

QoS Is Still an Issue, Congestion Pricing Is Not the Solution

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Extended Abstract

A network clearly needs to be designed to meet user performance requirements for a wide variety of applications. In a commercial setting, Return on Investment (RoI) must be covered by the price users pay for the services provided by the network. It matters whether the investment is just in an amount of commodity infrastructure or also in complex value-added services justifying a higher profit margin. Quality-of-Service (QoS) is often seen as the basis for such added value. We discuss the issue of RoI and consider the complementary role of pricing as a QoS mechanism.

Unfortunately, none of the QoS models proposed for standardization over the past decades has provided a satisfactory solution. On one hand, it proves practically impossible to perform resource allocation so that a given flow, characterized by a traffic “profile”, encounters precise performance criteria. On the other hand, it is rather easy to ensure excellent quality for all simply by providing capacity that is somewhat greater than expected demand. It is hardly possible to realize finely modulated quality levels, since performance deteriorates rapidly and unacceptably as demand exceeds capacity. We explore the scope for service differentiation based on our understanding of the stochastic nature of network traffic and discuss the limits on possible QoS control.

Overprovisioning is not a satisfactory solution for operators under the present business model where pricing is largely independent of traffic volume. Growth in demand due to the popularity of applications like file sharing and video streaming requires added investment in infrastructure but brings negligible return. Operators are, therefore, seeking to introduce a new network model giving priority to managed services whose usage is subject to a particular pricing scheme. We consider the viability of this two-tier service model and its acceptability in the light of the on-going debate on network neutrality.

QoS control would be considerably simpler, if users were made to pay in relation to the amount of congestion they cause. This is the principle of congestion pricing and a number of possible schemes have been proposed for the Internet. Despite arguments for microeconomic optimality, these schemes seem completely unworkable, if only for their obvious lack of charging transparency. A recent proposal to preserve flat rate charging for end users and to apply a form of “congestion policing” instead of congestion pricing does not appear to be a satisfactory alternative. We explain why we believe pricing should be reserved for its primary function of RoI.

Following the above discussion we conclude by proposing the outline of an alternative approach to QoS control. The essential mechanisms are network imposed fair sharing, load shedding as necessary to avoid overload, user controlled sharing of last mile resources, and simple usage-based charging. We present feasibility arguments and highlight areas needing further research.