Chapter VII
Power Saving in Wireless Multimedia Streaming to Mobile Devices

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ABSTRACT

Wireless networks are becoming a part of everyday life for many people. When a mobile device has wireless LAN capability, multimedia content can be streamed over a wireless network to that device. However, a major disadvantage of all mobile devices is their limited battery lifetime. Multimedia streaming puts extra pressure on the battery, causing it to discharge faster. In some cases, streaming tasks cannot be completed purely because the battery of the device becomes fully discharged, which causes significant user dissatisfaction. This chapter describes adaptive buffer power save mechanism (AB-PSM), a novel power saving wireless communication solution that enables an increase in battery lifetime during mobile multimedia streaming.

INTRODUCTION

There has been significant development in areas of both portable devices and wireless networks in recent years. It is now considered reasonable to support multimedia-streaming applications on mobile devices via wireless networks at high quality (Muntean & Cranley, 2007). However, development has concentrated on various pieces of hardware and software and has, to a large extent, neglected power. For example, although memory, CPU, and network bandwidth resources have increased exponentially in recent years, batteries have fallen behind in terms of development, improving by only about 2% per year over the last 50 years.

As it is a need to improve battery duration in order to keep up with the rising curve of application-based processing, device complexity, and wireless networking capabilities, our research proposes a novel power saving solution for wireless multimedia streaming process which enhances the existing IEEE 802.11 power save mechanism.

A typical architecture for mobile multimedia streaming includes a server, which streams multimedia content over a wireless IP network to a number of client devices. These devices could be PDAs, smartphones or any other mobile device with wireless connectivity. In relation to possible power savings, the multimedia streaming process can be described as consisting of three stages: reception, decoding and playing (Adams & Muntean, 2006). Other researchers have shown that energy savings can be made in each stage, for example by using pre-buffering in the reception stage, feedback control during decoding and backlight adjustment for playing. However, it is not a common practice to combine energy savings in the three stages in order to achieve the best overall savings. Due to the large amount of power used by the network interface card, the reception stage is the largest consumer of the battery and consequently could contribute the most in any power saving effort.

In this context, this chapter describes a novel adaptive-buffer power save mechanism (AB-PSM) that provides significant power savings in the reception stage, and hence to the overall battery life. The mechanism introduces a supplementary application level buffer and a control solution to manage when data is transmitted to wireless mobile stations. In this way, they are allowed to extend their time spent in power save mode and therefore they use less power.

The chapter starts with a description of the wireless multimedia streaming process main issues related to mobile devices, multimedia delivery, and wireless communications solutions. Related works that propose solutions for power saving in data reception, decoding and playing stages of multimedia streaming are presented and discussed in section three whereas section four gives details about the major characteristics of wireless communication solutions. The proposed AB-PSM is described in details in section five and testing setup, scenarios and results are presented in section six. The chapter ends with conclusions.

WIRELESS MULTIMEDIA STREAMING TO MOBILE DEVICES

Mobile Devices

Mobile devices are becoming smaller and more advanced in terms of processing power, memory, and communications capabilities. They are now capable of running increasingly complex applications and in particular, these devices can now play high quality multimedia clips due to improved screens and speakers. Additionally, many of these devices have wireless connectivity and can support multimedia streaming. In general, all mobile devices are battery powered, batteries, which can be recharged after depletion. However, chargers are in general heavy and require mains power supply, which may not be available while on the move. Also the charging process is lengthy and for best efficiency requires the mobile device to be switched off. These battery power limitations affect the most users' experience during mobile device usage. Examples of mobile devices with very limited battery power supply include personal digital assistants (PDA) and mobile phones. In comparison, the laptops have better batteries, but also drain more power.

Mobile devices are also becoming more popular than ever before. According to the Commission for Communications Regulation[1] in the Irish Communications Market quarterly report (Comm, 2007), mobile penetration in Ireland is now at 111% based on a population of 4.235 million. These figures are based on the number of