

Chapter 16

Quality of Experience vs. QoS in Video Transmission

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ABSTRACT

In legacy television services, user centric metrics have been used for more than twenty years to evaluate video quality. These subjective assessment metrics are usually obtained using a panel of human evaluators in standard defined methods to measure the impairments caused by a diversity of factors of the Human Visual System (HVS), constituting what is also called Quality of Experience (QoE) metrics. As video services move to IP networks, the supporting distribution platforms and the type of receiving terminals is getting more heterogeneous, when compared with classical video distributions. The flexibility introduced by these new architectures is, at the same time, enabling an increment of the transmitted video quality to higher definitions and is supporting the transmission of video to lower capability terminals, like mobile terminals. In IP Networks, while Quality of Service (QoS) metrics have been consistently used for evaluating the quality of a transmission and provide an objective way to measure the reliability of communication networks for various purposes, QoE metrics are emerging as a solution to address the limitations of conventional QoS measuring when evaluating quality from the service and user point of view. In terms of media, compressed video usually constitutes a very interdependent structure degrading in a non-graceful manner when exposed to Binary Erasure Channels (BEC), like the Internet or wireless networks. Accordingly, not only the type of encoder and its major encoding parameters (e.g. transmission rate, image definition or frame rate) contribute to the quality of a received video, but also

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QoS parameters are usually a cause for different types of decoding artifacts. As a result of this, several worldwide standard entities have been evaluating new metrics for the subjective assessment of video transmission over IP networks. In this chapter we are especially interested in explaining some of the best practices available to monitor, evaluate and assure good levels of QoE in packet oriented networks for rich media applications like high quality video streaming. For such applications, service requirements are relatively loose or difficult to quantify and therefore specific techniques have to be clearly understood and evaluated. By the mid of the chapter the reader should have understood why even networks with excellent QoS parameters might have QoE issues, as QoE is a systemic approach that does not relate solely to QoS but to the ensemble of components composing the communication system.

INTRODUCTION

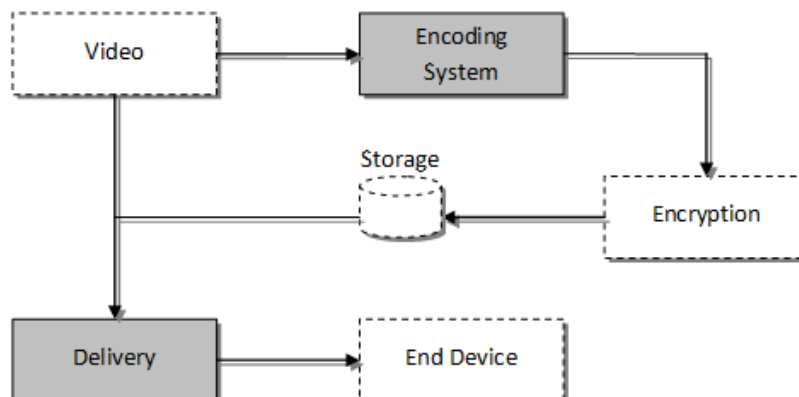
Monitoring and improving video experience is gaining particular interest in Internet Protocol Television (IPTV), and Mobile TV as means of delivering TV broadcasts inside restricted network infrastructure, swayed by the fact that the main issue is no longer how to make video distribution a reality but rather how to improve the quality of the video stream delivered to the end device and ensure the best user experience, so that this can also be used as a value adding proposition to any solution available to an end consumer.

The usage of video encoding tools and optimization of the required bit rate for video transmission brings new multimedia opportunities for the service providers, e.g. delivering more TV services and the deployment of High Definition (HD) content distribution (Wiegand et al, 2003).

While offering new services is important, it is also necessary to assure the quality of them so that the service level content service provider or carrier's brand is not diluted. Nevertheless, assessing the quality of the contents delivered to the end devices is still a huge challenge, but is fundamental for the eventual establishment of Service Level Agreements (SLA) between whoever provides the service and who consumes it.

From a technical point of view the Quality of Experience (QoE), when delivering video to an end device, can be seen as the quality remaining in the user's device after the whole encoding and delivery process, that means the distortion introduced to the raw content in every step until the content reaches the decoder at the end device. There are several elements involved in the video delivery chain, as depicted in Figure 1, and some of them introduce distortion. The ones marked in solid line are the

Figure 1. Overview of the video delivery chain



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