Research Journal of Applied Sciences, Engineering and Technology 2(2): 176-179, 2010
ISSN: 2040-7467

Submitted Date: November 17, 2009 Accepted Date: January 06, 2010 Published Date: March 10, 2010

Measurement of Transmission Time Delay and Efficiency of ATM LANE

Saad Alshaban, K.M. Lubna, Al-Azzawi and Sattar Sadkhan
University of Jerash, College of Engineering, Jerash, Jordan

Abstract: Present work describes the performance level of internetworking using ATM technology; the important parameters (transmission time delay, throughput, efficiency) are calculated to show the properties of applying ATM in LAN environments. Moreover to develop the skills of designing ATM LANE, the researcher issued a Computer Assisted Learning (CAL) at present1. It provides high efficiency and management ability because it assures higher transmission speeds for messages of variable length for multiple traffic types.2. It enables users of the simulation program to achieve a through and logical understanding of the benefits of internetworking with ATM technology.

Key words: ATM, efficiency, LAN, time delay, videoconferencing

INTRODUCTION

This research could be considered as one of the crucial researches carried out in the field of: networking with the ATM technologies. Designing ATM LAN emulation models.

Illustrating the possibility of redesigning the local area networks (LAN) with the use of the ATM technology.

Providing a guide to internetworking with ATM technology for the researchers in the field of designing computer networks.- A computer aided learning (CAL) simulation set by the researcher .The cell buffer was divided physically and the readout of cells was determined by the scheduler so the buffer length is infinitely long (Rob, 2002), Paper of Jeffrey (1998) , the research proposes that the organizing of the ATM network into a hierarchy made for efficient routing and allow for expansion. The research reached the following conclusions:- The best place to locate the ATM core switch is in the backbone. The high speed and fixed small size ells in ATM technology present difficulties in effectively controlling congestion not found in other types of data communications. In this paper three important parameters (transmission time delay, throughput and efficiency) which determine properties for ATM LANE designed in previous chapter are calculated: Paper of Hans (1990), research presents a method to analyze the delay of the messages sent through an Asynchronous Transfer Mode (ATM) network and consider a network with a number of sources and destination nodes, each transmitting / receiving multiple data streams carrying real-time messages. The research reveals that to guarantee short delays for urgent messages is done by the use of priority queues in the source nodes and in the ATM switch. The priority queues enable messages of different urgency to efficiently share the network resource (William, 1998) and Locken (2002). The research proposes a method, which is required to control the connection and cell administration; with that method the buffers and the capacities of the physical links of ATM switching are demonstrated. The research reveals that:- The delay time is not so large when the traffic load is balanced.- In line speed of 149.76 Mbit/s the output is (353,207 cell /s).- The ATM switches can responsible for the heaviest traffic flow and to the largest number of call setup.- For smaller networks, an intermediate switch may not be necessary. In that case, the edge switch can connect directly to the core.

Problem of the research: The importance of this research is that it demonstrates the following:

Due to scarcity of researches in field of designing computer networks based on ATM technology, which is considered to be very important advanced technology necessary for effective communication, because of its vast advantages that could cover most of the required high quality specifications, needed for efficient networks. It became very important to adopt and apply this technology for the first time in Iraq, where this in turn demands a comprehensive research of different aspects of this technology to accomplish full understanding of all the scientific details and basic information about internetworking with ATM technology, thus the need for a scientific research using ATM technology arises, henceforth the researcher conducted at the present research which is going to overcome the difficulties manifested when internetworking with ATM technology with LAN environments to achieve the following:

- Cognition the effect of using ATM technology in LAN environments.
- Designing ATM LANE to connect the two buildings of (The Department of Computer and Software Engineering in the University of Technology).

Corresponding Author: Saad Alshaban, University of Jerash, College of Engineering, Jerash, Jordan

The objectives of the research are as follows:

- Discern the benefits of the ATM technology.
- Demonstrating of the ATM protocol reference models and its basic layers.
- Studying the effects of the ATM technology in the LAN environments.

The organizing of internetworking ATM technology with LANs into a hierarchy will make efficient routing and allow for expansion.

MATERIALS AND METHODS

Transmission time delay calculation: In sending a massage and receiving it in any communication system, one of the most impotent parameters to be taken into consideration is the transmission time delay, through which the throughput rate can be calculated. In order to calculated (transmission time delay) the following steps are utilized.

$$\text{Bit-Rate} = \frac{\text{Data Size}}{\text{Transmission Time Delay}} \quad (1)$$

$$\text{Transmission Time Delay} = \frac{\text{Data Size}}{\text{Bit-Rate}} \quad (2)$$

Data size = user data +header
Data size=53 bytes (fixed) = 424bits

From Eq. (1) e transmission time delay can be calculated for one cell as shown in Table 1, and a curve which represents the changes in the transmission time delay for one cell with the changes of the bit-rate is shown in the Fig 5.

The changes in the bit rate will be from (155.52 Mbit/s to 622.08 Mbit/s).

Note: 155.52 to 622.08 Mbps is chosen because this actual speed of ATM transmission.

Efficiency calculation: Efficiency (η) is the number of the useful information bytes divided by the total number of bytes. So the efficiency can be calculated by the following formula (Davis, 2002).

$$\text{Efficiency } (\eta) = \frac{\text{message length}}{\text{message length + protocol overhead}} \quad (3)$$

Message length = user information Protocol overhead = cell header Hence the cell in ATM is fixed Message length protocol overhead= 53 byte for one cell. To calculate the message length with the protocol overhead, we have to know the number of cells in each message, this can be achieved by dividing the message length by 48 bytes, then multiplying the number of cells by (53 bytes) data for one cell, so: If we take for example image message from table (6-2) to calculate the efficiency, we obtain the following result: message length = 426000 byte

Message length + protocol overhead = 470375 byte

$$\text{Efficiency } (\eta) = \frac{426000}{470375} = 90.556\%$$

Table 1: Throughput for the text message

Transmission time delay (sec)	Throughput (Mbit/s)
0.01158	140.6897
0.00868	187.5862
0.00695	236.5217
0.00579	281.3793
0.00496	326.4000
0.00434	379.5349
0.00386	418.4615
0.00347	466.2857
0.00316	510.0000
0.00289	562.7586

Table 2: Throughput for the linage message

Transmission time delay (sec)	Throughput (Mbit/s)
1.72073	140.8704
1.29055	187.8268
1.03244	234.7836
0.86036	281.7425
0.73745	328.7002
0.64527	375.6567
0.57357	422.6162
0.51622	469.5672
0.46937	516.4369
0.43018	563.4850

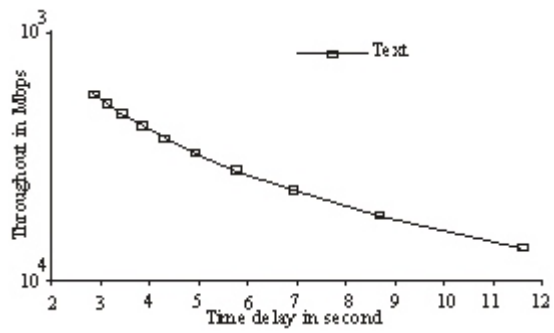

Fig. 1: Illustrate the changes in the throughput with the changes of the transmission time delay for text message

RESULTS AND DISCUSSION

This study is a practical approach to mainly the theoretical concept which is almost well known in literature, therefore it has been decided not to go in full details, except the practical exercise, and the resulted design should be correlated to theoretical concept, in order to do some modification on design and to have some comments on the site. From using formula 1,2 and 3 as has been mentioned before Fig 1 and Table1.

The results come fit with William (1998) and Hans (1990). How through put of text result with time delay change? In the same way Fig. 2, Table 2 shows for image. Fig. 3, Table 3 showed for video clip, Fig. 4, Table 4 shows for audio clip and Fig. 5, Table 5 shows for Videoconference.

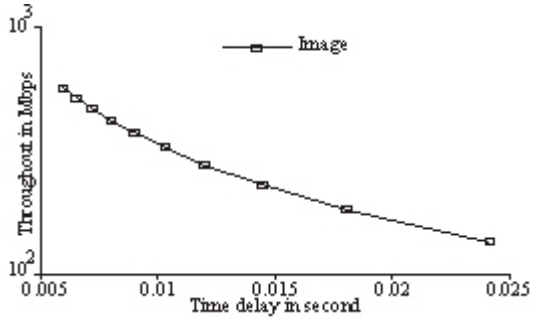

Fig. 2: Illustrate the changes in the throughput with the changes of the transmission time delay for linage message.

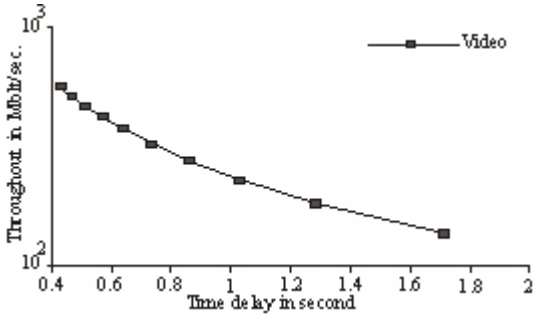

Fig. 3: Illustrate the changes in the throughput with the changes of the transmission time delay for video clip message

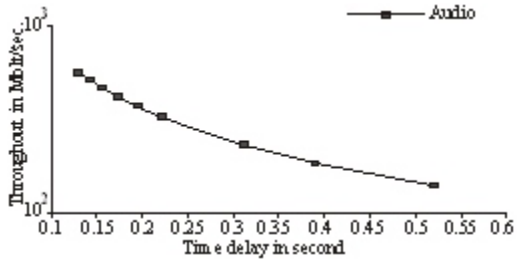

Fig. 4: Illustrate the changes in the throughput with the changes of the transmission time delay for audio clip message

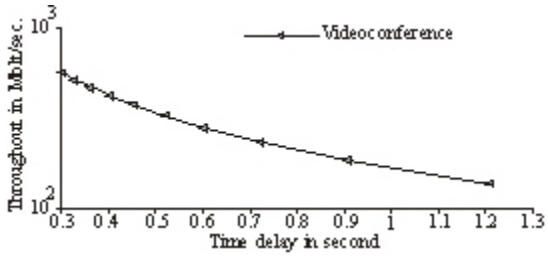

Fig. 5: Illustrate the changes in the throughput with the changes of the transmission time delay for videoconference message

Show relationship of through put with time delay for video conferencing in range of starting of time delay of range of 0.2 to about 10 sec. This clearly depends on type of ATM Switching is being used. Through put is shown

Table 3: Throughput for the video clip message

Transmission time delay (sec)	Throughput (Mbit/s)
0.02419	140.8264
0.01814	188.2873
0.01451	235.0345
0.01209	281.6529
0.01036	327.6923
0.00907	374.5055
0.00806	420.7407
0.00725	466.8493
0.00659	516.3636
0.00604	568.0000

Table 4: Throughput for the audio clip message

Transmission time delay (sec)	Throughput (Mbit/s)
1.20962	140.8701
0.90721	187.8267
0.72577	234.7834
0.60481	281.7401
0.51841	328.6534
0.45360	375.6534
0.40320	422.6101
0.36288	469.5668
0.32995	516.4329
0.30240	563.4802

Table 5: Throughput for the videoconference

Transmission time delay (sec)	Throughput (Mbit/s)
0.38972	187.8267
0.31177	234.7833
0.25981	281.7400
0.22269	328.6967
0.19486	375.6534
563.4801	422.6101
0.15588	469.7
0.14174	516.4329
0.12990	
0.51962	140.8700

inversely proportional with transmission time delay as results. This study was conducted in the department of computer/university of technology at Baghdad/ Iraq. Provides self-routing capabilities

CONCLUSION

The practical contribution of present work has established an easy method of designing ATM LANE in the site (The Department of Computer and Software Engineering in the University of Technology) .The present works comes fit with work of William (1998) and Hans (1990).

ATM LANE is best suited to campus backbone, because it affords the following to the users:

- Provides timely access to network resources.
- Supports messages traffic of variable length.
- Provides higher transmission speeds.

Provides self-routing capabilities for multiple traffic types.

- Supports new data communications and telecommunications applications.
- Offers guaranteed network access for voice and video applications.

- Enables users to request a desired level and quality of service.

The computer aided learning simulation program can be very helpful in the educational field, for post-graduate students (The Department of Computer and Software Engineering and The Department of Technical Education) and for other part of scientific researchers.

- Studying all models of the ATM LAN emulation design to use one of these models in designing ATM LAN Emulation to (The Department of Computer and Software Engineering).
- Studying the effect of changing optical fiber mode (OC) transmission medium on three important parameters necessary for all computers communication networks, (transmission time delay, throughput and efficiency).
- Developing a Computer Aided Learning (CAL) simulation program that facilitates the designing and ability to do necessary calculation. This present results comes fit with reference William (1998) and Hans (1990).

REFERENCES

Davis, R.H., 2002. ATM for public networks. McGraw-Hall.

Jeffrey, F., 1998. Routing and Switching in ATM Network. http://www.byte.com

Locken, H.A., 2002. Asynchronous transfer mode fundamentals. Galina Pildush Publisher.

Rob, J., 2002. Design internetworking IP-over –ATM. Juniper Networks,Inc.

William, S., 1998. High–Speed Networks TCP / IP and ATM design principles. Prentice Hall, Inc, New Jersey.

Hans, H., 1996. Guaranteeing real-time traffic through an ATM network. IEEE Communication Magazine, April.