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Improving Routing Performance in Wide Area Networks using MPLS

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Abstract - The stability of end-to-end Internet path is dependent both on the under- lying Telecommunication switching system as well as Routing Architecture. Due to the increase in Internet popularity and traffic, the traditional routers had the potential to become traffic bottlenecks under heavy load because of their limited aggregate bandwidth and packet-processing capabilities. To overcome these limitations, Hardware and software based modifications have been implemented to improve the routing performance. This paper focuses on comparative study of IGP based routing MPLS based Traffic Engineered Routing. The significant performance improvements are observed for traffic following the MPLS enabled paths.

***Keywords*— Routing Performance, MPLS, IGP, Traffic Engineering,WAN.**

I. INTRODUCTION

I.1 Multi Protocol Label Switching (MPLS)

With the rapid development of a large number of new businesses, many researchers felt the need to enhance the network performance in complex networks. In recent years, how to improve the network quality of service has become an important requirement in designing large networks. Then, IETF proposed the Multi-Protocol Label Switching (MPLS) as a new technology for the high speed networks.MPLS (*M*ulti-*P*rotocol *L*abel *S*witching is an evolving technology that facilitates several problems in the internet, such as routing performance, speed, and traffic engineering

Multi-protocol Label Switching (MPLS) is an important broad band technique to support and strengthen IP services. MPLS includes Label Edge Router (LER), which is responsible for attaching appropriate labels on the packet. LER can either be an ingress or egress router. A label is an identifier to transmit data in the network. The labeled packets are forwarded or routed through the path known as Label Switch Path (LSP). During transmission, the egress or penultimate LER is responsible for removing label from the packets. [1] MPLS is a connection oriented technique and thus it provides reliable services according to the customer demands and profit goals [2]. It works between the second and third layer of the OSI model of networks [3].

II. Simulation Setup

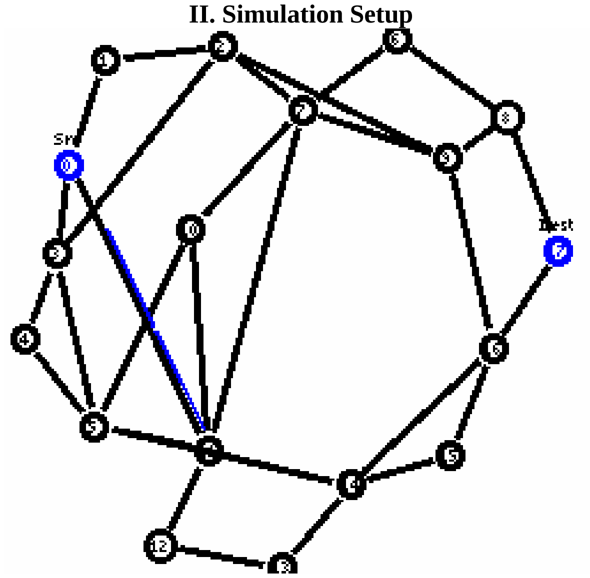

Fig 1. Simulation Topology-1

We simulated the design of our comparative study of MPLS implementation with respect to regular IGP based routing with Network Simulator (NS-2) [6]. The topology consists of 18 nodes in which one sender (ingress) and destination (egress) nodes are connected to 10 MPLS enabled label switched routers (LSRs). We performed the test with using MPLS and by using IGP routing. TCP Round trip time has been computed and plotted the results.

2. SIMULATION RESULTS

we have established the LSPs between Ingress Router and Egress router, which are directly following the IGP shortest path. We have performed the throughput test, to measure the performance of TCP flow from Ingress Router to egress router with using MPLS Path and without using MPLS which means by using the usual IGP shortest path. The results of throughput measurements are plotted in the form of a graph.

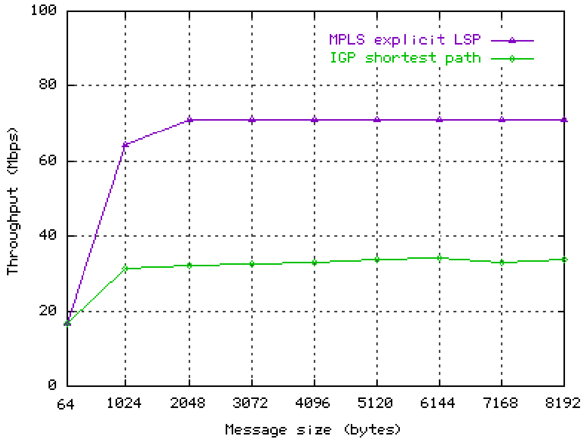

Fig 2: TCP Throughput measurement

Fig 2 shows the throughput measurements of TCP flow between the source router and destination, as a variation of message sizes, and while traversing an MPLS explicit path and also IGP shortest path. The bottom line shows the throughput when the traffic flow traverses the IGP shortest path. The top line shows the throughput when the same traffic flow traverses an MPLS LSP path from Ingress Router to Egress Router. As it can be seen clearly from Fig 2 shows that when the traffic from Ingress to Egress traverses through the IGP shortest path, the result is that a low throughput of TCP traffic is observed. When the traffic is traversing through the MPLS LSP path, the high throughput of TCP traffic is observed which indicates the enhancement of Routing through MPLS when compared to the IGP shortest path.

The average round-trip time (RTT) for TCP is also measured and using request/response performance method. The performance metric here is the aggregate number of request/response packet pairs (transactions) per second. That means, the test gives the amount of transactions exchanged per second, where one transaction is the exchange of a single request and a single response. So, from this result, we can calculate, and infer the average round-trip latency incurred by each message.

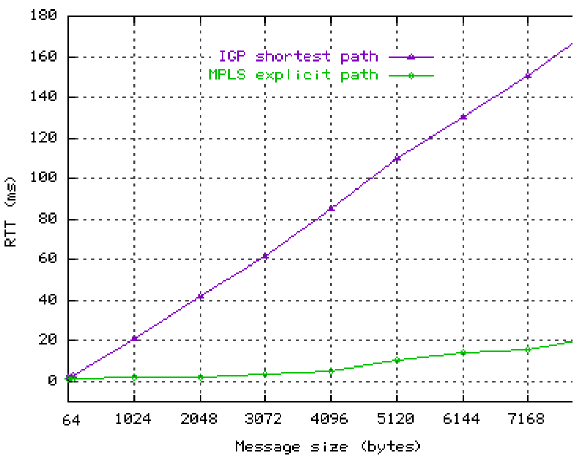

Fig 3: TCP average round-trip latency

The Fig 3 shows the TCP average round-trip latencies. Obviously, the round-trip latency dramatically increases for the congested IGP path, while it is minimal for packets traversing the MPLS enabled LSPs.

In all the measurements, the very significant performance improvements are observed for traffic that follows the MPLS enabled LSPs. But, without MPLS traffic engineering, all unlabeled packets take the shortest path, while other links remain unutilized. And if the traffic traverses across the IGP shortest path route, it incurs long delays, and throughput degradation. This shows how MPLS is robust to maximize the utilization of links and nodes throughout the network. Especially, the results of the delay analysis strongly support the approach of improving routing performance through MPLS.

3. CONCLUSIONS

MPLS offers enhanced routing capabilities by supporting more than just destination-based forwarding. Some of the new cost-reduction and revenue-generating services that can be deployed with MPLS include traffic engineering, CoS-based forwarding, and VPNs. By separating the control component from the forwarding component, MPLS provides the flexibility to evolve control functionality without changing the forwarding mechanism, thus uniquely positioning MPLS to support the deployment of enhanced forwarding capabilities that will be needed for the Internet to continue its explosive growth.

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