Chapter 41
Knowledge-Based Support of Medical Work in Home Care

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ABSTRACT
Healthcare applications involve complex structures of interacting processes and professionals that need to exchange information to provide the care services. In this kind of system, many different professional competencies, ethical and sensibility requirements, as well as legal frameworks coexist, and because of that, the information managed inside the system should not be freely accessed. On the contrary, it must be subject to very complex privacy restrictions. In the chapter, the authors describe a case study of a knowledge-based distributed system, the fundamental issues that must be considered in design of a distributed healthcare application. The K4CARE system is an example of an application to the medical domain of homecare assistance. Homecare involves professionals from different institutions (hospital, social workers, etc.) that must interact around any particular patient, and which used to be located in different physical places having their own and independent information systems.

INTRODUCTION
Medical environments use to involve high complex structures of interacting processes and professionals where a high quantity of information is managed and exchanged. In addition, all healthcare environments can be considered distributed. The services usually involve professionals from different institutions (hospital, social work organizations, etc.) structurally independent, which must interact around any particular patient, and which usually are located in different physical places having their own and independent information

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systems. Thus the applications must work in a highly distributed environment using several different types of communication and end-user devices. Due to the distributive nature of decision support systems in health care, multi-agent architecture is often employed. Moreover, the multi-agent architecture is particularly suitable for the domain of home care. Therefore, while building the decision support system for home care, K4Care, we followed the multi-agent paradigm.

Each decision support system has to work with different types of knowledge. On one hand, the system must consider and analyse the necessary medical knowledge, however, on the other hand, each system must take into consideration the actual institution, in which it is deployed, and follow the local specifics. Both of these types of knowledge are often captured as more general procedures – or more precisely, they are formalized as a procedural knowledge. Medical knowledge is often formalized in the form of medical guidelines that contains recommended procedures for diagnosing specific diseases and/or their treatment. Formalization of the organizational processes on the other hand follows from the domain of business processes and uses general methods of business process modelling.

In this chapter we describe the knowledge-based system supporting the home care services. The system is designed and implemented as distributed utilizing multi-agent technology, ontologies for medical knowledge representation, electronic home care record for storing and retrieving patient data, and two types of user interface, namely Web-based interface for PCs and mobile application to be run on smart phones.

**KNOWLEDGE-BASED HOME CARE E-SERVICES**

The care of chronically ill patients involves lifelong treatment under continuous expert supervision. Admission to hospital and residential facilities can be unnecessary and even counterproductive, and could saturate national health services and increase health care costs.

K4Care Platform is a software system providing Knowledge-Based HomeCare eServices. It is a response to the needs of the increasing number of senior population requiring a personalized HomeCare (HC) assistance. The system integrates knowledge and skills of specialized centres and professionals of several EU countries. The knowledge and skills are incorporated in an intelligent Web platform in order to provide e-services to health professionals, patients, and citizens in general. It offers a unique solution that integrates features of a healthcare information system with a decision support system and works in highly distributed environment.

The K4Care platform serves a broad range of HC providers such as local health units integrated with social services of municipalities, specialized HC centres, other organizations of care or social support as well as specialized care (e.g. rehabilitation, oncology, etc.).

K4Care provides medical doctors with following functions:

- Creating record of a new patient.
- Storage and retrieval of patient records using defined selection criteria (e.g. recently examined patients, greatest interval from the last visit, the same diagnosis, etc.).
- Inspection of formal intervention plans (developed from medical guidelines), the right to develop new formal intervention plans have only some qualified users.
- Development of individual intervention plan (IIP) for each patient based on his/her diagnosis (or combination of diagnoses) and previous treatment. These plans are successively stored in the patient record.

Other care givers are provided with relevant data and information about the patients and are allowed to insert data specified in medical doctors’ requests.