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Hybrid Model to Measure QoE in IPTV: Methodological Proposal

J.C. Cuéllar, J.H. Ortiz and J.L. Arciniegas

Abstract- **This article presents advances in research to obtain a hybrid model which allows the quality of experience within the residential IPTV service to be measured. The contents include a description of background information about objective and hybrid methods, the problem that needs to be resolved and the methodology to be used during the project. Our hybrid model will use quality of service parameters and a NR (No Reference) algorithm to evaluate the quality of video. This approach is not based on the results of subjective tests put forward to users previously.**

Keywords- QoE,QoS, FR, NR, RR, IPTV.

I. INTRODUCTION

The current growth in IPTV service leads us to forecast that by 2016 this service will represent 88% of all global Internet traffic [1]. As a result, at some point in the future, this situation could lead to congested networks, degradation in the level of service provided, and therefore, end user dissatisfaction. Based on the situation above, it is very important for service providers to be able to know the quality of experience (QoE) associated with the services offered. This knowledge allows for constant monitoring, thereby avoiding degradation in the level of service and subsequent user dissatisfaction. To measure QoE, the authors in [2] propose the following three methods: subjective methods, objective methods and hybrid methods. These will be discussed below.

In subjective methods QoE is measured by means of surveys answered by a group of users. These surveys are generally conducted in a controlled manner following the guidelines proposed in [3][4][5][6][7]. MOS (Mean Opinion Score) is used as the scale of measurement.

In objective methods there are two ways to classify the different algorithms or forms of measuring the quality of video. One of them depends on whether it is necessary or not to utilize a reference signal to measure QoE. The other depends on the type of analysis realized for the video stream.

For the type of measurement that uses a reference signal, there are three categories: [8]

Full Reference (FR): in this method the original video signal that is transmitted, available in the receptor, is compared with the signal that is received to determine the quality of video sent to the user.

Reduced Reference (RR): in this method part of the information of the original signal that is transmitted is available in the receptor and can be used to determine the quality of video that is received.

No Reference (NR): in this method only the video signal that is received is available to determine the quality of video.

Hybrid methods relate measurements obtained with a subjective or objective method, which reflect the perceived QoE by the user, with parameters of Quality of Service (QoS) like delay, packet loss, etc. This relationship is represented by means of a mathematical model or a correlation model [2].

As can be seen above, each method has its pros and cons. With subjective methods, the real QoE of the user can be obtained for a particular service used, but the evaluation is costly, time consuming and it cannot be done with live video (real time). On the other hand, objective methods don't reflect the perception of the user because they use a limited number of variables. Additionally, the calculation of some of these variables is very complex [9].

As a result, due to the disadvantages inherent in subjective and objective methods, hybrid methods can be used to calculate the quality of experience perceived by the user. This is the reason why various authors [8] have proposed a series of mathematical and correlation models to resolve this problem. Every model is oriented depending on the subjective or objective method that is included in the model to evaluate the QoE and the quantity of quality of service parameters that it uses.

II. PROBLEM TO RESOLVE

Some authors [8] have proposed models to measure QoE to IPTV service, these models using subjective or objective methods to evaluate QoE with a few QoS parameters. This kind of approach has several cons. One of them is precision of the model to evaluate QoE because it uses a few QoS parameters and subjective method to evaluate QoE. This approach is expensive because it needs many testers to guarantee the precision of the model.

To contribute to the solution of the problem by proposing a model, we use a No Reference method to obtain a measurement of the QoE perceived by the user with a determined number of parameters of QoS.

This type of an approximation has various advantages: the complete decodification of the video for each video bitstream is not necessary; it requires a lower bandwidth for monitoring purposes [10] and these types of models are better suited for real time environments where the original video signal is not available to use as a reference [11]. Our proposal will be the first one to use a No Reference method to measure QoE in

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IPTV service as other authors [8] propose models using a subjective method to measure the QoE.

To obtain the model we are working in two ways: the first one is to design a testbed to get the data to generate the model, and the other one is to select the No Reference method to measure the video QoE.

For the testbed we design a small network where the WAN link will be simulated with the NetEm WAN Emulator [12] . In this platform, we have performed delay, jitter and packet loss tests using a H.264 video stream, generated using a VLC server in a Linux platform.

We selected a No Reference algorithm (Recommendation ITU-T P.1202.2 [13]) to measure the quality of video and obtain a measurement of the QoE.

III. Project Progress

We are working on implementing the No Reference method to get the QoE measurement from a video stream, the Recommendation ITU-T P.1202.2 [13] was selected because it works in the same manner as a No Reference method.

The Rec. P1202.2 has four components, and its implementation has been complex because it is necessary to identify many parameters in the video stream. Now we are in the implementation of the first component; the extraction of basic parameters. This extraction is done from the information side; from SPS (Sequence Parameter Set), NAL (Network Abstraction Layer) and PPS (Picture Parameters Set) in the video stream, or from picture level in the video stream. The identification of each parameter has taken more time than was calculated because it is necessary to identify the video bitstream level in each macro block and its components, to get the parameters to begin the process in calculating the quality of experience in video stream.

This step is the most critical part, given that after the No Reference method has been implemented, it needs to be integrated into the testbed with the WAN emulator to be able to analyze its behavior with respect to variations in the parameters of QoS. With the data obtained, (the variation of the parameters of QoS and the result obtained from the No Reference algorithm), it will be possible to obtain the model using a multivariate regression.

IV. Conclusions and Future Work

The proposed model utilizes a different approach to that of the authors consulted. Our model will contribute to the solution of the problem utilizing a greater number of QoS parameters, allowing the service provider to obtain a more precise vision of the value of QoE perceived by the user. Also, the data used to generate the model was not obtained from subjective tests put forward to users.

After the model has been developed we will do several tests to compare the results of our model with different objective models and hybrid models.

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