Enabling Technologies for Mobile Multimedia

Kevin Curran
University of Ulster, Northern Ireland

INTRODUCTION

Mobile communications is a continually growing sector in industry, and a wide variety of visual services such as video-on-demand have been created that are limited by low-bandwidth network infrastructures. The distinction between mobile phones and personal device assistants (PDAs) has already become blurred, with pervasive computing being the term coined to describe the tendency to integrate computing and communication into everyday life. Audio quality is highly sensitive to jitter, and video is sensitive to available bandwidth. For lip synchronization, audio and video streams need to be synchronized to within 80-100 milliseconds for skew to be imperceptible (Tannenbaum, 2005). Packets are effectively passed automatically through to the presentation device. Interpretation of the delivered information is left to human perception; because humans are far more tolerant than computers, lost packets are likely to be perceived merely as a temporary quality reduction. Nevertheless packet loss is still a significant problem for isochronous interactions. For example, since a typical packet size is generally above the threshold for audible loss (approximately 20 milliseconds), the loss of a single audio packet can be noticeable to the receiver. Resource reservation protocols are an attempt to resolve these difficulties by allocating resources prior to communication. Uncompressed multimedia data require a lot of storage capacity and very high bandwidth. Thus the use of multimedia compression is very essential. Since the source should encode the streams and the destination should decode them, multimedia compression imposes substantial loads on processing resources, such as CPU power (Yan & Mabo, 2004). New technologies for connecting devices like wireless communication and high bandwidth networks make the network connections even more heterogeneous. Additionally, the network topology is no longer static, due to the increasing mobility of users. Ubiquitous computing is a term often associated with this type of networking.

BACKGROUND

The creation of low bit rate standards such as H.263 (Harrysson, 2002) allows reasonable quality video through the existing Internet and is an important step in paving the way forward. As these new media services become available, the demand for multimedia through mobile devices will invariably increase. Corporations such as Intel do not plan to be left behind. Intel has created a new breed of mobile chip code named Banias. Intel's president and chief operating officer Paul Otellino states that "eventually every single chip that Intel produces will contain a radio transmitter that handles wireless protocols, which will allow users to move seamlessly among networks. Among our employees this initiative is affectionately referred to as 'radio free Intel'."

Figure 1. PDAs

Products such as Real Audio (www.realaudio.com) and IPCast (www.ipcast.com) for streaming media are also becoming increasingly common; however, multimedia, due to its timely nature, requires guarantees different in nature with regards to delivery of data from TCP traffic such as HTTP requests. In addition, multimedia applications increase the set of requirements in terms of throughput, end-to-end delay, delay jitter, and clock synchronization. These requirements may not all be directly met by the networks, therefore end-system protocols enrich network services to provide the quality of service (QoS) required by applications. In ubiquitous computing, software is used by roaming users interacting with the electronic world through a collection of devices ranging from handhelds such as PDAs (Figure 1) and mobile phones (Figure 2) to personal computers (Figure 3) and laptops (Figure 4).

The Java language, thanks to its portability and support for code mobility, is seen as the best candidate for such settings (Román et al., 2002; Kochnev & Terekhov, 2003). The heterogeneity added by modern smart devices is also characterized by an additional property, which is that many of these devices are typically tailored to distinct purposes. Therefore, not only memory and storage capabilities differ widely, but local device capabilities, in addition to the availability of resources changing over time (e.g., a global

Figure 2. Mobiles

Figure 3. Desktops

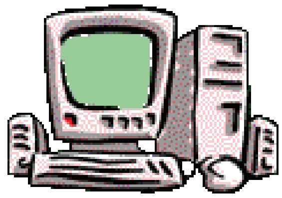

Figure 4. Laptops

positioning satellite (GPS) system cannot work indoors unless one uses specialized repeaters—see Jee, Boo, Choi, & Kim, 2003), thus a need exists for middleware to be aware of these pervasive computing properties. With regards to multimedia, applications that use group communication (e.g., videoconferencing) mechanisms must be able to scale from small groups with few members, up to groups with thousands of receivers (Tojo, Enokido, & Takizawa, 2003).

The protocols underlying the Internet were not designed for the latest cellular type networks with their low bandwidth, high error losses, and roaming users, thus many 'fixes' have arisen to solve the problem of efficient data delivery to mobile resource-constrained devices (Saber & Mirenkov, 2003). Mobility requires adaptability, meaning that systems must be location-aware and situation-aware, taking advantage of this information in order to dynamically reconfigure in a distributed fashion (Solon, McKevitt, & Curran, 2003; Matthur & Mundur, 2003). However, situations in which a user moves an end-device and uses information services can be challenging. In these situations the placement of different cooperating parts is a research challenge.

ENABLING TECHNOLOGIES FOR MOBILE MULTIMEDIA

In 1946, the first car-based telephone was set up in St. Louis in the United States. The system used a single radio transmitter on top of a tall building. A single channel was used, and therefore a button was pushed to talk and released to listen (Tanenbaum, 2005). This half-duplex system is still used by modern-day CB-radio systems used by police and taxi operators. In the 1960s the system was improved to a two-channel system, called improved mobile telephone system (IMTS). The system could not support many users, as frequencies were limited. The problem was solved by the idea of using cells to facilitate the re-use of frequencies. More users can be supported in such a cellular radio system. It was implemented for the first time in the advanced mobile phone system (AMPS). Wide-area wireless data services have been more of a promise than a reality. It can be argued that success for wireless data depends on the development of a digital communications architecture that integrates and interoperates across regional-area, wide-area, metropolitan-area, campus-area, in-building, and in-room wireless networks.

The convergence of two technological developments has made mobile computing a reality. In the last few years, the UK and other developed countries have spent large amounts of money to install and deploy wireless communication facilities. Originally aimed at telephone services (which still account for the majority of usage), the same infrastructure is increasingly used to transfer data. The second development is the continuing reduction in the size of computer hardware, leading to portable computation devices such as laptops, palmtops, or functionally enhanced cell phones. Unlike second-generation cellular networks, future cellular systems will cover an area with a variety of non-homogeneous cells that may overlap. This allows the network operators to tune the system layout to subscriber density and subscribed services. Cells of different sizes will offer widely varying bandwidths: very high bandwidths with low error rates in pico-cells, and very low bandwidths with higher error rates in macro-cells as illustrated in Table 1. Again, depending on the current location, the sets of available services might also differ.

Unlike traditional computer systems characterized by short-lived connections that are bursty in nature, Streaming Audio/Video sessions are typically long lived (the length of a presentation) and require continuous transfer of data. Streaming services will require, by today's standards, the delivery of enormous volumes of data to customer homes. For example, entertainment NTSC video compressed using

Related Content

The Novel Method of Adaptive Multiplayer Games for Mobile Application using Neural Networks
Widodo Budiharto, Michael Yoseph Rickyand Ro'fah Nur Rachmawati (2013). *International Journal of Mobile Computing and Multimedia Communications (pp. 10-24).*
www.irma-international.org/article/novel-method-adaptive-multiplayer-games/76393

A Trustworthy Usage Control Enforcement Framework
Ricardo Neisse, Alexander Pretschnerand Valentina Di Giacomo (2013). *International Journal of Mobile Computing and Multimedia Communications (pp. 34-49).*
www.irma-international.org/article/trustworthy-usage-control-enforcement-framework/80426

Towards Multimodal Mobile GIS for the Elderly
Julie Doyle, Michela Bertolottoand David Wilson (2010). *Multimodality in Mobile Computing and Mobile Devices: Methods for Adaptable Usability (pp. 301-320).*
www.irma-international.org/chapter/towards-multimodal-mobile-gis-elderly/38546

Imperceptible Simplification on Mobile Displays
Fan Wu, Emmanuel Agu, Clifford Lindsayand Chung-han Chen (2012). *International Journal of Handheld Computing Research (pp. 37-54).*
www.irma-international.org/article/imperceptible-simplification-mobile-displays/64364

Exploitation of Health on Instagram: Motivations, Social Support, and Influencers
Michael G. Blight (2021). *Privacy Concerns Surrounding Personal Information Sharing on Health and Fitness Mobile Apps (pp. 164-185).*
www.irma-international.org/chapter/exploitation-of-health-on-instagram/261911