iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** V **Month of publication:** May 2018

DOI: http://doi.org/10.22214/ijraset.2018.5308

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue V, May 2018- Available at www.ijraset.com

Launching a High Speed Transmission Link from Service Provider End to the Customer

Sneha M[1], Supriya J[2], Supriya Jain P[3], Sushmitha N Raj[4]
[1, 2, 3, 4]*Under the guidance of Komala.M (Associate professor) and Murthy CH.VV SSS (JTO-DTTC, BSNL) SJBIT,Uttarahalli Main Road kengeri, Bengaluru-560060.*

Abstract: In the previous years, the need and requirement for voice and data by the customers was limited, for which there were two separate hardware lines. As days passed, demand for various services such as video calling, conference calling etc., with high speed increased. To satisfy all these requirements and bundling of multiple services, a high speed transmission link from service provider end to the customer is essential. This paper emphasizes on launching a high speed line from service provider exchange end to the user. This procedure mainly stands on the concept of Synchronous Digital Hierarchy (SDH) technology. SDH helps in transmitting huge amount of data and information from one end to the other end through its frame structure. Hardware equipments such as Manageable Add-Drop Multiplexers (MADM) and Add-Drop Multiplexers (ADM) are used. These are configured through browser. This paper also focuses on various protection schemes.
Key Words-SDH, MADM, ADM

I. INTRODUCTION

In the previous years, people were using limited number of Internet services. As days passed, the numbers of customers as well as their service requirements are increasing, in addition to increase in number of services. To satisfy all their needs and bundling of multiple services, a high bandwidth transmission line between the service provider and the customer is essential. This will be accomplished using Synchronous digital hierarchy (SDH). So the project deals with implementation of high bandwidth transmission line between service provider and the customer through a cutting edge technology like SDH.

Synchronous Digital Hierarchy (SDH) is a standardized protocol that transfers multiple digital bit streams over optical fiber using lasers or highly coherent light from Light Emitting Diodes (LEDs). At low transmission rates, data can also be transferred via an electrical interface. The method was developed to replace the Plesiochronous Digital Hierarchy (PDH) system for transporting large amount of telephone calls and data traffic over the same fiber without synchronization problems. SDH, which is essentially the same, was originally designed to transport circuit mode communication from a variety of different sources, but they were primarily designed to support real-time, uncompressed, circuit-switched voice encoded in PCM format. The primary difficulty in doing this prior to SDH was that the synchronization sources of this various circuits were different. This meant that each circuit was actually operating at a slight different rate and different phase. SDH allowed for the simultaneous transport of many different circuits of differing origin within a single framing protocol. SDH is not itself a communication protocol, but a transport protocol.

The SDH standard was originally defined by the European Telecommunications Standards Institute (ETSI) and is formalized as International Telecommunication Union (ITU) standards G.707, G.783, G.784 and G.803.

Using SDH technology, a bandwidth ranging from 2Mbps to 10 Gbps, can be extended to the customers end from service provider's end. This project deals with implementation of bandwidth ranging from 64kbps to STM-1 and finds application in satisfying the customer's latest service needs like Video On Demand (VoD),Games on Demand(GoD),Bandwidth on Demand (BoD),Video Conferencing, High Definition TV(HD TV) etc.

II. PLESIOCHRONOUS DIGITAL HIERARCHY

PDH is one of the multiplexing techniques for transporting voice or data over multiple devices which are working with clock source with accepted tolerance levels for synchronization. It is mainly meant for Digital transmission of the signals.

PDH technology uses Pulse Code Modulation (PCM) technique which is based on Time Division Multiplexing (TDM). Transmission modes used were coaxial cable, twisted pair and microwave.

A. Multiplexing techniques in PDH

Multiplexing techniques available are

1) Frequency Digital Multiplexing (FDM)

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue V, May 2018- Available at www.ijraset.com

2) Time Division Multiplexing (TDM): TDM involves sharing a transmission medium by a number of circuits, in time domain. Each channel is sampled at a specific rate and transmitted for a fixed duration and this is shown below

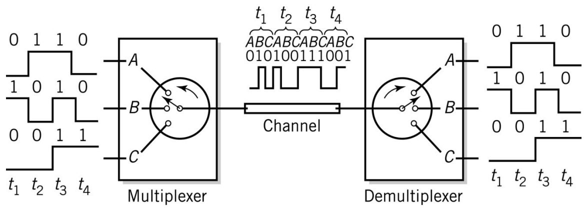


Figure 1: Time Division Multiplexing

At a given instant of time, only one channel is transmitted through the medium and by a sequential sampling, signals of all the channels are transmitted on the medium one by one. Thus the entire medium (bandwidth) is periodically available in each channel. The time used by one channel is called Time Slot (TS).
In PSTN two PCM systems dominate:
developed by Bell Laboratories, used in USA & Japan
E1, developed by CEPT (Conference of European Postal and Telecommunications) used in most of the other countries
In both the systems, data streams are divided in frames of 8000 frames/sec and each frame of 125µs occupies multiple Time Slots.
In E1system, a Frame has 32 time-slots, out of which TS1 to TS15 and TS17 to TS31 are used for voice channels, TS 0 holds a synchronization pattern called Frame Alignment Word (FAW) and TS 16 holds signaling information of 2 voice channels. Each TS has 8 bit data and whole frame has a time duration of 125µsec.
In T1 system, a Frame has 24 time-slots, out of which TS1 to TS24 are used for voice channels and a framing bit is used for synchronization. Each TS has 8 bits and whole frame has a time duration of 125µsec with (24*8 +1)193 bits. So the bit rate of the T1 is = 193bits/125µs = 1.544Mbps.
Bit rate of E1:
30 Channel system contains 32 TS in each frame.
Each time slot=8 bit word;
Total no. of bits per frame=32 X 8 = 256
Sampling Frequency is 8000 Frames /Sec
Total no. of bits in one second=256 bits/Frame X 8000 Frames/Sec=2,048,000 bits/sec =2048 Kbps
= 2.048Mbps
To move a multiple of 2.048 Mbps/1.544Mbps data from one point to another, these data streams are multiplexed in groups, which is done by taking one bit/byte from the first stream and one bit/byte from the second stream and one bit/byte from every other stream. This results in increase of the simultaneous channel capacity of the transmission. This can be implemented practically by a process known as Interleaving. Two interleaving methods can be adopted. They are

III. SYNCHRONOUS DIGITAL HIERARCHY (SDH)

A. Introduction

Synchronous Digital Hierarchy (SDH) is a hierarchical set of digital transmission structure, standardized to transport suitably adapted amount of information in the signal over a physical transmission network. SDH is a simple, economical and flexible method of multiplexing wherein, synchronous means that there is one master clock and all the elements are synchronized with it, digital means that the information is in binary and Hierarchy says that the bit rates are in a hierarchical order.

B. Network Elements in the SDH network

The common physical network elements used in SDH multiplexing method are as follows

1) *Line Terminal Multiplexer (LTM):* The LTM maps lower order signals such as the PDH signals into SDH.
2) *Add Drop Multiplexer (ADM):* The ADM helps in adding or dropping of lower order signals.
3) *Synchronous Regenerator:* The Regenerator observes and directs the transmission quality of the line and also regenerates the incoming line signal.
4) *Digital Cross Connect (DXC):* The DXC allows the switching of transmission lines which have different bit-rates.

5) *Multiple Add Drop Multiplexer (MADM):* The MADM permits multiple exchange connectivity.
6) Network Management System (NMS): NMS monitors security, performance, fault, configuration and accounting issues in th SDH Network

C. Frame Format of SDH

The SDH Frame structure consists of 9 rows and a number of columns depending on the Synchronous Transport Module (STM) level as shown below. The basic transmission format for SDH is STM-1which is as shown in figure below. The STM-1 frame lasts for 125microseconds and hence there are 8000frames per second and has a bit rate of 155.52 Mbps.

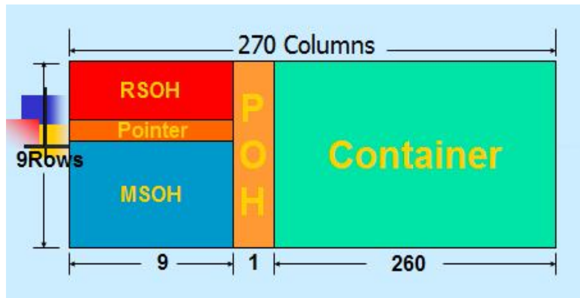


Figure 2: STM-1

D. Mapping

STM mainly stands on the concept of Mapping. Mapping is a process used when tributaries are adapted into Virtual Container (VC) by adding justification bits and Path Overhead (POH) information. The following are the steps involved in Mapping of E1s to STM-1/STM-N.

1) *Step 1: Formation of a Container:* C-12 = E1(32 bytes)+ stuffing bytes(2 bytes) = 34 Bytes
2) *Step 2: Formation of Virtual Container -12 :* VC-12 = C-12(34 bytes)+Lower Order Path Overhead (LOPOH)(1 byte)= 35 bytes
3) *Step 3: Formation of Tributary Unit (TU-12):* TU-12= 9 X 4 matrix TU-12 = VC-12(35 bytes) + Pointer (1 byte) = 36 bytes
4) *Step 4: Formation of Tributary Unit Group- (TUG2):* 1 TUG-2 = 3 X TU-12 = 3 X 9 X 4 = 9 X 12 matrix TUG-2 =3TU-12s = 108 bytes

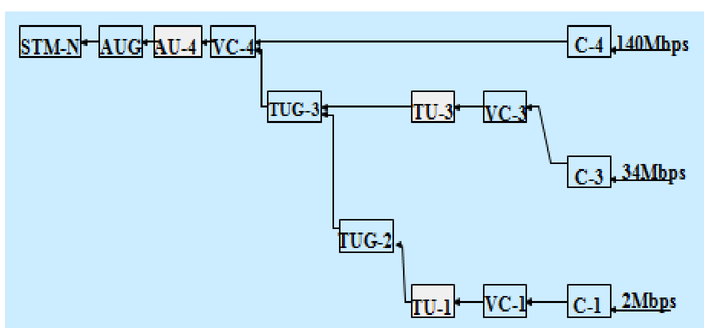


Figure 3: STM-N Mapping

E. Synchronization in SDH

Many of the transmission systems are asynchronous, hence the delay bit and errors are more, and traffic in the network is also more in those systems. SDH as name tells it has the master reference clock to monitor all the slave clocks with the help of its crystal frequency.

F. Synchronization Hierarchy

In digital synchronization hierarchy Digital switches and digital cross-connect systems are commonly employed for synchronization. The network is organized with a master slave relationship where all the clocks at higher level nodes feed time to clocks at lower order nodes with the help of PRC (Primary Reference Clock).

The internal clock of an SDH terminal derives its timing signal from a Synchronization Supply Unit (SSU) used by switching systems and other equipment. Hence, this terminal can serve as a master for other SDH nodes, providing timing on its outgoing STM-N signal. SDH network ultimately derive its timing from a PRC.

All network elements are synchronized to a central clock to avoid synchronization issues. This central clock timing is generated by a high-precision Primary Reference Clock (PRC) with conformed ITU-T Recommendation G.811 with specific time accuracy of 1X10^-11. This clock signal must be distributed throughout the entire network. Subordinate Synchronization Supply (SSU) and Synchronous Supply Units (SSU) and Synchronous Equipment Clocks (SEC) is used to pass on the signal to lower nodes with a hierarchical structure.

The clock signal is regenerated in the SSUs and SECs with phase locked loops. If the clock supply fails, the affected network element switches over to a clock source with the same or lower quality, or switches to hold-over mode. The SSM is used to inform the neighboring network element about the status of the clock supply and it is also the part of the overhead.

G. Alarms in SDH

A human observable indication that draws attention to a failure usually giving an indication of the severity of the fail is known as an alarm. It is the report to the user of a defect. In general, the alarms can be of audio visual type, for better visualization and attention.

Audio and Visual Alarms: Audio alarms are indicated by using sound and visual alarms are indicated with different colour LED's.

The different LED colours of the visual alarms are-

1) Critical/Major Alarm: RED colour on LED indicates critical or major alarm.
2) Minor Alarm: AMBER colour on the LED indicates a minor alarm.
3) Deferred/Reminder: YELLOW colour on the LED indicates a delay in the signals.
4) Power On: GREEN colour on the LED indicates power on condition.

Based on overhead bytes and sections of SDH, alarms are also classified as regenerator Section (RS) alarms, Multiplexer Section (MS) alarms, Higher Order Path Overhead (HOPOH) and lower order path overhead (LOPOH) alarms.

H. Protection schemes

Modern society network failures, whether due to human error or faulty technology, can be expensive for users and network providers. As a result protection schemes was discussed in SDH. Two basic types of protection mechanisms are discussed in Automatic Protection Scheme (APS). They are

1) Linear protection
2) Ring protection

I. Applications

Few of the application areas of SDH are as given below:

1) Access Network
2) Aggregation Network
3) Metro Network
4) Long distance National as well as International
5) Wireless Backhauling
6) SCADA (Supervisory Control and Data Acquisition)

IV. IMPLEMENTATION

A. The project Discussed in This paper is Implemented Using the Following Hardware Equipment,

1) Manageable Add Drop Multiplexers (MADMS) STM 16:-02 nos. Make: Siemens; Model no: Surpass Hit-16.
2) Add Drop Multiplexers (ADMS) STM1- 02 nos. Make: FIBCOM; Model no: NM2100-1.

The MADM-16 equipment consists of different sub racks which includes DC power feeding block/ Miniature Circuit Breaker (MCB), Power rack/Main sub rack, Extension/Auxiliary sub rack, Line Termination Unit (LTU), Equipment Order Wire (EOW)and Fan . Each sub rack can be made of full slot, half slot or double half slot. The overview of Siemens MADM-16 is shown in the below.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue V, May 2018- Available at www.ijraset.com

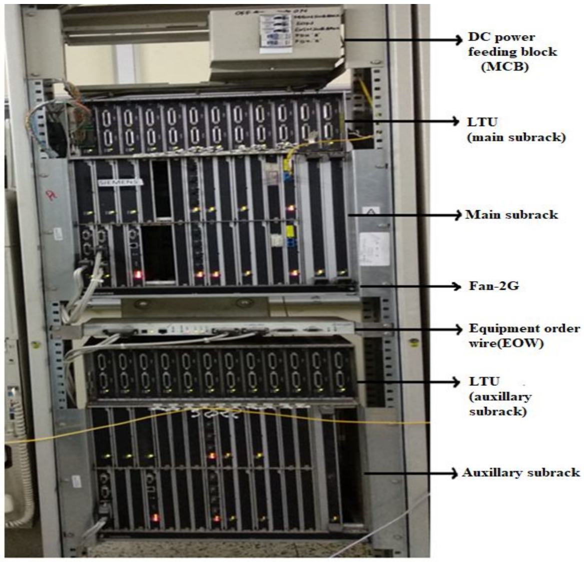


Figure 4: Overview of MADM-16

3) DC power feeding block/ Miniature Circuit Breaker (MCB) feeds DC power to the equipment and protects the entire device by preventing the excessive current flow.
4) Power/Main Sub-rack, on the whole consists of seven half slots, ten double half slots and two full slots. Three half slots form power supply units (PSU 160) and they help in supplying power to the entire equipment. One half slot, known as Common Connection Unit-2G (CCU-2G) consists of sync port (synchronization to PC), loops (for testing) and slot for power/alarms. Two half slots known as EXT can be configured with Auxiliary cards which allows additional Extensions like EOW out of which only one slot is used and the other one is empty. One half slot is configured with CTRL-2G card. It consists of communication port and Ethernet port through which connection is given to personal computers and the total functionality of the equipment is managed. Eight double half slots form eight tributaries namely T1, T2, T3, T4, T5, T6, T7, T8. T1 and T2 can be used for HD cable connection, Ethernet dropping and E3 dropping. They are not utilized in this project. T3 and T4 are configured with 4XMM1 cards using which 4 STM-1s can be dropped through each of these tributaries. T5, T6, T7 and T8 are configured with 63E1 cards using which 63 E1s can be dropped through each of these tributaries. Two double half slots can be configured with Line cards called L16.2 cards and are used for connecting the entire output of the system using Optical ports out of which only one is configured. The purpose of having two cards is to provide protection for the regular connection. Two full Switch slots are Higher Order to Lower Order (HOLO) cards. They help in higher order to lower order switching.
5) Extension/auxiliary sub rack has same slots as that of the power/main sub rack performing similar functions excepting Aux1 card, which is left empty. This sub rack is utilized to increase the capacity of the equipment, beyond main sub-rack's capacity.
6) LTU (Line Termination Unit): There are two LTUs: One for the main sub rack and one for auxiliary sub rack. They are mainly meant for physical copper cable connections for E1s dropping. Since there are 4 cards which provide 63 E1s dropping, each LTU has 252 ports through which physical connections can be established between the service provider and the customer.
7) Equipment Order wire (EOW) issued for extending a direct telephone connection with the other end equipment, mainly during emergencies.
8) Fan helps in maintaining the system temperature: Establishing a high speed transmission link between 2 customers at two locations namely A and B, requires two MADM-16s; one at each end of the link i.e. MADM-A and MADM-B.As each MADM is equipped with four 4XMM1 cards, each MADM can drop 16 STM-1s. Further, STM-1 can be dropped down to E1s using 63E1 card. Copper cables coming from the different ports of the main sub-rack or auxiliary sub-rack are extended and connected to the LTU. Copper cable connections from LTU are further extended to one end of the Digital Distribution Frame (DDF). From the other end of DDF, the copper cables are extended till the customer's premises by using out door network and are terminated to the router ports through different converters. MADM's at both the ends are connected with Optical fibre through line card L16.2 optical ports.DDF (Digital Distribution Frame) acts as an interface when a cable connection has to be organized, terminated or cross-connected in long-distant transport networks, or in access networks close to subscribers. It helps

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue V, May 2018- Available at www.ijraset.com

in connecting to the customer without disturbing the equipment. There are two DDF boxes, one for transmission and one for reception. Each box supports 8 connections.

B. Fibcom Adm-1hardware

The FIBCOM FOCUS AC1 is a product family where STM- 1 and STM-4 Add/Drop Multiplexers (ADM) and Terminal Multiplexers (TM) are implemented on a single module giving VC-4, VC-3 and VC-12 connectivity. This provides a cost efficient solution especially in small nodes where the requirement is to add/drop a limited number of 2 M bit/s signals. The number of tributary signals can be increased to full capacity by adding additional tributary modules. FIBCOM ADM1 of capacity STM-1 used in the project is shown in the following below figure

Figure 5: FIBCOM ADM-1

FIBCOM ADM1 (STM-1) is an 18 slots sub rack arranged as three motherboards that contain tributary cards, cross connection card, multi-function card and OEO card. Out of the three motherboards, a single motherboard (motherboard-3) is sufficient for making the equipment to work as an ADM-1. The motherboard-3 has 6 slots from 13-18. The 13th slot is the PS slot which is used to give power supply to the motherboard. The 15th slot has the OEO card which is used for Optical to Electrical conversion and vice versa. It is also used to connect the optical fiber of the system capacity STM-1 and also to drop 21E1's i.e., one TUG-3. The 17th slot contains the TEX card which is used when more than 21E1's need to be dropped and allows to drop further 21more E1's. The 19th slot contains the SRCF card which is a common card which is responsible for giving power supply to the whole equipment.

C. Overall Implementation

Depending on the customer's requirements and demands of bandwidth ranging from 2Mbps to 155Mbps, transmission links can be extended to customer from Service provider using MADMs. Two Siemens MADM-16s are installed, one at each of the customer's side and are connected using OFC cable.

The general implementations of MADM-16s are as shown in the below.

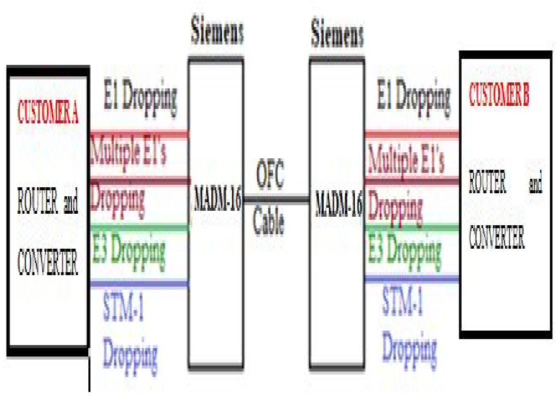


Figure 6: Implementation of MADM-16s

In some cases, like rural areas where there is long of high bandwidth transmission lines, ADM -1s are sufficient to meet the customer's requirements. These connections can be established using FibcomADM-1 equipment in tandem with the Siemens MADM-16 by dropping STM-1s from MADM-16 to ADM-1 and further dropping one or more E1s from Fibcom ADM-1 to customer's location.

The general block diagram for RURAL connectivity is shown in the following below figure.

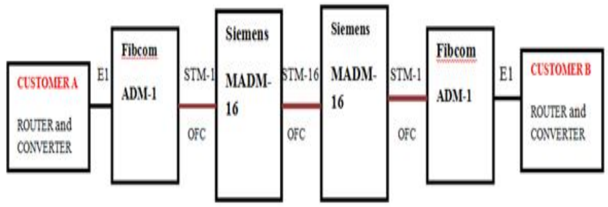


Figure 7: Implementation of ADM-1s

V. RESULT AND DISCUSSIONS

The high speed transmission link between two customers at locations A and B, is established using service provider's MADM through SDH technology. The customers need for bandwidth may vary from 2Mbps to 155.52Mbps, requirement may aslo vary from rural to urban locality, hence based on this, the process of link establishment changes and thus they are classified into 6 categories:

A. Urban Locality

1) Case 1: <=2Mbps: It gradually means a dropping of E1, any one of the tributaries (T5 to T8) of MADM-16's main subrack is selected and connected to LTU's port. LTU is connected to DDF and then through pillars it is connected to Customers modem and then to router using copper cables.

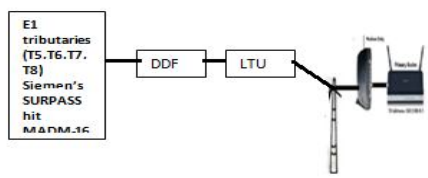


Figure 8: Physical link at location A for dropping E1

Figure 8 shows the physical link established at location A similar connections are made at location B.

In logical connection CNTRL-2G nad Pc's ethernet ports are connected and logged in to the browser, in c onnections one tributary (t3 to t5) is chosen and is configurated to update parameters as required i.e. VC as VC -12 bidirectional and so on. OFC is used to connect two MADM16s of customer A and B.

2) *Case 2:>2Mbps to <= 10Mbps:* It refers to drop multiple E1s, any one of the tributaries (T5 to T8) of MADM-16's main subrack is selected and connected to LTU's port. LTU is connected to DDF and then through pillars multiple wires are connected to Customers modem and then to ethernet converter and router using copper cables.

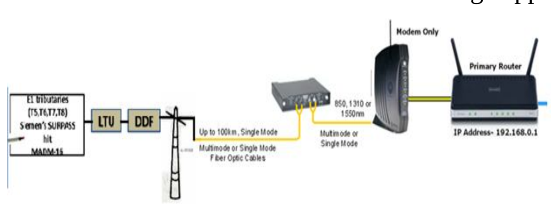


Figure 9: Establishment of link at customer B's side for dropping of multiple E1s

Above figure shows the connection established at customer's A side similar connection is established at B side.

In logical connection CNTRL-2G nad Pc's ethernet ports are connected and logged in to the browser, in connections one tributary (t3 to t5) is chosen and is configurated by chosing multiple connections to update parameters as required i.e. VC as VC -12 bidirectional and so on. OFC is used to connect two MADM16s of customer A and B.

3) *Case 3: >10Mbps to <=100Mbps:* It means a dropping of TUG-3, where STM-1s are dropped to TUG-3 ,any one of the tributaries (T3 or T4) of MADM-16's main subrack is selected and then dropped to modem through E3 dropping equipment using OFC, modem to Fast ethernet converter and then
to router via copper cables

Figure 10: Establishment of link at customer B's side for dropping of TUG-3

Figure above shows the physical link established at location B similar connections are made at location A.

In logical connection CNTRL-2G nad Pc's ethernet ports are connected and logged in to the browser, in connections one tributary (t3 or t4) is chosen and is configurated by chosing one STM-1 and then Lower ordr level tributaries so as to select E1s and further connections to update parameters as required i.e. VC as VC-3 bidirectional (to choose TUG-3 we have to drop 21 E1s at a time) and so on. OFC is used to connect two MADM16s of customer A and B.

4) *Case 4: >100Mbps and <= 155.52 Mbps:* It means direct STM-1 dropping by selecting any one tributaries (T3/T4) of MADM-16's main subrack is selected and then dropped to modem through Packet Over SDH (POS) via OFC as shown in figure below.

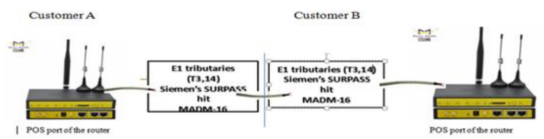


Figure 11: Establishment of link to drop STM-1

In logical connection CNTRL-2G nad Pc's ethernet ports are connected and logged in to the browser, in connections one tributary (t3 or t4) is chosen and is configurated by chosing one STM-1 and connections to update parameters as required i.e. VC as VC-4 bidirectional and so on. OFC is used to connect two MADM16s of customer A and B.

B. Rural Locality

1) *Case 1:* when customer needs a 2Mbps link, the following procedure needs to be followed :
1) Establish a physical connection from the MADM-16 equipment's main rack 4XMM1 card port-1 which is located at customer A's side to FIBCOM ADM1's OEO card via optical fiber. Extend one E1 connection from OEO card of FIBCOM ADM1to the customer's end through DDF using copper cables. Drop one STM-1 from MADM-16 to FIBCOM ADM -1 present at location A's side by following Case 4
2) one E1 from FIBCOM ADM-1 is droped to the customer at location A by connecting the COMM-port of the PC to the OEO card jumper port through access cable, then click on the software icon NM2100CT, Select AC as AC-1, version as 4.8 and click on "Connect to Local NE", Type NSAP address for location 'A' as the password to login, Select configuration and click on Connections and click on Expand all ,Select STM-N I/P (say 4/7/15/1) and right click on Connections, select unprotected connection and connect it to VC-4 (say 4/7/15/1) by dragging and dropping., Select TU-12 I/P say 4/7/15/1/2-3-3 and right click on Connections, select unprotected connection and then connect it to VC-12 say 4/7/15/8 by dragging and dropping, Similarly drop one E1 from service provider's MADM-16 at B's location to customer B's router through FIBCOM ADM-1 by repeating the steps from 1 to 4, Connect both the MADM-16s at A and B through L16.2 Card, port-1 via OFC
3) *Case 2:* When customer needs a bandidth of more than 2Mbps to 10Mbps, the following procedure needs to be followed
4) Establish a physical connection from the MADM-16 equipment's main rack 4XMM1 card port-1 which is located at customer A's side to FIBCOM ADM1's OEO card via optical fiber. Extend multiple E1s connection from OEO card of FIBCOM ADM1to the customer's end through DDF using copper cables. Drop one STM-1 from MADM-16 to FIBCOM ADM -1 present at location A's side by following Case 4
5) Multiplr E1s from FIBCOM ADM-1 is droped to the customer at location A by connecting the COMM-port of the PC to the OEO card jumper port through access cable, then click on the software icon NM2100CT, Select AC as AC-1, version as 4.8 and click on "Connect to Local NE", Type NSAP address for location 'A' as the password to login, Select configuration and click on Connections and click on Expand all ,Select STM-N I/P (say 4/7/15/1) and right click on Connections, select unprotected connection and connect it to VC-4 (say 4/7/15/1) by dragging and dropping., Select TUG-2 I/P say 4/7/15/1/2-3-3 and right

click on Connections, select unprotected connection and then connect it to VC-12 say 4/7/15/8 by dragging and dropping, Similarly drop multiple E1s from service provider's MADM-16 at B's location to customer B's router through FIBCOM ADM-1 by repeating the steps from 1 to 4, Connect both the MADM-16s at A and B through L16.2 Card, port-1 via OFC.

VI. CONCLUSION

A. SDH is an international standard for high speed telecommunication over optical/electrical networks which can transport digital signals in variable capacities. SDH solves most of the problems encountered in PDH as faster communication networks were developed such as the optical fiber networks.

B. The optical networks are becoming more and more important with increasing demand for the availability of high speed networks. With the help of SDH, higher bandwidth capacity services can be provided to customers by increasing optical fiber bandwidth. In a synchronous system, such as SDH, the average frequency of all clocks in the system is same because all clocks are monitored by reference clock that is highly stable. Thus, the STM-1 rate remains at a nominal 155.52 Mbit/s, allowing many synchronous STM-1 signals to be multiplexed without any bit-stuffing thus, STM-1s can be mapped to higher STM-N rate.

C. By combining highly accurate network synchronization systems with advanced optical network technology, high speed transport systems like SDH network elements can guarantee the high performance levels that user will demand from current and future Tele-communication systems. Also SDH allows to extend different new services to the customers like Games on Demand (GoD), Bandwidth on Demand (BoD), Video conferencing, HDTV etc.

VII.FUTURE SCOPE

A. For the project purpose, MADM's are connected in linear. For further improvements, they can be connected in ring and employ path protection schemes.

B. Ethernet card can be inserted in MADM16 to directly drop Ethernet connections through Ethernet port to the customer's routers. Ethernet port helps in dropping speeds up to 100Mbps.Similarly E3 dropping card can also be inserted in MADM16 to drop direct E3 connections to the customer's routers for HD TV applications.

C. Next generation SDH principles like concatenation and Dynamic Bandwidth Assignment (DBA) can also be used to extend SDH further to complicated bandwidth requiring applications like Games on Demand (GoD), Bandwidth on Demand (BoD) and HD TV etc.,

D. For the project purpose, customer end router configurations are not considered. They can also be added to make the project implementation, end to end in real time.

E. Project mainly concentrates on establishing a high speed link but Performance monitoring can also be added to monitor the quality of the link established.

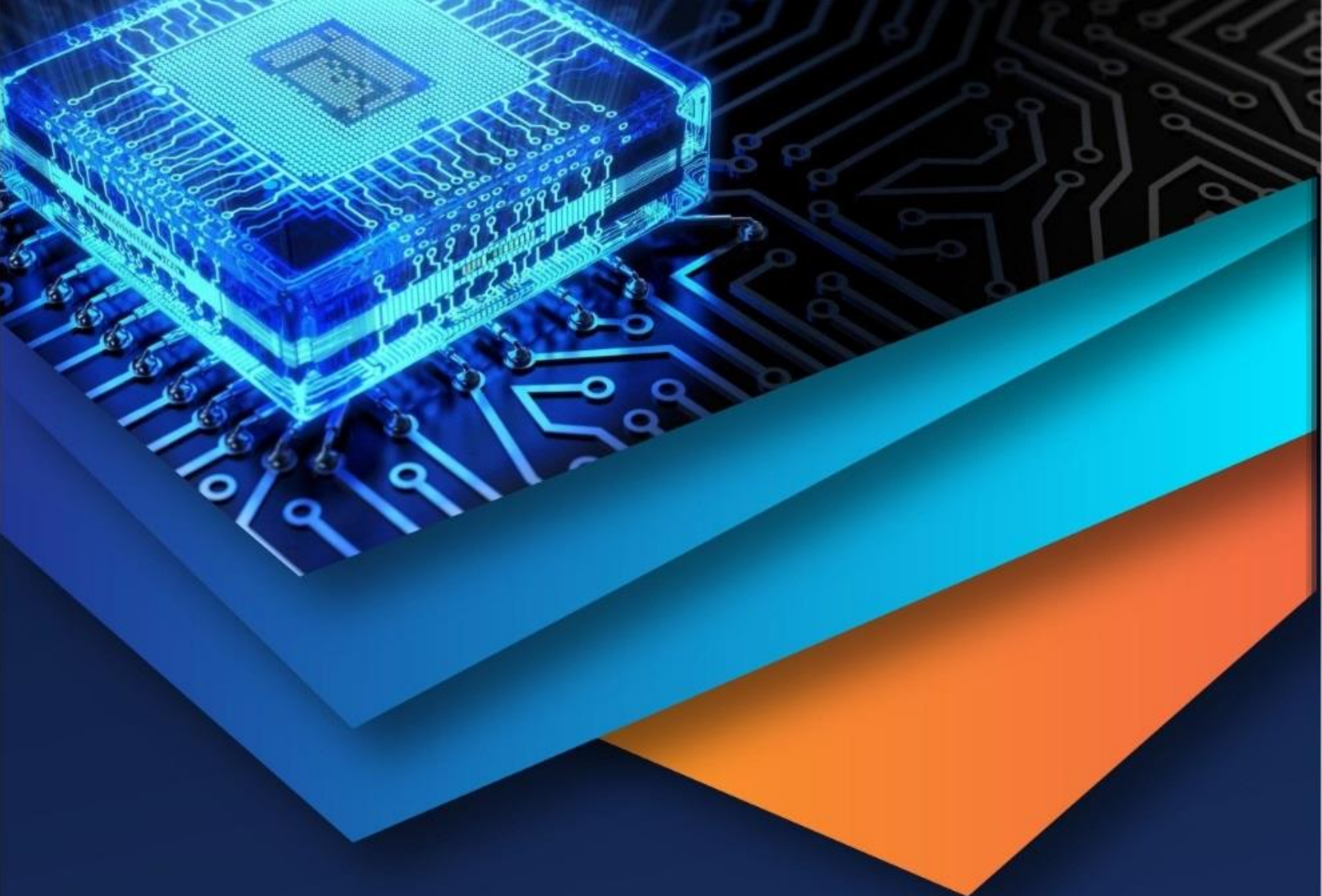
REFERENCES

[1] Comparative Analysis of Multipath Protection Algorithms for SONET/SDH", "Deepak Dhadwal, Ashok Arora, V R Singh", International Journal of Emerging Research in Management &Technology ISSN: 2278-9359 (Volume-3, Issue-11) November 201

[2] Traffic Engineering for Ethernet over SONET/SDH: Advances and Frontiers", "ChongyangXie, NasirGhani, Qing Liu, RolandeKouatang, Wei WennieShu", IEEE Network (Volume: 23, Issue: 3, May-June 2009)

[3] On Provisioning in Dual-Node Interconnected SONET/SDH Rings","SmitaRai, Ching-Fong Su, Takeo Hamada,BiswanathMukherjee",IEEE Journal on Selected Areas in Communications (Volume: 26, Issue: 3, April 2008)

[4] Synchronization Issues in SDH Networks", "Lianhong Zhou, Xu Wang, ChongxiFeng", International Conference on Communication Technology Proceedings (WCC - ICCT 2000), 2000.



10.22214/IJRASET

INDEX COPERNICUS

45.98

IMPACT FACTOR:
7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR:
7.429