Chapter I
Introduction to Mobile Multimedia Communications

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ABSTRACT

In order to meet the ever increasing demand by people using mobile technology and its associated services based on multimedia elements in addition to voice, mobile communication technologies has since evolved from analog to digital and 1G to 4G. This chapter presents a contemporary review of all generations of mobile communication technologies, including their standards. 1G to 3G mobile communication technologies are mainly optimised for voice communication, using circuit switched networks. To provide high transmission mobile services at low cost in all levels of networks—personal, home, and cellular—it is imminent to exploit the merits of all existing technologies such as Bluetooth, WLAN, and HiperLAN, and use IP as a backbone network in 4G mobile communication standards. The key research challenges for mobile terminals, systems, and services for 4G networks are also presented in this chapter.

INTRODUCTION

Multimedia refers to the combination of different types of media elements such as text, audio, image, and video in a digital form which is represented and manipulated by a single electronic device or a single computing platform such as a PC (Chapman & Chapman, 2000). Interactive multimedia

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provides the interaction facility with users so they can access and exit the system as they wish.

Text comprises a string of alphabets from a particular character set. Image is a visual object consisting of a rectangular pattern of dots or primitive elements—lines, curves, circles, and so on (Halsall, 2001). Examples of images are computer generated graphics and digitized documents, pictures, and graphic arts. Images could be either 2D or 3D. Both text and images are inherently in a digital form. Bandwidth requirement for the transmission of text and image is less than that of high-fidelity audio and video. Audio is generally represented by the amplitude of sound waves, which includes low-fidelity speech during telephonic conversation, high-fidelity CD-quality audio and surround sound.

Video is a sequence of still images or frames displayed in a repaid succession so the human eye cannot pick up their transitions, and hence it creates an illusion of motion. Examples of video include movies, short films, and animation. Both audio and video are continuous time varying signals and analog in nature. For an integrated representation, all media elements must be represented in digital form.

With the rapid growth of the Internet, multimodal representation and interactive facilities of multimedia-based systems, the necessity of required information, accurate presentation, and quick perception, the applications of multimedia are burgeoning in every aspect of human life ranging from home, education, medicine, e-commerce and m-commerce, to airport security. The demands of these applications are met with the different types of multimedia-based services that are a combination of a number of media elements, but not limited to—interactive television (text, audio, and video), video phone and conference (speech and video), computer supported cooperative working (text and images), on-line education (text, images, audio and video), multimedia electronic mail (text, images, and audio, for example), e-commerce (text, images, audio, and video) and Web and Mobile TV (text, audio, and video) (Halsall, 2001).

Due to the inherent high data rates, especially for audio and video, a number of compression techniques for both audio and video have been introduced, which has made it possible to transmit the video over broadband networks. Even with the advancement of compression technologies, the usual bit rate for a speech signal is 64kbps, while it is 384Kbps for low quality video, and up to 2Mbps for high quality video (Sawada, Tani, Miki, & Maruyama, 1998). The tentative bandwidth requirement for the future networks for enhanced-reality multimedia communications are projected from 1Mbps to 30Gbps for 3D audio and 3D video (Ohya & Miki, 2005).

Requirements for an on-demand real-time telephone network access for various purposes such as business, education, and social, cultural, and psychological factors, the scope of technology has been expanded from land-base fixed communications, to wireless and mobile multimedia communications. With the advent of wireless and mobile networks, people now have the opportunity to communicate with anybody, anywhere, and at any time. The number of mobile users is rapidly increasing all over the world (Rao & Mendoza, 2005; Salzman, Palen, & Harper, 2001). It is estimated the number of worldwide mobile users will be 1.87 billion by the end of 2007 (Garfield, 2004).

To meet the ever-increasing consumer demands and make the multimedia-based services as appealing as possible, the mobile networks have evolved from 1G to 4G. 1G mobile networks were commercially released in 1980. Examples of a 1G network include Advanced Mobile Phone Service (AMPS) and Total Access Communication System (TACS). An AMP is in American roaming, while TACS is European roaming. These are based on cellular analog technology. They were initially provided voice service at a rate of

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