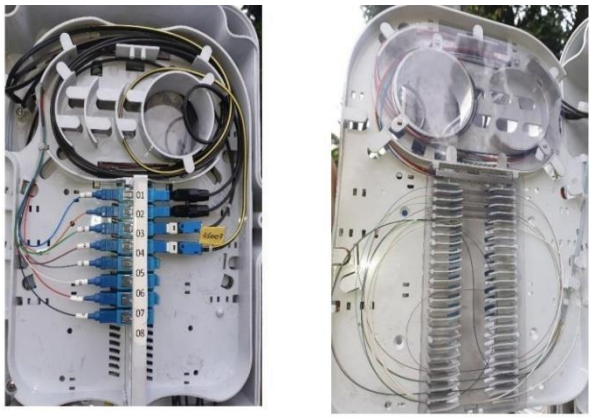


Figure 2. 4: FDP

2.1.6 FTTH Installation Diagram

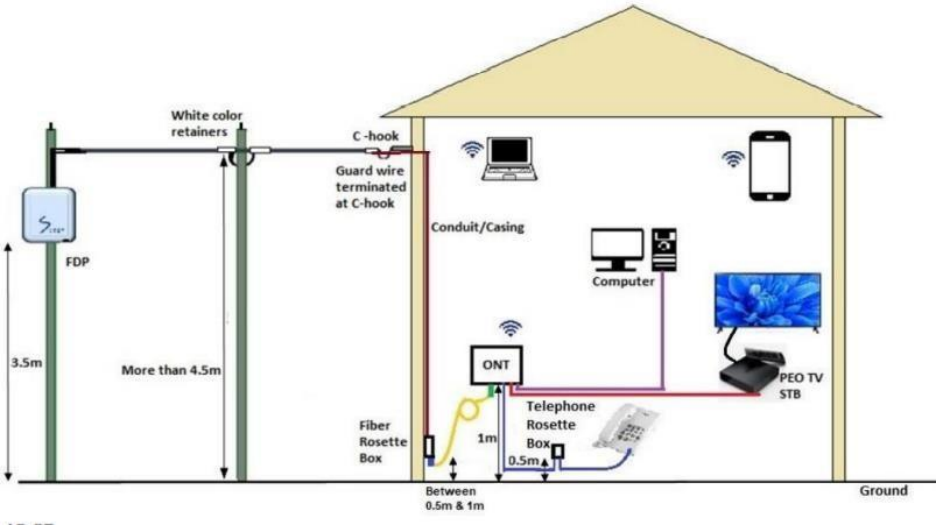


Figure 2. 5: FTTH New connection installation diagram

2.1.7 Fiber Rosette

In this fiber rosette, optical fiber drop cable joins to patch code through fiber core connector.

Figure 2. 6: Fiber Rosette

2.1.8 Optical Network Terminal (ONT)

More particularly, an ONT or fiber box is not a router or a modem which at times are also small white boxes. Unlike the ONT, chorus is a piece of hardware that chorus offers and Chorus deliver while the customer modem or routers that are offered by internet service providers or in other words the customer buys these devices on their own.

These connects directly to the ONT, and is commonly used to provide translation of general broadband signal deployed from the ONT to inmate home network. This is home network whereby modem or router is establishing an internet connection on devices, appropriately in a house whose modem enables internet connection wirelessly with the use of radio frequence of Wi-Fi or via Ethernet cable.

.

Figure 2. 7: ONT

2.1.9 Set Top Box

A set top box is an appliance which the users can use in order to find some of the videos from certain internet video service providers via the Internet. Today STB has many types and capabilities; it is a receiver and demultiplexer of the signals and broadcasts and the means for the receipt or supply of cable or satellite TV service, the transmission or receipt of the Internet connection through a cable or telephone line. These uses in not only in FTTH but in the ADSL line as well They use it in transmission over short distances and in downstream transmission specially in VDSL.

Figure 2. 8: STB

2.1.10 Telephone

Telephonic is employed in put across of information to another person Used in put across of information to another person. From it four circuits can be distinguished Receiving circuits, Transmission circuits, Dialing circuits and Ringing circuits.

- Receiving circuit: Electrify in the same way an electric signal as an audio signal is electrified or boosted.
- Transmission circuit: The mode of operation of the device wherein sound waves are converted into electrical impulses.
- Dialing circuit: Integrated keypad is feasible to deliver short voltage pulses on any of the numeral buttons, while beeps for button increases sound.
- Ringing circuit: – Could only ring off if there is a ring, has vibrations if there is a ring.

Figure 2. 9: Telephone

2.1.11 Types of fiber connectors

An optical fiber connector ends an optical fiber and can be connected and disconnected much more rapidly than joining. Connection features mechanically join and gel the cores of fibers in a way that allows light to pass through Even connectors mechanically connect and bring the cores of fibers to a position that will allow light to pass through. Greater connectors therefore cause reflection or improper alignment of the fiber; whereby the signal loses a meager amount of light. There are so many fiber connectors out in the real world. The article shows that in SLT is mainly used only three of connectors.

1. LC – Lucent connector (Most used)
2. FC – Ferrule connector (Most used)

3. SC – Square/Standard connector (Most used)
4. ST – Straight tip connector

Figure 2. 10: Types of fiber connectors

2.1.12 Fiber Patch Code

Optical jumper: fiber optic patch cord is a fiber cable with connectors on both ends of personal cables and convenient to link to CAT V, an optical switch or other telecommunication equipment. This is a very strong layer of protection hence used in establishing of the optical transmitter the optical receiver and the terminal box.

A patch code by the transmission mode is an optical fiber.

01. Single mode fiber patch code

In single mood fiber, one type of light mode is propagated at a time. It use laser diodes and used in long distance transmissions core diameter 9µm.

02. Multi-mode fiber patch code

In multimode fiber, it can propagate multiple modes. Light source like LED is sued and used for short distance transmission core diameter 50µm.

Figure 2. 11: Single mode fiber patch code

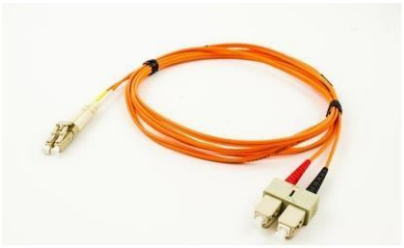


Figure 2. 12: Multi mode fiber patch code

2.2 Theoretical engineering concepts with practical applications

2.2.1 Optical Fiber Cable Jointing

There are two methods of jointing fiber cables.

01. Mechanical Splicing
02. Fusion Splicing

Before any above splice, there is preparation for Optical Fiber cable.

- Strip the Cable Jacket using Cable Stripper.
- Strip the Fiber Cladding using Cutting Jig.
- Clean with Acetone to remove Dirt.
- Cleve the Fiber using Cleaver.

2.2.2 Fiber Splicing Equipment

There is main fiber splicing Equipment.

- Fusion Splicer

- Hot Jacket Remover
- Fiber holder
- Cleaver
- Stripper
- Fiber Protection Sleeves

2.2.2.1 Fusion Splicer

Fusion splicing is the working that is done between the end to end or joining of the two optical face of the fiber recognition an ideal end product of this process is that any light which passes through the said Optical fibers should not bounce off the splice, and on the other hand the mechanical strength of the splice and the size of the splice joint should resemble the fiber as closely as possible.

Figure 2. 13: Fusion splicer

2.2.2.2 Hot Jacket Remover

We used to hot jack remover for remove fiber cable Rubber mask.

Figure 2. 14: Hot jacket remover

2.2.2.3 Fiber Holder

Fiber holder used for keeping the fiber cable in the Fusion Splicer. There are many types of holders. FHS – 09(patch code), FHS – 04(Ribbon fiber), FHS – 025(single fiber).

Figure 2. 15: Fiber holder

2.2.2.4 Cleaver

If properly employed the fiber will break or splinter crosswise lying across the face in the position of the intended location it will not be necessary to use the glass stringer or lip. Another example is the ferrule cutter: implements that only require moderate sleek to thread a fiber across an area at the same time as a high force is used to set the fiber to clicks.

Figure 2. 16: cleaver

2.2.2.5 Stripper

Removing the polymer coating that protects optical fiber in advance of fusion splicing is known as stripping.

Figure 2. 17: Stripper

2.2.2.6 Fiber Protection Sleeves

When fusion splicing two fibers together, Fiber Protection Sleeves are frequently utilized. Following the completion of the splice, the protection sleeve is intended to shield the exposed fiber and splice joint.

Figure 2. 18: Fiber protection sleeves

2.2.3 Mechanical Splicing

This method based on a mechanical alignment of two cleaved fiber ends. This is the method that terminating Fibers on to a Connector. If Splice is done correctly, Loss will be less than 0.5dBm.

Figure 2. 19: Mechanical splicing

2.2.4 Fusion Splicing

This Method is done with Splice machine and normally these machines produce Splice with loss less than 0.05dBm

After the Cable preparation, ends of the two cables have to insert in to the splice machine. In the Splice machine, first melt inside and then connects two ends. Then heat sinking sleeve is used to cover the joint.

Figure 2. 20: Fusion splicing

2.3 Design, development, and testing participated in or observed

2.3.1 Planning section

Presently, SLT has three large career areas; On first instance, OPMC is delivered by the section in activity planning. This report of the division in crucial to the corporation to ensure that it supports the core business of SLT for instance: whereby once the strategic leadership team of an organization has agreed to undertake a new project it should be able to support it with the funds generated from the project business. That is why this is and here is the central place of this section to present how the Achieving happens of the corporate profit for the company and the customer satisfaction.

2.3.2 Base Transfer Station (BTS)

Mobile networks for the most part encompass base transceiver stations that in simplest terms are fixed radio transceivers. In case of the establishment of the BTS the BTS can be best described as the place where portable equipment interconnect to the network. This transmits and receives radio signals to portable machine and transmits or translates the radio signals into the digital signals and transmits the signal on the network to other terminal connect in the network or internet. three, base transfer station have more numbers of devices.

1. Base Band Unit (BBU)
2. Remote Radio Unite (RRU)
3. Antenna

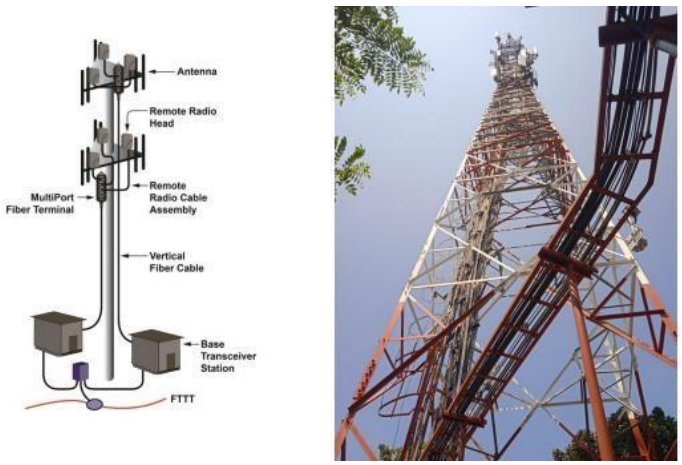


Figure 2. 21: BTS

2.3.2.1 Base Band Unit (BBU)

A baseband unit (BBU) is a telecommunications network device that uses baseband signals. Baseband is the original transmission frequency before modulation. An example of a Radio Access Network (RAN) is a BBU directly connected to one or more remote radio units (RRU), located in close proximity to the antenna. There are two basic components for a RAN, the baseband processing unit and RF processing unit. The baseband unit is often referred to as the "centralized hub" of a base station; itself managing the uplink and downlink data traffic and its connection with the remote radio unit (RRU An example of a BBU Digital signal processor (DSP) often to convert signal states from analog to digital signal processing or vice versa.

Figure 2. 22: BBU

2.3.2.2 Radio Remote Unit (RRU)

An operator's network is connected to user equipment such as cell phones and mobile devices by a distributed and integrated frequency unit called a radio remote unit (RRU).

Figure 2. 23: RRU

RRU Function

1. Serves as a transceiver, sending and receiving user signals to the base station and back again.
2. Offers delayed power and back-to-back connectivity and support for user equipment.
3. Use a jumper to control and process the electromagnetic signals that the antenna sends out.
4. Offer an interface that unites electromagnetic and optical fiber in two physical links.
5. Offer auxiliary equipment control assistance, such as the RCU (Remote Control Unit), which is commonly referred to as RET (Remote Electrical Tilt), for electrical tilt adjustment.

2.3.2.3 Antenna

These are mounted on towers or other structures and are responsible for transmitting and receiving radio signals to and from mobile devices. BTS typically have multiple antenna to provide coverage in different directions.

Figure 2. 24: GSM Antenna

Figure 2. 25: Parabolic Antenna

2.4 Maintenance, supervision of technical activities and quality control

2.4.1 Fiber testing equipment (Fault locate)

Glass-like characteristics have traditionally been applied to fiber optic cable. While the cable has been constructed to safeguard the fragile glass fiber inside, it is nevertheless more prone to breakage than a copper wire. A shattered fiber is the most frequent damage, yet it's hard to find. Yet excessive force during cable tugging or despoiling can also cause fibers to break.

2.4.2 OTDR (Optical Time Domain Reflector)

For examining the quality of fiber optic cables, the Optical Time Domain Reflect meter (OTDR) is helpful. It is able to quantify length, confirm splice loss, and identify errors. While installing fiber optic cable, an additional popular use for the OTDR is to provide a "picture" of the wire. Working Principles of OTDR A light pulse at a certain wavelength is produced by the laser and travels down the fiber under test. Along the way, some of the transmitted light is reflected, refracted, or dispersed back down the fiber to the photo detector in the optical test reflector.

Figure 2. 26: OTDR

When measuring the power of fiber optic equipment or an optical signal that is transmitted through a fiber cable, an optical power meter (OPM) is a useful tool. The optical power measurement and associated optical signal wave length are displayed on the display device.

Figure 2. 27: OPM

2.5 Hands – on experience gained through hardware/software tools, test equipment, test instruments etc.

2.5.1 Copper Line Distribution

2.5.1.1 SLT Telephone Call Function

Landline telephones dial numbers. Signals go to the Rosette box first, after the dial. There will be a discharger from the rosette box. The distribution point, or DP, will receive the signal next. Cabinet will get the message from DP. It will then be sent to MSAN after that. CEA (Carrier Ethernet Access) will receive the signal. MPLS will be the next stop after that. Toss (Soft Switch) will be used from MPLS. An indicator that connects and dials a number is the SS system. The above system is how telecom calls operate. The same way that ADSL and IPTV work. Every single number will be stored in the Soft Switch. MPLSs are always in communication with one another. Throughout the MPLS, IP data transport is required. How phone calls operate is shown in the following diagram.

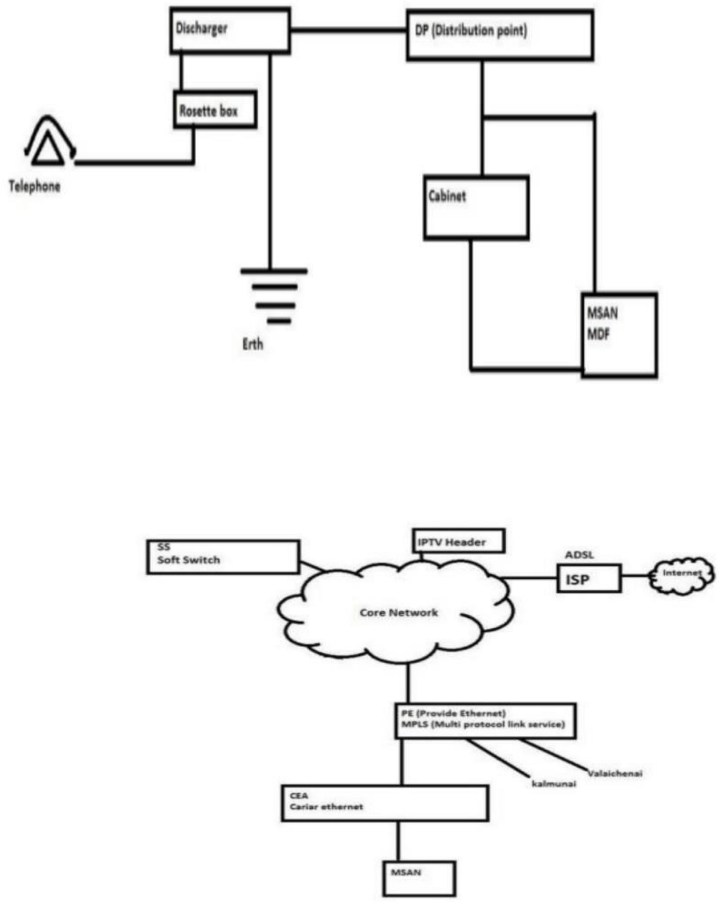


Figure 2. 28: SLT Telephone call function

2.5.1.2 General outside plant network and key components

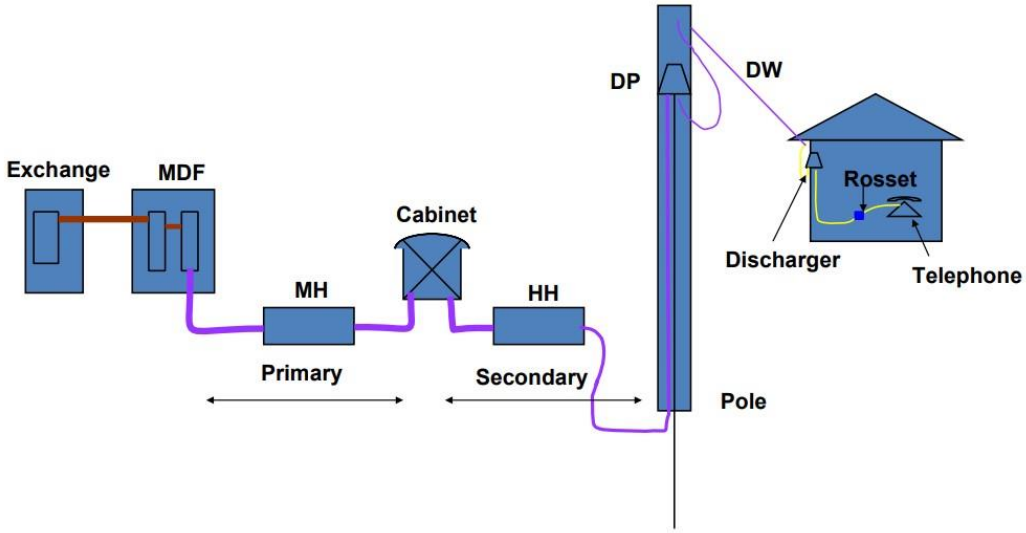


Figure 2. 29: Outside plant network

2.5.1.3 Manhole and Hand hole

The gateways for maintaining and repairing subterranean cables are manholes and hand holes. Manholes and hand holes differ primarily in that a manhole allows for repair work. Hands alone are necessary to operate a hand hole, however.

Figure 2. 30: Manhole

2.5.1.4 MDF (Main Distribution Frame)

Based on Fig. 3.32, the main flexible area is MDF, where mistakes in communication can be checked or connected or disconnected. Main distribution frame is what MDF stands for. The MDF is biaxial. Primary side refers to the side that connects exchange. Secondary side refers to another one that is linked to the customer side. The jumper wires connect the primary and secondary sides. MDF uses a -48V DC voltage, provided by the exchange side, to power up its lines. And varied depending on the jumper wires' color codes and connection type. Connectivity of Data: Red and White

Voice Links: White and blue

The Black and White ADSL Connections

Figure 2. 31: MDF

2.5.1.5 Cross Connection Cabinet

Along with connecting the MDF side and the DP/CCT side, the cabinet has a flexible point. A flexible point in the cabinet also uses jumper wires to link the MDF side and the DP/CCT side. Ten cables are released from the cabinet for a certain DP. One way to link the primary pair to the DP side pair is by utilizing jumper cables based on the client phone number. Testing and protection are done in cabinets.

Figure 2. 32: Cross connection cabinet

2.5.1.6 MSAN (Multi Service Access Node)

SLT uses MSANs from the Huawei and ZTE brands to provide broadband services like DSL and ISDN phone service from a single platform. Multi-service access nodes are devices that are normally put in telephone exchanges and connect customers' phone lines to the core network. Huawei produces every indoor MSAN in Kurunegala. Because of IP multimedia system (IMS), every type of MSAN in Sri Lanka is connected to every other type in a two-way ring for safety reasons. Two different MSAN kinds were also employed.

1) Indoor MSAN

2) Outdoor MSAN

Their placement caused them to be classified into two types:

a) Pole Mounted and

b) Ground Mounted

Figure 2.33: Pole Mounted MSAN

Figure 2.34: Ground Mounted MSAN

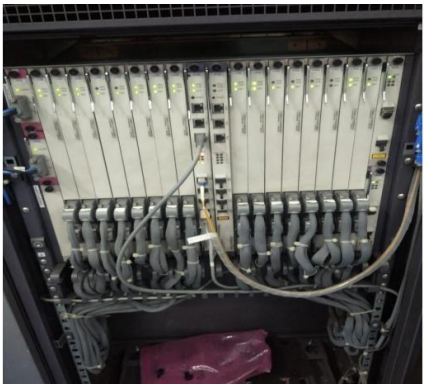


Figure 2. 33: Indoor MSAN

2.5.1.7 Service offered by MSANs

- Broadband Internet access: - High speed internet connection for homes and business using ADSL, VDSL etc. Also in FTTC (Fiber to the cabinet).
- Data services: - Leased lines and other dedicated data connection for business and organization.
- Voice Service: - Traditional phone calls and digital phone lines (PSTN and ISDN).
- Video Service :- IPTV (Internet Protocol TV) or other video demand
- Emerging Service: - support for future service like fiber optic connectivity or mobile backhaul.

The types of cards used in a MSAN depend on the specific implementation and the service offered. Here are some of the most common types

01. Control and Switching Card

Act as the brain of MSAN, managing overall operation configuration and communication with other network elements. It may also handle function like routing and switching.

Ex: - GISB (ZTE), SCUN (Huawei indoor), SCUB (Huawei Outdoor)

02. Testing subscriber line card

Testing card is specialized hardware components used for testing and troubleshoot in various aspects of MSAN functionality. They are design to simulate different condition and generate test signals to verify that the equipment was correctly

Ex: - TSLE, TSLC

03. Integrated subscriber line card

Combine voice and data capabilities for multiple services over a single copper line.

Ex: - GELC-32 lines (ZTE), CAME-48 lines (Huawei)

04. SHDSL subscriber line card

This is like nitro boost for internet access. They give houses far from the main hub faster, equal speed lanes for both uploading and downloading, make in everything smooth and zippier.

Ex: - GSDL, GSDLB, SHLM

05. Environmental and power control card

EPC card in an MSAN plays a crucial role in ensuring the smooth operation and energy efficiency of the system.

06. Power Card

These refer to a module of component within the MSAN systems responsible for managing power distribution to the various line cards and module.

Ex: - PWR (ZTE), PRTE (Huawei)

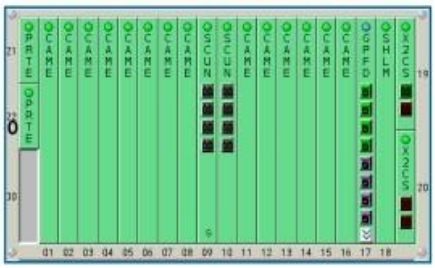


Figure 2. 35: Huawei MSAN cards

Figure 2. 34: MSAN cards real view

Figure 2. 36: ZTE MSAN cards

2.5.1.9 Alarm systems in MSAN

01. AC main failure alarm

This is an MSAN signal a disruption in the primary alternating current power supply, promoting network administrators to take corrective action to maintain the functionality of the telecommunication need equipment

02. Flood alarm

This is an MSAN is an alert that trigger risk or occurrence of overflowing, prompting administrators to take swift action to protect the telecommunication equipment from potential water damage.

03. Smoke alarm

This alarm in an MSAN alarm administrators to the presence of smoke or fire, triggering immediate actions to address the risk, ensure safety and prevent damaged to the telecommunication equipment

04. Battery low alarm

The battery low alarm in MSANs signals administrators when backup power is running low, prompting them to take action to ensure uninterrupted operation of the telecommunication equipment.

05. Door alarm

The door in Alarm in a MSANs alerts administrators to unauthorized access so tampering with the equipment, prompting quick intervention to ensure the security integrity of the telecommunication infrastructure.

06. Sub card communication failure alarm

In a ZTE MSANs indicates a disruption in communication between the main card and a sub card, prompting administrators to investigate and resolve issue to ensure function in telecommunication equipment.

2.5.2 Copper DP

From the cabinet, a ten-pair cable is extracted, with each pair being pulled from a loop. The subscriber premises are connected to overhead telephone lines that are drawn from the DP. As overvoltage protective devices, surge arresters make up the DP.

Figure 2. 37: Copper DP

2.5.3 Discharger

Utilizing a discharger shields subscribers, routers, and phones against lightning-induced high voltage current. The communication line will be cut off if a high voltage current burns the fuse. Subsequently, the wire conducts a high voltage current to the earth.

Figure 2. 38: Discharger

2.5.4 Rosette

The telephone wire with an RJ 11 output is connected using a connector called a rosette.

Figure 2. 39: Rosette

2.5.5 DSL

a method that replaces conventional copper phone lines with high-speed internet connection. While prior digital up techniques require slower internet connections, ADSL, one of these sort of DSL, uses the telephone infrastructure already in place to transfer digital data, enabling quicker internet connections. With DSL, consumers can connect to the internet

constantly without having to key in their phone numbers. Two categories exist:
1. Asymmetric Digital subscriber line (ADSL).

2. Very Hight Bit rate Digital Subscriber Line(VDSL)

2.5.5.1 ADSL

Using the existing copper wire telephone connections in households and businesses, ADSL (Asymmetric Digital Subscriber Line) technology enables quick data transmission at a high bandwidth. Broadband connections that are constantly on are made possible via ADSL, as opposed to standard dial-up copper phone line service. Asymmetric communication protocols, such as ADSL, use a majority of the channels for downstream transmission to the user and a minor portion for user-provided uploads. Urban areas have access to high-speed DSL connections, including ADSL connections, by 2000. Using the same phone line, ADSL allows for the simultaneous transport of digital and analog (voice) information. Downstream internet connection data rates ranging from 512 kilobits per second (Kbps) to around 6 megabits per second (Mbps) are frequently supplied for it.

2.5.5.2 VDSL

Very High Bit rate Digital Subscriber Line is known by its acronym, VDSL. The latest broadband internet technology, known as VDSL, delivers better connection speeds while still using your copper phone line. The copper line that connects your home to the network equipment determines the speed of this technology, much like ADSL does. Put otherwise, you get faster Internet access the further you are from the network equipment and its switching.
Increased efficiency in sharing a single shared line and improved Internet user experience are two benefits of VDSL. Fiber optic cables are used to connect a fiber optic node installed in close proximity to the user's location to the Internet service provider (ISP). Internet TV (VOD), VoIP systems, and other high-bandwidth applications are the most popular uses for VDSL.

2.5.5.3 ADSL Splitter

In the presence of an ADSL line, a splitter is used. Voice often has low frequencies while data has a high frequency range. Splitter is used to filter them and connect to the network and phone. The filter is a low pass one. Our ability to use the internet and phone service uninterrupted is made possible by this splitter.

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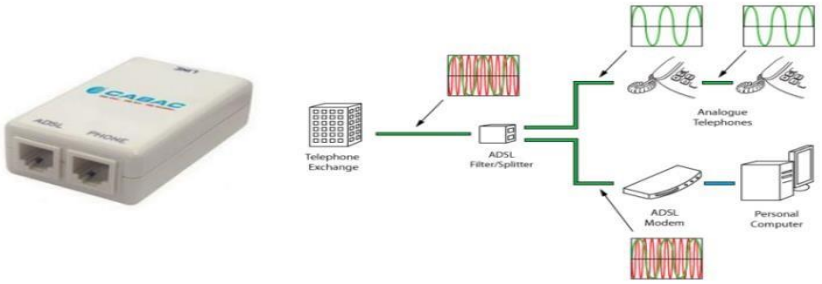


Figure 3. 40: Splitter

2.5.6 Factors to determine ADSL speed

2.5.6.1 Line Attenuation

The loss of signal intensity when a signal moves across a DSL connection is called attenuation, or 'line loss'. Amplification results in decreased signal speed and quality as the line length increases. Copper wire length, diameter, and condition all affect attenuation, which is expressed in decibels (dB). Depending on your distance from the exchange and the caliber of your wire, DSL attenuation typically ranges from 20 to 60dB.

2.5.6.2 Signal to noise ratio

The difference between your DSL line's signal intensity and background noise is called noise margin, or signal-to-noise ratio (SNR). The quality and stability of your connection improve with increasing noise margin. In order to combat the noise, the DSL modem must use more power and less bandwidth, so a bigger noise margin also translates into a slower speed.

Depending on your distance from the exchange and the caliber of your wire, a typical DSL noise margin is 6 to 15 decibels.

2.5.7 Link Budget Calculation

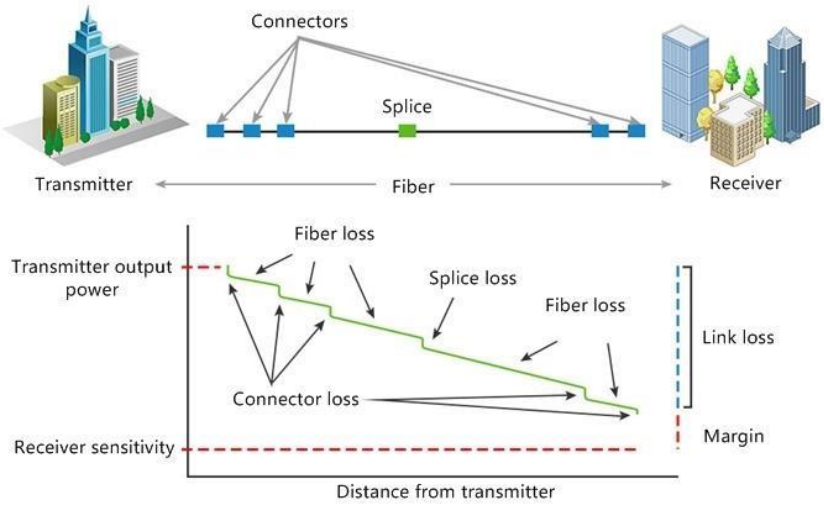


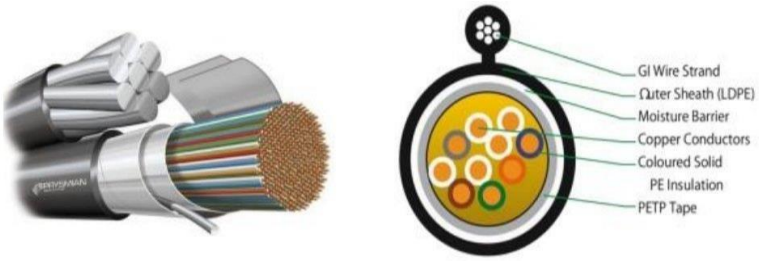
Figure 2. 41: Link Budget

Essential analysis metrics in fiber optic network design are link budget and link loss budget. The link budget is mostly utilized prior to installation, while the link loss budget is utilized both before and after installation. In order to verify that the connection can function correctly after the cable plant is placed, the estimated loss values are compared with the test findings.

2.5.8 Aerial cable installation standard

- Antenna cable suspension must occur at a regular distance of 50 cm from each pole's summit.
- It is necessary to position the second cable on the other side at the same level, and it must be suspended on the same pole.
- Less than 100 centimeters should be the minimum distance from foliage and trees, and the minimum clearance from the ground to the lowest point in the cable's span must be at least 4.5 meters along highways and 5.5 meters at road crossings.
- The maximum drop in aerial cable is allowed to be 0.8 meters.
- All the way through the cable rout, the shield must remain electrically continuous.

- Throughout its entire length, the suspension strand must maintain electrical continuity.



	Aerial Cable Type
1.	10 pair
2.	20 pair
3.	30 pair
4.	50 pair
5.	100 pair
6.	150 pair
7.	200 pair

Figure 2. 42: Arial cable installation

2.6 Problems encountered and how they were resolved

2.6.1 Transmission section

Maintain the transmission paths of the area are the main job of this section. And also supply connections to the FTTH cabinets, maintain the data nodes, maintain the microwave links, supply high speed dedicated internet connections using service switches are the other functions of this section.

There are many ring networks which are used by Sri Lanka Telecom.

- Huawei Rings – ACR, OSN 200, OSN 3500 , OSN 500
- ZTE Rings – S 330, S 200, S 380

All ring networks have connected to Kurunegala and Matale from both sides. And also, there is a Mesh network in SLT. It's called as SLBN (Sri Lanka Back born network).

With the help of the Kurunegala and Matale supply edge routers, the Carrier Ethernet Aggregation (CEA) node, which connects all MSANs in the Kurunegala area to the core network, is reached. The MPLS network is mostly used for data transfer. VoIP, or voice over IP, is the foundation of the new PSTN network. Multi-Protocol Label Switching, or MPLS, is the name of the network. Accordingly, the speech is divided into packets here, with the source and destination addresses included in each packet. The message is divided into tiny data packets in this network, and as circuits become available, they search for the most efficient path. A packet's header address indicates where it should go and what order to reassembly in at the destination, even if each packet may take a different path. In contrast to packet switching, circuit switching requires a dedicated point-to-point connection throughout the discussion.

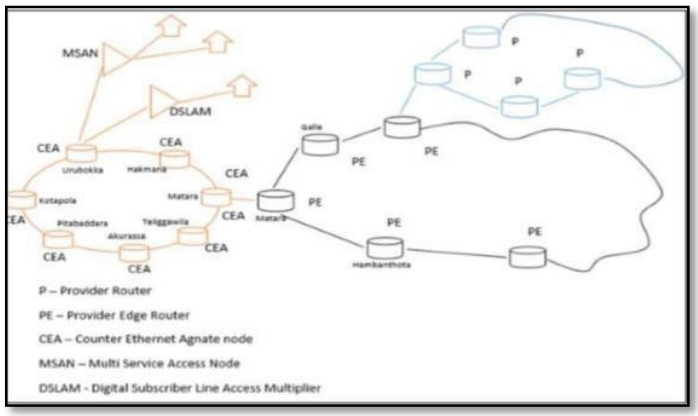


Figure 2. 43: MPLS Network

2.6.2 Fiber Optic Closure Installation

When using outdoor fiber optic cable, fiber optic splice closure is typically utilized to create room for joining outdoor fiber optic cables. The fiber that has been spliced and the junction sections of the outdoor fiber cables will be shielded by the fiber trays within and the fiber optic splice closures. Both dome and horizontal types of fiber optic splice closures are commonly employed, with the latter being more common. The two primary types of outside plant splice closure are horizontal and vertical versions.

A flat or cylindrical casing is what a horizontal type splice closure resembles. For optical cable splicing and joints, they offer room and protection. These have three mounting options: subterranean, buried, and aerial. Types that are horizontal are employed. greater frequency than closures of the vertical type (dome type). It is possible to have hundreds of fiber connections in a horizontal fiber closure.

The cable is first stripped during the installation process. Subsequently, divide the upper and lower halves. The sheath can then be removed. Cut the tension member after that. Grease and sheath gasket should be applied after. Next, fix the tension component. once the unit protection tube has been inserted. after inserting the cable into the tray for splicing. The protective tube should then be arranged. Storage of the fibers follows necessary splicing. Step two is to stack the splicing tray. fix the cables after that. after which the closure was sealed. Put the fiber closing in place at last.

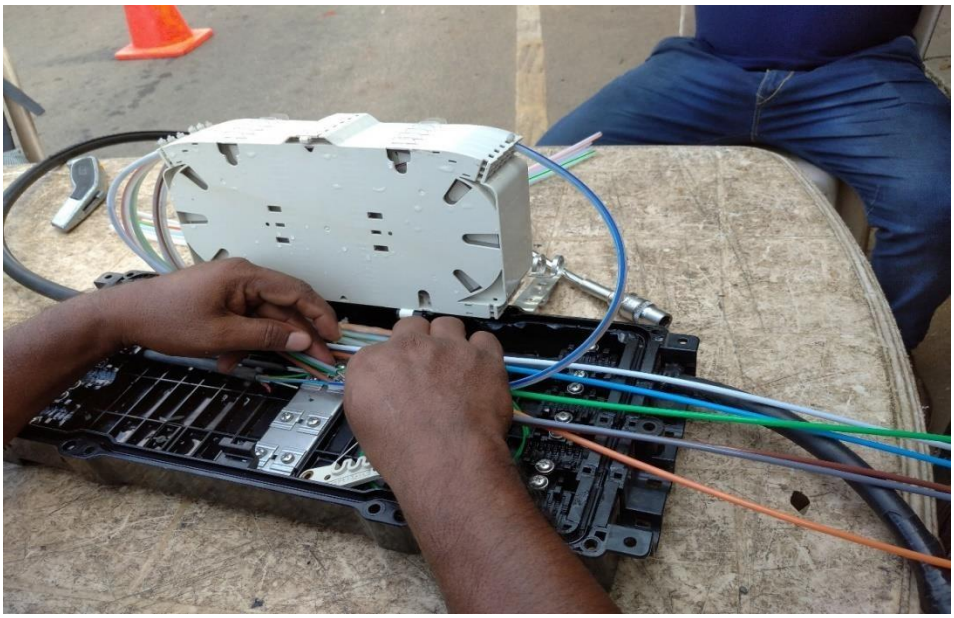


Figure 2. 44: Fiber closure installation

CHAPTER 03

3.1 CONCLUSION

I was trained at SLT from May 27, 2024, to November 26, 2024, for around six months. I made an effort to act professionally throughout this time. The primary telecommunications company in Sri Lanka is called Lanka Telecom. It was a really worthwhile experience to be able to finish my Specialized Industrial Training at Sri Lanka Telecom Kurunegala. I learned about Base Transfer Station, ADSL, optical fiber transmission, and wire line technology during the course. I want to sincerely thank all of the technical and non-technical workers at Sri Lanka Telecom Kurunegala, as well as the engineering managers and engineers, for their important support in helping me comprehend the theoretical and practical elements of my training. I was able to obtain experience in both the Network Division and OPMC thanks to the meticulously designed training program.

I am particularly thankful to OPMC Manager Mr. Nandana, Senior Executive Assistant Manager Mrs. Manel, Network Engineer Mr. Krishantha, Senior Assistant Engineer Mr. Prasanna, Senior Assistant Engineer Mr. Sigera, Assistant Engineer Mr. Kosala, Senior Executive Assistant Engineer Mrs. kumari, Senior Executive Assistant Engineer Mr. Buddika and TTO Mr. Aruna for their guidance and encouragement.

In my experience, being exposed to the field before the lecture series at the training center proved beneficial. This approach allowed me to gain initial hands-on experience and try to understand the technologies and systems with the help of the technicians. This foundation then allowed me to grasp the theoretical concepts presented in the lectures more effectively.

Finally, I extend my heartfelt gratitude to all the Engineers, Assistant Engineers, Technicians, and Non-technical Staff of SLT Kurunegala, especially those in the Network section and OPMC, who provided encouragement and support throughout my training, ultimately enabling me to successfully complete this program.

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Training Organization:		Sri Lanka Telecom PLC
Training Period	:	From 27th May 2024 to 26th November 2024

This is to certify that report is prepared by me under the training conducted at above organization.

…….…… ……..……

Date Signature of the Trainee

This is to certify that is prepared by above under my regular supervision.

…….…… ……..……

Date Signature of the Supervisor