Chapter X
Quality of Experience for Video Services

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ABSTRACT

This chapter discusses the quality assurance of multimedia services over IP networks from the end user standpoint and introduces the concept of quality of experience (QoE). The discussion of quality assurance includes aspects that range from the network and application layers to the end user perspective. The focus of the discussion presented in this chapter is oriented to the video services delivery that can be considered a significant evolution of services providers' portfolio. This chapter presents quality requirements for video and TV services and performance measures that focuses on the quality perceived by the end user. This approach is broader than that oriented to quality of service (QoS), which focuses on the performance measures from the network perspective. QoE takes into account how well a service meet customers goals and expectations rather than focusing only on the network performance.

INTRODUCTION

Many telecommunications service providers around the world are moving toward integrated service offerings by combining voice, video, and high-speed data services. IP-based technology plays an important role on this scenario by enabling the delivery of such services over a common multiservice IP network. A variety of access technologies can be used to reach the end user. The recent advances in wireless technologies in terms of throughput and quality assurance make them an alternative to the traditional wired line technologies for multimedia services delivery.

The multimedia services delivered to the end user using broadband networks include broadcast

TV, video on demand (VOD), video telephony, voice over IP (VoIP), multiplayer games, and audio streaming among others. Such services bring additional challenges in terms of quality assurance because of their intensive network resources utilization and stringent performance requirements.

This chapter discusses the quality assurance of multimedia services over IP networks from the end user standpoint and introduces the concept of quality of experience. The discussion of quality assurance includes aspects that range from the network and application layers to the end user perspective. The focus of the discussion presented in this chapter is oriented to the video services delivery that can be considered a significant evolution of services providers' portfolio.

The video services represent a relatively new element introduced into the traditional telecommunications services portfolio offered to mass markets that already includes voice and, more recently, high-speed data services. IP-based technology is being used by the majority of service providers to support such video services, commonly known as Internet protocol television (IPTV) services. In this context, it is important to make a distinction between IPTV and Internet TV (Heavy Heading, 2006). Both are delivered over IP networks using a broadband connection, but with different control and quality assurance levels. IPTV is a video service offered by a service provider that owns the network infrastructure and controls content distribution to its customers, generally using an IP set-top box. Internet TV encompasses content sourced from anywhere on the Internet that can be streamed or downloaded by the end user generally using a PC or, more recently, a set-top box.

As service providers roll out IPTV services, they face a new set of challenges (Heavy Heading, 2006). Their top priority is to deliver an enhanced experience to their customers. IPTV services must meet or exceed quality levels currently offered by traditional TV players, such as over the air, satellite, or cable providers. Providing such service quality levels is even more complex when delivering video using a multiservice IP platform where multiple services share same resources. Current quality of service (QoS) practices are focused on network aspects to implement quality management and metrics such as network delay, jitter, packet loss and throughput are used to indicate the services performance. Such metrics can be effective for traditional data services but are not adequate to support multimedia services quality assurance.

IPTV services require a more comprehensive quality management approach to ensure customer experience (Heavy Heading 2006, Kerpez, Waring, Lapiotis, Lyles, & Vaidyanathan, 2006). User perception is far beyond network aspects. It encompasses all the interaction between the user and the service. The concept of quality assurance focusing on the end-user QoS has been ultimately referred as quality of experience (QoE) (Jain, 2004). There is a need to ensure quality on an end-to-end basis and at a higher abstraction layer by combining traditional QoS and QoE in one integrated framework. The concepts of QoE discussed here and illustrated with the video services are also valid for other IP services.

QUALITY OF SERVICE (QOS) AND QUALITY OF EXPERIENCE (QOE)

The term quality of service (QoS) is broadly used today and it is commonly associated to broadband, wireless, and multimedia services that are IP-based. Networks and systems are gradually being designed in consideration of end-to-end performance required by user applications.

However, the term QoS is usually not well defined and frequently misused. The definitions of QoS are very comprehensive and most publications use the term QoS but do not define it. The ITU-T Recommendation E.800 provides a definition of QoS: "the collective effect of ser-