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A Comparative study of X.25, Frame Relay and ATM in High Speed networks

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***Abstract*—To carry out the real time data with high accuracy and with minimum delay between a set of communication devices high speed network is used, which is based up on the optical fiber technology. It is not sufficient to use the high speed data rate alone, unless there is efficient utilization of the bandwidth of the medium. This paper presents the comparative study of three high speed technologies viz. X.25, Frame relay and ATM. Frame relay and ATM are the variations of basic X.25 technology. Based on the various performance metrics, the comparative study demonstrates that ATM has less delay compared to the X.25 and Frame relay and thus is efficient for transmission of the real time data.**

***Keywords*— High Speed Networks, X.25, Frame Relay, ATM**

I. INTRODUCTION

High speed network is a generic term which is related to the services of internet, which are generally faster than that of average services. In order to determine whether the connection is high speed or not, it is compared with the speed of dial up services. But as the new technologies and services are emerging, more number of users is shifting towards the use of internet, as a result of which bulk of internet traffic is generated. This demands the increase in the capacity of the existing network to meet the quality of services. But on the other hand, the users expect the services that have minimal error, minimal delay and minimal jitter value. In order to full fill the demands of users to some extend some new technologies gave birth which are X.25, Frame relay and ATM. X.25 was developed to provide interface between the end system and the packet switching node. Although X.25 provides certain degree of reliability, it also has major disadvantage of high overhead due to transfer of data and control signals on the same channel. To overcome the limitations of X.25, frame relay was developed in which the data and control signals were carried on the separate channels and thus reduces the overhead. ATM is also the variation of frame relay. It has minimal flow and error control thus supports high processing and less delay. Both frame relay and ATM technologies take the advantages trustworthiness and fidelity of modern digital equipments and have revolutionized the communication system. [1][2][3][4]

II. X.25

X.25 is a standard that was designed by ITU-T and acts an interface between the packet switching network and the system. X.25 involves its functionality at three levels which are physical level, link level and packet levels shown in Figure1. The physical level provides physical interface between the end system and the connection that attaches the end system to the packet switching node. The physical level standard that it uses is X.21some times EIA-232 is also used. The link level is responsible for transferring of data over a physical level in reliable manner. The standard used at the link level is LAPB.The last level which is responsible for providing virtual circuit services which allow subscribers to establish logical connection with other subscribers called as virtual circuit. The virtual circuit is the logical connection between the two end devices over the network. [1]

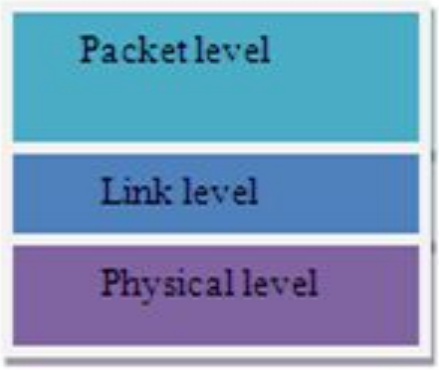

Figure 1: Different levels of X.25

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III. FRAME RELAY

Frame relay is an ancient technology that was initially developed for the transmission of data over the narrow ISDN band. The main aim behind the design of the frame relay is limit the overhead in X.25 to some extent. The frame relay consists of multiple LAPF connections for the transmission of the data, among these connections one LAPF connection is dedicated for carry out the control information. The main disadvantage of the frame relay is that there is no point to point flow and error control but involves end to end flow control. Like X.25 and A T M frame relay also carry out the multiplexing of connections over a single link, in which each connection is assigned with a unique DLCI number. The multiplexing of logical connections take place at layer 2 thus result in eliminating one processing layer when compared with the X.25 .In frame relay the establishment and tearing of connections involves of four types of messages ,these are setup, connect, release and release complete . Frame relay offers services to the end users which are connection oriented and untrustworthy services. In frame relay before transmitting any data a path establishment phase is invoked in order establish the virtual circuit. [1][2]

IV. ATM

ATM (asynchronous transfer mode) is also same times known as cell relay. It is much like similar to that of frame relay. Both cell relay and the frame relay provides fast packet switching by making use of the modern digital equipments. In ATM the logical links are multiplexed over the single connection like that of the frame relay and X.25.The fixed size of packets that flow over the logical connection is known as cells. By using these fixed size of cells ATM is highly efficient than that of frame relay. There is lest flow and error control in ATM which result in the fast processing with minimum overhead. In this type of technology, when the end user wants to transmit the information, it is packetized into small size of fixed blocks known as cells by making the use of virtual connection concept. ATM exploits the concept of the logical connection which is referred as VCC (virtual circuit channel) .These virtual circuit channels are parallel to that of data link connection and virtual circuits in frame relay and X.25.the VCC in ATM is set up between the two end devices through the network. In ATM the VCC is employed between user network exchange and network -network exchange. The second sub layer of processing in ATM is known as virtual path, a virtual path consists bundle of virtual channel connections having g same end points. [1][3]

A. ATM Protocol Architecture

The architecture of the ATM is shown in Figure2. It has three layers which are ATM Layer, ATM adaption layer, higher layer. In addition to these layers it also consist three separate planes. The main function of the physical layer is that, it consist all the transmission medium related information and signal encoding scheme related specifications. The A t m layer is employed for the transmission of the data in fixed size of cells between the en d devices over the logical connections. The third layer known as ATM adaption layer is responsible for the mapping of information from higher layers into a t m cells in order to transmit over the network .It also performs the reverse function by mapping information from ATM layer to higher layer. The user plan is responsible for the error and flow control in ATM architecture. The main function of the control plane is to carry out call and connection control functions. The third plane in this architecture is management plane, which manages system related functions.[1][3][5]

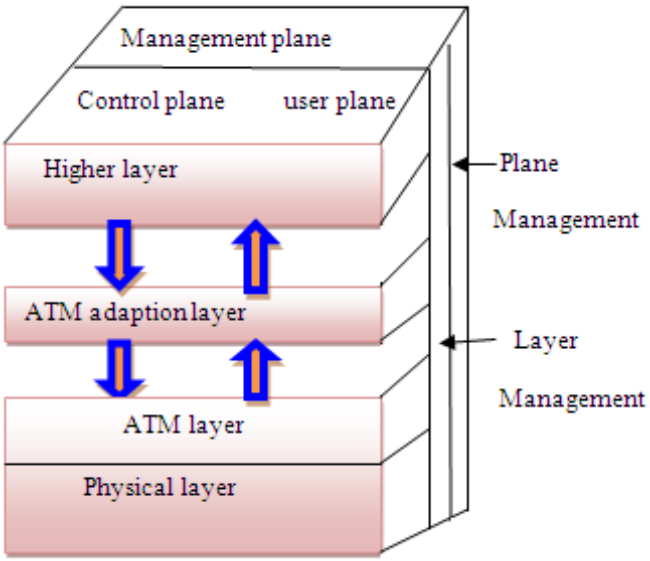

Figure 2: ATM Protocol Architecture

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TABLE 1

COMPARATIVE STUDY OF X.25, FRAME RELAY AND ATM

Parameter	**X.25**	**Frame Relay**	**ATM**
Reliability	low	high	low
Overhead	high	medium	less
Multiplexing of logical connections	yes	yes	yes
Multiplexing layer	layer 3	Layer 2	--
Flow control	link to link	end to end	minimal flow control
Error control	link to link	end to end	Minimal error control
Delay	high	medium	less
Through put	less	medium	High
Streamlined connection	low	medium	high
Multi protocol support	No	Yes	Yes

The comparative study in Table2 depicts that all the three technologies perform multiplexing of logical connections over a single physical channel but at different layers. ATM though being latest technology provides high throughput and less delay but at the cost of minimal flow and error control. X.25 provides link to link flow and error control while as Frame Relay provides end to end flow and error control. Further the connection in Frame Relay and ATM is more streamlined as compared to X.25.

V. CONCLUSION

High speed network is a need of hour to handle the gigantic traffic produced every minute. This paper presents the comparative study of three high speed network technologies viz. X.25, Frame Relay and ATM. X.25 is the basic technology while as Frame relay and ATM are its variations, having high data rates and processing speed and has thus revolutionized the communication system.

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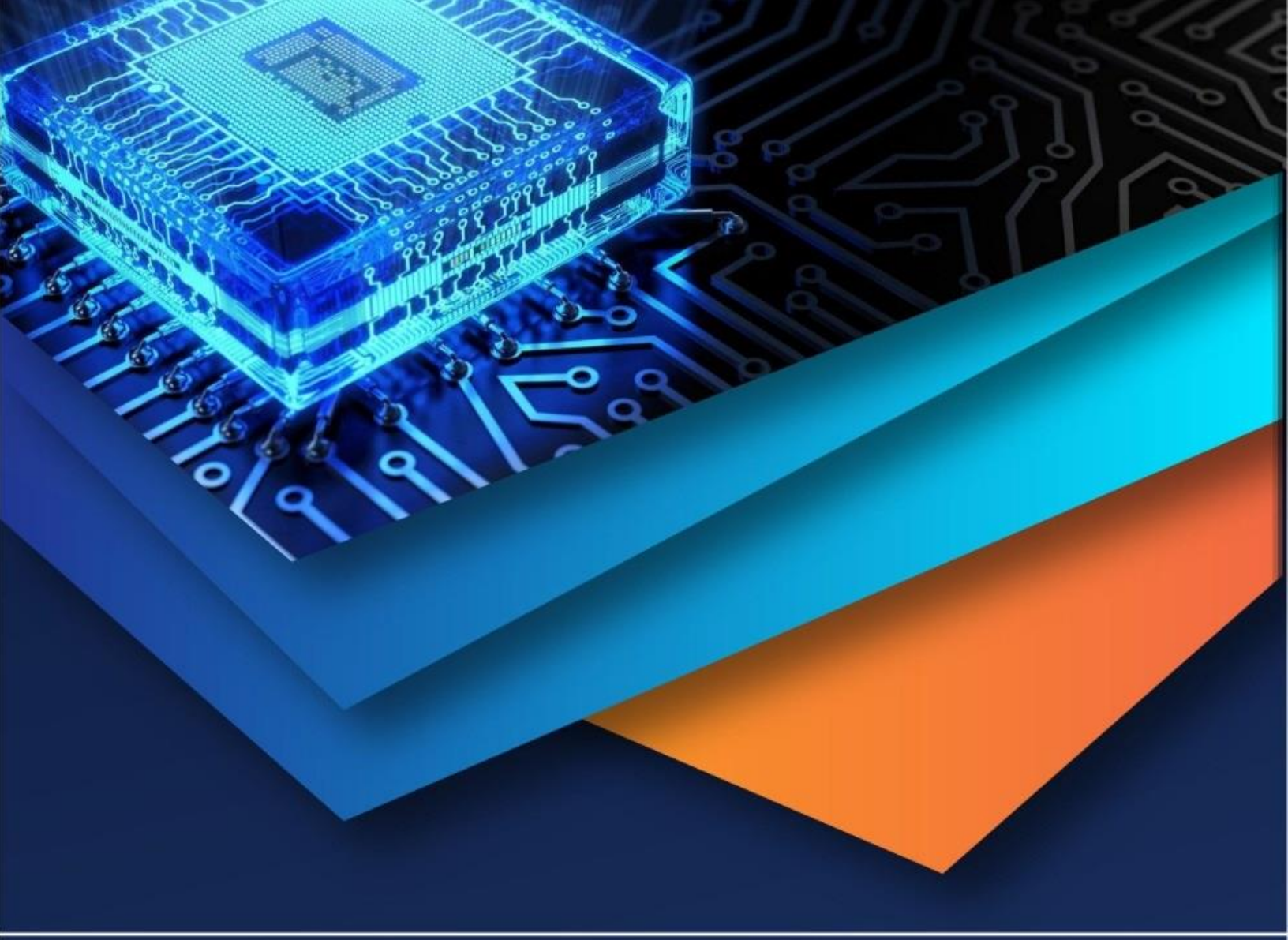

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