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Performance Estimation of Real-time Video Conferencing in MPLS and Non MPLS Environment

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Abstract Nowadays, the technological avenues in modern techniques of networking have provided means to resolve the challenging environment of traffic engineering. Prima facie, video conferencing that has gained worldwide popularity, has led us to an idea to optimize its' video traffic by using Multi-protocol Label Switching as opposed to conventional IP Networks. MPLS can be a promising technology in dealing with real time applications that have low network delays and provide efficient utilization of network resources. In our study to model certain scenarios of both IP and MPLS networks, we found Optimized Network Engineering Tool (OPNET) to be the best suited tool in providing comparative performance statistics of throughput and end to end packet delay. The Simulations showed better performance of the MPLS environment over IP Networks when traffic for video conferencing were analyzed and their results were compared.

Keywords IP, MPLS, OPNET

1. Introduction

In the World of this age, real time applications are becoming famous in every aspect. A rapid increase of multimedia traffic like voice and video over the internet can now be witnessed. This has raised the requirement to exercise more care in handling voice and video traffic due to delay sensitivity, least quality of service parameters and limited bandwidth [3]. It is now very important to determine appropriate networking mechanism which can ensure efficient routing of packets and better performance over both data and delivery of packets over the network. Multi-Protocol Label Switching is our chosen mechanism which will provide lower delays in the delivery of packets over the networks. In this paper we compare the performance levels of MPLS and traditional IP Networks in real time applications of video conferencing. The parameters we choose to simulate in OPNET are throughput and end-to-end delay to evaluate MPLS and IP networks and see which one outperforms the other.

1.1. Survey of Related Works

The performance of networking environments under MPLS and non MPLS are evaluated by using traffic engineering aspects. The non MPLS scenario refers to conventional IP network based on OSPF [1]. This analysis has shown results that MPLS has better network performance for heavy traffic scenarios. A study is held in [2] using NS2 Simulator to calculate the performance of constraint based label distribution protocol (CR-LDP) and resource reservation protocol (RSVP) in MPLS environment. The study shows that CR-LDP in MPLS network will provide better performance results by overcoming the scalability limitations of RSVP. By taking File Transfer Protocol into perspective, performances of IP, MPLS and ATM networks are evaluated using OPNET and found [3] that MPLS and ATM performs better in terms of delay and response time than an IP network.

2. Contribution & Problem Statement

The actual time applications of video conferencing usually suffer from delay or packet loss in conventional IP networks.

The purpose is to minimize high latency rate and reduce packet drops ratio. In a bid to accomplish the required quality of service for video conferencing, the research question is drafted as "Under what networking mechanisms, MPLS will outperform IP while considering the parameters of delay and throughput on the received packets of real time video conferencing".

A hypothesis is built in our research idea that MPLS will have an optimum performance mechanism when is compared with IP while evaluating delay and throughput in video conferencing applications.

The main contribution is to estimate performance of real

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time video conferencing application in MPLS networks in comparison to IP networks and to validating our findings through OPNET to show that MPLS has a better platform to serve against traditional IP networks. The parameters of end-to-end delay and throughput are chosen to analyze the relative performance of video conferencing application in both environments.

2.1. Problem Solution

A. Implementation

The design of network topology is simulated on OPNET. The MPLS network is developed by considering a case scenario via employing 2 Label Edge Routers (LER) and 7 Label Switching Routers (LSR). The LSRs' are interlinked with 44.72 Mbps speed by virtue of PPP_DS3 medium. The links of LERs' are connected with LAN clients and video server by using switch as eth4_fddi4_tr4_switch_adv. This switch is thereby connected to video Server using 10 Base T Link at the speed of 10 Mbps and LAN client. The configuration of applications is done in a profile configuration setting to map these applications with the clients and servers accordingly. The MPLS Forward Equivalence Class (FEC) and Label Switched Path (LSP) are setup using MPLS configuration in which CR-LDP is defined as the routing protocol. Every Pack in Fig. 1 enters at the ingress LER and is loaded with labels that move along the LSP. The FEC classify the category of each labels forwarded to every LER. The insertion and removals of each labels are made at ingress and egress LER routers individually. Simulated parameters are given below in Table 1.

Table 1. Simulation Setup in Opnet

Parameter	*Value*
Number of nodes	9
Protocol used in IP	OSPF
Protocol used in MPLS Design	CR-LDP
Frame inter arrival rate	15 frames/s
Frame size	128 x 240 pixels
Type of service	Interactive multimedia

Figure 1. MPLS Network Design

MPLS model substitutes the IP network model. The LERs and LSRs of MPLS design are changed with the IP routers and the routing protocol is selected to be the Open Shortest Path First (OSPF).

2.2. Results

The Simulation is set to commence at the 30th second and is shown in the output graph. Figure 2, shows the end-to-end delay of an MPLS network and the traditional IP Network with end-to-end delay perpendicular on a vertical axis and time of simulation on a horizontal axis.

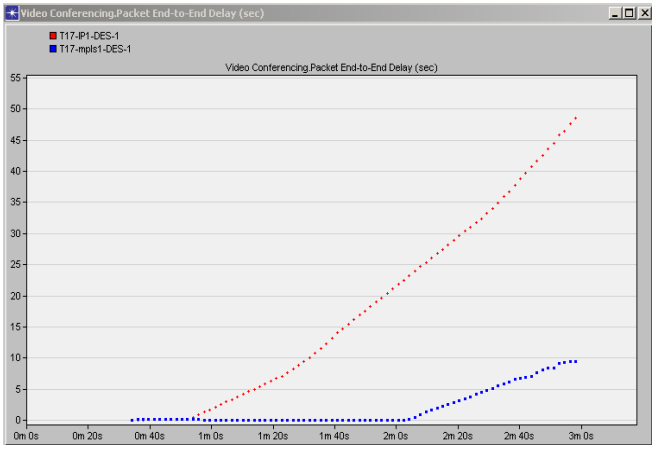

Figure 2. Video conferencing packet end-to-end delay

The recommended threshold of end-to-end delay for video conference is 150 ms, yet 400 ms is acceptable in [4]. It can be viewed from the end-to-end delay graph that IP network heads out the threshold at 1 minute, while the MPLS network heads out after 2 minutes 10 seconds approximately. In fig 3, blue, green and red lines show the average number of packets transmitted from source, average number of packets received in MPLS network and average number of packets received in traditional IP networks.

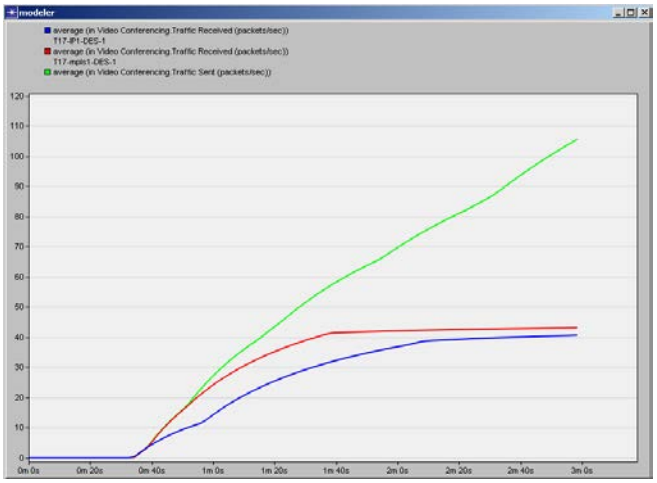

Figure 3. Video packets throughput

Throughput is an average success rate of message delivery onto a communication link or channel. Average number of packets sent and received in both the networks are shown

comparably in Figure 3. The throughput graph shows the better and more average number of packets received in MPLS network as compared to the average number of same packets received in the conventional IP networks.

3. Conclusions

The performance of MPLS and IP networks are studied and analyzed by applying the real time application of video conferencing. Routing mechanisms are configured and evaluated. It is thereby concluded that MPLS performs well with an enhanced throughput and decreased end-to-end delay in real time video conferencing applications.

The scope of future work can be extended if the same application of real time video conferencing is compared performance wise in MPLS and GMPLS Generalized Multi-Protocol Label Switching (GMPLS) environments using high definition video mode.

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