

Chapter 18

Perceptual Quality Assessment of Packet- Based Vocal Conversations over Wireless Networks: Methodologies and Applications

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ABSTRACT

In this chapter, the authors describe the intrinsic needs to effectively integrate interactive vocal conversations over heterogeneous networks including packet- and circuit- based networks. The requirement to harmonize transport networks is discussed and a foreseen architecture multi -operators and -services is presented. Moreover, envisaged remedies to the ever increasing network complexity are also summarized. Subjective and objective methodologies to evaluate voice quality under listening and conversational conditions are thoroughly described. In addition, software- and emulation- based frameworks developed in order to evaluate and improve voice quality are rigorously described. This chapter stresses parametric model-based assessment algorithms due to their ability to be useful for on-line network management. In particular, the authors describe parametric assessment algorithms over last-hop wireless Telecom networks and packet-based networks. The last part of this chapter describes several management applications which consider users' preferences and providers' needs.

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1. INTRODUCTION

Next-generation network infrastructure should cater simultaneously to a multitude of services having different *quality of service* needs. In fact, next-generation networks should be well-engineering to deliver services as a *triple-play* package which includes voice, video, and data or *quadruple-play* when wireless access facility is included. Services over next-generation networks could be delivered over a heterogeneous infrastructure using a wide variety of wired and wireless mobile access devices. New generation of services should offer, on the one hand, for provider additional revenue and more management flexibility, and on the other hand, for consumer personalized, ubiquitous, reliable and secure services. From consumer perspective, new services should ultimately provide, at a reduced price, a good quality of experience.

There are several *pitfalls* which should be properly addressed in order to successfully achieve intended goals. In fact, the high service flexibility entails enormous complications at network design, management, and evaluation stages. To cope with the ever increasing network complexity, several ongoing projects have been launched within standardization bodies, academic institutions, as well as industrial enterprises in order to define and standardize new architectures and management policies dedicated for next-generation networks. The ultimate goal of new proposals is to offer a good *Quality of Experience* (QoE) for subscribers while optimizing network resource utilizations. The estimation of QoE is of keen economical importance since it could be used to quantify the suitability of new proposals and technologies which will be adopted for next-generation networks. Moreover, QoE could be used by new management policies for quality monitoring, tuning, planning, and enhancement in a user-friendly way.

The remainder of this chapter is organized as follows. Section 2 presents a number of network-

ing multimedia services which could be catered to consumers over next generation networks. Section 3 discusses some convergence scenarios and gives a brief survey about foreseen mobile wireless network architecture. Section 4 goes over the QoS provision methodologies for delay-sensitive services. Section 5 provides an in-depth description of the assessment methodologies used to evaluate vocal services. A comprehensive description of assessment frameworks of voice conversations is given in Section 6. A thorough description of parametric assessment algorithms over mobile Telecom networks and packet-based, best-effort, networks is given in Section 7. Several management applications over wireless networks using QoE are described in Section 8. We conclude in Section 9.

2. NETWORKING MULTIMEDIA SERVICES

The actual trend of network evolution is characterized by the *convergence* of Internet and Telecom services. This convergence is driven by standardization bodies as well as industry due in part to the expected value-added (Chauveau, 2005). Basically, this is performed by integrating/adding Telecom services over IP infrastructure. Technically, this integration is merely done by dividing original digitized stream into media units which constitute the payload part of carried IP packets. Moreover, the flexibility of packet-based networks enables providing other services such as radio over IP, IPTV, and video/music streaming.

Telecom services such as conversational services (vocal/video) and instantaneous vocal/video messaging are characterized by their sensitivity to delay. However, the *unmanaged* packet-based networks such as the Internet are suited to deliver delay-insensitive services such as E-Mail, FTP, and WWW. This service is sometimes called *elastic* media since delay and delay variation do not greatly affect the quality of service. Indeed,

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