

Doc at Hand: Knowledge Sharing and Decision Support for Healthcare Professionals

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Extended Abstract

In a scenario where Healthcare organizations tend to rapid decentralization, with multiple actors involved in the care delivery processes, the importance for professionals to collaborate, access and share data and knowledge becomes more and more stringent. New technologies have improved the ability of electronically storing, transferring and sharing medical data; at the same time, they also create serious questions about who has access to this information and how it is protected.

The aim of Doc@Hand is to support healthcare professionals in this changing environment, by providing a set of IT tools that help reducing the time and associated costs to collect the information and knowledge required, and, more crucially, in making the best use of it for a more informed decision making (diagnoses, therapies, protocols).

To make all that, it is necessary information security. The aim of information security consist of protecting information both in written, spoken, electronically recorded, or printed form from accidental or malicious modification, destruction, or disclosure. Information security includes the protection of Healthcare systems of computer hardware and software, and networks. Security and authorization will make sure that data and information are accessible and distributed to all interested actors, at the same time meeting the strictest requirements for data security and privacy, not only from a general IT point of view, but also to comply with ethical regulations.

Health care is an information-intensive activity producing large quantities of data from laboratories, wards, primary care organizations and, in the future, from wearable, wireless devices. Wireless networks are expanding the range of data availability and needs increasing the complexity of health delivery environments giving to caregivers the capability to access data from everywhere and at anytime. Thus, information management in healthcare requires considerable collaboration, mobility, and data integration [4]. In addition, the standard doctor-patient 1-to-1 relationship is being replaced by an n-to-m relationship in which the patient is one of the actors, the others being a team of health care professionals each specializing in a single aspect of care. The need for collaboration also derives from the rapid evolution of research in many sectors providing stress and difficulty for caregivers to take greater control of their own professional development and continuing education, especially when the daily routine leaves few resources and time to dedicate to this activity. Sharing of information means also to deal with a widening spectrum of diseases (e.g., infectious diseases) that a doctor may need to treat, as a consequence of people mobility around the world. In the latter case, diseases that are well understood and successfully treated in a country, could be completely unknown or ignored in another, originating delays in the diagnosis that could be fatal to a patient, or even to a wide segment of the population. Indeed it is the present inability to share information across systems and care organizations that represents one of the major impediments to progress toward shared care [4].

PROJECT OBJECTIVES

Doc@Hand is a 30 months EC project of the Sixth European Programme (IST-1-508015) started on January 2004 and ending on July 2006. The main objective of the Doc@Hand project is the development of a distributed intelligent system aimed at supporting health professionals in their day-by-day activities, which allow to use all information *anytime* and *anywhere*, completely hides to the user the physical location of the data.

Doc@Hand intends to develop, test and validate an application that:

- allows transparent access to heterogeneous and geographically dispersed databases owned by separate, but cooperating organizations;

- proactively search – primarily using push technologies as opposed to traditional “pull” approach - for relevant information without the need for the user to perform an explicit query, based on domain ontology as well as static and dynamic information about the user profile and current activities;
- provides the user with representation tools and intuitive interfaces to easily filter and navigate through the information;
- integrates existing decision support systems, and is also able to extract knowledge from unstructured and semi-structured documents;
- incorporates all the above in a cooperative environment that allows virtual communities to be created for exchanging opinions around patients or scientific issues;
- design the system in way to protect patient’s sensible data form possible unauthorized accesses, both involuntary and fraudulent.

The integrated environment developed will be accessible from portable platforms such as tablet PCs to support the increasing mobility of Healthcare professionals, and will be validated by major clinical institutions for full adherence to standards and regulations for security and sensitive data handling.

PROJECT ORGANIZATION

The vision behind Doc@Hand is a tool that assists the healthcare professional in his day-by-day activity, supporting his mobility needs - exploiting mobile computing and wireless connectivity (such as UMTS) coupled with autonomous capabilities when offline, providing a comprehensive view of documents and knowledge, relevant to the activity that the Healthcare professional is currently performing, that are located in different and heterogeneous repositories, and “anticipating” his information needs and making it available at hand without the need for an explicit search/retrieve request. This intelligent system takes into account the user profile, the context of work, his preferences to adapt to different conditions, and modifies accordingly the search and pushing criteria. The project will then develop an highly customisable system that allows profiling of the user in several dimensions: his role (specialist, GP, etc.), his work plan (hospital, visits at his office or at patient’s home, etc.), his user interface preferences, that will be validated through an extensive set of trials at two major hospital sites, Corporaciò Sanitaria Clinic in Barcelona and Guy’s and St. Thomas Hospital in London, that will be the centres of two information providers networks.

Finally, the system will be designed to protect patient’s sensible data from possible unauthorized accesses, both involuntary and fraudulent, by commercial subjects (e.g. employers, insurances)

The successful implementation of the system will be measured by the following quantified objectives:

- Reduced time needed to search for information and knowledge and organize results by 60% in at least 80% of the working situations
- Relevance of the search results of at least 80% (meaning that only once in five times the doctor will have to manually search for additional data)
- Reduction of *noise* (results not relevant to the current context) by 50%
- Reduction of costs associated to duplication of activities (i.e. laboratory tests) due to the lack of available information by 80%

SYSTEM ARCHITECTURE

To achieve the above user/functional objectives, the project has as its main technological objective to design and develop an IT system made of:

- A. An **Infrastructure** module
This module deals with the data interoperability issue, and allows flexible and customisable data exchange policies between the participating organizations based on open standards (SOAP/UDDI services)
- B. A **Semantic Subsystem**
that performs intelligent, context driven searches on the distributed DBs. It will perform data/text mining and knowledge extraction, exploiting the domain ontologies that will be developed during the project.
- C. A **Profiling** module, that performs the key functions of
 - Building and maintaining the static (e.g. role, preferences) and dynamic (i.e. the Personal Organizer module, able to track the user activity and feed the Application Server with information on the current user activities) profile of the user
 - “Pushing” the information to the user “desktop”
- D. An **User Interaction** module that performs all functions related to the user, on both the Application Server and the Client device:

- User interface
 - Knowledge representation and navigation
- E. A **Services** module, that includes:
- Security and Authorization
 - Workgroup tools
 - Data Synchronization tools to keep the user device data base up-to-date with relevant information for off-line operation
 - Configuration tools

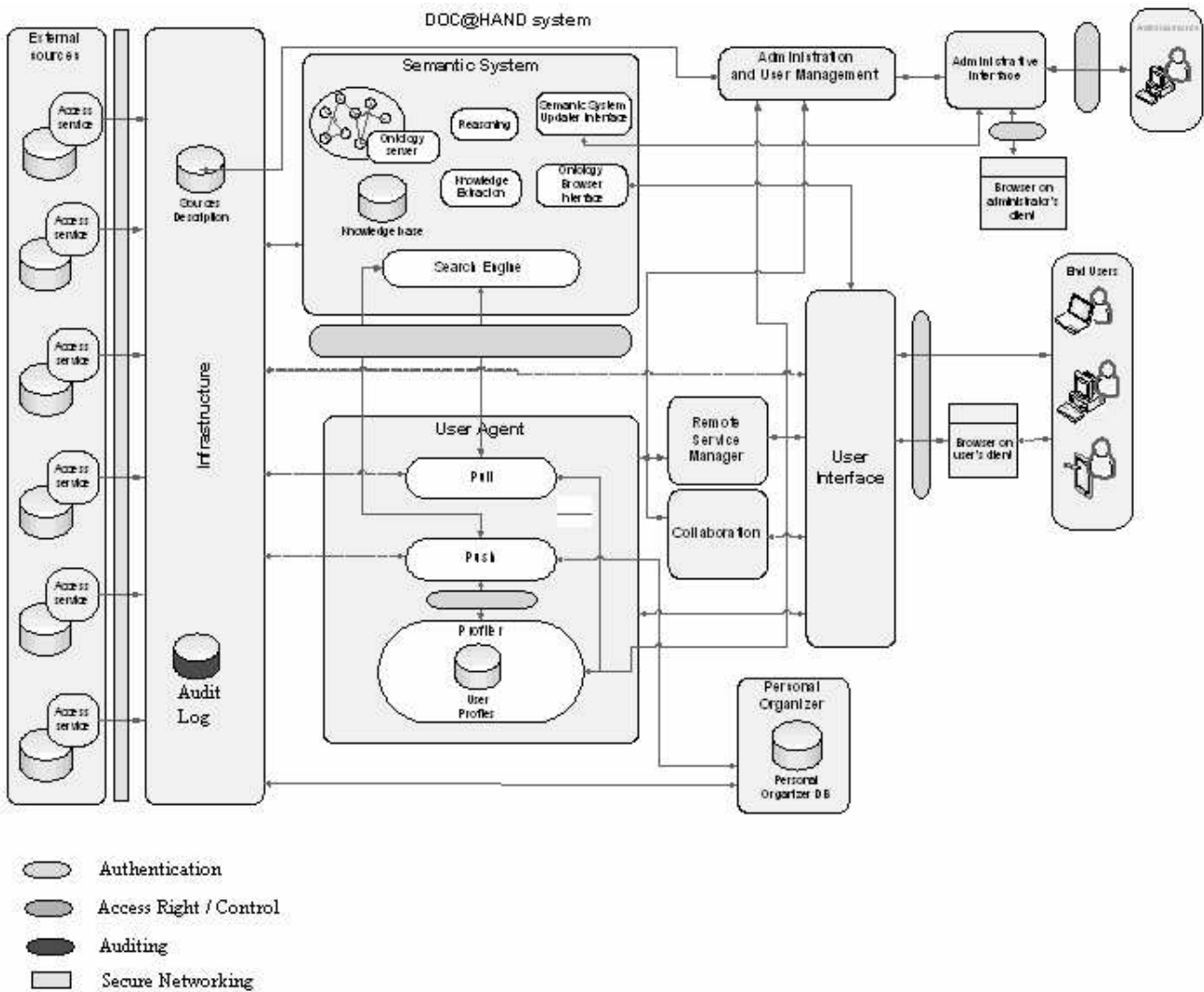


Figure 1 – Architectural View

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