Chapter 21
Advanced Video Distribution for Wireless E–Healthcare Systems

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ABSTRACT

This chapter is dedicated to the investigation of IEEE 802.16, a technology that would allow efficient, reliable and affordable healthcare. More specifically, the chapter presents not only an overview of the telemedicine services and developed technologies, but also provides a detailed description of the WiMAX wireless broadband technology for efficient video and data delivery. A new technique for efficient video distribution over WiMAX networks for healthcare applications is also presented in conjunction with some conclusive test results. The theoretical work is supported by in depth software simulations using a network simulator.

INTRODUCTION

What is e-Health? The purpose of e-Health is to build a system which is uniting patients, doctors, medical organisations and devices in order to make healthcare more qualitative and accessible. Such a system should facilitate doctors' work and ease patients' life. Here are some examples of the applications of E-Health Management Networks:

- **Transmission of patient's information to a doctor:** In this case patients can transmit the results of their measurement of their health indicators (such as blood pressure level, electrocardiogram, level of glucose, etc.) to a doctor (General Practitioner (GP) Doctor, specialist), hospital or a healthcare organisation, where they would be estimated and processed. This application is especially important for homebound patients, elderly and disabled people for whom

travelling is dangerous, not recommended or just rather difficult. It is also very helpful for people who have to measure their health indicators on a frequent regular basis, saving the inconvenience and cost of travelling either for them or for medical staff that has to serve their needs.

- ◦ Another important e-Health application is serving hard-to-reach regions, or distant and rural places and hospitals, which have no the needed specialist at their disposal.
- ◦ Patient's data could be also transmitted from a laboratory (Medical Diagnostic Laboratory, Microbiology Laboratory, X-ray Laboratory, etc.) to a specific doctor or medical institution.

- **Transmission of emergency information:** Transmission of emergency information includes cases when an ambulance or a doctor outside a hospital is sending crucial information about the condition of a patient to the Emergency Centre. This operation enables staff in the Emergency Centres to act as fast and accurately as possible, when the patient reaches the hospital. Some emergency cases include situations when the emergency signal comes from a patient registered in an organisation in the help of elderly, diseased or disabled people. A number of these healthcare centres use special systems, based on sensor networks (wearable or implemented at the patient's home) to look after their patients. If a system encounters a problem, it sends an emergency signal to the Care Organisation where the patient is registered in, or to another organisation if needed.

- **Experience exchange between doctors at different places:** By providing communication and experience exchange between professionals in distant hospitals, time of diagnosis could be significantly decreased by getting quick choice about a resolving problem. This could be done by direct voice and video streaming or information exchanges between databases of medical institutions. The data transmission in some of the cases could be either wired or wireless, but nevertheless in this research we focus on the wireless transmission of information for being the most up-to-date, convenient, and in many situations – the only method to transmit crucial medical data. A healthcare system based on wireless technologies could bring significant benefits such as:

- ◦ Improving the overall health condition of the community,
- ◦ Improving the healthcare efficiency,
- ◦ Enhancing healthcare access by seamless medical information exchange,
- ◦ And facilitating meaningful and transparent partnership between patients and healthcare providers by giving ubiquitous healthcare access.

The increasing demand for healthcare information systems and various needs of connection between healthcare professionals has been a trigger for the technological development within the area of e-Health services. One of the main advantages of these services for the patients according to 'eHealth News EU' (Engle, 2009), is the ability to keep people where they want to be, for instance at home with their family. These systems allow patients to monitor daily their health conditions and enable more accurate prescription of medications. Daily health monitoring also gives patients valuable reassurance, knowing that they always can keep a contact with a doctor by sending 'data' and receiving 'acknowledgement'; and hence reducing the number of hospital admissions which saves time of the healthcare professionals (Bashshur & Shanon, 2009; Reuters, 2009). Such systems are called mobile healthcare (m-Health) IT. M-Health typically refers to moving portable devices with

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