Perceived Quality of Service - PQoS

{xtypo_sticky} Fast and accurate video PQoS estimation over wireless networks{/xtypo_sticky}

It is well known that the goal of any QoS mechanism is to maintain a good level of user-perceived QoS even when the network conditions are changing unpredictably .

Typical QoS provisioning solutions for multimedia video applications have been always based on the idea of trying to reserve or assure certain network guarantees, so that packets coming from delay or bandwidth sensitive applications receive a better treatment in the network. This approach has been demonstrated to work very well in fixed networks. However, in wireless networks it is not always possible to offer any guarantee, due to continuously changing conditions and unpredictable radio link quality.

Increasing bandwidth is a necessary first step for accommodating real-time streaming applications, however it is not sufficient, due to large bandwidth fluctuations experienced in wireless networks.

Fluctuations in network resource availability due to channel fading, variable error rate, mobility, and handoff, makes QoS provisioning more complex in wireless networks. Moreover, determining how network congestion manifests itself in degraded stream quality is still an open issue and only some very recent studies are available [1][2]. Understanding the relationship between stream quality and network congestion is an important step to solving this problem, and can lead to better design of streaming protocols, computer networks, and content delivery systems.
One of the critical issues to keep in mind when dealing with provision of multimedia services is the quality of sound or picture presented to the end user, assuming a high-quality source and an error-free environment. This quality is directly proportional to the bit-rate used in the encoding process, thus more recently, diverse solutions were proposed for scalable multimedia transmissions over wireless networks [5][6]. Many of these adaptive solutions gradually vary the video streams’ characteristics in response to fluctuating network conditions thereby allowing for the perceived quality to be gracefully adapted.

Nevertheless, the quality experienced by a user of multimedia service not only depends on network parameters but also on higher layers’ characteristics. An alternative way for providing the agreed quality of service is to estimate the PQoS (Perceived Quality of Service) index, with the aim of selecting the best scaling for the video content in order to achieve the “golden selection” between quality of service, bandwidth availability, bit rate and frame transmission rate.

The objective quality perceived by the non-expert user can be measured with purely subjective criteria, as opposed to the Network QoS, which relies on objective measurable parameters (throughput, BER etc.). A complicating factor is the individual nature of how users evaluate the quality that they receive. Any two users who may be sharing a common experience (i.e. identical applications) are likely to have significantly different views of the QoS; thus, the important thing is to understand how such individual views are used for estimating the connection between wireless network parameters and user perception of QoS provided over that network.

This linkage will typically take the form of a numerical mapping (mathematical relation) between some measure of the user-perceived quality (e.g. the Mean Opinion Score (MOS) [3]) and a particular set of network parameters (e.g. available bandwidth).

Typically, the five-point scale MOS is used to collect feedback from end users on the subjective quality of a media stream. However, assessments of subjective quality are time consuming and expensive; furthermore, they cannot be easily and routinely performed for real time systems. On the other hand, objective metrics would be of great benefit to applications involving scalable video coding and multidimensional bit rate control used in mobile video broadcasting systems. According to these consideration,

there is a need for a quality metric estimator, based on the VQM objective metric [4][5], that accurately matches the subjective quality and can be easily implemented in real-time video systems.

Fig.1 Testbed used for P-QoS estimation over wireless networks.

References

1. H. Koumaras, A. Kourtis, C-H Lin, C-K Shieh, “A Theoretical Framework for End-to-End Video Quality Prediction of MPEG-based Sequences,” The Third Inter. Conf. on Networking and Services, ICNS07, Athens, Greece, June 19-25 2007.

2. O. A. Lotfallah, M. Reisslein, S. Panchanathan, “A framework for advanced video traces: Evaluating visual quality for video transmission over lossy networks,” EURASIP Journal on Applied Signal Processing,(Article ID 42083), 2006.

3. ITU-T Recommendation P.910, “Subjective video quality assessment methods for multimedia applications,” Recommendations of the ITU, Telecommunications Sector.

4. Final Report from the Video Quality Experts Group on the Validation of Objective Models of Video Quality Assessment, Phase II [Online]. Available: www.vqeg.org

5. M.H. Pinson, S. Wolf, “A new standardized method for objectively measuring video quality,” IEEE Transactions on Broadcasting, Vol. 50, Issue 3, Sept. 2004, pp.312-322.