Best Suitable Transport Protocol Under Various Scenarios of Multi-Protocol Label Switching

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ABSTRACT: ***Multi-Protocol Label Switching is a best technique for efficient utilization of network resources, a small overhead labels. The Internet Protocol is the dominant protocol in computer networks today. MPLS adds the flavor of virtual circuits in computer networks. Which transport layer protocol (TCP Vegas, TCP New Reno, SCTP) performs the best when it is used along with MPLS is still an open question. We evaluated the efficiency of the three transport protocols under MPLS technology by considering average delay, throughput, channel wastage and average packet delivery performance as the decision variables. The results showed that in scenario of delay TCP Vegas perform better with minimum average delay while in case of throughput, channel wastage and packet delivery SCTP perform better than other protocols used in this research. Results are obtained through simulations over Network simulator 2.***

KEYWORDS: MPLS, Transport Protocols, Average Delay, Channel Wastage

I- MULTI-PROTOCOL LABEL SWITCHING (MPLS)

A framework that facilitates the effective routing, forwarding and switching of data streams through the network is called MPLS. It handles the issues related to data rate, reliability, scalability and quality of service of traffic in communication network. MPLS facilitate the bandwidth and service related issues of IP communication networks. It solved the issue related to scalability and routing. It is used to carrying different types of traffics including IP packets, ATM, Synchronous Optical Network (SONET) and Ethernet frames. It is a technology which combines the network-layer routing with label-swapping model.

A label provides a way on which data packets are travels. A label existed in a MPLS shim with other fields and this shim lies between the link layer and network layer headers. The values of packets are used to search the adjoining routers by those routers who used as receiver. After assigning the label to the packet, the packet passes through the central point on label switching.

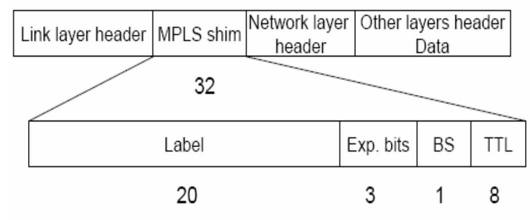

Figure 1: MPLS Label Format [2]

II- RELATED WORK

M. Saeed Akbar et al [16], present the experimental results of TCP variants in MPLS with consideration on TCP Reno, TCP Vegas and TCP Tahoe. It has been proved that TCP supports reliable data communication under different network conditions. Different variations of TCP show variable degree of flexibility in IP networks. MPLS traffic engineering methods has potency to supplying the services of QoS. Experimental analysis shows that Reno and Tahoe perform worse while TCP Vegas shows good results after a short duration variable delays in the initial periods of data transmission. The fixed delay in MPLS makes TCP Vegas a desired protocol for medium level networks.

A- Limitations of Related Work.

The study of this literature of shows that SCTP performs better as compared to the TCP and its variants implemented in different network environments. But problem is that there is no any scenario of transport protocols especially SCTP implemented in MPLS network environment .Now we check the efficiency of SCTP and TCP New Reno and Vegas in MPLS network by using different quality of service parameters especially delay, throughput, and channel utilization. Richard J. La [26] discusses the few issues of TCP Vegas that have a serious influence on the functionality of this protocol. The last contradictory property is analyzed also by Mo et al. [27]. They show that due to the assertive nature of TCP Reno, when size of buffer are greater, then TCP loses to TCP Reno that cover up the available buffer space that forcing TCP Vegas to move back.

III- STUDY

We in this paper study the performance of different latest transport layer protocols under MPLS. The protocols we evaluated in this paper include TCP Vegas, TCP New Reno and SCTP. The performance is measured with respect to various types of parameters. The first parameter is the average delay. We measured that out of the three protocols which one gives minimum average delay under MPLS. The 2nd parameter is the throughput and the third parameter is the channel wastage. Average packet delivery ratio is also considered to decide the better transport protocol for MPLS.

IV- SIMULATION TOPOLOGY

For purpose of label distribution among the nodes, MPLS uses the LDP. This topology comprise of 15 nodes, those are divided in to two further domains those are IP and MPLS. The area of MPLS enable nodes are comprised of 11 nodes, those are listed as from LSR2 to LSR11. The IP domain consists of 4 nodes, labeled as Node0, Node1, Node13 and Node14 are connecting with ingress and egress router respectively and those connected with the MPLS domain. In the topology src0 agent attached to IPNode0 and src1 agent is attached to IPNode1 acts as sender node while dst0 agent is attached with IPNode13 and dst1 agent is attached to IPNode14 act as receiver node. Packet forwarding scheme in this topology is based on the distance vector routing protocol, all the packets are travel on the two designated routes to investigate the throughput, average delay, channel wastage and packet delivery of SCTP, TCP New Reno and TCP Vegas on the MPLS network with variable bandwidth and packet size of 1000bytes. During the different experiments, channel has variable bandwidth. The traffic types FTP and CBR are used here with the 1000bytes packet size and with 500 seconds of simulation time with and with out rerouting scenarios.

V- PERFORMANCE ANALYSIS

To evaluate the performance we consider the different cases mentioned below:

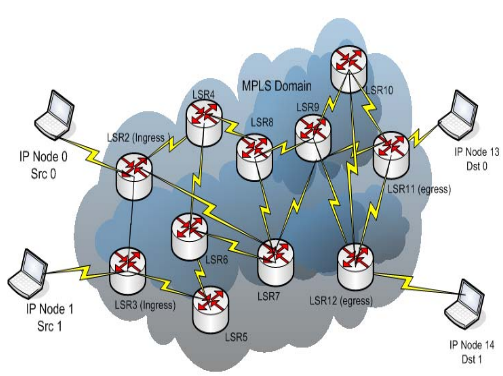

Figure 2: Implementation Scenario

A- *When Underlying Traffic is FTP*

With FTP traffic and packet size of 1000 bytes with varying bandwidth from 1 to 8 MB we calculated the average delay, throughput and channel wastage for the three transport layer protocols.

1- *Average Delay*

Figure 3 shows that TCP Vegas gives minimum average delay while the SCTP gives the maximum. But when the bandwidth is maximum almost all the three protocols give the same results.

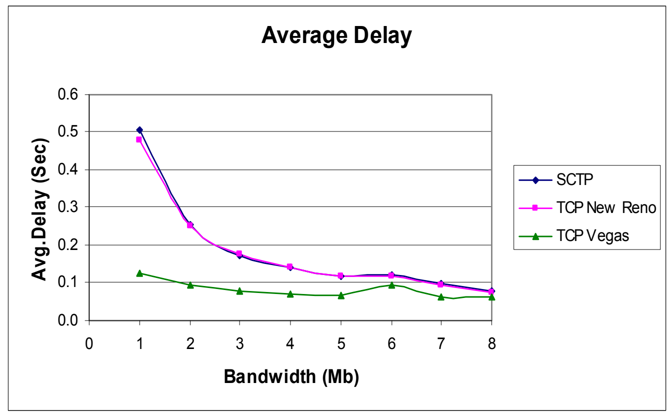

Figure 3: Average Delay with FTP

2- *Throughput*

Throughput of almost all the protocols is same as shown in the figure 4.

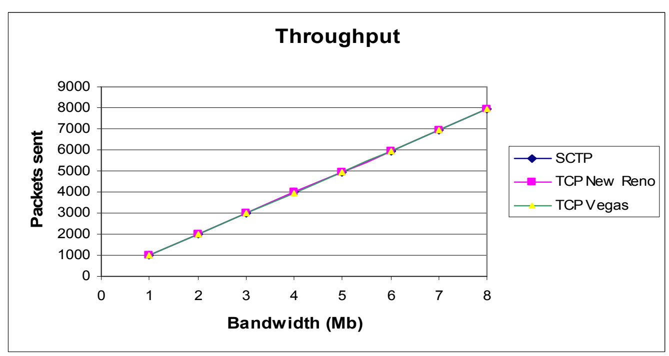

Figure 4: Throughput with FTP traffic

3- *Channel Wastage*

Channel wastage is high in TCP Vegas while its tie between New Reno and SCTP under various level of bandwidth.

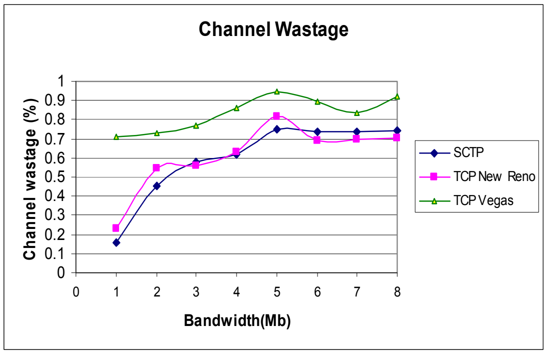

Figure 5: Channel wastage with FTP traffic.

B- Rerouting with FTP Traffic

When a link failed in a network, the traffic that uses the failed link must change its path to reach its destination: the data traffic rerouted from a primary path to a backup path. These paths can be fully disjoint or partially combined. Rerouting can be use in both circuit and packet switching networks. We take FTP traffic with packet size 1000 bytes and variable bandwidth.

1- Average Delay

Again TCP Vegas wins the race and performs well in terms of average delay.

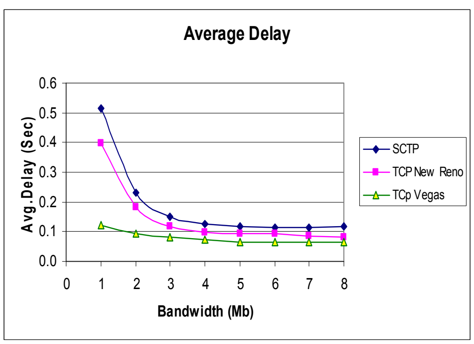

Figure 6: Average delay with rerouted FTP traffic.

2- Throughput

As the scenario of re-routing arrives the throughput of the TCP Vegas drops suddenly while the throughput of SCTP and New Reno remains intact.

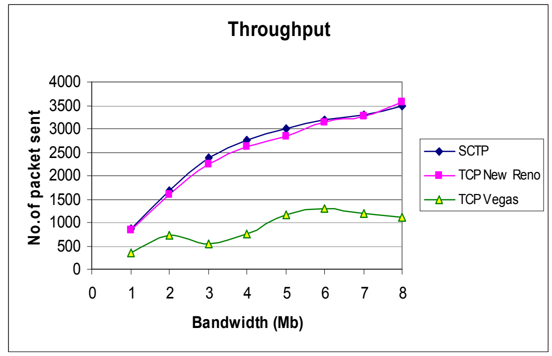

Figure 7: Throughput with rerouted FTP traffic

3- Channel Wastage

Channel wastage of TCP Vegas is again high but that of SCTP is very low.

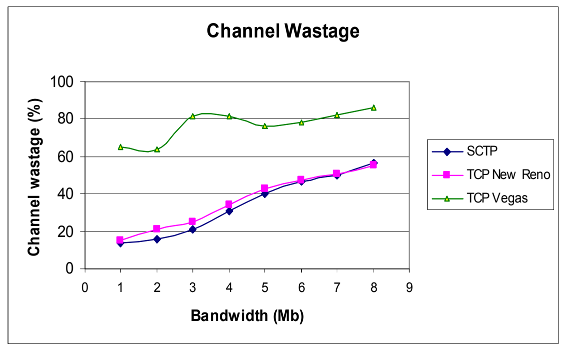

Figure 8: Channel wastage with rerouted FTP traffic.

C- Packet delivery Analysis with FTP Traffic

In the figure below packet delivery analysis is given for the three transport protocols. When there is no scenario of re-routing packet delivery ratio of all the protocols is same but in case of re-routing SCTP performs very well as compared to TCP Vegas.

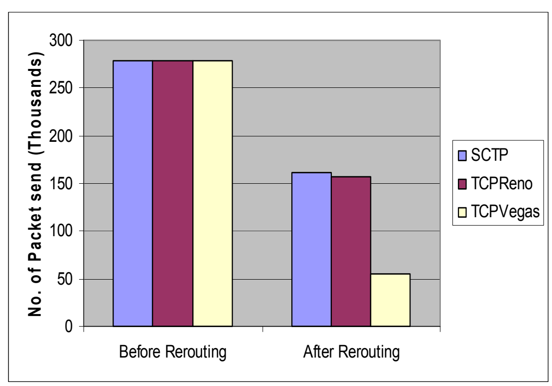

Figure 9: Packet delivery analysis with FTP traffic

VI- CONCLUSION

In this research, quantitative analysis of TCP variants TCP Vegas, TCP New Reno and the new transport protocol SCTP have been performed for FTP under different bandwidths and varying packet size. The quality of service parameters analyzed in research is average delay, throughput, packet delivery and channel wastage with variable network bandwidth. The study evaluated that TCP Vegas exhibits minimum average delay mostly in all case of before and after rerouting in comparison of TCP New Reno and SCTP while SCTP has perform better in case of throughput, channel wastage and packet delivery in all bandwidth before and after rerouting scenarios. All these three protocols almost send the same number of packet with different bandwidth and 1000 bytes packet size. It is observed that STCP show some consistent behavior when the bandwidth increases.

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