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Traffic Management and QOE in MPLS Network based on Fuzzy Goal Programming

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ABSTRACT: Traffic management enhance the network by avoiding congestion of packets that result to packet drops and degradation of network efficiency fuzzy goal programming based on the fuzzy characterization for ensuring traffic engineering traffic engineering and management in a multi-protocol label switching network. FGP is used as characterization tool to achieve a high quality of experience (QOE). An M/M/1 queuing model is used along with a new topology for fuzzy goal programming algorithm that enhances the QOE and acts as a great application for smooth traffic engineering.

KEYWORDS: MPLS, QOE, M/M/1, GP, Traffic Engineering, LSP, FGP, ATM, QOS, Jitter, Delay.

I. INTRODUCTION

Multiprotocol label switching (MPLS) is a flexible key to report the difficulties faced by present networks—speediness, quality-of-experience (QOE) management and traffic engineering. MPLS has appeared as a sophisticated key to encounter the management of bandwidth and service requirements for next-generation Internet protocol (IP)–based backbone networks. MPLS reports concerns related to scalability and path -routing (built on QOE and QOS metrics).

QOE (Quality of Experience) and QOS (Quality of Service) nomenclature are conventionally used interchangeably however are literally two separate conceptions. QOE is that the total system performance from the purport of read of the users. It's the live of end-to-end performance at the accommodation level from the network user perspective and a designation of however well the system meets the user's wants. Quality of Service (QOS) conjointly refers to a group of technologies (QOS mechanism) that transmute the network administrator to manage the results of congestion in integration as providing differentiated accommodation to cull network traffic flows or to optate users. In order to distribute acceptable accommodation quality, QOS targets ought to be established for every accommodation and be enclosed ahead of time in system style and engineering processes. QOE for the tip utilizer is crucial and can be a key human with cognation to competitory accommodation offerings. Subscribers to network accommodations don't care however accommodation quality is achieved. What matters to subscribers is however well an accommodation meets their goals and prospects their (QOE).To achieve this finish, the QOE engineering method involves the subsequent steps.

- Defining the QOE matrices and targets
- Identify QOE tributary factors and dependencies (delay, disturbance and loss).
- Traffic engineering and resource allocation. This involves routing, bandwidth allocation etc. In my case I have introduced a load equalization algorithmic rule to optimize the impairments and disturbance so as to maximize the QOE.

Goal programming (GP) is multi-criteria decision making technique. GP is used to include multiple objectives by which we can achieve the target value for each objective. In goal programming there exist two main assumptions-the decision maker decides the target and the deviations of the target which decides how far the attribute is from the target. With the help of these considerations, we may appear into a linear penalty function. In some circumstances the penalty function is piece wise linear function. Piecewise linear function can be expressed analytically and can be incorporated into a linear programming model. In fuzzy goal programming the goals are represented by fuzzy sets whose

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membership functions provide the satisfaction degree regarding the achievement of the targets. In fuzzy goal programming most of the cases the membership function is linear. But when the change in satisfaction level is not constant, the membership function becomes nonlinear and can be approximated by piecewise linear functions.

II. RELATED WORK

In the above research work, an M/M/1 model is used to measure the traffic engineering parameters and quality of service.A simple system of 2 parallel M/M/1 queues which operate at service rates μ1 and μ2 with Poisson arrivals at rate λ is shown in Fig.2.It is assumed that the system is stable (λp< μ1 and λ(1-p)< μ2) with infinite buffers. The delay lines T1 and T2 are connected with server 1 and server 2 respectively. Probabilistic splitting of traffic with λp being routed in the first path and λ(1-p) takes the second path is considered here. The propagation delay, minimum average delay and throughput have been measured. The goal programming is used as a decision making tool to determine the quality of differentiated services. Certain goals have been set through linear programming model to give the best possible satisfying solutions under various constraints. The membership function has been varied in accordance with the delay.

III. TOPOLOGY USED IN FGP ALGORITHM

A topology is proposed with a single pair of ingress and egress routers and with pre-established LSPs shown in the Fig. 1. The ingress router splits the input trafficλ into two different paths of arrival rates λ_1 and λ_2 . The algorithm can be implemented first with delay and then jitter as a decision criterion for splitting the incoming traffic

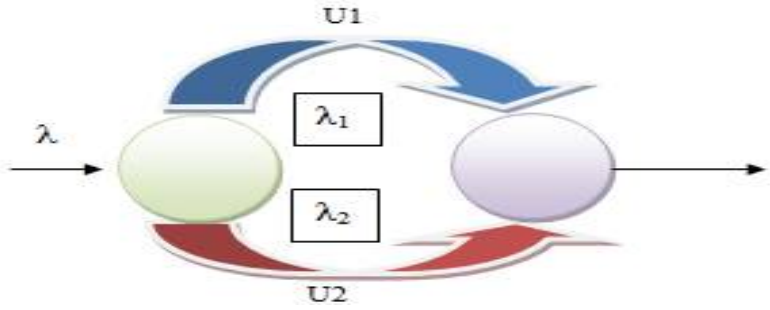

Fig.1. Proposed Network Topology in FGP

IV. ANALYSIS OF DELAY AND JITTER IN M/M/1 MODEL

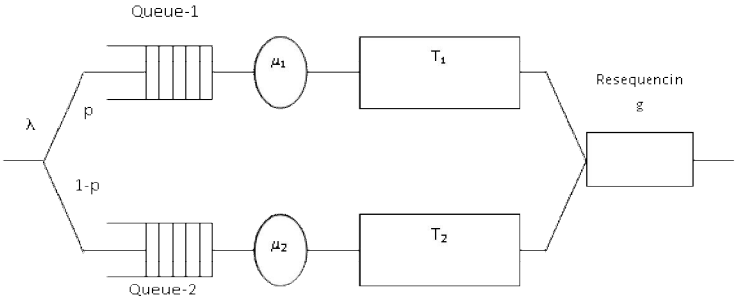

Fig.2. System of parallel M/M/1 Queue with delay lines

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For an M/M/1 Queue model shown in fig. 2, it can be written that,

$d(p) = \{p/(\mu-\lambda p)\} + \{(1-p)/\mu - \lambda(1-p)\}$ ..... (1)

Where d (p) =delay as a function of probabilistic splitting
p = probabilistic splitting, μ=service rate, λ=arrival rate

So we can say,

d (p) = E (D) (p), where E (D) (p) denotes expected value of delay ofFunction (p)

$d(j) = \{p/(\mu-\lambda p)^2\} + [(1-p)/\{\mu-\lambda(1-p)\}^2]$ .....(2)

Where, d (j) =delay as a function of probabilistic splitting
p = probabilistic splitting
μ=service rate
λ=arrival rate

$d(j) = E(D^2)(p)$

From Equation 1 and 2 we can plot graph of d (p) shown in fig.3 and d (j) shown in fig. 6 with respect to p by varying p from zero to one and taking value for μ and λ and can be made piecewise linearized.

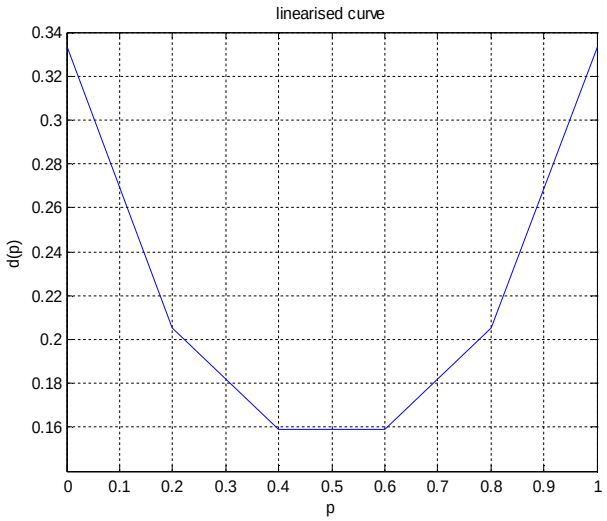

Fig 3. Piecewise linearized function of d (p) vs. p

A piecewise linear function can be expressed in the following way,

$$F(z) = \sum_{j=1}^{N} \infty_j |z - g_j| + \beta z + \lambda$$

Where,

$\infty_j = \frac{k_{j+1}}{2} - k_j$, $\beta = \frac{k_{N+1}}{2} + k_1$, $\lambda = \frac{a_{N+1}}{2} + a_1$

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Where, k_j is the slope and a_j is the y intercept constant of the line segment initiated at and terminated at g_j and can be visualized from the fig.4.

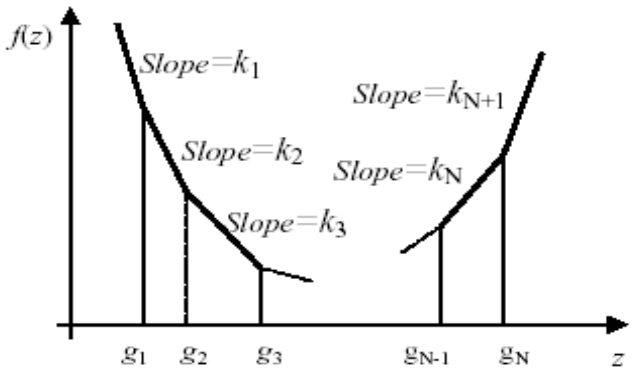

Fig.4. piecewise linearized penalty function

V. **RESULTS**

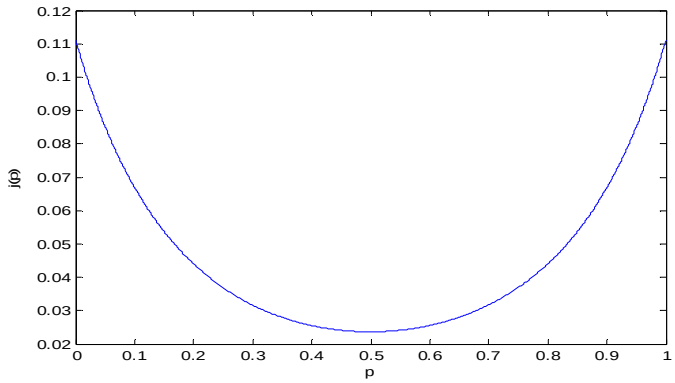

Fig 5. Plot of j (p) vs. p

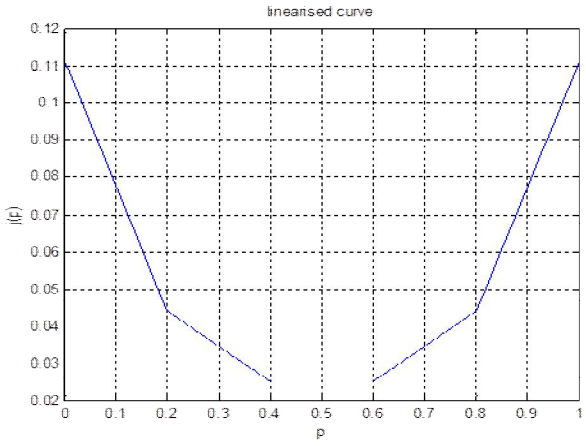

Fig 6. Piecewise linearized function of d (j) vs. p

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In our case we have a fuzzy goal whose membership function is decreasing and piecewise linear as fig 4 and fig 8, the concept is taken from fig.2, we can represent it by the following expression,

$$h(z) = \sum_{j=1}^{N} \infty_j |z - g_j| + \beta z + \lambda$$

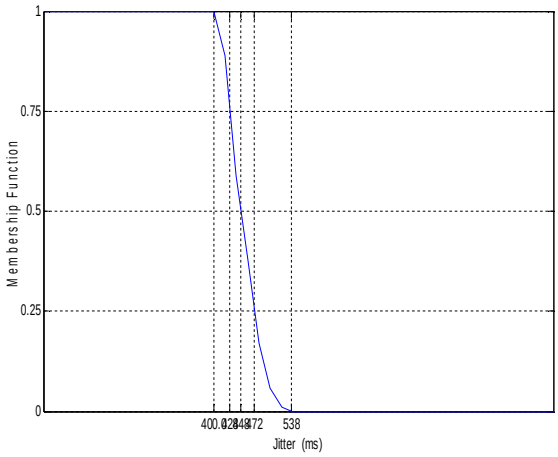

Fig.7. piecewise linear membership function for delay

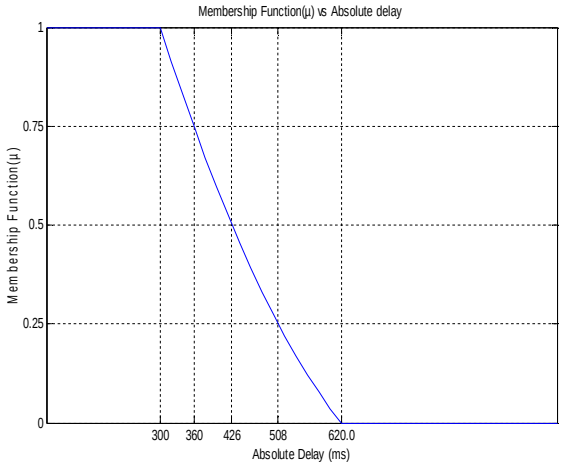

Fig.8. piecewise linear membership function for jitter

VI. CONCLUSION

In the above paper the QOE is measured through goal programming method where a piecewise linear membership function got varies with delay, jitter etc. The QOE is based on human assumptions which are totally differing from QOS. The adoption of a new topology along with Fuzzy Goal Programming improves the traffic engineering parameters and provides a good response of improving Quality of Experience(QOE).

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