Chapter III
Quality of Service Issues in Mobile Multimedia Transmission

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ABSTRACT

The focus of this chapter is on the quality of service (QoS) aspects involved in transmitting multimedia information via mobile systems. Multimedia content and applications require sophisticated QoS protocols. These protocols need to manage throughput, delay, delay variance, error rate, and cost. How errors are handled in a multimedia session can have significant impact on the delay and delay variance. Coding and compression techniques also influence how the final presentation is transformed by the impediments encountered on a mobile network. Providing the user with the ability to negotiate between cost, quality, and temporal aspects is important, as this allows the user to strike a balance between these factors. In moving from 2G to 3G, and, over the next decade to 4G mobile networks, the ability to transmit multimedia information is going to improve constantly. Nonetheless, providers must develop viable economic models and user interfaces for providing differentiated QoS to the users.

INTRODUCTION

Transmission of multimedia information over mobile networks to portable devices, such as laptops, mobile phones, and PDAs (personal digital assistants), is leading to the development of new applications. However, successful transmission of multimedia information over mobile networks cannot be taken for granted. Understating the impediments to successful transmission of multimedia information is of paramount importance. This chapter focuses on multimedia applications

that use mobile networks, and issues involved in the delivery of multimedia content with the desired quality of service (QoS). Current and future challenges in achieving successful mobile multimedia information transmission are also discussed.

Multimedia applications require more sophisticated QoS protocols than those for simple data transmission. The main parameters that underpin QoS are throughput, delay, delay variance, error rate, human perception of quality, and cost (Sharda, 1999). The interplay between these factors is rather complex, therefore, some simplifying assumptions must be made in developing methodologies for delivering multimedia content with the desired QoS.

For the delivery of desired QoS, one of the most promising concepts developed over the last few years is that of resource reservation. This entails reserving resources such as bandwidth on interconnects, and buffer space and processing power on switching nodes.

Packet switching networks embody the idea of statistical time division multiplexing (STDM); that is, resources are allocated to a communication session based on the demands of the traffic. This leads to more efficient, and therefore, more economical usage of the resources. However, the need to allocate resources dynamically adds complexity to the communication system's operation and management. Mobile multimedia communications are further complicated due to their variable transmission quality, the need to keep track of end system location, restrictions placed due to limited battery life, reduced screen size, and the cost of the connection.

Over the last decade, some progress has been made in establishing mobile multimedia transmission systems. However, much research and development is still required before we can take it for granted that a multimedia application, such as videoconferencing, would run with the desired QoS over a mobile communication infrastructure on a hand-held device as we zoom down a freeway at high speed, and, all this at a reasonable cost.

The next section of this chapter presents the challenges introduced by the mobile multimedia content, applications, and communication systems. It begins with an overview of mobile multimedia systems, and then presents the implications of coding and compression techniques for transmitting multimedia. Requirements of various multimedia applications and their relationship to mobile communication systems are also presented.

The third section presents QoS issues in transmitting multimedia content over mobile systems. Fundamentals of QoS concepts and different QoS models are introduced, and a novel model for managing QoS in real time is presented.

The fourth section presents directions for future research, and the final section gives the conclusions.

MOBILE MULTIMEDIA SYSTEMS

Overview

This section presents an overview of coding methods used for various media types, multimedia applications, and current mobile communication systems. QoS issues related to each of these are also discussed.

Multimedia communication systems combine different types of media contents, such as text, audio, still images, and moving images, to achieve the overall objective of a communication session. Therefore, the network needs to provide a service which works well for all media types.

The requirements for successfully transmitting a particular media type depend upon its coding and compression techniques, and the application in which it is being used. Media content that must be transmitted live, or processed in real time, poses more stringent requirements. Consequently, live video conferencing is one of the most challenging multimedia applications.

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