Chapter 2.4
Medical Information Representation Framework for Mobile Healthcare

Ing Widya
University of Twente, The Netherlands

HaiLiang Mei
University of Twente, The Netherlands

Bert-Jan van Beijnum
University of Twente, The Netherlands

Jacqueline Wijsman
University of Twente, The Netherlands

Hermie J. Hermens
University of Twente, The Netherlands

ABSTRACT

In mobile healthcare, medical information are often expressed in different formats due to the local policies and regulations and the heterogeneity of the applications, systems, and the adopted Information and communication technology. This chapter describes a framework which enables medical information, in particular clinical vital signs and professional annotations, be processed, exchanged, stored and managed modularly and flexibly in a mobile, distributed and heterogeneous environment despite the diversity of the formats used to represent the information. To deal with medical information represented in multiple formats the authors adopt techniques and constructs similar to the ones used on the Internet, in particular, the authors are inspired by the constructs used in multi-media e-mail and audio-visual data streaming standards. They additionally make a distinction of the syntax for data transfer and store from the syntax for expressing medical domain concepts. In this way, they separate the concerns of what to process, exchange and store from how the information can be encoded or transcoded for transfer over the internet. The authors use an object

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oriented information model to express the domain concepts and their relations while briefly illustrate how framework tools can be used to encode vital sign data for exchange and store in a distributed and heterogeneous environment.

INTRODUCTION

Mobile healthcare applications receive more and more attention due to the ability to reshape healthcare delivery, for example, enabling self-management of patients whilst they pursue their daily activity. Information and communication (ICT) technology and infrastructures which provide the necessary ubiquitous connectivity enable these applications. Competitive value-add ICT providers moreover facilitate these applications with alternatives to computation and communication services. Today's environment for networked applications is therefore rich in ICT services which are accessible anywhere and anytime, for example by prepaid or subscription contracts between users and ICT service providers or by collaboration contracts between these providers. Such environment enables applications to select (wireless) connections of required quality and technology which are considered best for their purpose. A mobile application may for instance seamlessly switch over between GSM, UMTS or WiFi 802.11 (Schiller, 2003) connections that are offered by competing providers. These developments enable mobile healthcare applications in choosing the appropriate situations with adequate ICT support that permit healthcare to be delivered where previously it was difficult or impossible to do so (Wootton, 2006).

Due to these ICT and business advancements, a travelling patient with a chronic disorder can be monitored continuously everywhere in the country of residence as well as abroad. If his health condition requires, he may be examined at a care centre abroad that uses equipment different than at his country of residence. This may further imply that the format of the processed healthcare data differs from the format used at his residential care centre. Local care centre's policy or local governmental health regulations may also impose the use of a different healthcare data format standard. In (near) future mobile healthcare therefore, we typically need to deal with healthcare data which are represented in multiple format standards due to the different policy or regulations and the heterogeneity of applications, systems and ICT technology.

This chapter describes a framework which enables healthcare data, in particular (digitized) continuous-time patient's vital signs and professional annotations, be processed, exchanged, stored and managed modularly and flexibly in a mobile, distributed and heterogeneous environment. A framework is often described as a basic conceptual structure to compose something from fitting parts. In the context of this chapter, a framework is an integrative (standardized) conceptual structure which brings together a set of components which themselves may be standards such as vital signs format & encoding standards (Blair & Stefani, 1998). It therefore addresses questions like:

- How to deal with healthcare data expressed in accordance with several data format standards and how to encode the data to fit to the characteristics of the provided connections to enable effective and efficient data transfers;
- How to deal with professional (textual, graphical or multimodal) annotations and derived (i.e. trend) signs in sync with the analyzed vital sign segments;
- How to manage vital sign data sets of a patient that originate from the same measurement session in a (distributed) study, which typically process data in several steps using processing tools with specific parameter settings. Similarly, how to manage vital sign data sets (of the same patient