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ACKNOWLEDGEMENT

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SUMMARY

I had conducted field practical training at Tanzania Telecommunication Corporation Limited (TTCL) in Mwanza for six weeks. During field practice, I did various works and tasks in different department which are Department of Access network, switching and data, Radio and Transmission, power and air condition. During my Industrial Practical Training I gained different experiences in installation of power in different switches, configuration of router, fiber cable installation, and maintenance of MSAN (multi-service access node) switch, Telephone line installation, troubleshooting of data network, wireless connection and its devices. Therefore this practical activities done during the industrial training will help basically to analyze and justify the overall knowledge obtained on the different aspects in the field of Telecommunication, Networking and advancement of Technology at large

CHAPTER ONE: INTRODUCTION

Historical background of TTCL

TTCL is a public institution which operate in nationwide, providing high-quality and reliable networks which offer a comprehensive range of telecommunication services to businesses, consumers, operators and the government.

TTCL was established in 1994, after the dissolution of Tanzania Posts and Telecommunications Corporation. The dissolution resulted into separated the Telecommunications business from the postal services business, postal bank business and creating an independent communication regulator.

Major Product /service provided by TTCL

- Data- TTCL provides bandwidth to different vendors like Vodacom, Tigo, Airtel and Smart Also there are something known as Visual Private Network which used special to the Bank.
- Voice- this provides mobile phone

Also the services offered by the company include:

- Customer premise equipment's
- Leased lines to cellular and ISPs
- Private leased lines
- Internet services
- IP Virtual Private Network (IPVPN)
- TTCL Broadband
- TTCL mobile
- Interconnection to cellular and other licensed telecommunications operators

Vision

Vision of TTCL is to be a leading world class communication services provider in Tanzania and their focus is their Customers, and their strength is their people.

Mission

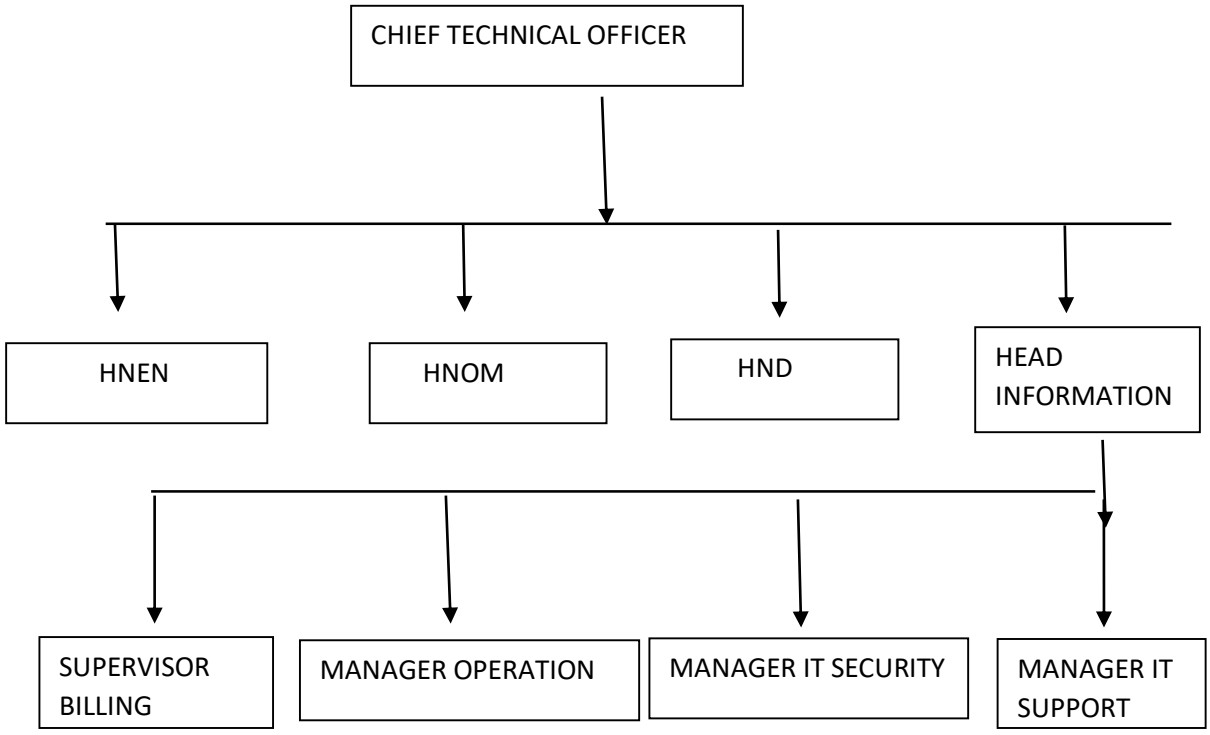
The mission of TTCL is to provide world class communication services to their customers, through continuous technological and customer care improvements with qualified and motivated employees and contribute to the national development and usage of ICT

Task performed during industrial practical training

- Trouble shoot of data network
- Configuration of different switches and routers
- Installation of power in the switches and maintenance of power equipment
- Installation of fiber optic cables
- Clearance of Voice and Data line fault
- Build new subscriber detail into IP Multimedia Subsystem (IMS)
- Termination of National ICT Backbone

Organization chart of TTCL Company

The TTCL Company has the following governing structure.



CHAPTER TWO

ACCESS NETWORK

An **access network** is the part of a telecommunications network which connects subscribers to their immediate service provider. It is contrasted with the core network (for example the Network Switching Subsystem in GSM) which connects local providers to each other. The access network may be further divided between feeder plant or distribution network, and drop plant or edge network.

Access process

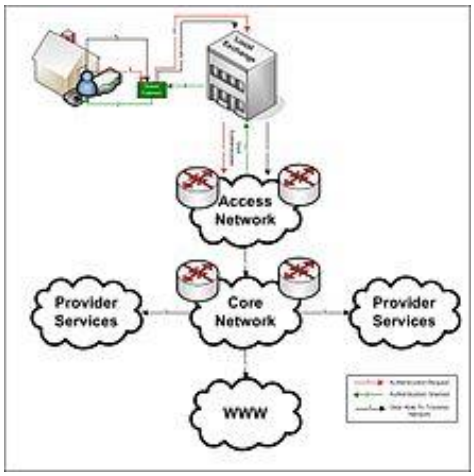


Figure 1: access process

In access network site there are frames where by customers are connected which are;

i. Main distribution frame(MDF)
ii. Distribution point (DP)
iii. Cabinet

MAIN DISTRIBUTION FRAME

In Telephony, a **Main Distribution Frame (MDF)** is a signal distribution frame for connecting equipment (inside plant) to cables and subscriber carrier equipment (outside plant) and also MDF a passive device (no need of electrical power). The MDF is a termination point within the local Telephone exchange where if a new connection is given at the exchange side and cable side relevant point are connected by using another small cable these cables are called **jumper**. All cable copper pairs supplying services through user telephone lines are terminated at the MDF and

distributed through the MDF to equipment within the local exchange.

In the MDF section it is comprised with the MDF frame and a line test console. Within this section there is a termination of the cables. This deals with a lot of networks wires and lots of terminations that the room needs to be at a low temperature to reduce the heat produced by the PGS, MODEMS and other terminating equipment.

Figure 2: Appearance of Main Distribution Frame

DISTRIBUTION POINT (DP)

A distribution point is the point within a network where the cable or fiber terminates. This point provides a point of entry for engineers to terminate or test the network.

5 pair or 10 pair cable is laid from cabinet to DP that means there are 10 loops, 5 loops in DP. When a new connection is provided a pair of cable is drawn from DP to home this means that 10 to 5 telephone new connection can be provided from a DP

CABINET

Cabinet this is the point where multiplier cables are drawn from MDF to cabinet. Also cabinet consist of two sides which are exchange side (E-side) from TTCL company and distribution side (D-side) to the Customer

Figure 3: Cabinet

Tasks performed by access network

The access network department perform different tasks which are surveying field of work ,connect aerial or ground cables from customer to main distribution frame via cabinet and distribution point, troubleshooting of different problems of phones lines and data cable lines (phone lines faults).

Termination of fiber optic cables

FIBER OPTIC CABLE SPLICING

Two Optical fiber splicing methods are available for permanent joining of two optical fibers. Both methods provide much lower insertion loss compared to fiber connectors.

- Fiber optic cable fusion splicing – insertion loss<0.1db
- Fiber mechanical splicing – insertion loss<0.5db

Fiber Optic Cable Fusion Splicing is the act of joining two optical fibers end-to-end using heat. The goal is to fuse the two fibers together in such a way that light passing through the fibers is not scattered or reflected back by the splice, and so that the splice and the region surrounding it are almost as strong as the intact fiber.

Figure 4Optical fiber splicing machine

The following are the procedures used in preparing each fiber end for fusion splicing

Stripping the fiber

Stripping is the act of removing the protective polymer coating around optical fiber in preparation for fusion splicing. The splicing process begins by preparing both fiber ends for fusion, which requires that all protective coating is removed or stripped from the ends of each fiber.

Figure 5: Stripping machine (stripper)

Cleaning the fiber

The customary means to clean bare fibers is with alcohol and wipes. However, high purity isopropyl alcohol (IPA) is hygroscopic: it attracts moisture to itself.

Cleaving the fiber.

The fiber is then cleaved using the score-and-break method so that its end-face is perfectly flat and perpendicular to the axis of the fiber. The quality of each fiber end is inspected using a microscope. In fusion splicing, splice loss is a direct function of the angles and quality of the two fiber-end faces. The closer to 90 degrees the cleave angle is the lower optical loss the splice will yield. Before the cleaving process with your first piece of fiber remember to slide a splice protector/sleeve onto the fiber then cleave it.

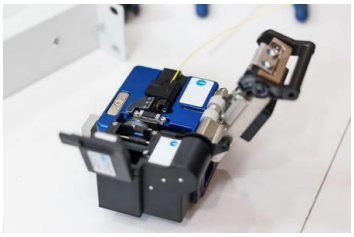


Figure 6: Cleaving machine (cleaver)

Splicing the fibers.

Once your first piece of fiber is cleaved, cleave the other piece of fiber (this second piece doesn't need a splice protector/sleeve) and place into the fiber clamp in the fusion splicer. The end of the fiber has to stop approx. halfway between the blue fiber guide and the center of the electrodes. Shut the main lid and the machine will perform the fusion splice. Push the Blue/Go button if it doesn't automatically start.

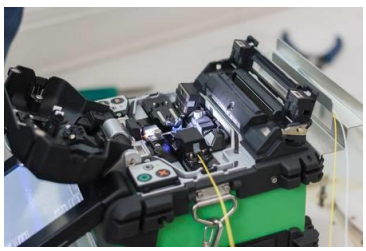


Figure 7: Splice fiber cable

A splice loss estimate is measured by the splicer, by directing light through the cladding on one side and measuring the light leaking from the cladding on the other side. A splice loss under 0.1 dB is typical.

Heat shrink the fiber protection sleeve

Making sure you don't touch the bare fiber, slide the fusion splice protector over the bare piece of fiber with the join in it, keeping the bare fiber in the center of the fusion splice protector.

Open the heater at the back of the fusion splicer, place the fiber in the right clamp, and while holding tension on the fiber, put the fiber in the left clamp.

The heater should automatically start. If it doesn't, you will need to push on the heater button that corresponds to the heater that you are using.

Figure 8: heating the sleeve to protect the fiber

Wait for several seconds until you hear the machine to beep and the light goes off. Remove the fiber with splice protector/sleeve from the heater and place in the cooling stand for further cooling.

Fibers are terminated in connectors so that the fiber end is held at the end face precisely and securely.

CHAPTER THREE

Switching and Data section

Switching is the technique by which nodes control or switch data to transmit it between specific points on a network .there are three common switching techniques:

- Circuit Switching
- Packet Switching
- Message Switching(in message switching end users communicate by sending and receiving message that include the entire data to be shared)

In switching section is where anew subscriber details can be added passing through different nodes which perform different tasks, such anodes are

CSCF (call session control function)

This node is the core call controller, it functions as session/call control component.it mainly deal with registration and authentication, signaling and call routing, emergence call processing.

ATS

Is a telephone application server which realizes general telephone services .it provide **Basic call services** (such as call out features e.g. local, mobile, international and STD calls), **Supplementary services** (call barring services, call forwarding services), triggers all calls to CCF for online charging.

HSS

Store IMS subscriber data (including services profile and authentication data (**user name** and **password**))

ENS

It is embedded in HSS. The main role played by ENS are **Resolving domain name to IP address, resolving telephone number to sip address /URL mapping** (i.e. **tel: 2134000** and **sip:+255213400@ttcl.co.tz**)

AGCF (access gateway control function)

This perform connections of all MSANs to IMS network .Customers connected to MSAN and IAD registers to IMS through AGCF .Also Port TID ,location information ,equipment ID and location are all modified in this node

CHAPTER FOUR

Radio and Transmission

Radio is the technology of using radio waves to carry information, such as sound, by systematically modulating properties of electromagnetic energy wave transmitted through space, such as their amplitude, frequency and phase. A radio communication system requires a transmitter and receiver, each having an antenna and appropriate terminal equipment such as a microphone at the transmitter and a loudspeaker at the receiver in the case of a voice communication system

Uses of Radio

- In maritime for sending telegraphic message using Morse Code between ship and land
- Radio was used to pass an orders and communication between armies and navies on both sides in world war
  Today radio takes many forms including wireless networks and mobile communications of all types, as well as radio broadcasting

Telephony

Mobile phones transmit to a local cell site (transmitter/receiver) that ultimately connects to the public switched telephone network (PSTN) through an optic fiber or microwave radio and other network elements. When the mobile phone nears the edge of the cell site's radio coverage area, the central computer switches the phone to a new cell. Cell phone originally used FM, but now most use either GSM or CDMA digital modulation schemes. Satellite phones use satellites rather than call towers to communicate.

GSM

This is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 9000MHz,1800MHz and 1900MHz frequency bands. GSM system was developed as the time division multiple access (TDMA) technique for communication purpose .GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client of data, each in its own particular time slot. The digital system has an ability to carry 64kbps to 120Mbps of data rate

Features of GSM module:

- International roaming
- Support for new services
- Fixed dialing number
- High quality speech
- Short message services
- SIM phonebook management

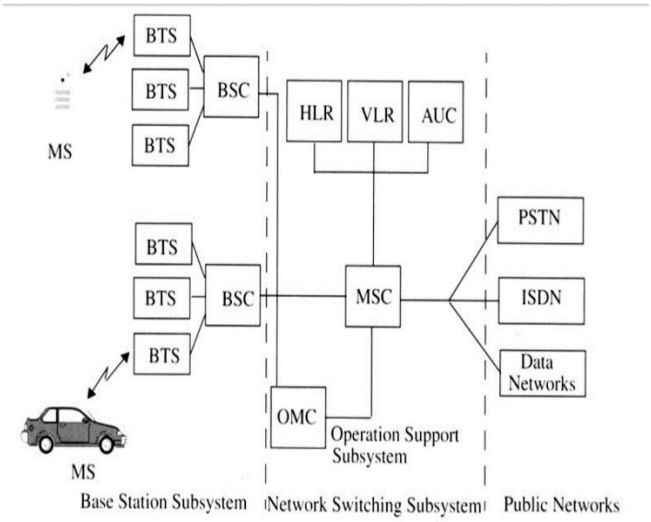


Figure 9: GSM architecture system

CDMA (code division multiple access)

This refers to any of several protocols used in second-generation (2G) and third generation (3G) wireless communications.as the term implies, CDMA is a form of multiplexing, which allows numerous signals to occupy a single transmission channel, optimizing the use of available bandwidth. The technology is used in ultra-high-frequency (UHF) cellular telephone systems in the 800-MHz and 1.9-GHz bands. CDMA employs conversion (ADC) in combination with spread spectrum technology.

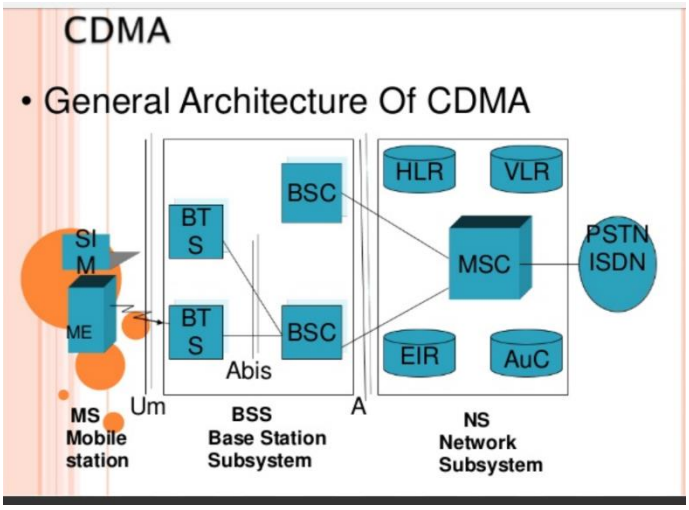


Figure 10: general architecture of CDMA

WIRELESS COMMUNICATION TECHNOLOGY

Wireless Technologies:

- **Terrestrial Microwave** - Terrestrial microwaves use Earth-based transmitter and receiver. The equipment looks similar to satellite dishes. Terrestrial microwaves use low-gigahertz range and communications are limited to line-of-sight. Microwave antennas are usually placed on top of buildings, towers, hills, and mountain peaks.
- **Communications Satellites** - The satellites use microwave radio as communications medium which are not deflected by the Earth's atmosphere. The satellites are stationed in space, typically 22,000 miles above the Equator. These Earth-orbiting systems are capable of receiving and relaying voice, data and TV signals.
- **Wireless LAN** - Wireless local area networks use a high and low frequency radio-wave technology. Wireless LAN use spread spectrum technology to enable communications between multiple devices in a limited area. An example of open-standards wireless radio-wave technology is IEEE 802.11b.
- **Bluetooth** It's a short range wireless technology. Operate at approximately 1 Mbps with range from 10 to 100 meters. Bluetooth is an open wireless protocol for data exchange over short distances.

CHAPTER FIVE

POWER SUPLLY AND POWER PLANT

The system operates on two power supply systems a -48vV DC system, and a 220V (or 115V) AC, 50 or 60 Hz three-phase system. Solid state DC/Dc converts provide the operating voltage required by the switching equipment frame, namely +5V DC and +12V DC for each frame. Standard grounding for switching system equipment is provided to minimize performance error or component failure due to power surges. Further protection is provided by fuse modules regulating power distribution to frame.

All equipment requiring direct current operates at a nominal voltage of -48V DC. Normal operation is guaranteed from -43 to -58V DC.

Batteries are charged on fully floating basis. It is recommended that charges be provided in N+1 redundancy, operating in a load sharing arrangement.

Main battery

It is recommended that the capacity of the main battery should be capable of maintaining call processing for three hours of busy hour load.

Power plant

TTCL receives 11kv, 50Hz 3phase supply from TANESCO. The voltage is passed into its two step down transformers rated 500V, 50Hz, 1600A.Here the voltage is being reduced from 11kv to 415v which is then passed in a switch.

When mains fail, there are two standby generators which automatically switched on and supplies power. At the transition period from mains supply to generator supply, the D.C batteries supply power.

Figure 11: Automatic generator and backup batteries

Then from the switch the voltage reaches the BUS BAR (distributer).

From the bus bar it goes to the rectifiers. The rectifiers converts A.C into D.C which is preferred mostly by electronic devices. Then the D.C voltage is stored in the D.C batteries. If A.C is needed again an inventor is connected to obtain A.C for air conditions and other A.C machines. The D.C voltage is used to operate D.C devises.

POWER ARCHTECTURE

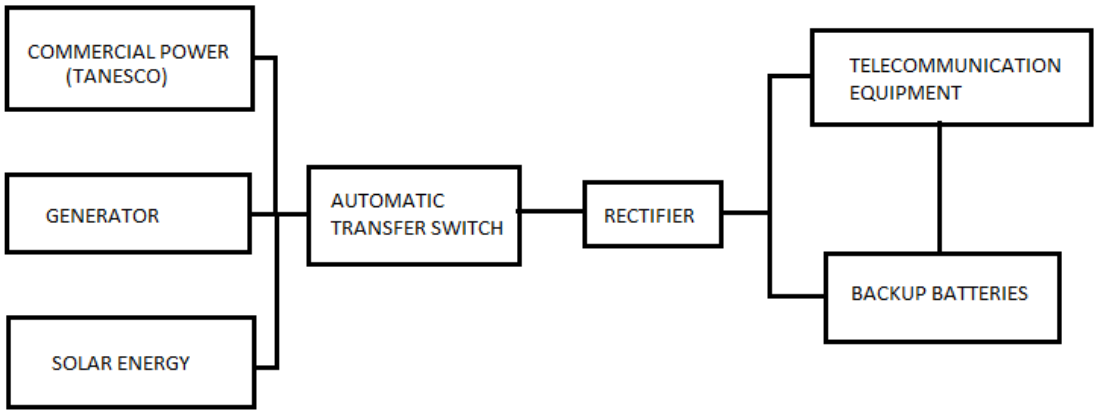


Figure 12: **Power Architecture**

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

CONCLUSION

Industrial practical training has more benefits because it help students to expand their knowledge and also to apply what they have learnt in their colleges. This also help the student to get experience and to increase their confidence of working in different organization with more experienced workers and also help the students to get new knowledge which was not learnt yet in their colleges.

RECOMMENDATION

To what I have learnt during my practical training, I would like to congratulate the TTCL CORPORATION for accepting and taught us different telecommunication skills but I would like to recommend them that they should allow students to perform many activities on their own especially in power, data & switch, and radio & transmission.

Also I give thanks to the University of Dodoma for their hard working on finding us places for practical training but I would like to recommend them that they should extend the time for practical training and early confirmation of places for practical training.

CHAPTER SEVEN: REFERENCES

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APPENDICES

A. Lecture notes

B. Weekly Report/Logbook