QoS Routing for Computer Networks- A Fuzzy Logic Based Approach

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If one were to choose any one technology that has most affected human civilization in the last decade, almost inevitably, it would have to be the Internet. There is no sign that the phenomenal growth of the Internet will subside any time soon.

With more and more widespread use of the Internet, the service requirements are fast changing. An entirely new breed of applications has cropped up. These new applications cannot tolerate significant delays or data loss. For example, a telephone system that delivers 'broken' sentences with delays of say ten to fifteen seconds is 'useless'. Therefore, any significant degradation in service parameters of the network can completely disable this new breed of applications.

With the realization of the need to implement 'better than best-effort' services on computer networks, the concept of 'Quality of Service' (QoS) is born. To support the 'new-breed' of applications on the Internet, some sort of QoS guarantees have to be provided for.

Quantifying QoS is largely a subjective matter. For example, what may be 'reasonable' quality of service for one telephone user may be described as 'poor' by another. Also clear-cut and 'crisp' demarcations cannot be defined for QoS. In other words, there is an inherent objectivity and uncertainty (fuzziness) involved in quantifying QoS. Therefore it is proposed in this thesis that a 'fuzzy logic' based approach be used for quantifying QoS. The thesis suggests that QoS be treated as a 'fuzzy' variable, and modelled using 'fuzzy logic'; so as to yield a novel 'fuzzy logic' based approach to QoS routing and management.

For the 'fuzzy' modeling of QoS, the effect of three parameters – Bandwidth, Delay and Cost – on the Quality of Service available has been investigated. All the three parameters have also been treated as 'fuzzy' quantities. In the final algorithm, all three input parameters have been mapped into five, sufficiently overlapping fuzzy sets labeled as Unacceptable, Poor, Average, Good and Excellent. A comprehensive set of sixty-five rules has been written and a QoS model developed.

For a detailed study and testing of the QoS model crisp values were assigned to each input variable and the crisp, defuzzified value of the QoS obtained was observed. Detailed plots of Bandwidth-Delay vs. QoS, Bandwidth-Cost vs. QoS and Delay-Cost vs. QoS were plotted. It was seen from the plots that the rule base used is satisfactory and the QoS model thus developed is adequate.

The contributions put forward in this thesis can lead to a full-fledged project of design and development of a Fuzzy Router to be used for implementing fuzzy QoS model on computer networks.