

Recovery Path Optimization using Modified Assured Quality Model (M.A.S.Q) in MPLS based Network

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Abstract

In this paper, an improved algorithm for continual network service provisioning in case of edge failure has been presented. Currently, most of the research related to network resource management in case of edge failure has focuses on rerouting of packets. These packets are treated individually. The performance achieved through rerouting the traffic on alternate path mainly depends upon path optimization strategy. There are several parameters which are considered in literature for selection of optimal path. According to the best of my knowledge, while choosing optimized path, there are several important parameters that are yet not considered for optimal path selection. The parameter includes throughput, load-balance-threshold and available bandwidth of the link. This research focuses to consider these above mentioned parameters for selection of alternate (optimal path) in case of edge failure. We believe, if Path Switch Router selects the alternate path incorporating above mentioned parameters then network efficiency due to better selection of optimal paths will be further improved. In this research paper alternate path selection process is modified to consider the new parameters and achieve better network performance in case of network node failure.

Keywords: Multiprotocol label switching; label switching router (LSR); Path Switch Router (PSL); Path optimization; Network Node Failure.

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INTRODUCTION

Analysis of internet usage for last two decades shows a dramatic increase. Increase in the number of users and user-applications have continuously been questioning the sufficiency of available resources to meet the required quality of services. One approach to meet such quality of service requirement is to improve resource infrastructure. However, expansion in infrastructure alone cannot overcome the problem. For better quality of service and reliable connectivity of network, Multiprotocol label switching (MPLS) has already been proposed. MPLS overcomes many problems especially in recovery of path in case of node or edge failure. Logically MPLS may be placed as layer 2.5 in OSI design. It enables the network operator a standard based solution to handle with the constantly increasing Internet traffic. MPLS is a routing technology. It has no concern with the type of data. MPLS is not a standalone technology, it combines itself with the packets of any type. In order to forward the packet effectively, it adds the label to the packets. A label has all the information which is necessary for routing of respective packet. In MPLS based network, Label distribution protocol shares the

control signals with every hop to figure out optimized path. In case of link failure, there are two mechanisms for providing alternate path. They are global repair and local repair ([Mirkar et al., 2014]). In global repair recovery point is far and must be reported by fault indication Signal (FIS) (Makam et al., 1999). In case of local repair FIS signal does not travel to the previous ingress router. Generally local repair is preferred over global repair (Makam et al., 1999). The next section of this paper represents some essential basics related to MPLS based network.

MPLS domain: It is the group of interconnected nodes on which MPLS techniques are applied.

LSR and LER: Normally there are two types of routers which are used in MPLS base network. The core routers lie within a MPLS network while edge routers lie at the corners of MPLS based network. The core routers are called label switch routers (LSR's) and edge routers are called Label edge routers (LER's).

Header: The MPLS header is also called as a label or shim header. It has a fixed length of 32 bits (4

octets) and is packed in between the Layer 2 header) and the Network Layer header.

LSP: Label switching path (LSP) is way from which labeled packets are transmitted.

FEC: The Forward Equivalence Class (FEC) represents a group of packages, all of which are transmitted by the same transmission criteria.

LDP: Label distribution protocol (LDP) defines the process and messages for LSR's and LER's (Rosen et al., 2001; Papneja, R., et al. 2013).

The interconnections of different MPLS components are shown in figure 1.

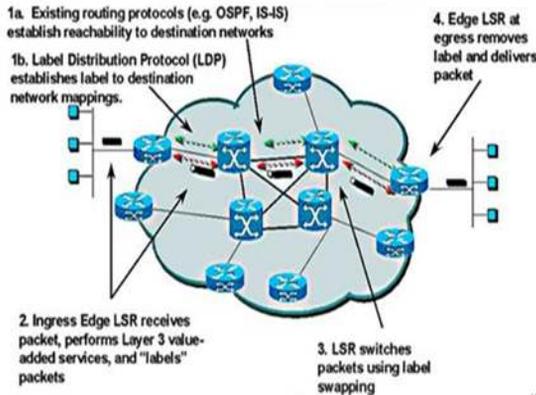


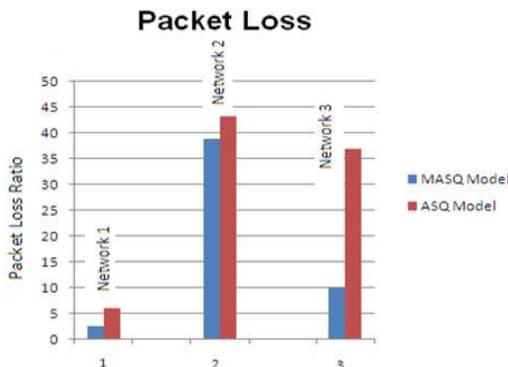
Figure 1: MPLS Operation

RESULTS AND DISCUSSION

The Results show the comparison between ASQ and MASQ model for three different scenarios. The simulation analysis is done at different stages of scenario.

Packet Loss Ratio

The chart is showing the number of dropped packets for the Scenario 1,2 and 3 depending on the link that breaks.



Graph 1: Packet loss

After applying MASQ model in Scenario 1, packet loss reduces from 6 % to 2.5%. 6% is the packet loss value obtained after applying ASQ model and 2.5% is the value obtained by applying MASQ model.

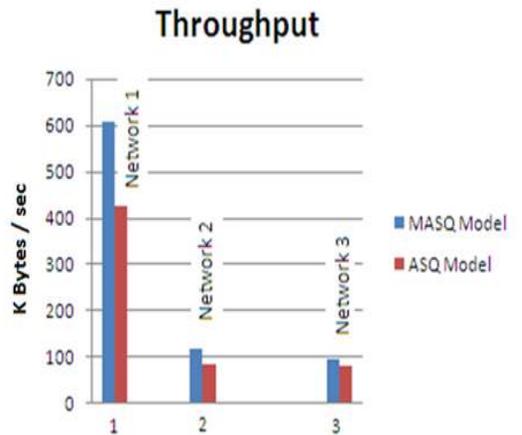
In Scenario 2 by applying MASQ model Packet Loss has been decreased from 43.90% to 39%. Thus 4% improvement is achieved.

In Scenario 3 model Packet Loss has been decreased from 36.92% to 10.00%.

It is clearly shown from the graph 1 that packet loss ratio of all the three networks is much improved by applying MASQ model.

Throughput

Throughput is a measure of how many packets of information a system can process in a given amount of time.



Graph 2: Throughput

Above chart is clearly showing the improvement in throughput values. By applying MASQ model in Scenario 1, throughput value has been increased from 427.079 KB/sec to 609.181 KB/ sec.

In Scenario 2, throughput value is increased from 83.45 KB/sec to 116.75 KB/sec.

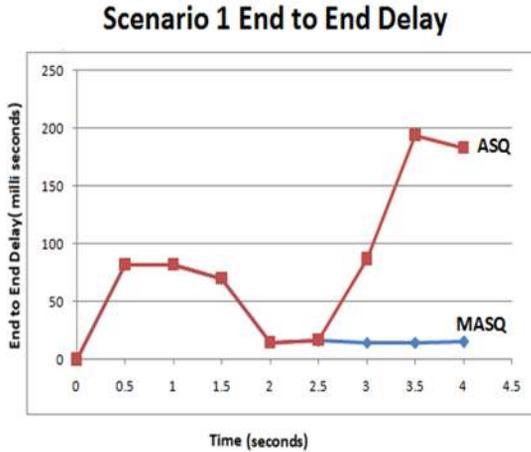
The case of improvement in throughput is also observed in Scenario 3. In this case value is increased from 81.165 KB/sec to 97.8184 KB/sec.

End to End Delay

High End to End Delay means more time is required to reach packets from source to final destination. Low end to end mean less time is required for data to arrive at destination. Hence low End to End delay is good.

Scenario 1 End to End Delay

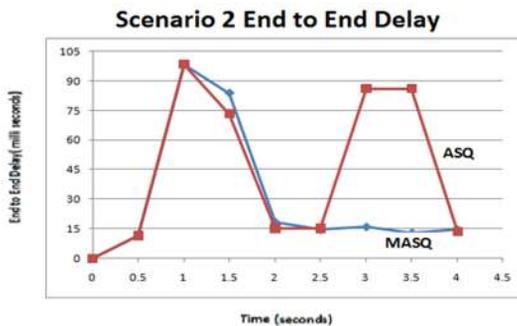
Graph 3 is showing same value till 2.5 seconds .After 2.5 second both models (ASQ or MASQ) select different alternate paths from each other. The alternate path selected by ASQ model has less number of nodes and low available bandwidth therefore has less End to End delay.



Graph 3: Scenario 1 End to End Delay

Scenario 2 End to End Delay

In this scenario both models give same value before 3 seconds. At 3 seconds link failures occur. This is point where ASQ model and MASQ model will be differentiated. The alternate path selected by ASQ model has much higher end to end value while alternate path selected by MASQ model has much lower End to End value. This increase in value will continue till 4 seconds.

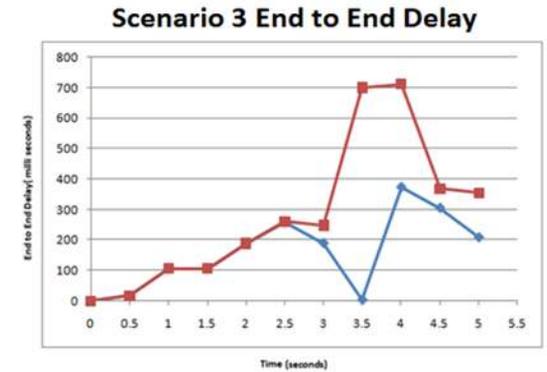


Graph 4: Scenario 2 End to End Delay

Scenario 3 End to End Delay

The last network has equal link bandwidths. In this case first cross traffic and link failure occurs before 2.6 seconds. The parameter on which ASQ model

selects the alternate path has much higher End to End delay. During the same interval recovery path selected by MASQ model has much lower End to End delay.



Graph 5: Scenario 2 End to End Delay

CONCLUSION

This paper provides the working of MPLS-based network. In this research, working is discussed in case of link failure. After failure of link different models have been proposed for selecting optimized path .The model includes Makam model, Hashkin model, Houdessa model and ASQ model. In some models packet stream itself act as a FIS and in some models separate FIS is generated. In the proposed model packet stream itself act as a FIS signal. This method reduces the time required to reach the optimized path. This model is based on the modification of ASQ model (Mirkar et al., 2014). Furthermore in the presented model selection of alternate path does not depends only on the number of hops and bandwidth link. It also depends on the bandwidth of link at the particular instant. Any path which has more bandwidth at a particular time may not hold same bandwidth at any other instant. The justification has been warranted by the values of packet loss rate and throughput on a network in which both MASQ and ASQ models have been applied.

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