Chapter 18
The K4Care Platform: Design and Implementation

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ABSTRACT

This chapter describes the technological challenges faced during the design and implementation of the K4Care system, an agent-based Web-accessible platform that helps medical practitioners to deliver Home Care services in an efficient way. The system incorporates a Knowledge Layer, with an explicit representation of the required medico-organizational knowledge. The administrative and care actions are performed by the coordinated operation of intelligent agents, that represent the human users of the system. Users can access the platform by means of a Web interface. Several Web 2.0 technologies have been used in order to provide a rich interaction, putting an especial care on connecting the Web browser with the multi-agent system in an efficient manner. An intermediate Data Abstraction Layer has been incorporated in order to allow agents to transparently retrieve the appropriate knowledge when needed. The separation of the knowledge from its actual use has allowed the development of a very dynamic, flexible and adaptable system. The platform also includes several techniques to personalize the interaction with the user both from the visual and functional points of view.

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INTRODUCTION

Health care usually involves complex and lengthy procedures, in which a large quantity of professionals with a wide range of expertise, knowledge, skills and abilities (from family doctors to medical specialists, nurses, laboratory technicians or social workers) have to co-ordinate efficiently their activities to provide the best possible care to patients. It has been argued that the standard properties of *multi-agent systems* (Wooldridge, 2002) (distributed nature, autonomous behaviour, dynamic problem solving and coordination techniques) fit with the usual characteristics of the problems in health care (Nealon & Moreno, 2003). A natural solution is to represent each of the human actors involved in the health care process with an *agent* that is responsible of the human's knowledge, the actions he/she is allowed to perform, the communication with other actors, and the access to the personal and medical data stored in an Electronic Healthcare Record.

The economic cost of institutionalised health care is one of the heaviest burdens in the budget of most developed countries. A possible way of reducing this cost is the improvement of *Home Care* (HC) services (Jones, *et al.*, 1999), the reason being that these services delay the arrival of patients to health care institutions, which are very resource-consuming. Studies like (Jones, *et al.*, 1999), (Landi, *et al.*, 2001), (Scuvee-Moreau, *et al.*, 2002) and (Kavanagh & Knapp, 2002) show the great difference between the cost of home care and the cost of hospital care. The typical home care patient (HCP) is an elderly patient, with co-morbid conditions and diseases, cognitive and/or physical impairment, functional loss from multiple disabilities, and impaired self-dependency (Campana, *et al.*, 2008). These patients require a continuous monitoring of their medical and social status, and a periodic follow-up and re-planning of personalised treatments. The use of ICT, as illustrated in the Web-based system described in this chapter, eases the access to the appropriate knowledge by all the involved actors, and facilitates the co-ordination between them.

One of the main problems of the applications in health care is that they are usually designed ad-hoc for a very particular purpose in a specific health care organization, and that makes them rigid, inflexible and not easily extendible or re-usable. The aim of our work has been to make a Web-based platform that facilitates the management and delivery of Home Care services and that is designed in such a way that it can be easily adapted or tailored to accommodate the specific circumstances, resources and working methods of a particular home care centre. This requirement led to the strict separation of the medical and organizational knowledge, explicitly represented in different knowledge structures, from the way in which it is actually used to deliver the care services. Any change in the knowledge repositories automatically triggers the appropriate changes in the behaviours of the actors of the system. Therefore, the code of the system does not have to be changed at all in different instantiations of the platform.

This chapter presents a detailed description of the design, architecture, principal components and main technological challenges faced during the development of the *K4Care platform*, which has been developed within the European K4Care project. The system models a complex environment in a fully decentralized way, eases the management of Home Care services and is remotely accessible via a rich Web interface (based on several Web 2.0 technologies) by any of the users. All the different kinds of professionals involved in HC are considered in the K4Care model (Campana, *et al.*, 2008). The system adapts automatically to the personal profile of each user, allowing only the performance of actions related to the user's role. Moreover, the medical model (defined by means of a series of knowledge structures) is totally separated from the execution environment, defining a very flexible, modular and dynamic system that could be easily re-used in other health