



East West University

Department of Electronics & Communication Engineering

INTERNSHIP (Industrial Training)

Report On

Transmission and Data Communication System of VOICETEL Ltd.

as a partial fulfillment of Bachelor of science in Electronics and
Telecommunication Engineering at East West University.

Prepared By:

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ID:2012-1-55-035

Supervised By:

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Date of Submission: 24th DECEMBER,2015



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Disclaimer

This is to declare that this internship is based on the transmission and data communication system of ICX in Bangladesh. It has not been submitted elsewhere as an Internship or a project report purpose.

Signature of Supervisor

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Fatema Tuj Juhra

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Acceptance of Report

This internship report has been presented to the department of Electronics and Communications Engineering, East West University and submitted for partial fulfillment of the course ETE 498 (Industrial Training) as well as for the Bachelor of Science Degree in Electronics and Telecommunications Engineering (ETE), under complete supervision of the undersigned.

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Acknowledgement

First of all I wish to convey my heartfelt thanks and gratitude to Almighty Allah to complete the internship successfully and also those who all rendered their cooperation in making this report.

I am personally in debt to a number of persons who helped me very politely and gently whose advice, direction and co-operation incorporate me to earn experiences and give opportunities to learn about the report formatting and VOICETEL LTD. That's why every person of VOICETEL LTD deserves thanks for their kind accommodating attitude.

I would like to express my best regard, indebtedness and gratitude to my company supervisor Muztahid Alam, Engineer of VOICETEL Ltd. For his cordial guidance and active help throughout the entire period of my internship.

I want to convey my gratefulness to my company supervisor who gave me the opportunity to work under his department & helped me significantly by providing important suggestions in my internship period.

Finally I am forever grateful to my parents for their patience and love.

.....

Fatema Tuj Juhra

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Abstract

The main purpose of the internship program was to perceive the real life situation. The academic knowledge is not well enough to compete with real world. This internship program was helpful to face the real working environment.

This internship report contains all the information about my work experience with VOICETEL Ltd, which started its work in Bangladesh from 2011. In VOICETEL Ltd. I have spent a good time in learning and was rewarded for my best efforts, learnt to deal with different situations, had experience of corporate working environment which affects an employee performance and attitude towards work, had good time in learning and performing. I have also gathered experience. Confidence, on time decision making, consistency, hard work, team work, seeking success out of dark, innovation, creativity, organizational survival are the key learning's out of my job and and I would like to say that it will be one of my best skill that would remain with me and help me in future which will offer many challenges. I would like to highlight this, that my experience with Voicetel was very memorable and full of learning's, where I found a lot of positive changes in my attitude, learning and behavior.

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Chapter 1: Introduction

Introduction

Telecommunication in Bangladesh:

The liberalizations of Bangladesh telecommunications sector began with small steps in 1989 with the issuance of a license to a private operator for the provision of inter alia cellular mobile services to compete with the previous monopoly provider of telecommunications services the Bangladesh Telegraph and Telephone Board(BTTB).The telecom sector in Bangladesh is rapidly emerging.Bangladesh Telecommunication Regulatory Commission (BTRC)is the regulatory authority for this sector,overseeing licensing,policy etc.It is now one of the biggest sector of Bangladesh.

An Interconnection Exchange is a company which routes the Domestic International voice traffic to and from ANS and IGW.

Company Profile

Voicetel Ltd is an Interconnection Exchange(ICX) operator. Voicetel Ltd. has world class network,equipment,best team and international technology partners. Voicetel Ltd. was formed in the year 2011 by a dedicated team of professionals having wide experience in the fields of Business and Product Development.In April ,2012 Voicetel Ltd has been awarded with Interconnection Exchange Operator license by BTRC to connect all Telecom operators in Dhaka,Chittagong and Khulna. Voicetel's goal is to create a nationwide network aiming at creating strong equity through affordable,reliable,efficient services to our strategic partners through continuous technological innovation.

Chapter 2: ICX (Interconnection Exchange)

What is ICX?

Interconnection Exchange (ICX) is the switching center where many networks interconnect in order for offering easy access to other telecom operators. It enables the user of one network to communicate with those of other network. It allows monitoring and transparency.

VOICETEL ICX DIAGRAM

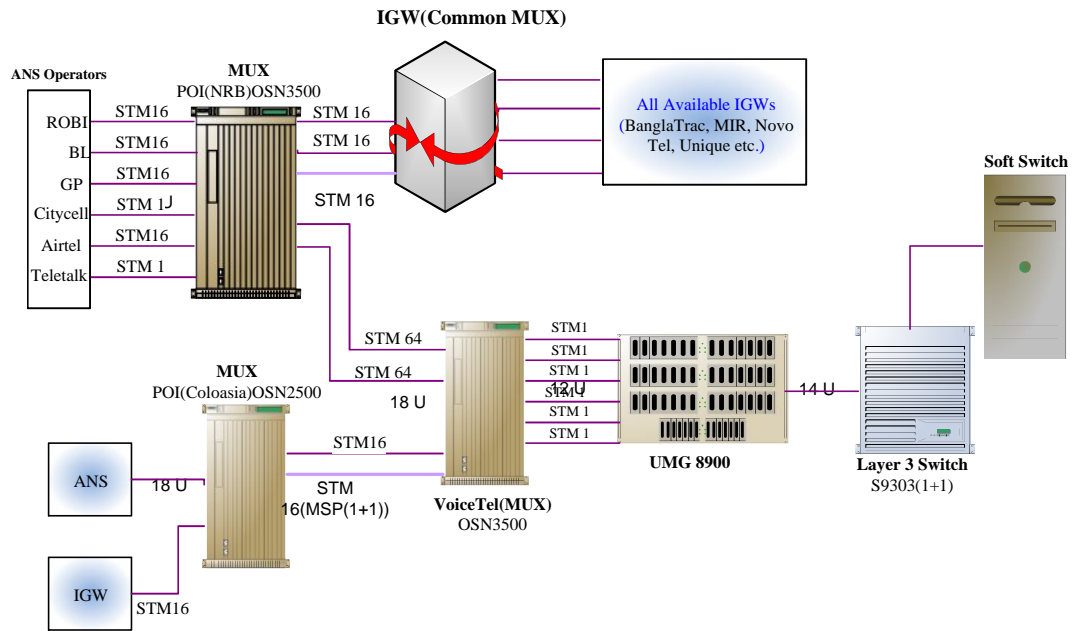


Fig 1.1: VOICETEL ICX Diagram Part (1)

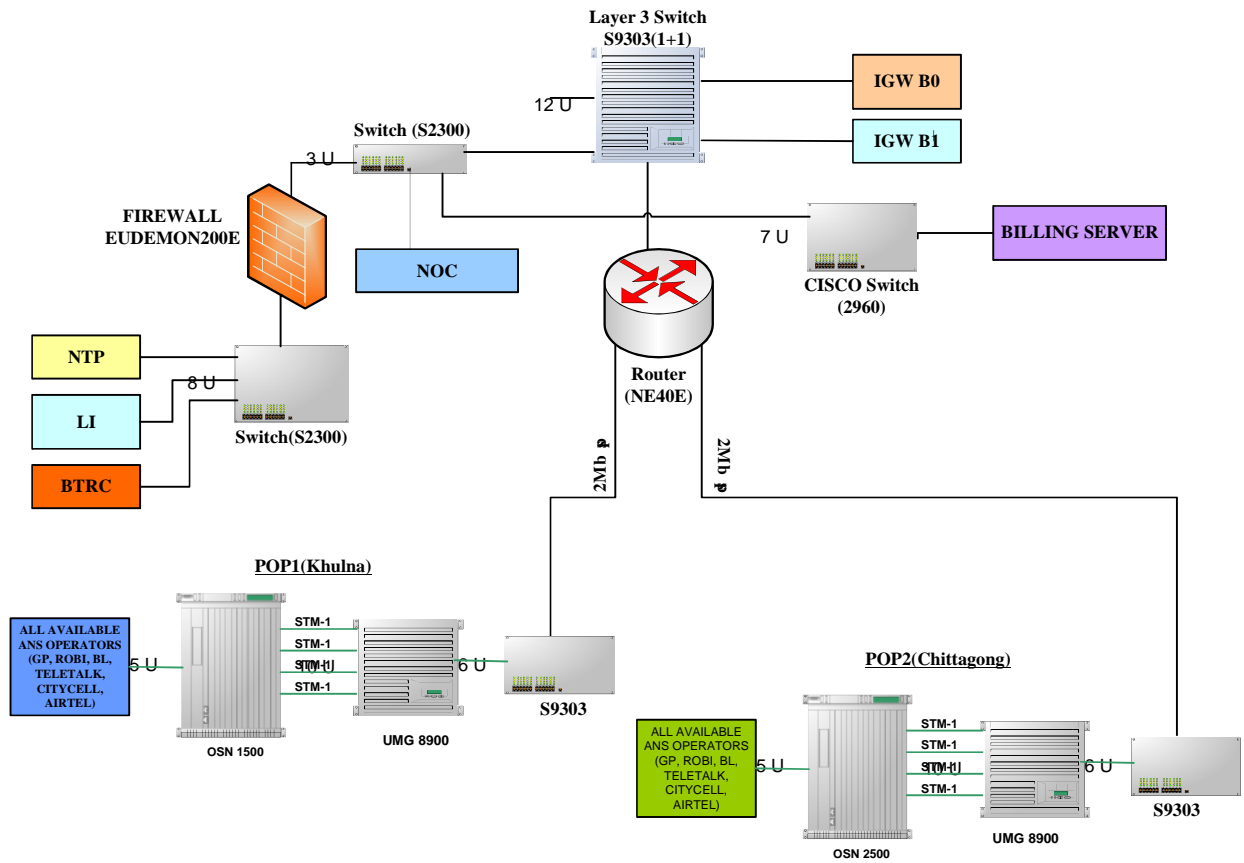


Fig 1.2: VOICETEL ICX Diagram Part (2)

Chapter 3: Transmission System

Transmission:

In telecommunications, transmission is the process of sending or propagating an analogue or digital information signal over a physical point-to-point or point-to-multipoint transmission medium (wired, optical fiber or wireless).

- One example of transmission is the sending of a signal with limited duration, for example a block or packet of data, a phone call, or an email [1].

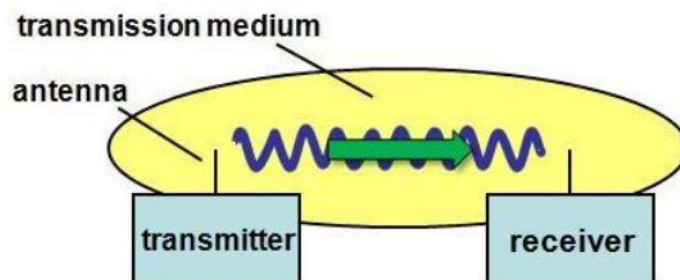


Fig 2.1:Transmission System

In Electrical Engineering, transmission is two types:

- 1.Data transmission
- 2.Power transmission

Data transmission:

Data transmission is the physical transfer of data (a digital bit stream or a digitized analog signal) over a point-to-point or point-to-multipoint communication channel.

The data are represented as an electromagnetic signal, such as an electrical voltage, radiowave, microwave, or infrared signal[2].

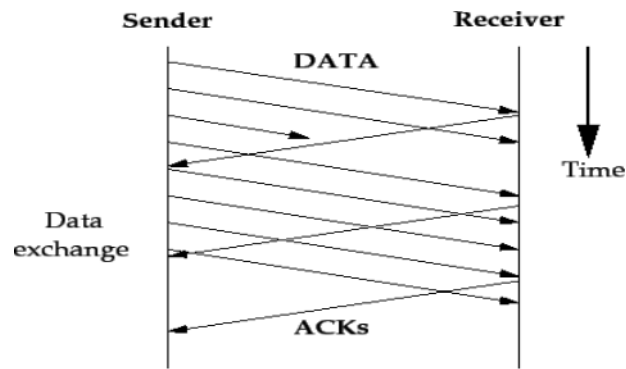


Figure 8: Data Transmission

Power transmission:

Power transmission is the bulk transfer of electrical energy, from generating power plants to electrical substations located near demand centers.

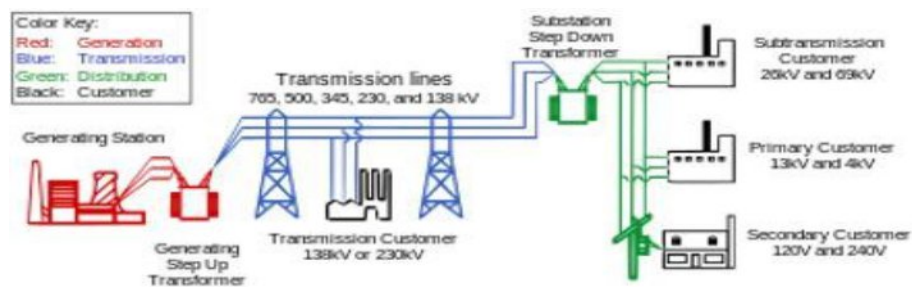


Fig 2.3: Power transmission

Generally data transmission is also two types:

1. Packet data transmission
2. TDM data transmission

Packet data transmission:

Packet data transmission is one kind of transmission where data, images, and even sound files are divided and reformatted into small units, transmitted over the network, and reassembled for use by the receiving computer.

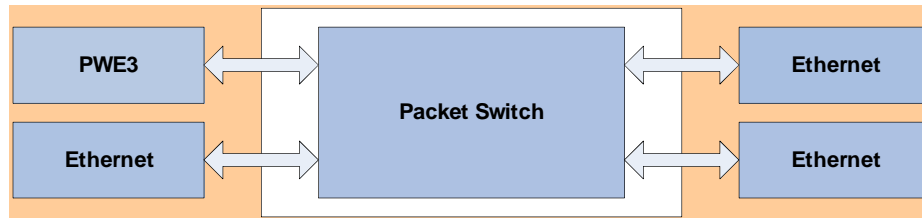


Fig 2.4: Packet Data Transmission

TDM data transmission:

Time division multiplexing (TDM) is a communications process that transmits two or more streaming digital signals over a common channel.

Time division multiplexing (TDM) is also known as a digital circuit switched.

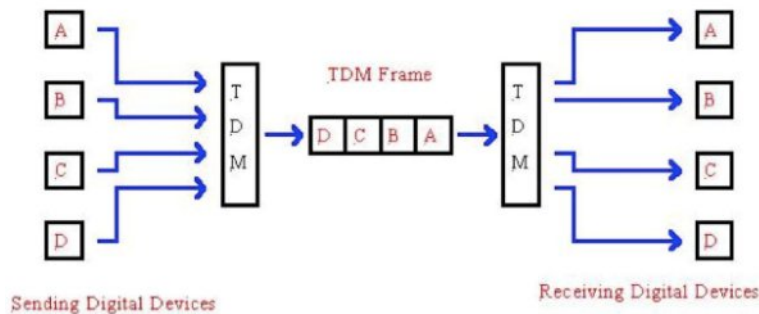


Fig 2.5:TDM data transmission

Capacity of Transmission:

In telecommunications and computer networking, a communication channel or channel, refers either to a physical transmission medium such as a wire, or to a logical connection over a multiplexed medium such as a radio channel.

STM-1:

The STM-1 (Synchronous Transport Module level-1) frame is the basic transmission format for [SDH](#) (Synchronous Digital Hierarchy).

- It has a bit rate of 155.52 Mbit/s.
- A STM-1 frame has a byte-oriented structure with 9 rows and 270 columns of bytes, for a total of 2,430 bytes.

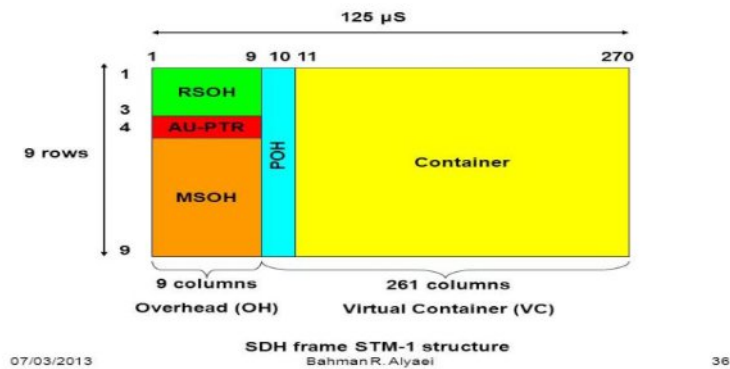


Fig 3.1: STM-1

STM-4:

The STM-4 (Synchronous Transport Module) is a SDH ITU-T fiber optic network transmission standard.

- It has a bit rate of 622.080 Mbit/s.

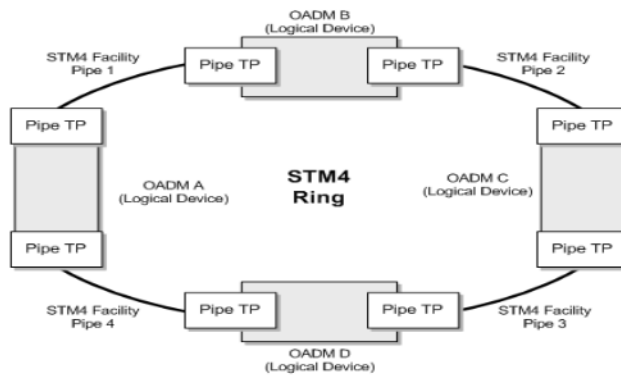


Fig 3.2: STM-4 Ring

STM-16:

The STM-16 (Synchronous Transport Module) is a SDH ITU-T fiber optic network transmission standard.

- It has the bit rate of 2,488.320 Mbit/s

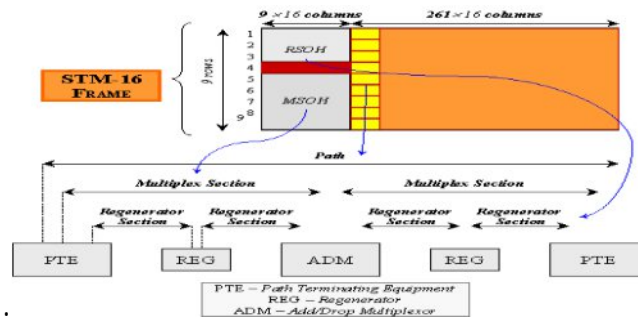


Fig 3.3: STM-16

STM-64:

The STM-64 (Synchronous Transport Module) is a SDH ITU-T fiber optic network transmission standard.

- It has a bit rate of 9953.280 Mbit/s (~10Gbit/s) [3].

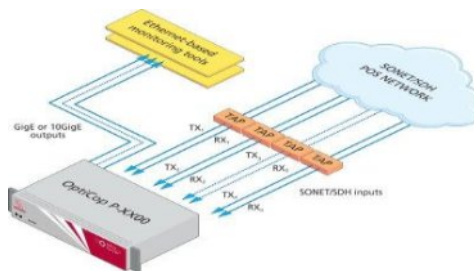


Fig 3.4: STM 64

E 1:

E1 (or E-1) is a European digital transmission format devised by the ITU-TS and given the name by the Conference of European Postal and Telecommunication Administration (CEPT).

Bandwidth :

GSM: GSM networks operating in the 900MHz and 1800MHz.

2G bandwidth: With GPRS (General Packet Radio Service), theoretical transfer speed of max. 50kbit/s (40 kbit/s in practical). With EDGE (Enhanced Data Rates for GSM Evolution), theoretical transfer speed of max. 1 Mbit/s (500 kbit/s in practice).

3G: The bandwidth of 3G is 21 Mbps.

4G : The bandwidth of 4G is 42 Mbps.

LTE (Long Term Evolution): The bandwidth of LTE is 160 Mbps-5 Gbps.

Parameters of data transmission and TDM transmission:

Data transmission:

Data transmission typically deal with the following OSI model protocol layers :

(1)Layer 1, the physical layer:

- Channel coding including
 - Digital modulation schemes
 - Line coding schemes
 - Forward error correction (FEC) codes
- Bit synchronization
- Multiplexing
- Equalization
- Channel models

(2) Layer 2, the data link layer:

- Channel access schemes, media access control (MAC)
- Packet mode communication and Frame synchronization

- Error detection and automatic repeat request (ARQ)
- Flow control

(3)Layer 6, the presentation layer:

- Source coding (digitization and data compression), and information theory.
- Cryptography (may occur at any layer)

TDM transmission:

TDM transmission typically deal with the following OSI model protocol layers :

(1)Layer 1, the Physical Layer:

- Physical Link: Transmitted data bits propagates across link.
- Guided Media: Signals propagate in solid media: copper, fiber.
- Unguided Media: Signals propagate freely, e.g. radio.

(2)Layer 2, the Data Link Layer:

- Error detection, correction.
- Sharing a broadcast channel: multiple access protocols and LANs.
- Link layer addressing.

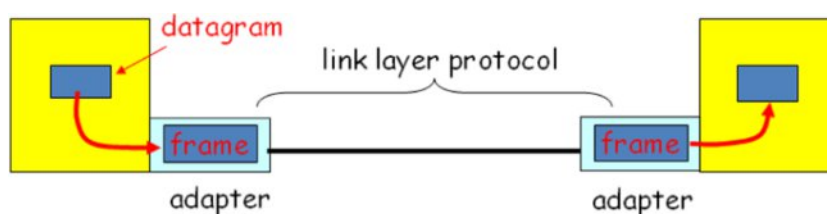


Fig 4: Data link layer

Technologies used in Transmission:

PDH:

The plesiochronous digital hierarchy (PDH) is a technology used in telecommunications networks to transport large quantities of data over digital transport equipment such as fibre optic and microwave radio systems.

SDH:

The Synchronous digital hierarchy (SDH) is an international technology standard that utilizes light-emitting diodes (LED) or lasers for synchronous optical fiber communication[4].

VPN (Virtual Private Network):

A VPN or Virtual Private Network is a method used to add security and privacy to private and public networks, like WiFi Hotspots and the Internet.

- VPNs are most often used by corporations to protect sensitive data.

MPLS (Multi-Protocol Label Swithing):

MPLS provides a mechanism for forwarding packets for any network .

- MPLS can encapsulate packets of various network protocols.

VPLS (Virtual Private LAN Service):

VPLS is a technology that provides Ethernet based multi-point to multi-point communication over IP/MPLS networks.

- It allows geographically dispersed sites to share an Ethernet broadcast domain by connecting sites through pseudo-wires.

DWDM(Dense Wavelength Division Multiplexing):

In digital signal processing, DWDM is a technique for increasing the bandwidth of optical network communication.

WCDMA (Wide-band Code Division Multiple Access):

WCDMA is a 3G technology that increases data transmission rates in GSM systems by using the CDMA air interface instead of TDMA.

LTE(Long Term Evolution):

LTE is a wireless broadband technology designed to support roaming Internet access via cell phones and handheld devices.

- LTE offers significant improvements over older cellular communication standards, some refer to it as a 4G (fourth generation) technology along with WiMax.

Theory of Transmission:

Multiplexing Method:

In the present PDH system, only 1.5Mb/s and 2Mb/s rate signals are synchronous. All other signals are asynchronous. Since PDH adopts asynchronous multiplexing method, low rate signals can not be directly added/dropped from PDH high rate signals. For example, 2Mb/s signals can not be directly added/dropped from 140Mb/s signals. Here arises two problems:

1. Adding/dropping low rate signals from high-rate signals must be conducted level by level. For example, to add/drop 2Mb/s low rate signals from 140Mb/s signals, the following procedures must be conducted. (Fig:1-2)

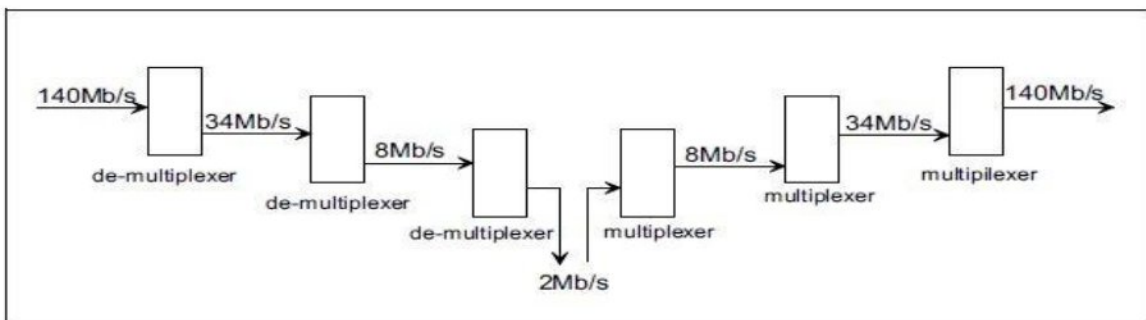


Fig:1-2

2.Since adding/dropping low rate signals to high rate ones must go through many stages of multiplexing and demultiplexing,. This is unbearable in large capacity transmission.That's the reason why the transmission rate of PDH system has not be improved further.

Advantages of SDH over PDH:

SDH has unparalleled advantages over PDH.

1.SDH is a new transmission system that has made radical revolution in technical system.

2.It uses universal interfaces to achieve compatibility with different equipment from different vendors.

3.It greatly enhances the utilization ratio of network resources and reduces the OAM costs due to the enhanced maintenance function.

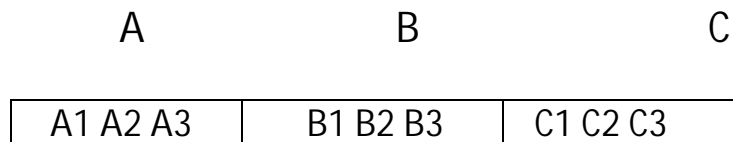
Electrical Interface:

SDH system provides a set of standard information structure level,i.e a set standard level.The basic signal transmission structure level is a synchronous transfer module –STM 1 at a rate of 155Mb/s.Digital signal hierarchies of higher levels such as 622Mb/s (STM 4) and 2.5 Gb/s(STM 16) can be formed by low rate information modules via byte interleaved multiplexing.The number of modules to be multiplexed is a multiple of 4.For example,STM -4=4×STM 1 and STM-16=4×STM-4.

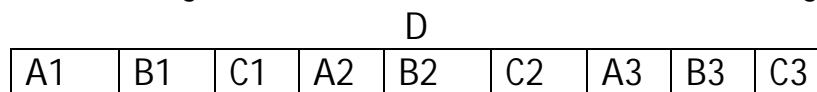
Technical Details:

What is byte interleaved multiplexing method?

We can explain it by the following example.There are three signals with the frame structure of three bytes in each frame.



If signal D is formed by byte interleaved multiplexing method,it will have a frame structure of 9 bytes in each frame and these 9 bytes are arranged in the order as shown in the following fig:



This multiplexing method is called byte interleaved multiplexing method.

STM-N Frame Structure:

STM-N frame structure makes SDH signal easier to implement synchronous multiplexing, cross-connection, add/drop and switching of tributaries.

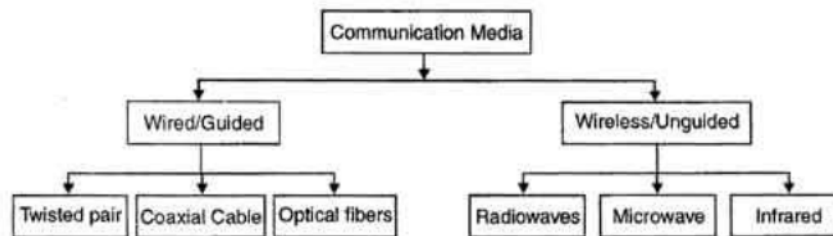
Therefore ITUT defines the frame of STM-N as rectangle block frames structures in unit of byte(8 bit).

Transmission Media:

Transmission media is a pathway that carries the information from sender to receiver.

- We use different types of cables or waves to transmit data.

Types of Transmission Media:



Fig(6.1):Types of Transmission Media

Transmission media is broadly classified into two groups.

1. Wired or Guided Media or Bound Transmission Media
2. Wireless or Unguided Media or Unbound Transmission Media

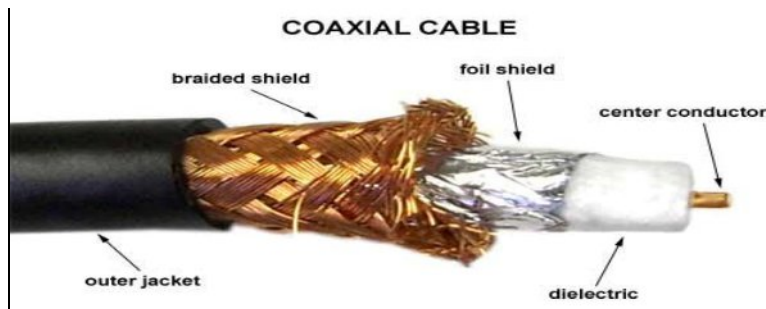
Wired or Guided Media or Bound Transmission Media:

Bound transmission media are the cables that are tangible or have physical existence and are limited by the physical geography.

- Popular bound transmission media in use are twisted pair cable, co-axial cable and fiber optical cable.

(1)Coaxial Cable:

Coaxial cable is a type of cable that has an inner conductor surrounded by a tubular insulating layer, surrounded by a tubular conducting shield. Many coaxial cables also have an insulating outer sheath Or jacket.

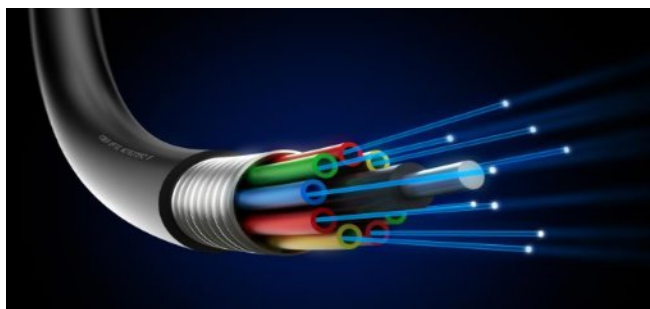


Fig(6.2): Coaxial Cable

(2)Optical fiber cable:

An optical fiber (or optical fibre) is a flexible, transparent fiber made by drawing glass (silica) or plastic to a diameter slightly thicker than that of a human hair.

- Single-mode fibers are used for most communication links longer than 1,000 meters (3,300 ft).
- Multi-mode fibers are used for short-distance communication links [5].



Fig(6.3):optical fiber cable

(3)UTP(Unshielded Twisted Pair):

UTP cable is a cable used in computer networking that consists of two shielded wires twisted around each other.

- Due to its low cost, UTP cabling is used extensively for local-area networks (LANs) and telephone connections.

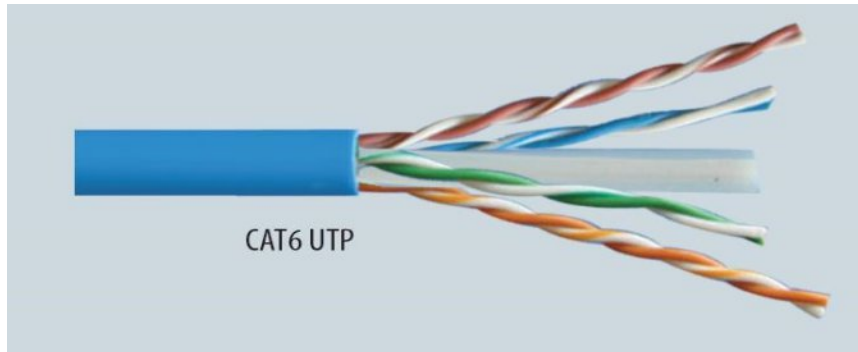


Fig 6.4: UTP cable

Advantages of optical fiber cabling compared to Unshielded Twisted Pair (UTP):

- Using Fiber over UTP is normally done for distance due to the extremely high costs.
- Fiber is used inside a building (for instance server to server connections, where the highest levels of security are needed, or for storage area networks).
- In some areas where noise is an issue, fiber is not affected by electromagnetic or RF noise.
- Distance is the main factor, especially with emerging standards for newer UTP standards, because standard cat5 cable can only go 100 meters, (328 feet).

Wireless or Unguided Media or Unbound Transmission Media:

Unbound transmission media are the ways of transmitting data without using any cables.

- Wireless LANs are being installed in office and college campuses.
- This transmission uses Microwave, Radio wave, Infrared are some of popular unbound transmission media.

(1) Microwave:

Microwaves are a form of electromagnetic radiation with wavelengths ranging from one meter to one millimeter; with frequencies between 300 MHz (100 cm) and 300 GHz (0.1 cm).

- Microwave include both UHF and EHF (millimeter waves), and various sources.
- It is used in communication, navigation, radar, radio astronomy, spectroscopy, heating and power application purposes.

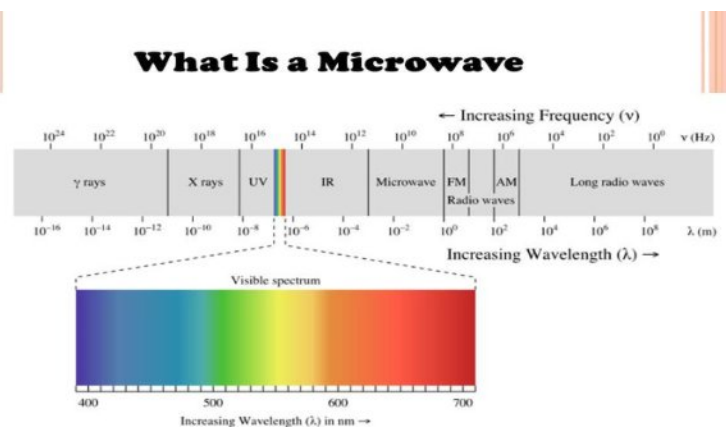


Fig 6.5: Microwave

(2) Laser:

A laser is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation.

The first laser was built in 1960 by Theodore H. Maiman at Hughes Laboratories.

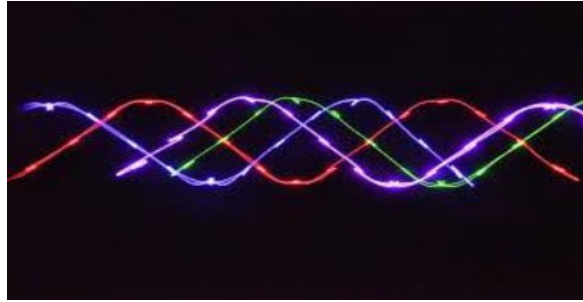


Fig 6.6: Laser wave

Transmission Architecture:

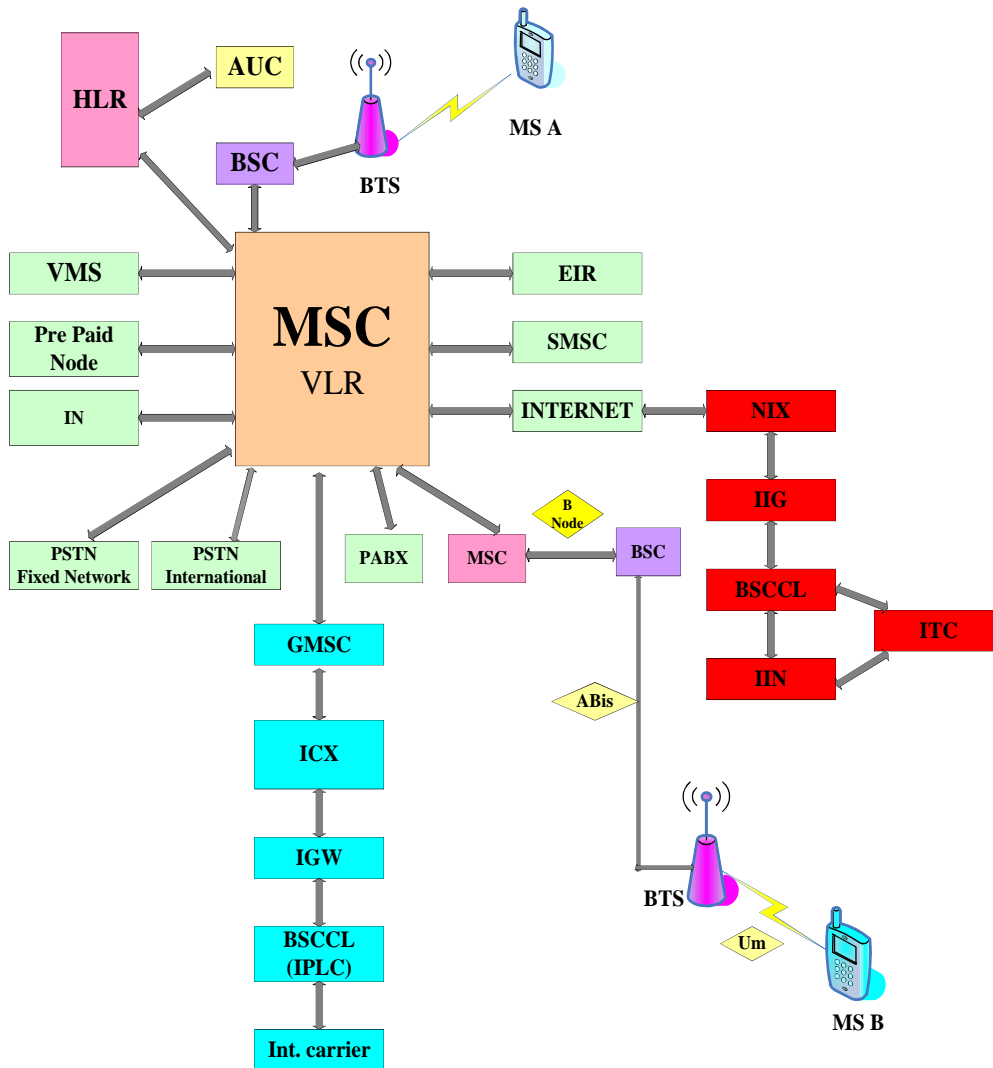


Fig 7: GSM Architecture

Mobile Phone to Public Switched Telephone Network (PSTN)

When a mobile subscriber makes a call to a PSTN telephone subscriber, the following sequence of events takes place:

- The MSC/VLR receives the message of a call request.
- The MSC/VLR checks if the mobile station is authorized to access the network. If so, the mobile station is activated. If the mobile station is not authorized, then the service will be denied.
- MSC/VLR analyzes the number and initiates a call setup with the PSTN.
- MSC/VLR asks the corresponding BSC to allocate a traffic channel (a radio channel and a time slot).
- The BSC allocates the traffic channel and passes the information to the mobile station.
- The called party answers the call and the conversation takes place.
- The mobile station keeps on taking measurements of the radio channels in the present cell and the neighbouring cells and passes the information to the BSC. The BSC decides if a handover is required.

PSTN to Mobile Phone

When a PSTN subscriber calls a mobile station, the following sequence of events takes place:

- The Gateway MSC receives the call and queries the HLR for the information needed to route the call to the serving MSC/VLR.
- The GMSC routes the call to the MSC/VLR.
- The MSC checks the VLR for the location area of the MS.
- The MSC contacts the MS via the BSC through a broadcast message, that is, through a paging request.
- The MS responds to the page request.
- The BSC allocates a traffic channel and sends a message to the MS to tune to the channel. The MS generates a ringing signal and, after the subscriber answers, the speech connection is established.

Topology of Transmission:

Ring Topology:

Ring topology is a computer network configuration where the devices are connected to each other in a circular shape.

Features of Ring Topology:

Each packet is sent around the ring until it reaches its final destination.

A number of repeaters are used and the transmission is unidirectional.

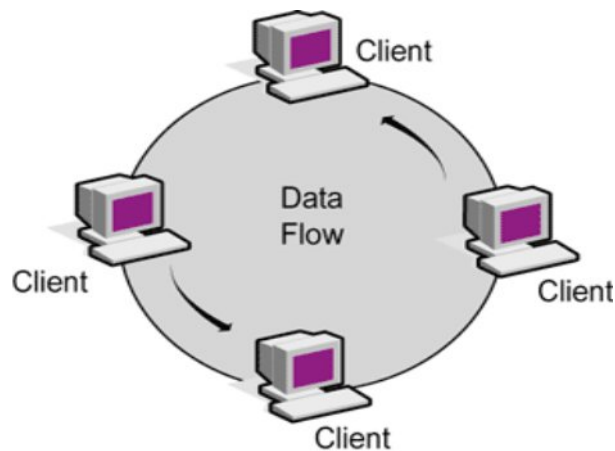


Fig 8.1: Ring topology

Uses of Ring topology:

The ring topology was most commonly used in schools, offices, and smaller buildings where networks were smaller.

However, today, the ring topology is seldom used, having been switched to another type of network topology for improved performance, stability[6].

MSP:

MSP means (Multiplexer section protection) 1+1. In this protection scheme an entire (including all timeslots travelling on that span) is protected. For SDH that span is defined as a multiplexer section.

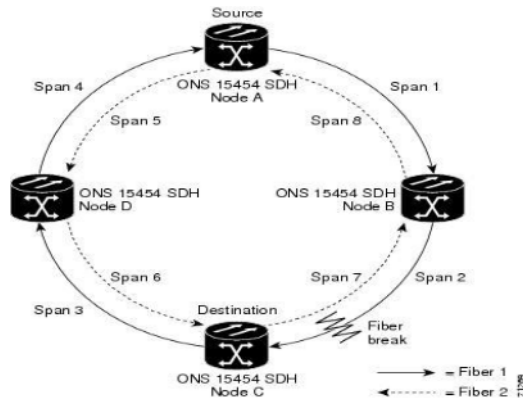


Fig 8.2: MSP protection in SDH

SNCP:

In telecommunications, subnetwork connection protection (SNCP), is a type of protection mechanism associated with synchronous optical networks such as synchronous digital hierarchy (SDH).

- ❖ SNCP is a dedicated (1+1) protection mechanism for SDH network spans which may be deployed in ring, point to point or mesh topologies.

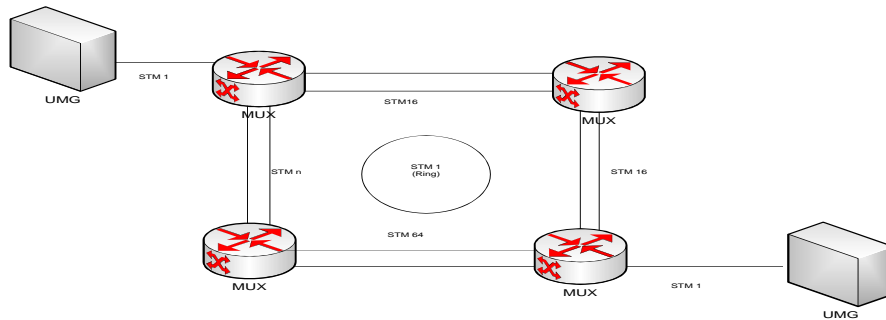


Fig 8.3: SNCP protection in SDH

Transmission medium and capacity permitted by BTRC:

3G:

In the 3G spectrum auction, on Sunday, 8th sep 2013, at Ruposhi Bangla Hotel in the capital Dhaka. The operator Grameenphone/GP bought 10 MHz and other operators Robi, Banglalink and Airtel bought 5 MHz each. The auction was

concluded with just four calls, selling a total of 25 MHz on the 2100 band. A big chunk of 15 MHz spectrum remained unsold.

- The first phase of the auction for 10 MHz blocks started at 11:15 am and the operator Grameenphone bid for \$21m for each MHz within 439 milliseconds. The operator won the bidding as there was no other player for this block. Grameenphone got the chance to choose 10 MHz spectrum in 2125-2135 band for downlink and 1925-1935 band for uplink.
- In the second phase, Robi bid for 5 MHz block within 410 milliseconds. Robi was given the opportunity to choose spectrum band and it took 2140-2145 band for downlink and 1950-1955 band for uplink.
- Airtel bid after 44.792 seconds. Airtel took 2135-2140 band for downlink and 1945-1950 band for uplink.
- Just before the end of the 5 minute period for bidding, Banglalink joined the race. Banglalink got the rest of the block 2145-2150 band for downlink and 1955-1960 band for uplink.
- The state-owned mobile operator Teletalk will get the 3G license by default on 2150-2160 band and it will have to pay \$21m, the price fixed by the auction.

LTE:

Long Term Evolution, LTE is a 4G wireless communications standard developed by the 3rd Generation Partnership Project (3GPP) .It is designed to provide up to 10x the speeds of 3G networks for mobile devices such as smartphones, tablets, netbooks, notebooks and wireless hotspots.

1)The 4G technologies are designed to provide IP- based voice, data and multimedia streaming at speeds of at least 100 Mbit per second and up to as fast as 1 GBit per second.

2)4G LTE is one of several competing 4G standards along with Ultra Mobile Broadband (UMB) and WiMax.

On February 12, the Ministry of Post and Telecommunication finalised the licensing policy for the 3G services by fixing the value of spectrum US\$ 20 million per MHz.

Transmission in ICX:

Call Flow Diagram (1)

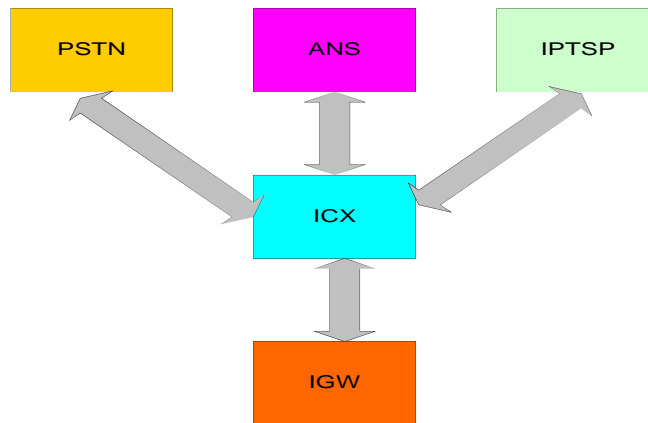


Fig 9.1: Call Flow Diagram (1)

Generally we know, calls are transmitted from ANS (Access Network Services) to ICX (Interconnection Exchange). Then calls are transmitted from ICX (Interconnection Exchange) to IGW (International Gateway). Calls are also transmitted from PSTN (Public Switched Telephone Network) and IPTSP (Internet Protocol Telephony Service Provider) to ICX. Then calls are transmitted from IPTSP (Internet Protocol Telephony Service Provider) to IGW.

Call Flow Diagram(2)

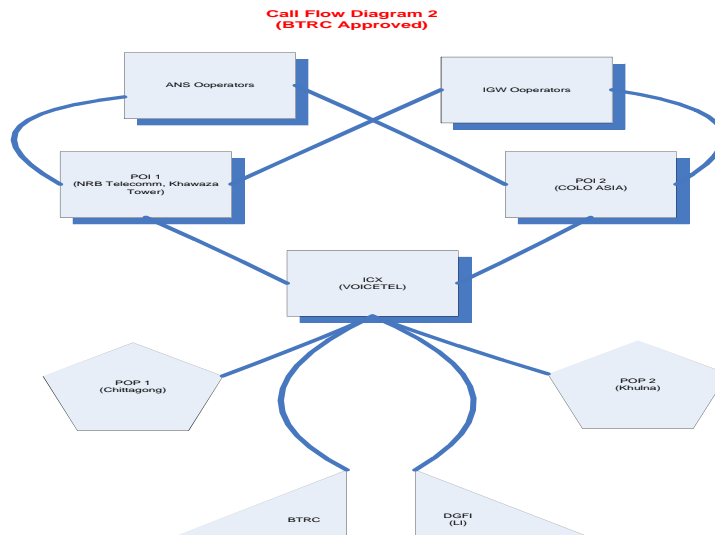


Fig 9.2: Call flow diagram (2)

In this diagram, two types of calls are transmitted. These are:

- 1.Domestic Incoming & Outgoing
- 2.International Incoming & Outgoing

Domestic Incoming & Outgoing call:

ANS is connected with ICX (Voicetel) through POI (Point of Interconnection).When a call is originated from Dhaka and terminated to Dhaka, ICX routed that call to the operator through the switch & UMG (Media Gateway)of ICX .There are two POPs ,POP Khulna and POP Chittagong. These are connected with ICX (Voicetel) by 2Mbps signaling links. That's why call of these two POPs don't go to ICX. ICX routed the calls from Dhaka.The domestic outgoing call is routed by vice versa process.

Call Details Record (CDR) of everyday is send to the Bangladesh Telecommunication Regulatory Commission (BTRC) .Directorate General of Forces Intelligence (DGFI) can access anytime to the Switch, Billing of ICX (Voicetel) for any kind of security purposes.

International Incoming & Outgoing call:

In case of International call, when anyone call from Dhaka to other country, that call go from ANS to ICX. Then

from ICX to POI 2 and then POI 2 to IGW. Normally the call is routed to that IGW, which IGW's performance is better.

When anyone call from any POP, at first call is routed from that POP to ANS. Then , that call go from ANS to ICX. Then from ICX to POI 2 and then POI 2 to IGW. The International incoming call is routed by vice versa process.

Point of Interconnection (POI) :

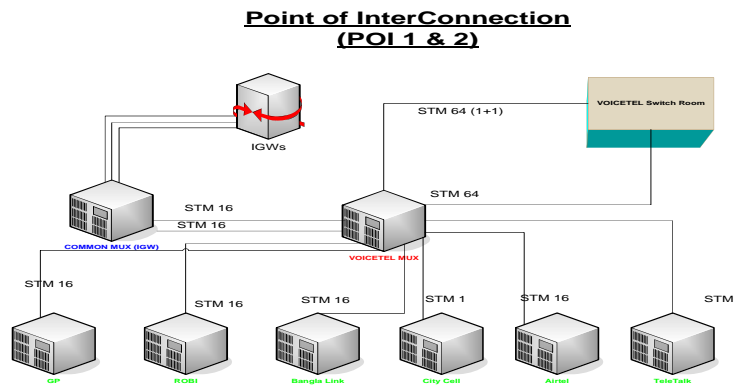


Fig 9.3: Point of Interconnection (POI 1 & 2)

Here, All IGWs are connected with common MUX. Common MUX is connected with Voicetel MUX by STM 16. Voicetel MUX is connected with Voicetel Switch Room MUX by redundant STM 64. Voicetel MUX is connected with all ANS by different STM links.

Voicetel Switch Room:

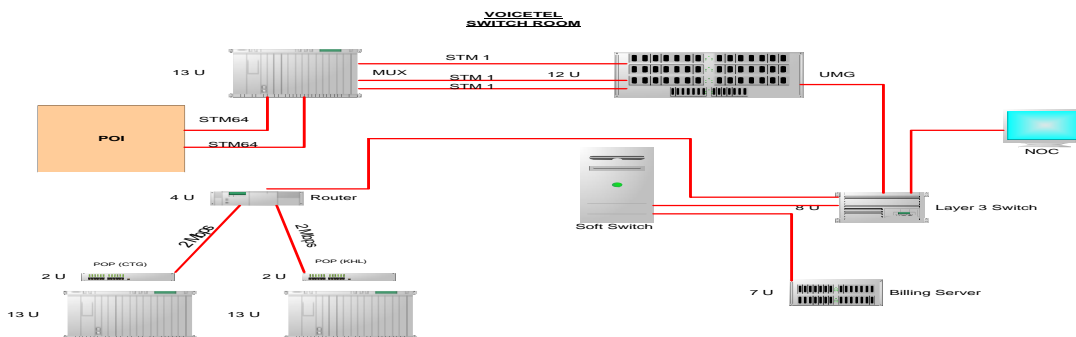


Fig 9.4: Voicetel switch room

From the fig, we can see that, POI is connected with Voicetel Switch Room MUX by two STM 64 links. Then the MUX is connected with UMG (Media Gateway) by many STM 1 links. UMG is connected with Layer 3 Switch.

Layer 3 Switch is also connected with NOC , Router and Soft Switch. Soft Switch is connected with Billing Server. The router is connected with two POPs Switch and MUX by 2Mbps signaling links. Point of Presence (POP) Khulna :

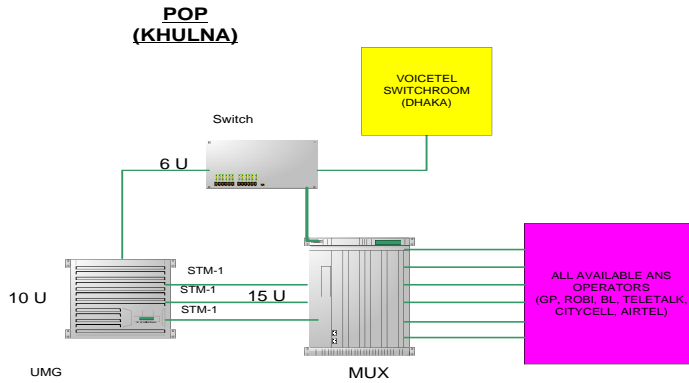


Fig 9.5: POP Khulna

From the fig, we can see that, at first from Voicetel Switch Room (Dhaka) connected with Switch (S9303) .The Switch is connected with MUX (OSN 1500)and UMG (8900).The UMG (8900) is connected with MUX by many STM 1 links. The MUX is connected with all available operators (GP, ROBI, BL, TELETALK, CIYCELL, AIRTEL)

Point of Presence (POP) Chittagong:

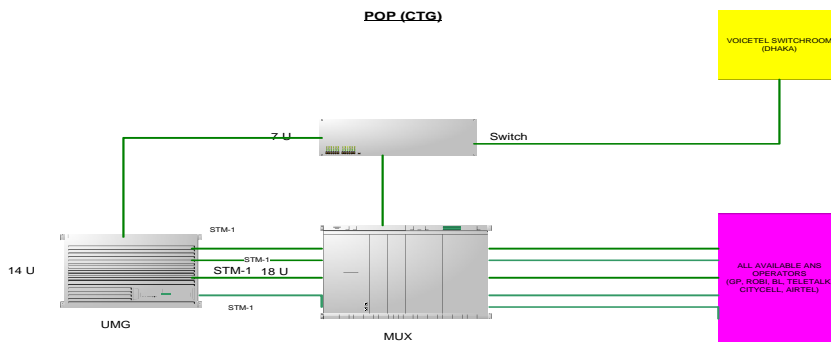


Fig9.6: POP CTG

From the fig, we can see that, at first from Voicetel Switch Room (Dhaka) connected with Switch (S9303) .The Switch is connected with MUX (OSN 2500)and UMG (8900).The UMG (8900) is connected with MUX by many STM 1

links. The MUX is connected with all available operators (GP, ROBI, BL, TELETALK, CIYCELL, AIRTEL)

Transmission in IGW:

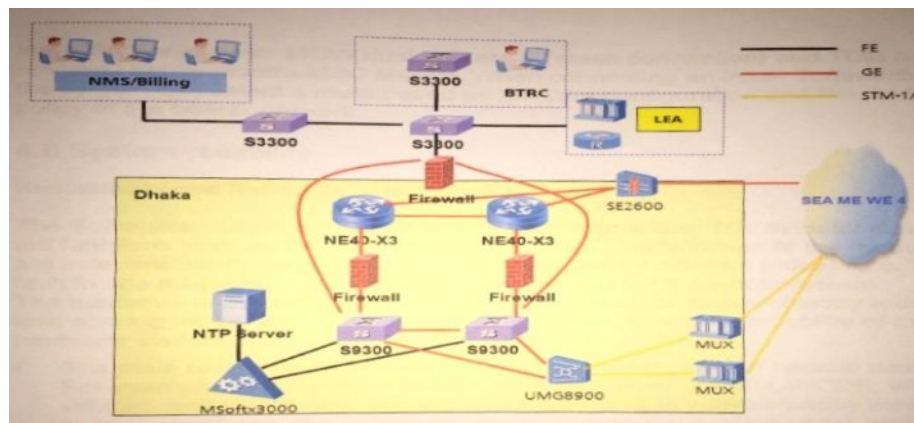


Fig 10: Transmission in IGW

Protocols used in Data Communication of ICX:

In data communication ,various types of protocols are used. And these are-

- ❖ OSPF Routing protocol
- ❖ EIGRP Routing protocol
- ❖ BGP Routing protocol

OSPF Routing Protocol:

Open Shortest Path First (OSPF) is a routing protocol for Internet Protocol (IP) networks.

- It uses a link state routing algorithm and falls into the group of interior routing protocols, operating within a single autonomous system.

EIGRP Routing Protocol:

Enhanced Interior Gateway Routing Protocol (EIGRP) is an advanced distance-vector routing protocol that is used on a computer network to help automate routing decisions and configuration.

- The protocol was designed by Cisco Systems as a proprietary protocol, available only on Cisco .

BGP Routing Protocol:

Border Gateway Protocol (BGP) is a standardized exterior gateway protocol designed to exchange routing and reachability information between autonomous systems (AS) on the Internet.

- The protocol is often classified as a path vector protocol but is sometimes also classed as a distance-vector routing protocol [7].

Signaling System 7 (SS7):

Signaling System 7 (SS7) is an international telecommunications standard that defines how network elements in a public switched telephone network (PSTN) exchange information over a digital signaling network. Nodes in an SS7 network are called signaling points.

- SS7 consists of a set of reserved or dedicated channels known as signaling links. There are three kinds of network points signaling points:

1) Service Switching Points (SSPs)

2) Signal Transfer Points (STPs)

3) Service Control Points (SCPs).

VLAN: A virtual LAN (VLAN) is any broadcast domain that is partitioned and isolated in a computer network at the data link layer (OSI layer 2). LAN is an abbreviation of local area network .

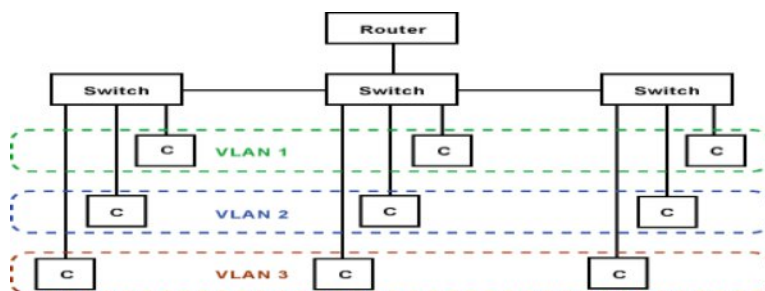


Fig 11.1: VLAN

Devices used in Data Communication System:

Firewall:

A firewall is a system designed to prevent unauthorized access to or from a private network. Firewalls can be implemented in both hardware and software, or a combination of both.

All messages entering or leaving the intranet pass through the firewall .



Fig 11.2: Firewall

Layer 2 Switch: Layer 2 switching uses the media access control address (MAC address) from the host's network interface cards (NICs) to decide where to forward frames.

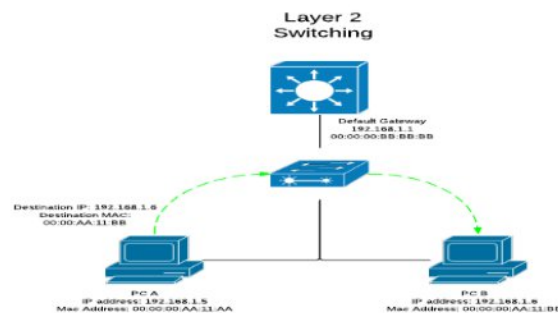


Fig 11.3: Layer 2 Switch

Layer 3 Switch:

A Layer 3 switch is a specialized hardware device used in network routing. Layer 3 switches technically share much in common with traditional routers[8].

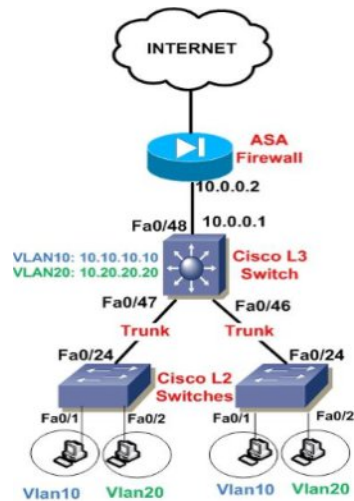


Fig11.4: Layer 3 Switch

FTP Server:

An FTP server is a software.html application running the File Transfer Protocol (FTP), which is the protocol for exchanging files over the Internet.

- FTP is built on a client-server architecture and uses separate control and data connections between the client and the server.

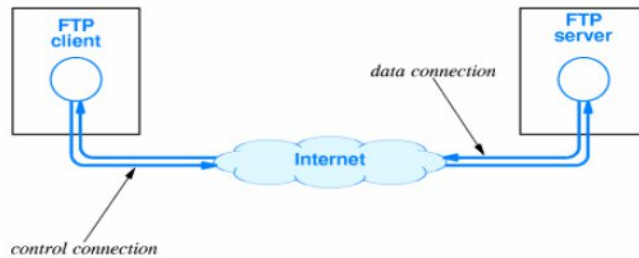


Fig 11.5: FTP server

Mirror Server:

A mirror is a Web site or set of files on a computer server that has been copied to another computer server so that the site or files are available from more than one place.

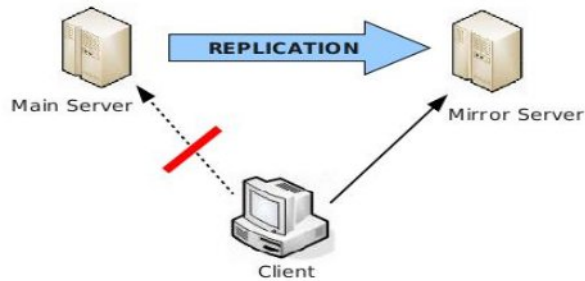


Fig 11.6: Mirror Server

Data Communication System of Voicetel:

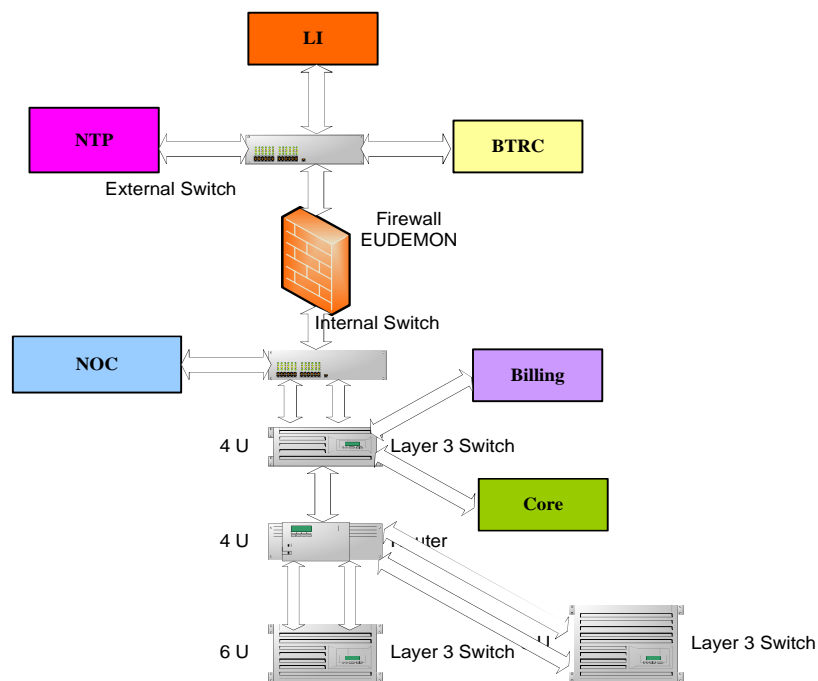


Fig 12.1: Data Communication system of VOICETEL(part 1)

In the Data Communication system of Voicetel(part 1),External switch(\$2300) give the permission to get in/out of the network.NTP Server,LI,BTRC is connected with external switch.This switch is connected with the firewall that has only one port.That permissions are stored individually in the Softx,Billing.

The firewall and NOC is connected with the internal switch.The internal switch is also connected with redundant Layer 3 switch.Layer 3 switch is connected with Billing and Core.Layer 3 switch is connected with router.That router is connected with two POPs redundantly.

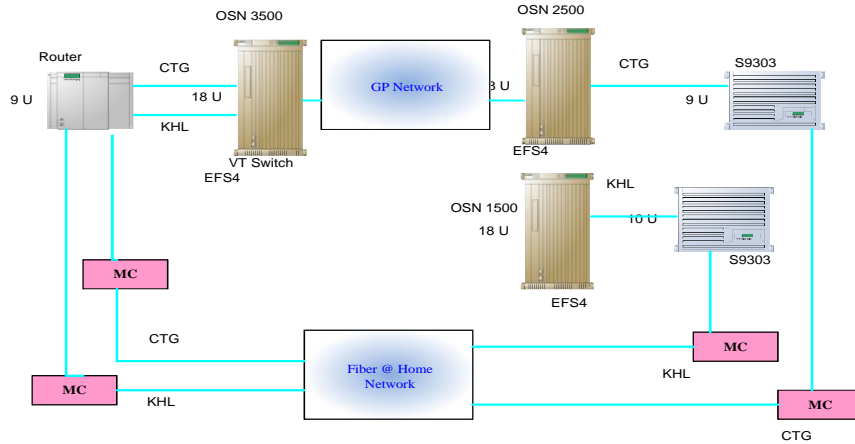


Fig 12.2: Data Communication System of Voicetel(part 2)

From the fig we can say that,router is connected with MUX(OSN3500) of Voicetel Switch room.In the MUX,EFS4 card is used which has 4 ports.As MUX(OSN3500) is already connected with the network of GP,this MUX is connected with MUX(OSN 2500) of CTG and MUX(OSN 1500) of KHL through GP network.These two MUX of CTG and KHL are connected with Switch(S9303).Two Connection of media converter of CTG and KHL from router connected with the two connection of media converter of switches(S9303) through the Fiber @ Home network.

Various Types of Alarms occurring in Transmission and Data Communication in ICX:

Normally there are 4 types of alarms.Such as-

- Critical alarm
- Major alarm
- Minor alarm
- Warning alarm

R_LOS alarm:

R_LOS is a critical type of alarm.The possible causes of this alarm are as following:

#A fiber cut occurs or the performance of the lines declines.

#The receive board at the local station is faulty.

#The transmit board at the opposite station is faulty.

R_LOF alarm:

R_LOF is a critical type of alarm. The possible causes of this alarm are as following:

#Two boards at different rates are interconnected.

#The transmit cable is faulty.

#The receive board at the local station is faulty.

#The transmit board at the opposite station is faulty.

IN_PWR_LOW alarm:

IN_PWR_LOW is a critical type of alarm. The possible causes of this alarm are as following:

The threshold of the optical power is not set properly.

The fiber connector is loose or dirty.

The transmit power of the opposite station is very low.

#The model of the selected optical module is incorrect.

AU_AIS alarm:

AU_AIS is a critical type of alarm. The possible causes of this alarm are as following:

#The local NE inserts the AIS alarm to the lower level circuit

#The upstream NE inserts the AIS alarm to the downstream NE.

#The transmit boards (including the cross-connect and timing board).

Chapter 4: Conclusion

Conclusion:

This paper has taken a detailed look at the transmission and data communication system of ICX in Telecommunication network in the context of Bangladesh's unique geographical, social, economic needs. The current ICX based interconnection arrangement offers certain advantages of simplified network architecture, creation of new revenue opportunity, enhanced capacity, redundant data connectivity. The creation of an interconnect clearing house is expected to replace the current traditional interconnection regime.

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