

# National Apprentice & Industrial

## Training Authority

### Report on Industrial Training

At

Sri Lanka Telecom PLC

Kalmunai



Sri Lanka  
College of Technology Maradana

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I would like to express my sincere gratitude to my parents, friends for providing me the support to complete this training program successfully. Finally, I would like to say thank you again to all who were mentioned and not mentioned here for giving their support.

Thank You.

## **Preface**

The Industrial Training Program scheduled under Diploma in Information Communication Technology. I got the good opportunity join as Sri Lanka Telecom PLC at Kalmunai regional office for a period of six months. Sri Lanka Telecom PLC (SLT) is the National Information and Communications Technology (ICT) solutions provider. SLT fulfill the needs of customers in the island through its high speed fiber technology, copper and wireless access network.

This great opportunity was given to me by Department of ICT in College of Technology Maradana and National Apprentice and Industrial Training Authority (NAITA). This was a valuable experience and I gain to start my career path. I would like to present this report with my total experiences during the four months.

I gained many experiences in industrial environment by interacting with different staffs in different working sections. In six months period of time I received a good knowledge and experiences through my internship with the Sri Lanka Telecom PLC, Kalmunai.

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## List of Abbreviations

✓ ADSL	- Asymmetric Digital Subscriber Line
✓ BRAS	- Broadcast Remote Access Server
✓ CEO	- Chief Executive Office
✓ CROO	- Chief Regional Operation Officer
✓ CPE	- Customer Premise Equipment
✓ DP	- Distribution Point
✓ DHCP	- Dynamic Host Configuration Protocol
✓ FTTH	- Fiber To The Home
✓ FDP	- Fiber Distribution Point
✓ GPON	- Gigabit Passive Optical Networks
✓ HDMI	- High definition Multi Interface
✓ IPTV	- Internet Protocol Television
✓ IP	- Internet Protocol
✓ MDF	- Main Distribution Frame
✓ MSAN	- Multi Services Access Node
✓ NGN	- Next Generation Network
✓ LTE	- Long Term Evolution
✓ LAN	- Local Area Network
✓ OPMC	- Outside Plant Maintenance Center
✓ ODF	- Optical Distribution Frame
✓ OLT	- Optical Line Terminal
✓ OTDR	- Optical Time Domain Reflectometer
✓ ONT	- Optical Network Terminal
✓ PSTN	- Public Switched Telephone Network
✓ PLC	- Public Limited Company
✓ RSU	- Remote Switching Unit
✓ STB	- Set Top Box
✓ SLT	- Sri Lanka Telecom
✓ TTO	- Telecommunication Technical Officer
✓ VPN	- Virtual Private Network

# Chapter 01: Introduction

## 1.1. About Training Organization

Sri Lanka Telecom PLC is the national Information and Communications Technology (ICT) solutions provider and the leading broadband and backbone infrastructure services provider in Sri Lanka for over 163 years. SLT is connecting over Ten million subscribers, and has always being in the forefront in catering to the nation's equipments. SLT enables opportunities that empower Sri Lankans and elevates the country's standing in the global arena. SLT's transformation into a digital service provider has seen the Company move beyond telecommunications services to provide a variety of services and solutions that cater to a digital lifestyle.

### 1.1.1 Logo of Organization



Figure. 01 Logo of Sri Lanka Telecom

### 1.1.2 Contact Details of Organization

- Head Office  
Address : Sri Lanka Telecom PLC, Lotus Road, P.O.Box 503, Colombo 01, Sri Lanka  
Phone : +94 112 021 000  
Website : <https://www.slt.lk>  
E-mail : [pr@slt.lk](mailto:pr@slt.lk)
- SLT Regional Office - Kalmunai  
Address : Yard Road, Kalmunai 32300, Sri Lanka  
Phone : +94 672 222 243  
Website : <https://www.slt.lk>

### **1.1.3 Nature of Business**

The Sri Lanka Telecom Group provides diversified services and an entire range of ICT solutions that cover fixed and mobile telephony, broadband, data services, Internet Protocol Television (IPTV), cloud computing and hosting services, and networking solutions to its varied customers via the latest technologies. The SLT Group primarily focuses on three operating segments which are the Group's strategic segments:

- Fixed ICT Operations
- Mobile ICT Operations
- Other segment Operations

#### **1.1.3.1 Fixed ICT Operations**

The Group's holding company, SLT, operates in the fixed ICT business. It provides telecom networks and ICT service to organizations of all sizes across all economic sectors, other telecommunications operators and internet service providers (ISPs), public sector institutions, and domestic customers.

ICT facilities and services provided include voice, data, broadband, wholesale, enterprise, cloud, international, and IPTV. One of the SLT Group's key strategic objectives is to drive adoption of broadband-based consumer and enterprise services by expanding the broadband footprint through the Next Generation Network (NGN) and National Backbone Network (NBN). These efforts are supplemented by an array of technologies including optical fiber, ADSL2+, VDSL2, carrier grade Wi-Fi, and both fixed and mobile 4G LTE technologies. The Company also uses its multiple international submarine cable networks to offer state of the art global services, securing its position as a key global player in the telecom industry.

### **1.1.3.2. Mobile ICT Operations**

Mobitel (Pvt) Ltd is a fully owned subsidiary of SLT, offers mobile ICT services including mobile telephony services, high speed broadband, enterprise solutions, international services, and a range of value-added services. Mobitel's coverage extends nationwide and includes international roaming with the partnership of a global web of over 650 networks.

As the only 4.5G/4G+ mobile network in Sri Lanka, Mobitel offers an unparalleled broadband network experience delivering burst speeds up to 300 Mbps and has been recognized by Ookla Speed test Awards as the fastest mobile network in Sri Lanka. Mobitel was the first mobile network operator to deploy a Sub-1G mobile broadband network utilising 850 MHz spectrum in Sri Lanka, increasing 4G LTE coverage across the island. Few years ago, Mobitel commenced rolling out its largest ever 4G LTE expansion project with over 1,600 LTE sites across the nation together with Voice over LTE (VoLTE), enabling customers to make high quality voice calls over the LTE network.

### **1.1.3.3 Other Segment Operations**

In its journey of transformation into a digital services provider. SLT has expanded beyond IT services to deliver products and services that utilises its core strengths, expertise and assets. SLT provided the following services through its subsidiaries.

- IPTV services and content creation facilities
- Human Resource solutions
- ICT infrastructure and system integrator solutions
- Digital Marketing
- Software Solutions
- Tertiary educational services
- Submarine cable maintenance

### 1.1.4. Ownerships of the Organization

Sri Lanka Telecom is owned by two main partners. The Sri Lankan government owns 49.50% stake through the Secretary to the Treasury and related institutions and 44.98% stake is owned by Global Telecommunication Holdings of Netherlands. The balance shares are publicly traded.

### 1.1.5. Subsidiaries of Organization

SLT offers the some services to subscribers through its subsidiaries.

Name of Subsidiaries	Services
Mobitel (Pvt) Ltd.	Mobile service provider
SLT Digital Info Services (Pvt) Ltd	Digital marketing, directory services, web development, event management and brand activation services
Sri Lanka Telecom (Services) Ltd	Network and systems integration solutions provider
SLT VisionCom (Pvt) Ltd	Internet Protocol Television (IPTV) Services provider.
Talentfort (Pvt) Ltd	Total HR solutions provider
Galle Submarine Cable Depot (Pvt) Ltd	Submarine cable depot service provider
eChannelling PLC	Pioneer software development and ICT services for the Healthcare industry
MOBIT TECHNOLOGIES (Pvt) Ltd	Software solutions provider
SLT Property Management (Pvt) Ltd	Managing SLT's real estate resources
SLT Human Capital Solutions (Pvt)	Dormant company as operations ceased with the deployment of staff by SLT

Table 01: Subsidiaries Companies of SLT

1.1.6 Organization Structure

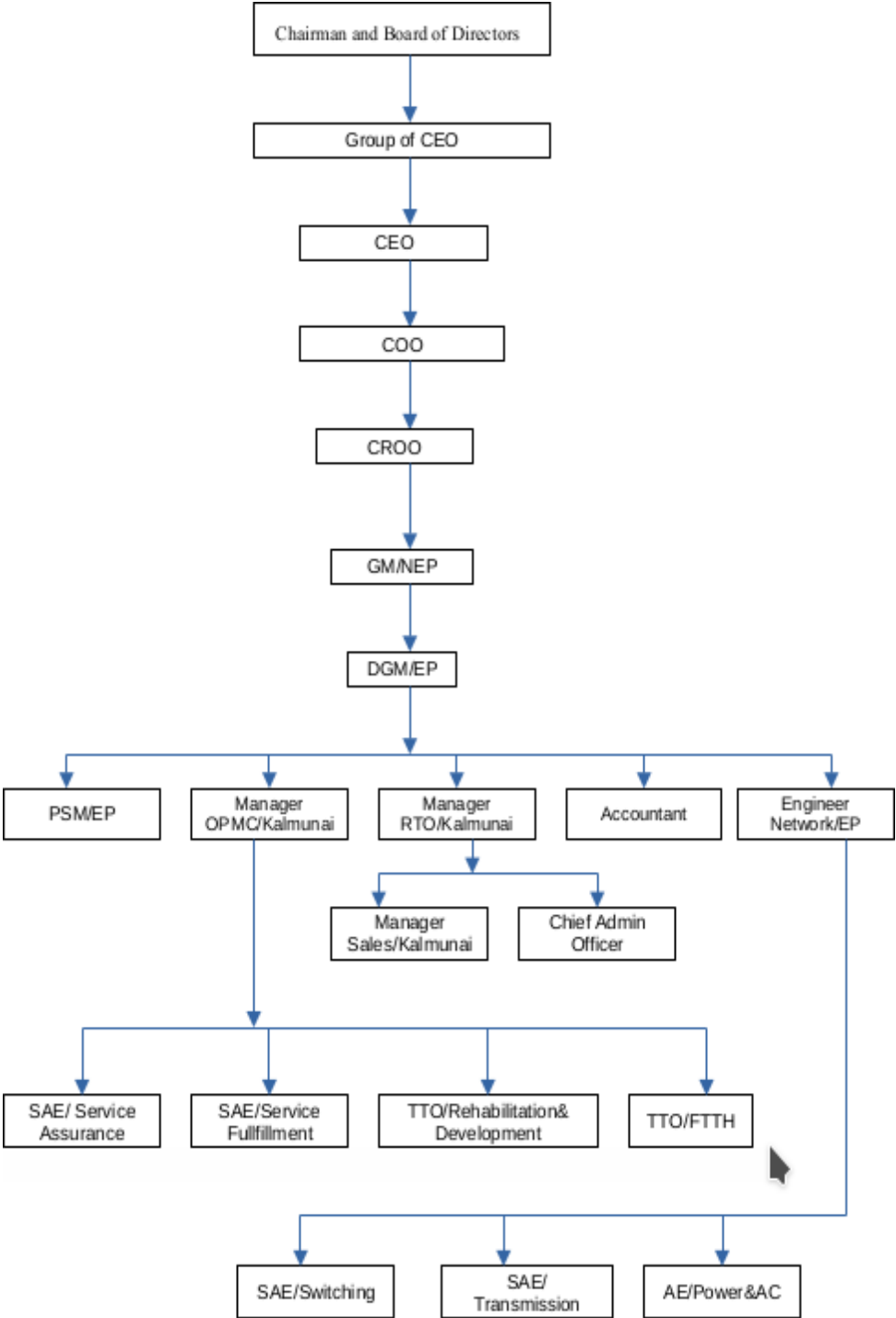


Figure. 02 Ogranization structure of SLT

### **1.1.7 Services and Products**

SLT offers following services to their customers.

- Fixed line Telephone services
- Mobile Telephone services
- Broadband services
- IPTV (PEO TV and Channels)
- IT services
- Hosting Services
- Mega line
- Smart line (F'Its)
- 4G/LTE (Long Term Evaluation)
- ADSL (Asymmetric Digital Subscriber Line)
- Data Center and Cloud services

## **1.2 Co - operate Plan**

### **1.2.1 Vision**

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

### **1.2.2 Mission**

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

### **1.2.3 Values**

- Customer Caring - We put our customers at the Centre of everything we do
- Trustworthy - We are true to our promises
- Innovative – We continuously invent new opportunities through creative thinking
- Responsive – We are ready to listen and act promptly
- Teamwork - We are one team with a common purpose to achieve common goals
- Excellence - We are committed to exceptional performance
- Results Driven - We are committed to enhancing shareholder value



## **1.3 Management Practices**

### **1.3.1 Recruitment Procedures**

According to the recruitment process, firstly vacancies were identified by the SLT regional branches. Then inform available vacancies to the Colombo head office. They decide number of employees to be recruited and create strategic plan for the recruitment. Then decide whether to recruit through direct SLT or SLT human capital solutions. If an employee is recruited by SLT, the Human Resource section of SLT is responsible for all Human Resource related activities such as Insurance, EPF, ETF, leave of the employee. If an employee is recruited by SLT human capital solutions, it is responsible for all Human Resource related activities of the employee. The decision depends on employment type and financial position of the organization SLT Human Capital Solutions. It is a fully owned subsidiary of Sri Lanka Telecom PLC. It provides human resource services to SLT. Then SLT calls for job applications through media such as newspapers and their official web site (<https://slt.lk/en/careers>) for vacancies. According to the work requirements, the suitable employees will be elected among the applicants.

### **1.3.2. Safety Precautions**

#### **1.3.2.1. Individual Safety Precautions for SLT employees**

- Pay close attention to any and all safety cautions and warnings posted on the appliance
- Always wear gloves, wear safety and safety glasses.
- Refrain from wearing loose clothing.
- Remember to remove any loose jewelry and Tie back long hair.
- Use the relevant tools for tasks and tools which are in good condition.
- Make the working space have enough light for clear visibility

#### **1.3.2.2. Electrical Safety Precautions for SLT employees**

- Turn off the power and completely unplug the appliance or electronic before repairing and check major appliance has its own grounded electrical circuit.
- Never use an extension cord to plug in the appliances
- Electricity has to be turned off before servicing any appliance or consumer electronic.
- Replace any damaged, pinched, or frayed wires before repairing and check connections before fixing any appliances.

### **1.3.3. Career Progression and Personal Development Strategies**

SLT provide training opportunities for their employees at all stages of their career at SLT. This begins with a special induction training program when an employee first joins the company and thereafter, they are encouraged to attend training programs on a regular basis to develop and update their skills. This includes internal training programs that are conducted on a regular basis by the SLT Training Center, external training programs as well as overseas training programs. SLT maintain transparent promotion system that provide career progression opportunities at each stage of an employee's career based on their qualifications, skills and experience in the organization. Performance of all employees are also closely monitored and acts as an incentive to encourage for continuous improvement.

## **1.4. Employee Benefits**

### **1.4.1. Employees Provident Fund (EPF)**

EPF was established by Act no.15 of 1958. The contributions are made to this fund on regular basis. Its purpose is to help employees to save a fraction of salary every month. The fund can be used in an event that the employee is no longer fit to work or at retirement. Employers have to remit every month to the central bank, an amount equal to 20% of the employee's total earnings to the fund. The Employee's contribution is 8% and the employer has to contribute an amount equal to 12% of the employee's total earnings.

### **1.4.2. Employees Trust Fund (ETF)**

ETF was established by Act no. 46 of 1980. An employee is entitled to ETF from the first day of his/her employment irrespective of whether he/she is permanent, temporary, apprentice, casual or a shift worker. Similarly, employees working on piece rate, contract basis and work performed basis of any manner are also eligible for membership. For the ETF employee does not have to contribute any and only the employer has to contribute an amount equal to 3% of the employee's total earnings. And also, to withdraw the fund, any specific age or condition is not required.

### **1.4.3. Leaves**

- **Short Leave**  
SLT employees can take one and half hours leave in a month only two days.
- **Annual Leave**  
SLT employees are entitled to 14 days of annual leave a year for every year they have worked for.
- **Casual Leave or Sick leave**  
SLT employees can take 7 days of leave for private matters, ill health, or any other reasonable cause.

### **1.5. Benefits and Privileges**

- **Financial support**  
Including loans for house development, vehicle, allowances as well as financial assistance schemes for higher education.
- **Health**  
Several medical assistance schemes are provided to treat critical illness and accidents which caused while on duty and there are regular health checks for employees under SLT's annual 'Suwatha' program.
- **Safety**  
Ensures an environment which is free from discrimination and harassment of any kind with the provision of latest technology, modern and comfortable.
- **Cheering extracurricular activities**  
Organize and encourage the employees to participate in annual trips, sports, cultural and religious programs, toastmasters meetings and also facilitate employees with special talents to bring them up to national and international levels.

## **1.6. About the training program**

Sri Lanka Telecom continues to facilitate inplant training by providing comprehensive industrial training for students from various institutes and universities island-wide at SLT's premises with state of the art facilities. These programs include practical training programmes that allow for study area rotation in such a way that allows the students to gain exposure to the latest technologies available today.

Under the course Diploma in ICT - Industrial Training, I was assigned as an apprentice at Sri Lanka Telecom PLC, Kalmunai for the period of 06 months, from 14th March, 2022 to 13rd September, 2022 by the Department of ICT in College of Technology Maradana in collaboration with National Apprentice and Industrial Training Authority (NAITA).

The training was conducted intently in OPMC and Network section at SLT - Kalmunai. I had both indoor and outdoor (field) work and the field works were conducted in many areas in Kalmunai. During this training period, the SLT staffs allowed to learn about latest technologies currently available in Networking and Telecommunication field such as Optical Fiber Technology, MSAN and IP core network of SLT.

## **1.7. Report Outline**

The following chapter outlines the knowledge that was obtained and practical experience of work during training period and outputs of the training.

## **Chapter 2: Training Experience and Knowledge**

### **2.1 Industrial Training**

Under the course I was assigned as an apprentice at Sri Lanka Telecom PLC, Kalmunai for a period of 27 weeks, from 14<sup>th</sup> March 2022 to 13<sup>th</sup> September 2022 by the Industrial Training of the Department of ICT in College of Technology Maradana in collaboration with National Apprentice and Industrial Training Authority (NAITA). In my industrial training period, I worked OPMC(From 14<sup>th</sup> March 2022 to 21<sup>st</sup> July 2022) and Network(From 22<sup>nd</sup> July 2022 to 13<sup>th</sup> September 2022) sections at Srilanka Telecom PLC, Operation Support Center are place where all Fiber Maintenance, MSAN Maintenance, 4G router Configuration, IPTV Configuration, PSTN Maintenance, RSU Maintenance, New PSTN and Data Connection, ADSL Maintenance, Copper Cable Maintenance.

On the first day of my training programme in the OPMC at Sri Lanka Telecom in Kalmunai. There I met the OPMC Manager, Senior Assistant Engineers and other Telecommunication Technical Officers. There are four divisions in the Kalmunai telecom. There were work sites switching, transmission and power/AC. I was instructed to train on OPMC. There are OPMC (Outside Plant Maintenance Center) and networking. There are ADSL, 4G and IPTV connection, PSTN maintenance section, New connection, Data, Cable development and maintenance (Underground and Overhead), Rehabilitation are available in OPMC Kalmunai. There are switching section, Power Distribution and AC, Transmission section is in networking Kalmunai. First week of training peroid I understood the Kalmunai SLT working system.

### **2.2 Outside Plant Maintenance Center**

OPMC means outside plant maintenance center which is place where all new connections, fault maintenance and rehabilitation are done. OPMC functions are Data and Voice Services and provide connections and services to all subscribers island wide. All maintenance and rehabilitation of the SLT services are handled by the OPMC. Under the manager of the OPMC there are several teams for various tasks. They are new connection team, 4G and IPTV team, FTTH team, PSTN and ADSL maintenance team, Underground faulty correction team (UG team), and rehabilitation team. Each section is handling by the Senior Assistant Engineer and Telecommunication Technical Officer. In OPMC, they have a Work Force Management System to coordinate and manage the every team and specific system to store, update and gather important information where ever they want.

2.2.1. Structure of OPMC - Kalmunai

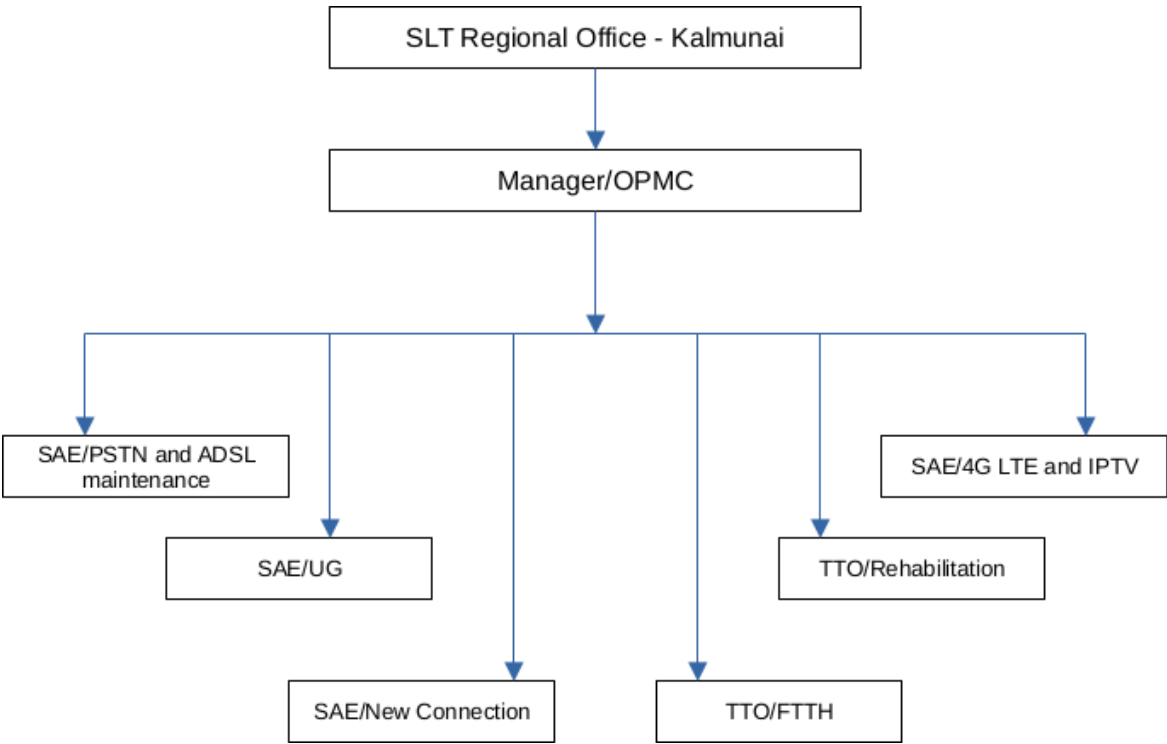


Figure 03: Structure of OPMC - Kalmunai Regional SLT Office

## 2.2.2. 4G LTE and IPTV

### 2.2.2.1 Job Profile of the Section

- Provide the new 4G connection to subscribers
- Provide the new IPTV connection to subscribers
- Collect the CPE from the subscribers after disconnection
- Resolve the faults in 4G and IPTV connection
- Configure the 4G router devices
- Install the external booster antenna for fixed 4G/LTE router.

### 2.2.2.2 Introduction

- **4G LTE**

4G networks are the next generation from the existing 3G networks. LTE stands for Long Term Evolution. 3<sup>rd</sup> Generation Partnership Project (3GPP) standards group has developed and maintains LTE high speed wireless technology. LTE is the technology behind 4G. It brings high speed to mobile and broadband data. LTE is designed for lower latency and increased bandwidth.

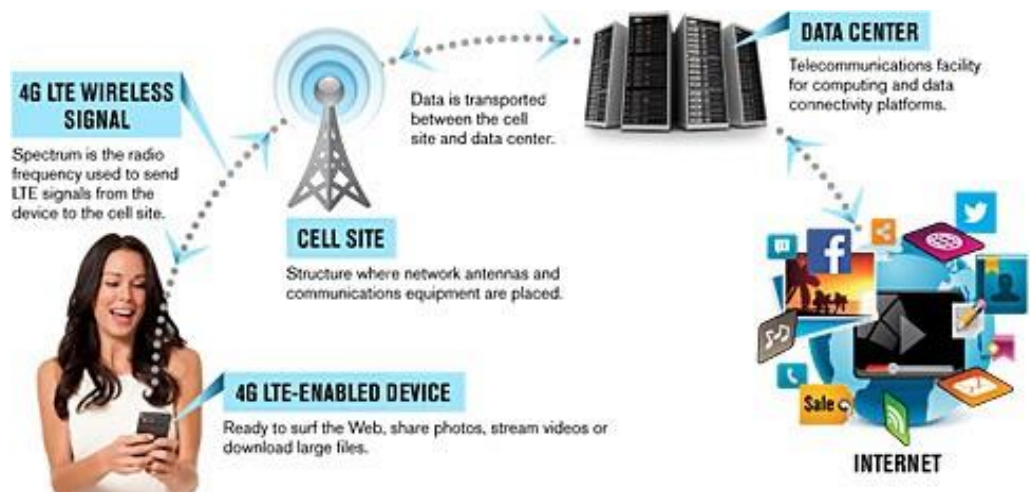


Figure 04: Architecture of 4G LTE



- **IPTV**

IPTV (Internet Protocol Television) is a service that provides television programming and other video content using the TCP/IP protocol suite, as opposed to broadcast television, cable television or satellite signals. An IPTV service, typically distributed by a service provider, delivers live television programs or on demand video content via IP networks. IPTV primarily uses IP multicasting with IGMP protocol for IPv4 based live television broadcasts and real time streaming protocol for on demand programs.

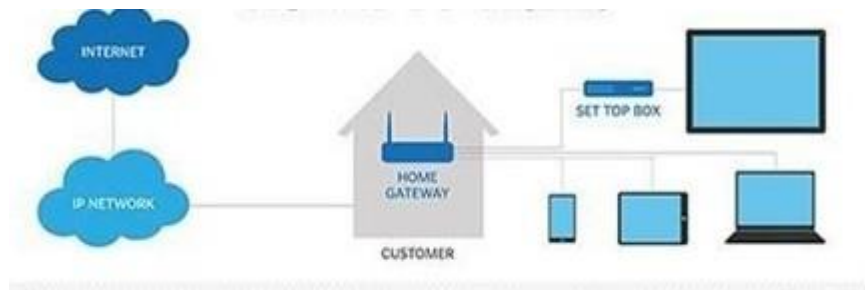


Figure 05: Architecture of IPTV

### 2.2.2.3. Encountered Faults in 4G and IPTV Section

- 4G Router configuration issues
- CPE (Router,STB) damaged
- 4G Signal issues
- RJ-45 Ethernet cable damaged between router device and STB
- STB firmware update issue

#### 2.2.2.4. Some Practical Experiences 4G LTE and IPTV Section

- **4G Router Configuration**

Step 1: Opened the web browser (Google Chrome or Mozilla Firefox) and typed default IP address(192.168.1.1) of router in the address bar.

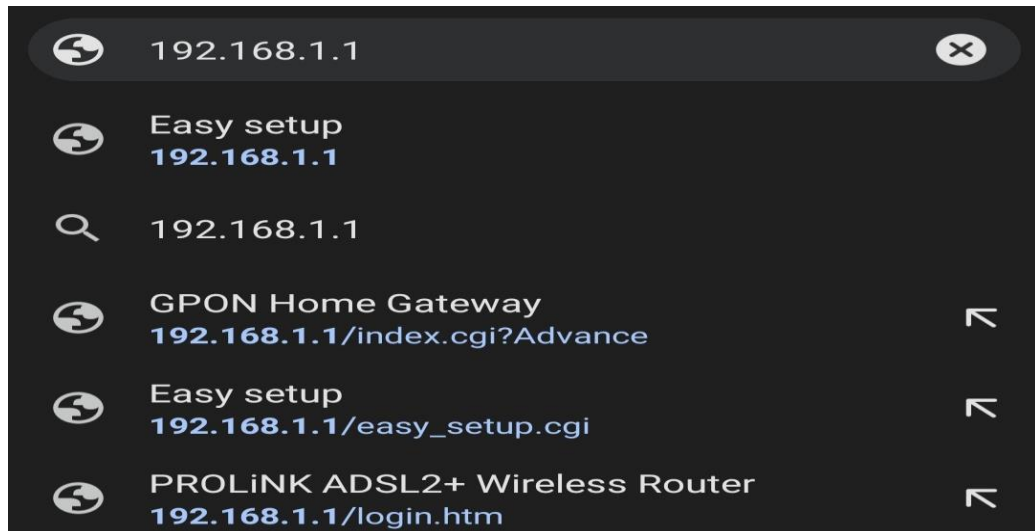


Figure 06: Default IP address of SLT 4G router

Step 2: In router's login page, entered the default Username as admin and Password as admin then clicked the login button to next step.



Figure 07: Login page of SLT 4G router

Step 3: Selected the Basic setting under the WLAN option. Then clicked Edit link.

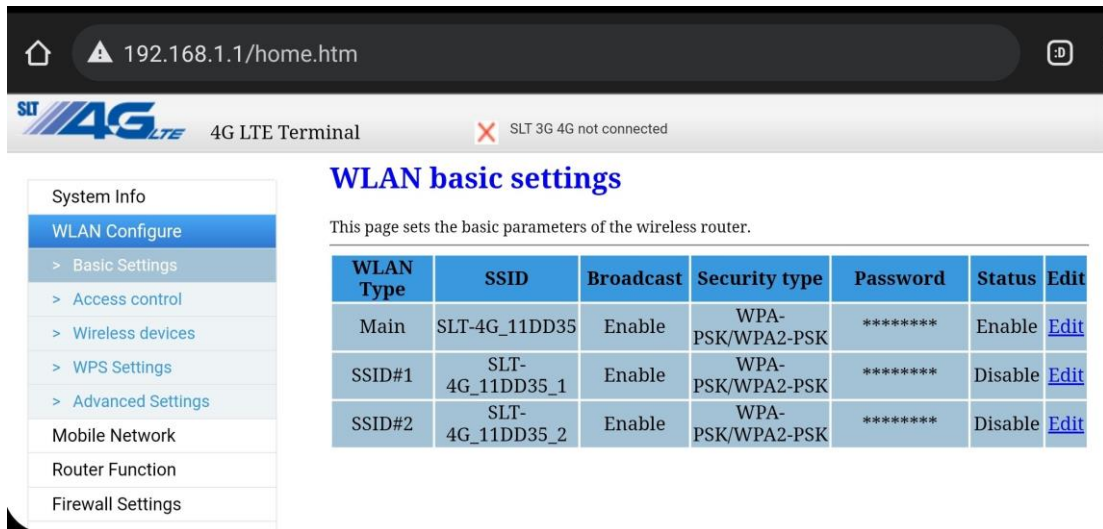


Figure 08: WLAN basic setting option of SLT 4G router

Step 4: Provided the SSID, SSID Broadcast, Security type and Password. Then clicked submit button to save the configuration changes and restarted the router.



Figure 09: WLAN basic configuration in 4G router

Step 5: To obtain the IP address automatically when a device is booting up and request an IP address to be logged on the network that 4G router, should be configure the DHCP server. In router, clicked the DHCP Setting option under the Router Function. Then clicked Edit link of main SSID.

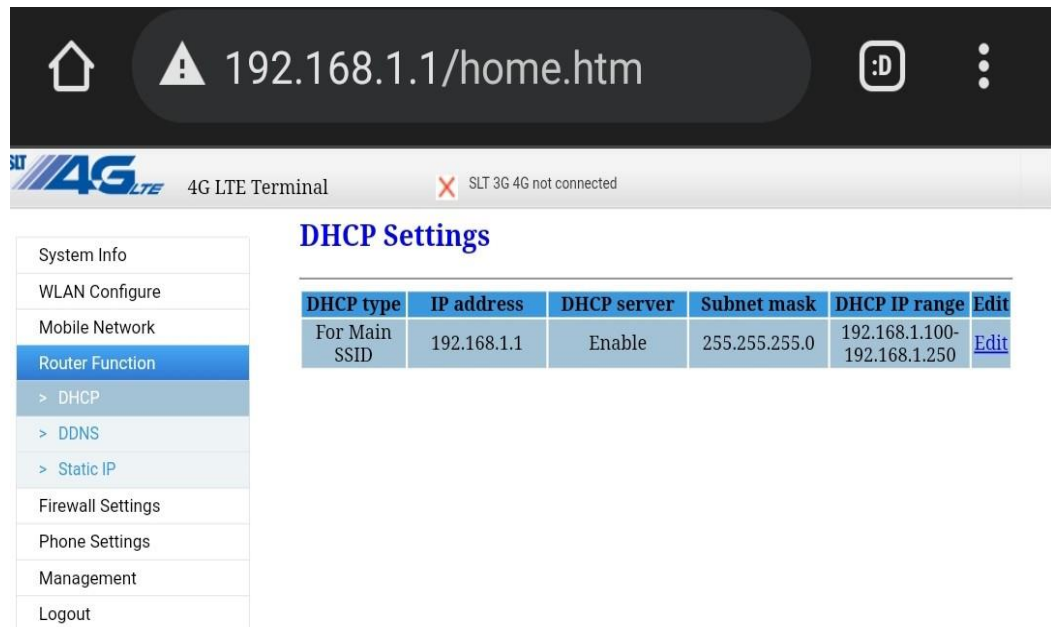


Figure 10: DHCP setting option of SLT 4G router

Step 6 : In here, assigned the default IP address to router, enabled the DHCP service, assigned IP address to Gateway, assigned DHCP IP range, assigned IP addresses to Subnet Mask, Primary DNS, Secondary DNS, and assigned time to lease time.

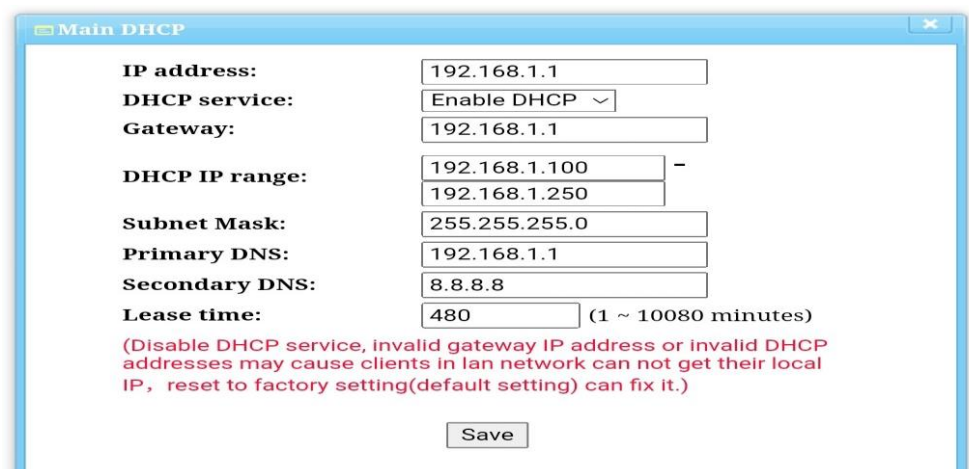


Figure 11: DHCP service configuration

- **Install new IPTV (SLT PEOTV) Connection**

First, We connected the TV and STB using HDMI cable. Then connected the ADSL router device and STB using RJ45 Ethernet cable. In SLT provided ADSL router device, the LAN port 4 is reserved to IPTV connection. So, we attached one end of RJ-45 Ethernet cable in 4<sup>th</sup> port of ADSL router. After the completed setup, connected the power adapter to the STB and router. After power is on, it was start automatically. Once the STB powered up, welcome screen will appear and press OK to continue. Finally, to register subscriber's account gives customer's telephone number as userID and default password 1111. then press OK to complete IPTV configuration.



Figure 12: IPTV (SLT PeoTV) connection

## **2.2.3. PSTN and ADSL Maintenance**

### **2.2.3.1. Job Profile of the Section**

PSTN and ADSL maintenance section is responsible for identify the faults through subscriber's report and troubleshooting those faults within 24 hours of reported time. More than this they do some additional maintenance works handovers from UG section as well. The working network of the PSTN and ADSL maintenance is from MSAN to subscriber's premises. In this section, technical team do the following some tasks.

- ADSL router configuration
- Check the customer's line connection at MSAN, DP, Discharger Unit, Splitter and Customer's device to ensure the location of faults.
- Troubleshooting PSTN faults
- Troubleshooting ADSL faults
- Replacing faulty CPE
- Rejoining broken drop wires

### **2.2.3.2. Introduction**

- **PSTN**

Public Switched Telephone Network refers to the telephone system that use copper wires to carry analog voice data. It consists of collection of individual telephones to allows subscriber to make land line call to one another. Originally, it was an entirely analog network laid with copper cables and switches. Presently, most part of PSTN networks is digitized and comprises of a wide variety communicating devices. The present PSTNs comprises of copper telephone lines, fiber optic cables, satellites, and undersea telephone lines. It is also linked to the cellular networks. Present PSTN systems are tightly coupled with WANs and are used for both data and voice communications.

- **ADSL**

ADSL (Asymmetric Digital Subscriber Line) is a technology for transmitting digital information at a high bandwidth on existing phone lines (copper line) to homes and businesses. Unlike regular dialup phone service, ADSL provides continuously available, “always on” connection. ADSL is asymmetric in that it uses most of the data transmit (Downstream) to the user and only a small part to receive information (Upstream) from the user. ADSL simultaneously accommodates analog (Voice) information on the same line.

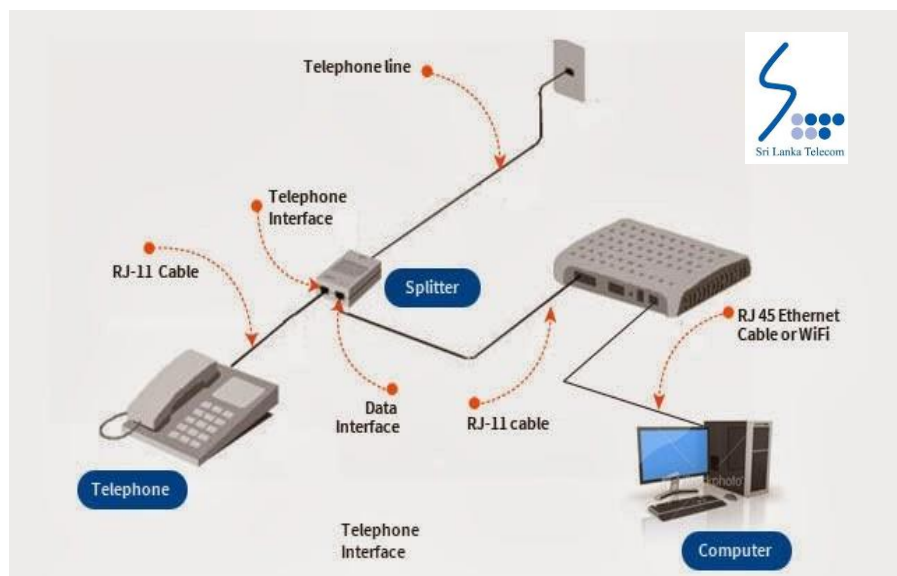


Figure 13: Connection setup of SLT ADSL

### 2.2.3.3. Encountered Faults in PSTN and ADSL Maintenance

- **PSTN Faults**

According to my work experiences in PSTN maintenance, PSTN faults mainly categorized in three parts.

1. Fault in Outside Plant (OSP)
2. Fault in Customer Premises Area
3. Fault in Network Side

### **1. Type of Fault in Outside Plant**

- Primary Cable Fault
- DP Faulty
- Drop wire fault

### **2. Type of Fault in Customer Premises Area**

- PSTN phone faulty
- Internal wire faulty
- Rosette box faulty
- Splitter faulty
- Rosette cord faulty

### **3. Type of faults in Network Side**

- loose connection in Jumber wire
- Wrong Jumbering at MDF
- Fuse faulty
- Tag block faulty

## **• ADSL Faults**

According to my work experiences in ADSL maintenance, ADSL faults mainly categorized in five parts.

### **1. Fault in MASN**

- a. MASN isolated
- b. TID faulty
- c. Jumber wire faulty, Tag block faulty in MDF

### **2. Fault between MASN to Discharger Unit**

- a. Cable loop faulty
- b. DP faulty
- c. Drop wire faulty



### 3. Internal Faults

- a. Discharger Unit faulty
- b. Internal drop wire faulty
- c. Rosette faulty
- d. cable faulty (RJ-11 cord wire, RJ-45 cable)

### 4. CPE Faults

- a. PSTN phone faulty
- b. Router faulty
- c. Router LAN port faulty
- d. Configuration issues

### 5. Username issues

- a. Username not active
- b. Usage threshold limit issue

## 2.2.3.4. Working Instruments of the PSTN and ADSL Maintenance

- **ADSL Splitter**

Splitter is used for separating voice and DSL digital signal from the local telephone line. Normally, Data contains with high frequency range and voice contains low frequencies. To filter them we use a ADSL splitter. It has a low pass filter and high pass filter. We can access voice connection and broadband connection without interruption.



Figure 14: ADSL Splitter

- **ADSL Router**

ADSL router device is provides broadband service to customers through LAN port and Wi-Fi.



Figure 15: ADSL Router

- **Testing Telephone**

Testing telephone is uses for testing purpose in PSTN and ADSL line connection. It is used for check and identify faults at MSAN, DP, Discharger Unit and Rosette. It consists four circuits of Receiving, Transmission, Dialing, and Ringing circuits.



Figure 16: Testing Telephone

- **Drop wire Connector**

Drop wire connector is used for join two ends of drop wire.



Figure 17: Drop wire connector

- **Nipper Tool**

It is used to separate guard wire from the drop wire and crimp drop wire connector with the wire.



Figure 18: Nipper Tool

- **Tone Tester**

It is used to identify and trace cables within a group without damaging the insulation.



Figure 19: Tone Tester

### 2.2.3.5. Some Practical Experiences in PSTN and ADSL Section

- **ADSL router Configuration**

In SLT – Kalmunai, they provided three types of ADSL router to their customers. So, a few router configuration and router logging details are different the router to router. The ADSL technicians should be identify the router model and its username and password for ADSL router configuration. Table. 01 shows the few router types currently used by SLT and its logging details.

Router Type	Default IP address	Username	Password
TP-Link	192.168.1.1	admin	admin
Pro-Link	192.168.1.1	admin	password
ZTE	192.168.1.1	admin	admin

Table 02: Login details of different ADSL routers

#### Step 1: Login the router

We configured the TP-Link ADSL router for internet access at customer premises. After connected our mobile device with router device, opened the web browser (Google Chrome) and typed default IP address of router (192.168.1.1) in address bar. Then entered to router's logging page. In logging page, We entered the Username as admin and Password as admin. Then clicked login button to go router's home page.

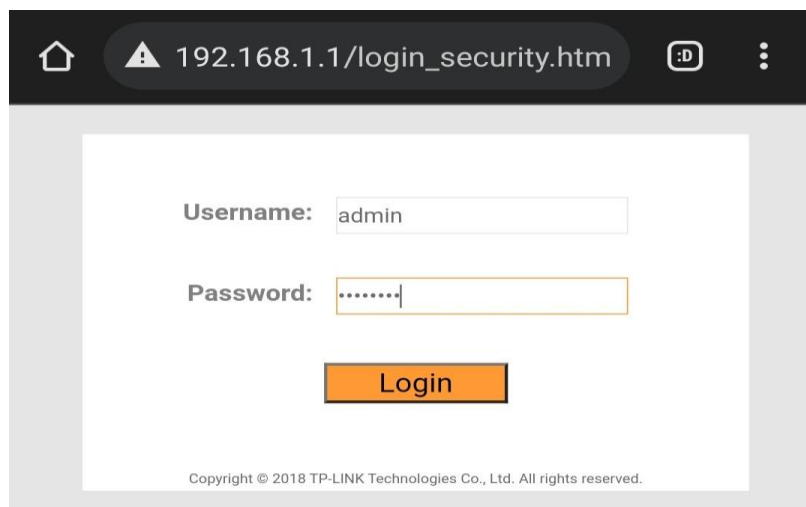


Figure 20: Login page of TP-Link router

## Step 2: Configuration for Internet Connection

In this step, We clicked the Interface Setup. And clicked the Internet tab at top of the window page. Then typed the information under the Internet setting. For internet connection, selected the Virtual Circuit value as PVC0, entered the VPI value as 8 and VCI value as 35. Under ISP option, selected ISP as PPPoA/PPPoE.

We entered the service name as SLT – Kalmunai, Username and Password. It obtained from SLT office. Then selected the Encapsulation value as PPPoE LLC and selected Dynamic option for get IP addresses automatically. Finally, checked the provided the information and clicked SAVE button to save the all configuration.

The screenshot displays the TP-LINK 150Mbps Wireless N ADSL2+ Modem Router web interface. The top navigation bar includes tabs for Quick Start, Interface Setup (selected), Advanced Setup, Access Management, Maintenance, Status, and Help. The Interface Setup tab is further divided into Internet, LAN, and Wireless sub-tabs, with Internet being the active one.

The main configuration area is organized into several sections:

- ATM VC:** Virtual Circuit is set to PVC0. Status is Activated. VPI is 8 (range 0~255) and VCI is 35 (range 32~65535).
- QoS:** ATM QoS is set to UBR. PCR, SCR, and MBS are all set to 0.
- IP Version:** IPv4 is selected.
- Encapsulation:** ISP is set to PPPoA/PPPoE.
- PPPoE/PPPoA:** Service name is SLT - Kalmunai, Username is ki2050117@sltb, and Password is masked. Encapsulation is PPPoE LLC. Bridge Interface is Deactivated.
- Connection Setting:** Connection is set to Always On (Recommended). TCP MSS Option is 1400 bytes.
- IP Common Options:** Default Route is set to Yes.
- IPv4 Address:** Get IP Address is set to Dynamic. Static IP Address, IP Subnet Mask, and Gateway are all 0.0.0.0. TCP MTU Option is 1480 bytes. NAT is Enabled. Dynamic Route is RIP2-B and Multicast is IGMP v2. MAC Spoofing is Disabled.

A SAVE button is located at the bottom of the configuration area.

Figure 21: Interface setting page of TP-LiNK router

Step 3: Restart the router device

Finally, We selected the SysRestart under the maintenance option. Then selected the system Restart with option as Current setting and clicked the Restart button to access the router.

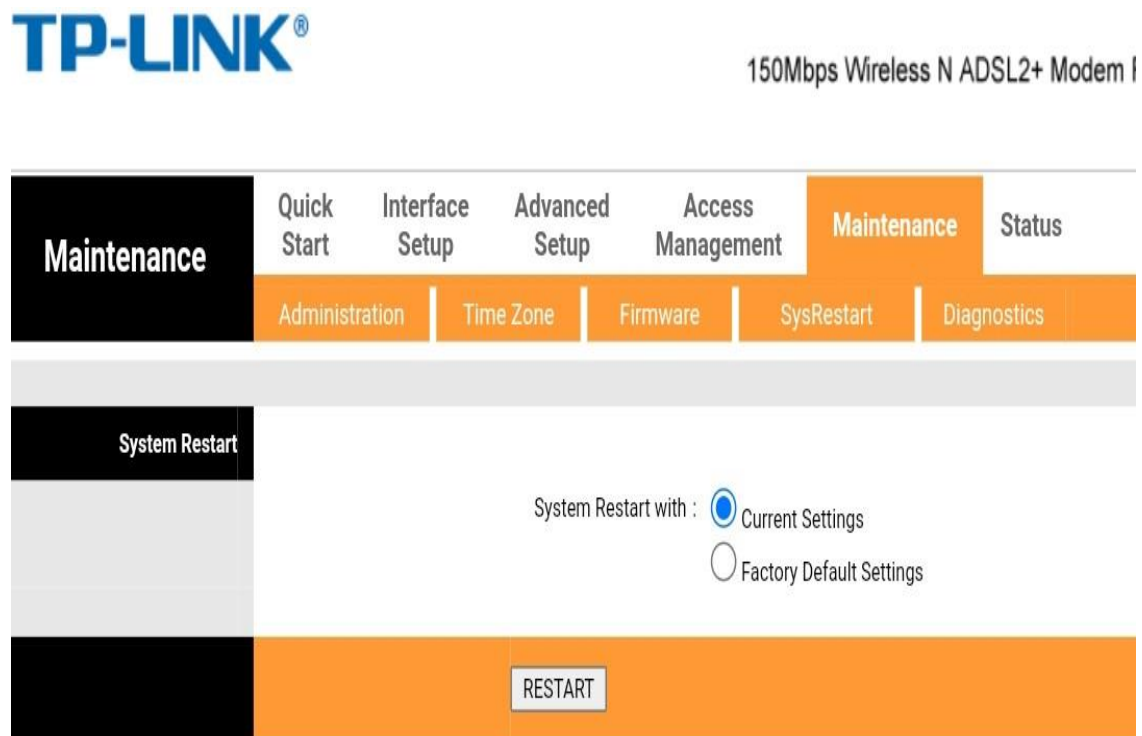


Figure 22: Maintenance page of TP-LiNK router

- **ADSL Router Installation at customer premises**

We visited to customer premises in Karaithivu to install the new ADSL router. First, we connected the telephone line from Rosette to ADSL splitter line port. Then connected the phone code wire from splitter to customer phone and connected the ADSL router to splitter at DSL or Modem interface with RJ-11 cord wire. Then power on router and connected the our mobile device via Wi-Fi to verify the connection setup. Finally, we tested the speed of the broadband connection using Speedtest software.



Figure 23: ADSL splitter connection



Figure 24: Connect the rosette with internal wire



Figure 25: ADSL router installation

## **2.2.4. Fiber To The Home (FTTH)**

### **2.2.4.1. Job Profile of the Section.**

Repair the broken optic fiber cables and install the optic fiber cable closure were the main work of the FTTH team. Except that they troubleshooting some faults in home networks that have fiber connections.

### **2.2.3.2. Encountered Faults in FTTH**

- Optic Fiber cable damaged
- Fiber patch cord faulty
- Fiber ONT faulty
- Fiber connectors faulty
- Fiber splitter faulty
- Configuration issues in Fiber ONT

### **2.2.4.3. Working Instruments in FTTH section**

- **Fiber Distribution Point (FDP)**

Fiber Distribution Point is used for distribute fiber connection to customers. Can supply 8 fiber connection from one DP. It is mounted 3.5 m on pole above ground level.



Figure 2.2.4.3.1 Fiber DP



- **Fiber ONT**

End equipment at Customer premises. Features depend on manufacturer and model.

Fiber will terminate at this point. User appliances connect to here



Figure 27: Fiber ONT

- **Fiber Connectors**

Fiber optic connector, or optical fiber connector, is a component to terminate the end of fiber optic cable and enables quicker connection and disconnection than fiber splicing.

In optic fiber communication field, Different type of connectors used in optic fiber communication for different purposes. Those are SC connector, LC connector, FC connector, ST connector, MU connector, E2000 connector, MPO connector, FSMA connector, and MT-RJ connector.



Figure 28: Different types of fiber connectors

- **Patch Cord**

Fiber optic patch cord is a fiber optic cable. It terminated with fiber optic connectors on both ends. Fiber optic patch cables are for indoor application only.



Figure 29: Fiber Patch Cord

- **Fusion Splicer**

It is used to weld (joining) two optical fibers together. It is important tool for fusion splicing.



Figure 30: Fusion Splicer

- **Fiber Cleaver**

It is used to cut the fiber with great accuracy in fusion splicing work. It holds the optic fiber under low tension, scores the fiber surface at the correct position, then applies greater tension until the fiber breaks.



Figure 31: Fiber Cleaver

- **Hot Jacket Remover**

Used for ribbon type fiber as it include 4 single fibers entangled to be equally treated same in splicing.



Figure 32: Hot Jacket Remover

- **Optic Power Meter**

It is capable of measuring power of an optical signal (average power). Losses are given in decibels.

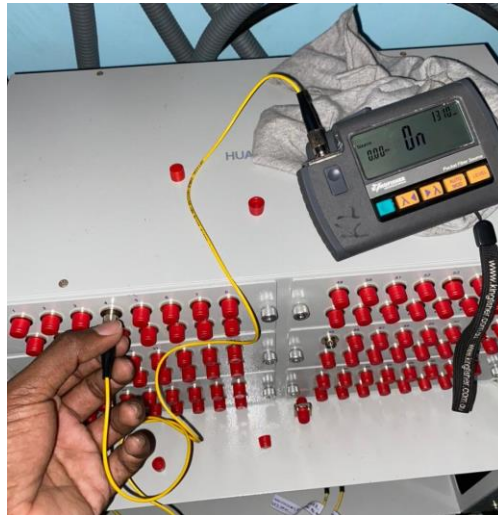


Figure 33: Optical Power Meter

- **Visual Fault Locator**

It is used to find fault location in between short distance such as patch code cable. The signal is visible in the end corner of the fiber if the fiber is healthy. There is a visible light break in the middle of fiber in case of damage.



Figure 34: Visual Fault Locator

- **Optical Time Domain Reflectometer (OTDR)**

It is used traces the number of connection points, length, losses, fault locations, power by using invisible light source when fiber is connected to coupling sockets of the equipment.



Figure 35: ODTR machine

- **Toolkit**

Fiber preparation toolbox is used to prepare fiber for splicing and the process is little different according to the fiber type. There are different tools for that preparation. Those are Nipper, Buffer Tube Stripper, Alcohol bottle, Knife, loose tube cutter, cable ringing tool, primary coat stripper, piller, screwdrivers, etc.



Figure 36: Tool box for fiber splicing

## **2.2.4.4. Some Practical Experiences in FTTH**

### **2.2.4.4.1. Fusion Splicing Activity**

The fusion splicing is very important task of the FTTH team. It is very delicate process and should handle carefully. In fusion splicing work, they are successfully completed this task using following five steps. The steps are Stripping, Cleaning, Cleaving, Splicing, and Protecting. Tools that used in fusion splicing those are Fusion Splicer, Hot jacket remover, Fiber cleaver, Sleeves, Fiber stripping tools, Fiber tube cutter, Alcohol. During my training period, we visited to various places in Kalmunai area for fusion splicing work.

Before the splicing, first we striped the primary buffer coating to expose the proper length of bare fiber using Primary Coat Stripper tool and other specific stripper tools. Next, Cleaned the fiber with alcohol dispenser to remove all gel and dust. Then cleave the fiber using the directions appropriate to the fiber cleaver being used. Then Placed each fiber into the guides in the fusion splicing machine and clamp it in place.

After completed the cleaning and cleaving process, we chose the proper program for the fiber core being spliced. The splicer showed the fibers being spliced on a video screen. Fiber core ends will inspected for proper cleaves and bad ones will be rejected. That fiber core must be cleaved again. The fibers core will be moved into position, refused to remove any dirt on the fiber core ends and preheat the fiber cores for splicing. The fiber cores will be aligned using the core alignment method used on that splicer. Then the fiber cores will be used by an automatic arc cycle that heats them in an electric arc and feeds the fibers together at a controlled rate.

When fusion is completed, the splicing machine will inspect the splice and estimate the optical loss of the splice. It will tell the operator if a splice needs to be remade. The operator removes the fibers from the guides and attaches a permanent splice protector by heat-shrinking or clamping clam shell protectors.



Figure 37: Fusion splicing activities



Figure 38: Fiber core alignment on splicing machine



Figure 39: fusion splicing completed stage



## 2.2.4.4.2. Fiber ONT Installation and Configuration

During training period with FTTH team, we visited different places in Kalmunai area for fiber ONT installation and configuration. The fiber ONT placed in proper location where connectivity for the instruments can be obtained easily and less interference from other Wi-Fi signals. The fiber ONT fixed in a way where the ports of the ONT are headed downwards and fixed one meter from ground level to protect the fiber ONT. We used the SC connector side of the patch code (Blue color) to connect the ONT and used SC connector side of the patch code (Green color) to connect the rosette. Finally, arranged patch code neatly to protect it.



Figure 40: fixed Fiber ONT



## **2.2.5. Data Section**

### **2.2.5.1. Job Profile of the section**

Data connection is an important part for Banks, Financial Organizations and some other government administrative offices. Therefore SLT has a responsible for continuous communication for them. And if the brake down period has reached the particular limit for the company SLT has to pay lack of money as compensation. Therefore SLT and there data team be always alert for prevent the disconnection. The following some tasks are accomplished by the Data team.

- IP configuration
- Replacing damaged network equipments
- Provide the VPN services
- Troubleshooting Data faults in Data connection
- IP Camera Surveillance system Installation

### **2.2.5.2. Encountered Data Faults**

- RJ-45 Ethernet cable damaged
- Data card faulty at MSAN
- IP configuration issues
- Customer Equipments damaged
- VPN service interruption

### **2.2.5.3. Working Instruments in Data Team**

- **RJ-45 Ethernet Cable**

Through Ethernet cable for ADSL routers, Fiber ONT to connect them with PCs, Ethernet switches, Wireless access Points.



Figure 41: RJ-45 Ethernet Cable

- RJ-45 Ethernet cable Crimping Tool

It is used to attach a connector (RJ-45) with a network cable (CAT5, CAT6).



Figure 42: RJ-45 Cable Crimping Tool

- Network Cable Tester

It is a used to test the strength and connectivity of a particular type of cable or other wired assemblies.



Figure 43: Network Cable Tester

## 2.2.6. New Connection Section

### 2.2.6.1. Job profile of the section

Current SLT new connections line set up is handled by the private contactors and SLT teams under these divisions are employed for final stage connection set up checking, connection activation and fault diagnosis. Do initial wire installation and setup configuration for PSTN and DATA connections. Normally, SLT provides PSTN connection for normal customers and organization as well. Data connection provides only for banks, Divisional Secretariats, Universities, and other government organizations. The following some tasks are accomplish by the new connection team.

- Provide new PSTN connection Provide new Data connection
- Reconnect the previous PSTN and DATA connections
- Rearranging line connection at customer's premise
- Jumbering the wire at MDF

### 2.2.6.2. Working Instruments of new connection section

- DP

It help to distribute the lines towards the subscriber because of the airtight covering copper wire prevented from the moisture and air which causes to the corrosion. DP is mounted on poles and drop wires are drawn from DP's to customer's home. Normally DP has maximum 10 wire loops.



Figure 44: Distribution Point

- Discharger unit or Fuse Box

Discharger is very important unit fixed at the customer's premises for the protect the telephone, router device and subscribers from lightning. It consists with two high voltage arresters for preventing hi-voltages and two fuses for preventing high current the earth wire and PVC cable staring from this point.



Figure 45: Discharger Unit

- Rosette

This is the connection unit between telephone set and discharger also it helps to make the maintenance work easy.



Figure 46: Rosette

- C-Hook

This is used to serve out the drop wire, from DP/Poles toward the customer.



Figure 47: C-Hook

- Retainer

This is used to retain a guard wire of drop wire, when distributing drop wires from DP to customer premises.



Figure 48: Cable Retainer

- Drop wire

These wires are generally used for outdoor installation in the telecommunication industry and to connect customer's telephone line to the local exchange. The conductor can be copper.



Figure 49: Drop wire

### **2.2.6.3. Standards using while implementing new connection**

- Minimum clearance of drop wire from the ground to the lowest in the span of drop wire shall be at 4.5 meters along the road and 5.5 meters at the road crossing.
- Buried dept of the DP pole is 1/5 of the pole height.
- The DP fixed on pole above 3.5 meters from ground level.
- If drop wire length greater than 500 meters, can joint with drop wire connector and less than 500 meters no needs cable joints.
- Discharger fixed firmly at a reachable height (1.5 meters to 2 meters) wires without spirals.
- Earth wire is to be connected to the discharger without spirals and joints.
- Internal wire stapled at 0.4m intervals.
- Rosette fixed on the wall 0.5m above the ground.
- The router device, ONT must fixed 1m above the ground level.

#### 2.2.6.4. Process Followed

In the Data and PSTN connection, first the physical connection is made from MSAN to customer premises end equipment. For a voice connection, the copper pair cable from customer end is connected to subscriber card in MSAN via MDF and the card port is configured and relevant details are updated in the Network Management System for the connection. And for a data connection, copper pair cable is connected to the Data card in MSAN via MDF and card port is configured according to the connection type by the network operation center in colombo for all the connection.



Figure 50: Loop checking at DP



Figure 51: cards checking at MSAN



Figure 52: Connection wire jumbering at MDF



## 2.2.7. Operation Support

SLT is a one of the very biggest organization with very wide coverage, a very large amount of employees and with many services and products with complex and interconnected operations. In order to provide a good service to the subscribers, all these operations and all the sections and the employees must be properly coordinated and correctly guided at each and every times. In order to satisfy the above requirements several systems have been designed in the SLT and its operations.

One such system is the Clarity. It is a operation support system of the SLT. It provides an interface for each and every section to look up for the duties they are been assigned or to update the system when the duties are completed or work progress so that other sections may work on that from that point.

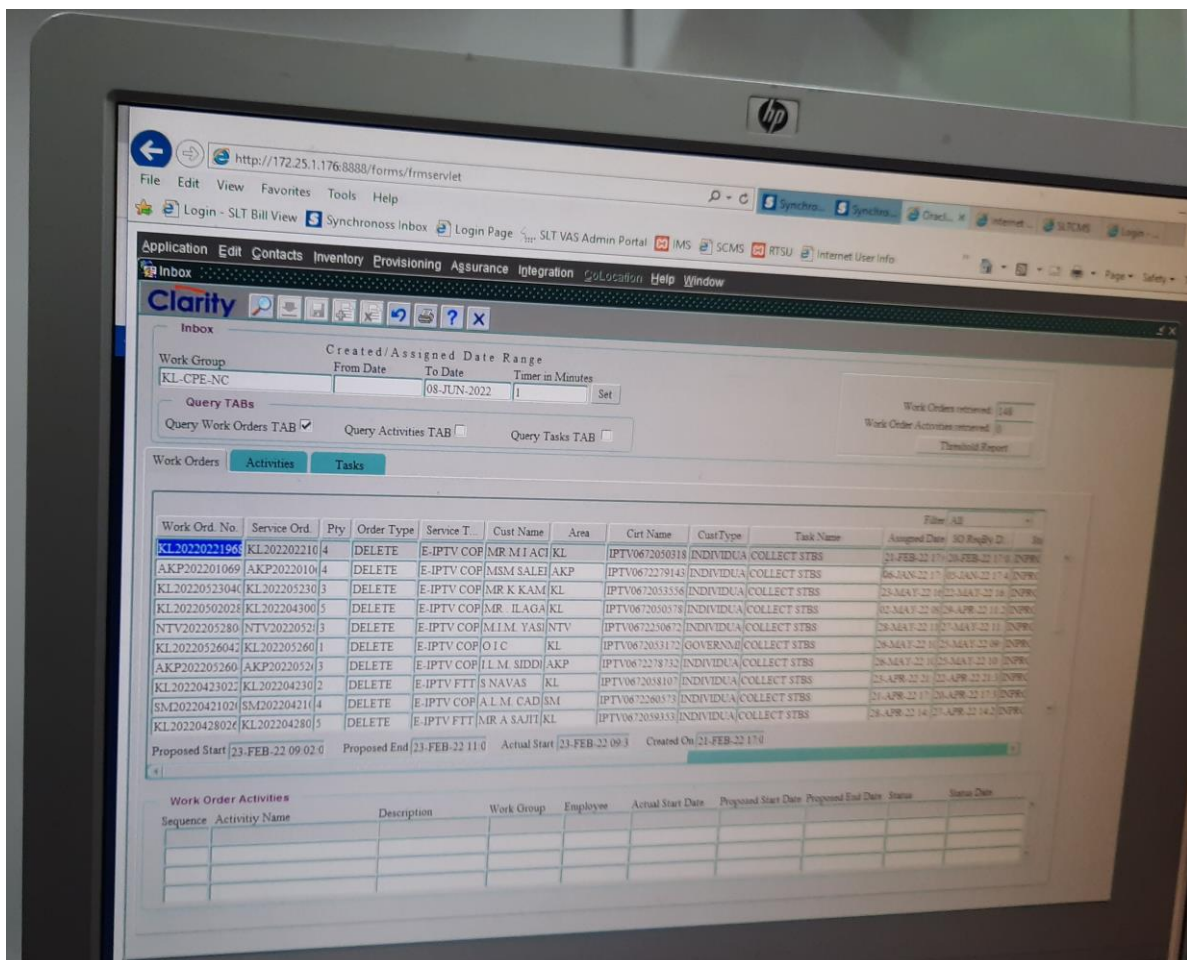


Figure 53: Clarity System of SLT



‘Work Force Management System’ is another concept which is a part of the clarity which defines the duties assigned to each section on some service order. For a one service order to be completed, several sub tasks may be needed to be done by relevant sections. Therefore work orders are issued with all the requirements and due dates etc. for a single task and they are either displayed on Clarity or posted to relevant sections. Then all the sections are issued with a work orders containing detailed task description for each section. Nowadays in SLT – Kalmunai, smart mobile devices are provided to all section’s teams for access the Work Force Management (WFM) system. It helps to reduce the workload of employees and communicate with other section.

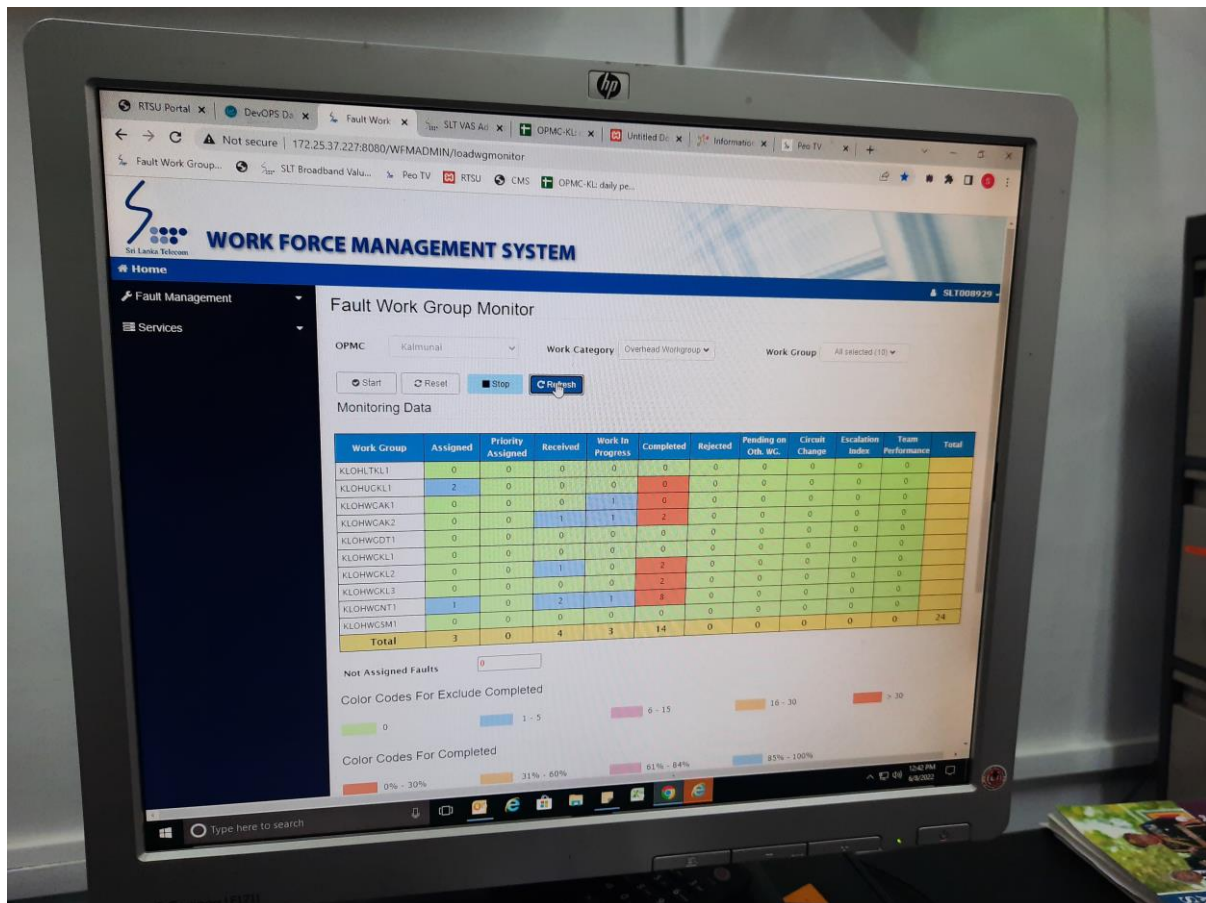


Figure 54: Work Force Management System of SLT

## Networking Section

### 2.3. Advanced Knowledge

#### 2.3.1. MSAN

MSAN has a special role in the telecommunication network. Multi Services Access Node (MSAN) is a platform capable of supporting all the widely deployed access technologies and services as well as the newly emerging ones, while simultaneously providing to a gateway to a NGN core. MSAN are very important and essential part for providing a host of services such as IPTV, broadband and the Voice. Multi-Service Access Node is a type of FTTN network. Fibers are connected to an existing node which is serving users with copper pair but below the required bandwidth. MSAN installation is cost effective when utilizing existing copper network to provide voice and xDSL services to residential and enterprise customers.

MSAN is a new technology which was replaced for Cross Connection Cabinet in SLT to support legacy and broadband services access technologies. MSAN connects to Public Switched telephone Network network via V5 interface for the delivery of Time Division Multiplexing based voice services and it connects to IP core network for broadband data services. MSAN is a triple-play ready platform that can offer perfect support for IPTV services with features.

All the MSANs in Sri Lanka are connected with each other in a two way ring network through IP Multimedia System (IMS) for the safety precautions. In SLT, there were two types of MSAN used – indoor (ID) MSAN and outdoor (OD) MSAN and it is could convey the services to around 2 km nearby area. The SLT has been used MSANs from Huawei and ZTE. All most of the MSAN in SLT-Kalmunai used ZTE type MSAN. A MSAN consists of control cards, uplink cards, data cards, power card, universal card, fan tray and backup batteries.



Figure 55: Outdoor MSAN



Figure 56: Indoor MSAN

### 2.3.2. Optic Fiber Cable

Fiber optic cables support long distance telecommunication and high-speed data transmission. Normally, Generally, one fiber optic cable is made up of five parts. Those are core, cladding, coating, strength member, and outer jacket. The “core” is incredibly thin strands of glass or plastic known as optical fibers. The “cladding” is an insulated casing closely surround the “core” providing lower refractive index to make the optical fiber work. The ”coating” is a protective layer of the optical fiber. The strengthen member, helps to protect the core against crushing forces and excessive tension during installation. As the name implies, an outer jacket is used to protect the cable from environmental hazards.

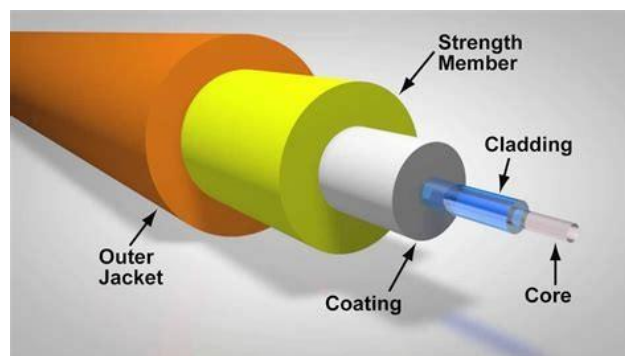


Figure 57: Structure of optic fiber cable

### 2.3.2.1. Optic Fiber Cable Types

- **Single-mode Fiber Cable**

Single Mode fiber optic cables have a small diametric core (9 to 10 microns) and allowing for a single light path. Generally, single mode optical fibers used in telecommunications operate at 1310nm or 1550nm wavelength. The most common application for single mode cables includes long-distance networking, where high- bandwidth signal transmission capabilities are necessary.

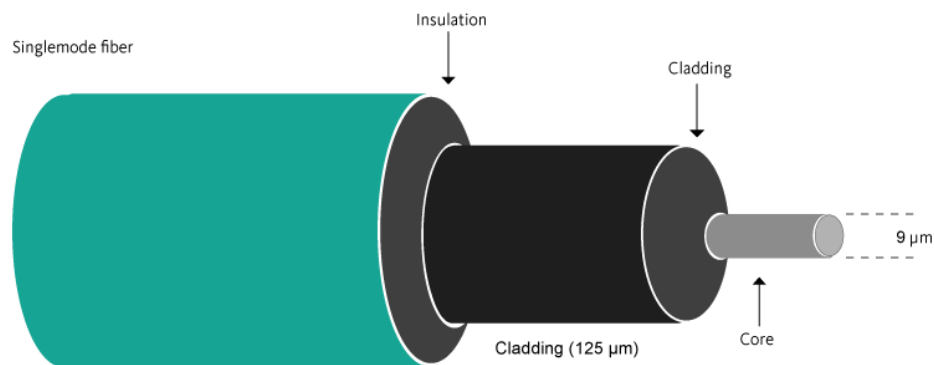


Figure 58: Single Mode Optic Fiber Cable

- **Multi mode Fiber Cable**

Multi mode fiber optic cable have a much larger diametric core (50 to 100 microns), which allows for multiple modes of light to get through. multi mode optical fibers used in telecommunications operate at 850nm and 1300nm. Multi mode optical fiber is used in short distance transmission within buildings such as computer network linking (LAN).

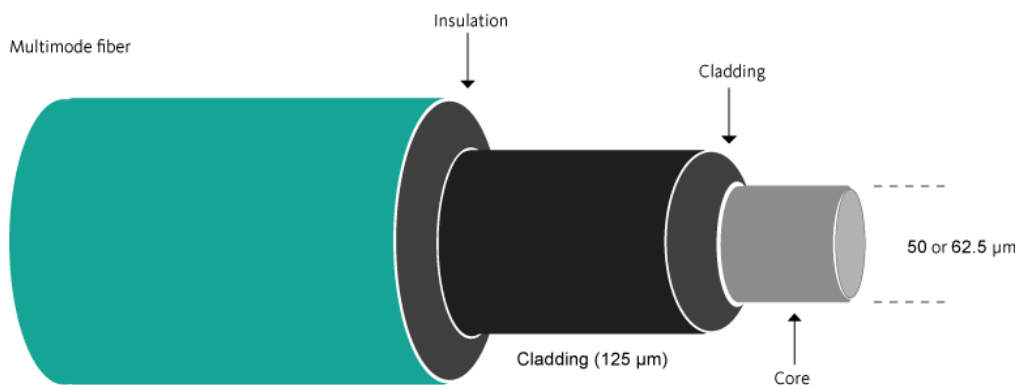


Figure 59: Multi Mode Optic Fiber Cable

### 2.3.3. FTTH

- Fiber to the home (FTTH), also called fiber to the premises (FTTP), is the installation and use of optical fiber from a central office directly to individual buildings such as customer residences, and businesses to provide uninterrupted high speed internet access. FTTH is the ultimate fiber access solution where each subscriber is connected to an optical fiber.
- FTTH can provide higher bandwidth for users to meet different demands of voice, video, and data with fiber as the transmission medium, which will gradually replace copper accessing technology. The current mass FTTH deployment is based on the passive method. Can Provide the Data download, VoIP, Video Conference, Music on demand ,multimedia contents, online gaming,HD digital TV through FTTH along with their bandwidth.

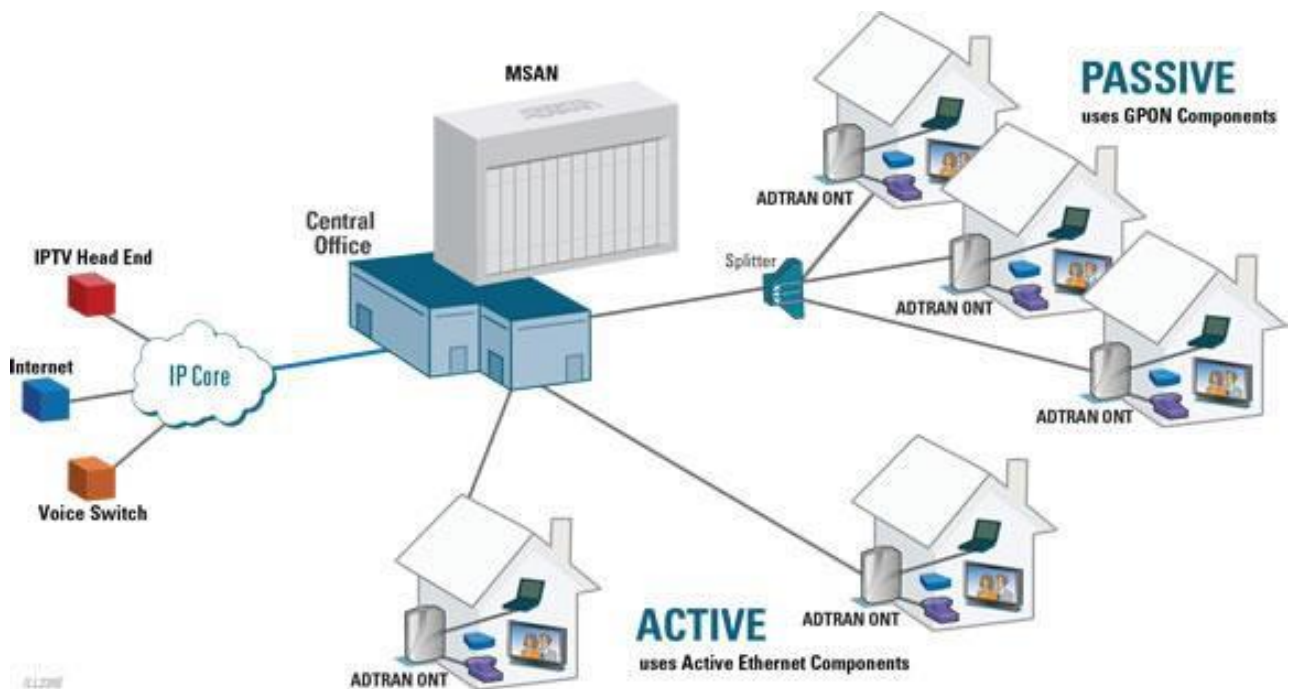


Figure 60: Architecture of FTTH Network

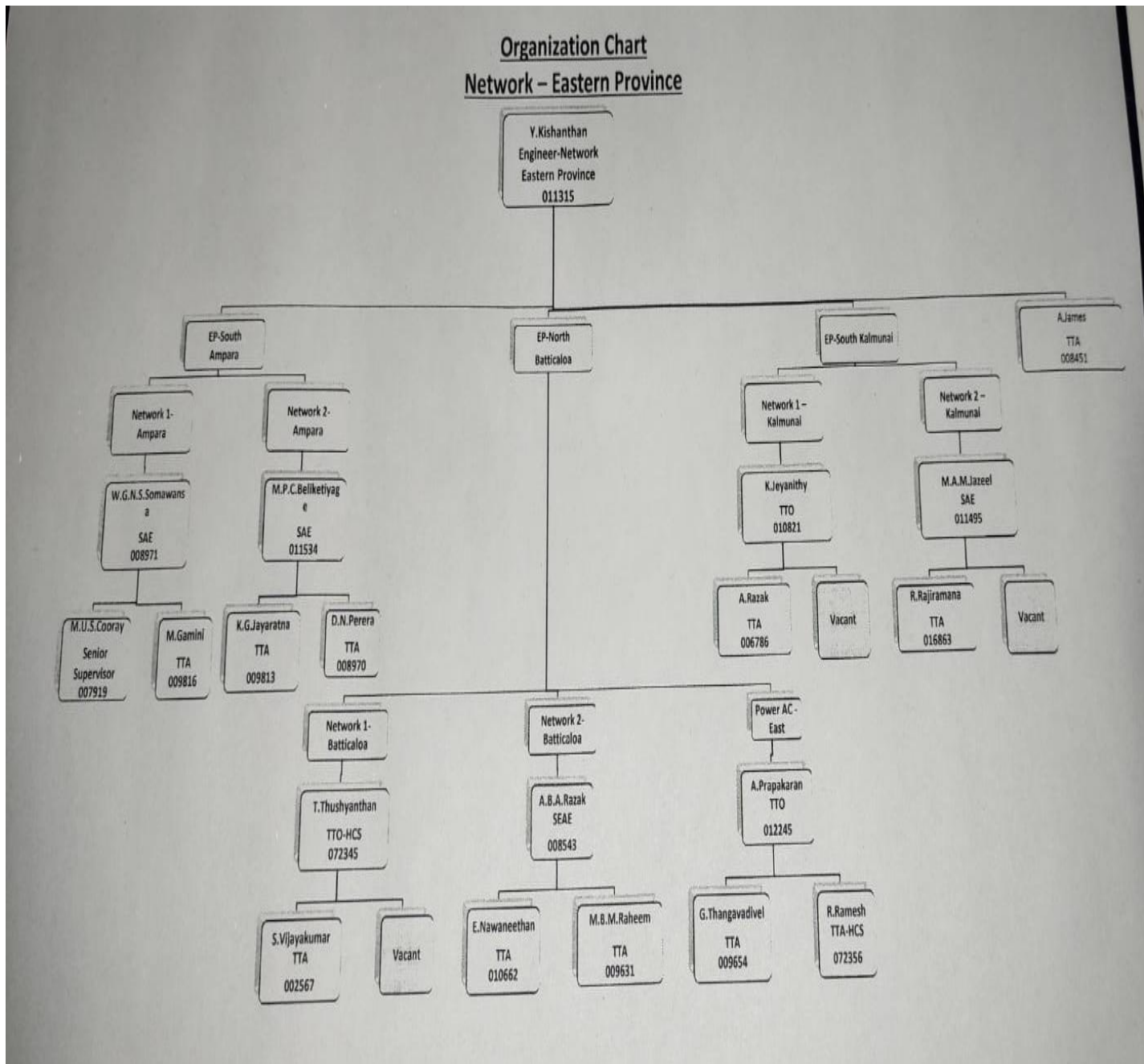
- In FTTH, Gigabit Passive Optical Networks (GPON), Optical Line Terminal (OLT), Optical Distribution Frame (ODF), Passive Optical Splitter (POS), Fiber Termination Cabinet (FTC), Fiber Distribution Point (FDP), Optical Network Unit/Terminal (ONU/ONT) are main components to build a FTTH networks.

## **2.4      Networking/Switching Section**

Networking section functions are MSAN maintenance, Fiber splicing, RSU maintenance and Fuel delivery work for all RSU areas (Kalmunai OPMC, Kalmunai Teleshop, Ninthavur, Sammanthurai, Akkaraipattu, Oluvil and Tirukovil). Ampara, Kalmunai, Batticaloa, Trincomalee switching sections are Under the Senior Engineer of the Network Section-Batticaloa. Each section is handling by the Senior Assistant Engineer and Telecommunication Technical Officer.



## 2.4.1 Organization Chart Network Section



### **2.4.1 Fiber Optic Splicing Closure Installation**

Fiber optic splice closure is usually used with outdoor fiber optic cables, provides space for the outdoor fiber optic cables to be spliced together. The fiber optic splice closures and the fiber trays inside will protect the spliced fiber and the joint parts of the outdoor fiber cables. Things that use in fiber splicing closure those are Upper enclosure, Lower enclosure, Gasket, Splice tray, Vacuum grease, Heat shrink sleeves, Unit protection tube, Cable tie, Hanger.

During my training period with the FTTH team, we visited different places in kalmunai area to install new optic fiber splicing closure. To install the splicing closure, we followed some procedures. Those are,

- Strip the fiber cable using cable stripper
- Separate the upper and lower enclosure.
- Remove the sheath.
- Cut the tension member.
- Apply grease and sheath gasket.
- Fix the tension member.
- Insert the unit protection tube.
- Introduce the cable into the splice tray.
- Arrange the protection tube.
- Splicing as required then Store the fibers.
- Stack the splicing tray.
- Fix the cables.
- Close and seal the closure.
- Install the fiber closure.





Figure 67: Some steps of fiber splicing closure installation

### **2.4.1 Working with Optical Power Meter**

Optical power meter is a testing instrument working to accurately measure the power of fiber optic equipment, or the power of an optical signal passed through the fiber cable. The sensor part of the device has been selected for the given range of power levels and wavelengths. The optical power meter is typically connected to the other extreme end of the fiber optic cable. This method is used for measuring the optical power that has been received at the other end.

Power meter was connected in the ODF which in the MSAN in Akkaraipaththu RSU (Remote Switching Unit). After that we connected the one of the patch cord in the power meter which is in Akkaraipaththu Telecom office. Later we connected other end in the ODF. Like that we did to MSAN. Then it was checked by giving suitable measurement to power meter from the Akkaraipaththu Telecom office.



Figure 68: Power level measured at fiber DP

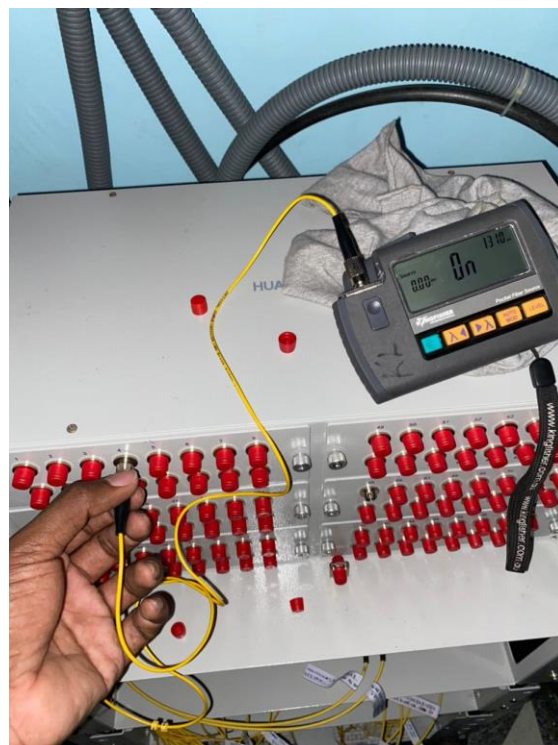


Figure 69: Power level measured at ODF

## 2.4.4 Main Components of FTTH Network

- **Optical Line Terminal (OLT)**

Central Office switch Aggregation equipment for GPON system. It contains a number of slots to install GPON service cards, upstream cards, control cards and power cards. 8 or 16 GPON ports depending on the model and vendor. Each GPON port serves up to 64 end-users (lower density of users per port is also possible varying the split ratio).



Figure 61: Optical Line Terminal

- **Optical Distribution Frame (ODF)**

outdoor cables are terminated and become available to interface with the active equipment or patching. offers flexible patching between active equipment ports or splitters and the outdoor cable termination. Fibers are identified and stored in physically separated housings or shelves to simplify fiber maintenance and to protect or avoid accidental interference to fiber circuits. Each fiber from the Feeder cables is spliced to a pigtail and terminated in an adapter at the front of the ODF panel.

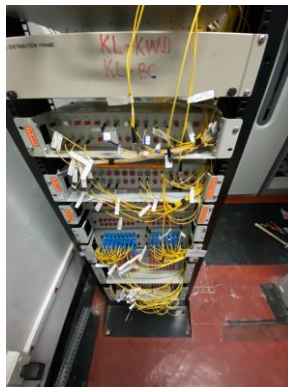


Figure 62: Optical Distribution Frame



- Fiber Termination Cabinet

Fiber Termination Cabinet(FTC), known as fiber termination box (OTB) as well, is a compact fiber management product of small size. It is widely adopted in FTTH cabling for both fiber cabling and cable management. One or more Splitters are included here. Upon the model and product number of splitters can be varied. Patching can be done at these points.



Figure 63: Fiber Termination Cabinet

- Passive Optical Splitter

Fiber optic splitter, also referred to as optical splitter. is an integrated waveguide optical power distribution device that can split an incident light beam into two or more light beams. Optical splitter has played an important role in passive optical networks (like FTTH) by allowing a single PON interface to be shared among many subscribers.



Figure 64: Passive Optical Splitter

- FDP

Splitter is included here. Patching can be done at these points. Flexibility is available here. Connection received from FTC and distributed among customer premises.



Figure 65: Fiber Distribution Point

- ONT

End equipment at Customer premises. Features depend on manufacturer and model. Fiber will terminate at this point. User appliances connect to here (PC,Laptop, STB,TV, Telephone, CCTV, etc)



Figure 66: Fiber ONT

## 2.5 Outcomes of activities during the training

### 2.5.1 Working with Optical Time Domain Reflectometer (OTDR)

An Optical Time Domain Reflectometer (OTDR) is an instrument used to test the optic fiber cable route. The analyzed data can provide information on the condition and performance of the fiber cable such as fiber cable losses, power level.

SLT had been using Handheld OTDRs which are often working on battery power, to measure fiber links and locate fiber breaks, points of high loss, high reflectance, end-to-end loss, and Optical Return Loss. Its user interface is usually simple and straightforward so that SLT technicians can be easily trained to operate the OTDR. OTDR sends a series of optical pulses into the fiber under test. There are number of options given in OTDR to test fiber connections. It traces the number of connection points, length, losses, fault locations, power by using invisible light source when fiber is connected to coupling sockets of the equipment.

Technical Officer and I checked which was done by OTDR machine. Jointed the one end of the patch cord in the OTDR machine and other end in the ODF then we checked by giving Km measurement. Once the OTDR test is completed, the system displayed the OTDR results in both numeric and graphical formats. The graph, also called trace, it showed where each connector, splice, or break is located, along with the signal loss (in dB) and reflection characteristics of each element.

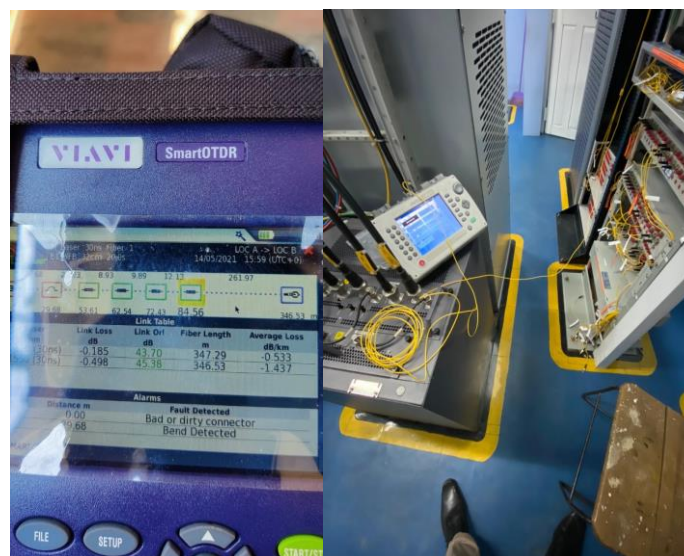


Figure 70: OTDR testing at ODF

## 2.6 Some Encountered Problems and Proposed Solutions

- I went to Ceylon Electricity Board office in Kalmunai with the technical officer. We repaired PEOTV in the CEB office. The PEOTV did not function in the CEB office. Then we checked the RJ-45 Ethernet Cable connector was broken. Then remove the cable connector. Then we did RJ-45 cable crimping.
- I and technical officer went to customer premises in kalmunai area. We repaired PSTN fault in the customer premises. The telephone line was worked with heavy noise. Then we checked the drop wire was damaged. Then remove the damaged parts of cable. Then we did dropwire rejoining.
- We went to police station in karaithivu. We resolved 4G router's signal issue in the Police station. The 4G router did not work in the police station. Then we checked the router for troubleshooting and network mode was changed automatically. Then we reconfigure the router device.
- I and technical officer went to customer premises. We connected patch cord in Fiber ONT at customer premises. As patch cord was broken which change new patch cord.
- We went to customer house in kalmunai area. We resolved the misconfiguration issue in ADSL router. The router did not internet function. Then we checked the ADSL router was with misconfiguration for internet connectivity. Then we configured the ADSL router.
- The fiber fusion splicing was done to join the broken fiber cable at kalmunai. After the customer's report, we visited to customer's residence area. Then we checked the fault location using OTDR machine. Then we did fusion splicing and checked the losses , power level of fiber wire.



## **Chapter 3: Conclusion**

### **3.1. Conclusion**

Sri Lanka Telecom (SLT) PLC is a leading telecommunication organization in Sri Lanka. It has an exquisite staff including highly qualified engineers, skilled technicians. I feel fortunate of having the opportunity to be a trainee at Sri Lanka Telecom as an undergraduate.

In my opinion, SLT is one of the best organizations for a undergraduate students to have industrial training, especially because they operate number of technical divisions internally to provide services which covers total telecommunication operation in Sri Lanka. This permits a trainee to get a broad understanding of process in networking and telecommunications.

I really appreciate all the staff members and the manager at SLT - Kalmunai who helped me to gain all these experiences and the training planning section of SLT for coordinating my training. I was trained in 4G LTE & IPTV section, Maintenance section (PSTN, ADSL), FTTH section, New Connection section (PSTN, DATA), DATA section, CPE repairing center and Operation Support section at Out Plan Maintenance Center and . The experience of working with the professionals was an amazing opportunity for an undergraduate like me. I am sure that this training period will definitely help my future carrier in many ways.

Finally, I consider it is a great privileged and overwhelmed experience to undergo a productive and wonderful training at Sri Lanka Telecom PLC.

### 3.2. References

- Sri Lanka Telecom.(2022). 2021 Annual Report.<https://slt.lk/si/content/annual-report-2021>
- Sri Lanka Telecom. Profile.<https://www.slt.lk/en/content/profile>
- Sri Lanka Telecom. Subsidiaries. <https://www.slt.lk/en/about-us/profile/subsidiaries>
- Sri Lanka Telecom. Vision, Mission & Values.\_  
<https://www.slt.lk/en/about-us/profile/vision-mission-and-value>
- Admin. (2018).What Is Fiber Optic Cable and How Does It Work?.\_  
<https://www.fiberopticsshare.com/what-is-fiber-optic-cable.html>
- Techno Pedia. (2018, December 23). FTTH Components and General Architecture.\_  
<https://www.technopediasite.com/2018/12/ftth-components-and-general-architecture.html>
- Cablesys. (2018, April 5). What are the Different Types of Fiber Optic Cables?.\_  
<https://cablesys.com/updates/fiber-what-are-the-different-types-of-fiber-optic-cables/>

### 3.3. Certification

Name of the Trainee : M.A.M.Aakil Zihaf  
NIC No : 199820202975  
Address : 155 B, Dr.Rizvi Road Kalmunaikudy-05  
Institute : College of Technology Maradana.  
Program : Diploma in Information Communication Technology  
Program Period : One and half Year  
Training Organization and Address : Sri Lanka Telecom PLC, Yard Road, Kalmunai.  
Training Period : Six months (14.03.2022 to 13.09.2022)

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

Date: .....

.....  
Signature of the Trainee

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

Date: .....

.....  
Signature of the Engineer

### 3.4. Appendixes

#### 3.4.1. Submarine Cables in Sri Lanka

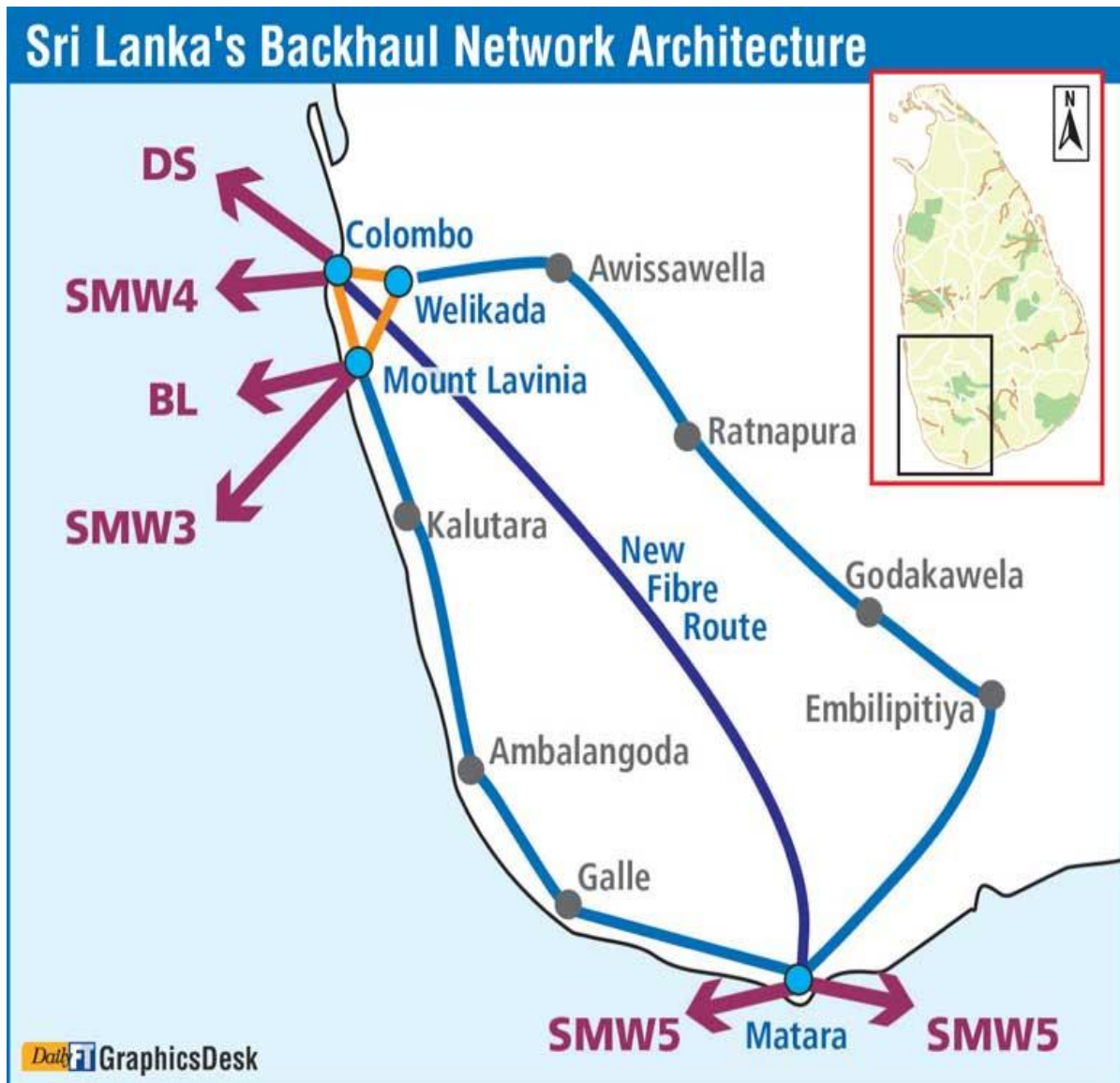


Figure 71: Submarine cables in Sri Lanka

DS	-	Diragu SLT Submarine Cable
SMW4	-	Sea Me We 4
BL	-	Barath Lanka Cable System
SMW3	-	Sea Me We 3
SMW5	-	Sea Me We 5

