

The main objective of the **K4CARE platform** is to offer an implementation of the K4CARE HC model in which the model (specified through a set of knowledge structures) and the execution logics are completely independent. In this manner, the implemented components are highly reusable and the system's behavior can be easily modified, adapted or personalized to the characteristics of a particular healthcare organization.

Another important objective of the platform is to offer a ubiquitous access to the actors involved in HC in a distributed fashion. On the one hand, this facilitates the care of elderly patients at home offering a remote access to the platform's functionalities. On the other hand, the lack of centralization introduces advantages regarding scalability, robustness and flexibility.

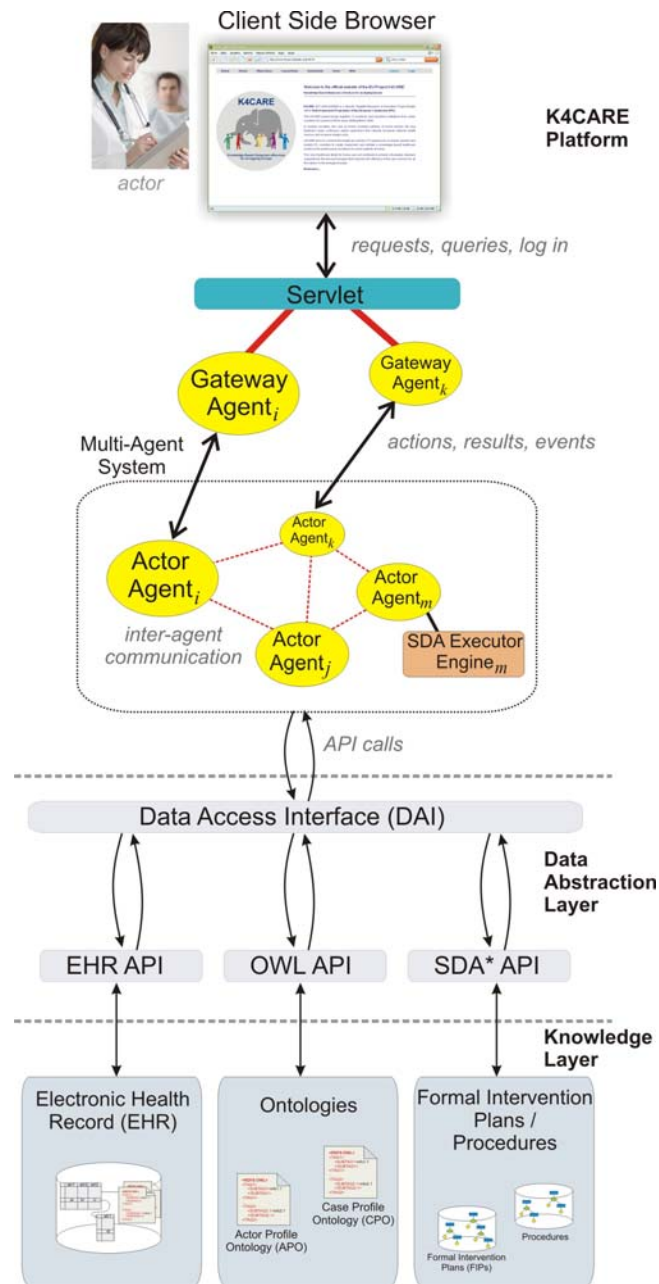
The platform has been implemented using a combination of several cutting-edge technologies such as **JADE Intelligent Agents**, **Ajax-based web interface**, **OWL ontologies** and **XML-based Electronic Health Care Record**.

The architecture of the K4CARE system is divided into the knowledge layer, the data abstraction layer, and the K4CARE platform.

The Knowledge Layer includes all the data and knowledge sources required by the platform. It contains an **Electronic Health Care Record** that stores patient records with personal information, medical visits and ongoing treatments. It is implemented by a collection of XML standard documents which structure medical data properly.

There are two ontologies which model the medical domain and the interactions between HC elements in a formal way. The **Actor Profile Ontology (APO)** which contains information about the types of actors, actions, services, procedures and documents available in the system, as well as their interactions. The **Case Profile Ontology (CPO)** which includes medical information on tests, signs & symptoms, syndromes, diseases, social issues and interventions.

The knowledge layer also contains procedural knowledge codified in the SDA* formalism. On the one hand, there is a repository of the **procedures** that implement administrative services used for HC management. On the other hand, there is a store of **Formal Intervention Plans**, which are general descriptions, usually defined by international health care organizations, of the way in which a particular pathology should be dealt with.



2. The **Data Abstraction Layer (DAL)** which provides Java-based methods that allow the K4Care platform entities to retrieve the data and knowledge that they need to perform their tasks. This layer offers a wide set of high-level queries that provide transparency between the data and the knowledge, their representation (OWL in the case of ontologies, SDA* in the case of procedures and Intervention Plans, or SQL calls in the case of the EHCR), and their use in the platform.

3. The **K4CARE Platform** is a web-based application with a client side (a *Web browser*) and a server side (a *Servlet*). Users interact with the system through a Web browser; each user is represented within the system by a permanent agent (**Actor Agent**) that incorporates all details about his/her roles, permissions and pending actions. These agents also manage all the queries and requests of the user and the other agents.

Actor Agents are responsible of coordinating their activities for the successful and efficient execution of administrative procedures and personalized medical treatments (**Individual Intervention Plans, IIPs**). Both procedures and IIPs are represented using the SDA* formalism.

A special kind of agent, called **SDA executor engine**, is created dynamically by an Actor Agent whenever a SDA*-based workflow has to be executed.

In order to exchange information between the agents and the users of the platform there is an intermediate bridge constituted by a *Servlet* and a **Gateway Agent (GA)**. The *Servlet* is connected with the browser user session. It creates a GA each time that an actor logs in the system, whose mission is to keep a one-to-one connection with the corresponding permanent agent, providing independence between the ubiquitous web accesses from the actor's PC or mobile device and the agent deployment in a secure node.

The agents of the multi-agent system embed the logic of the system by representing all the actors involved in the HC services. Agents act semi-automatically, in the sense that several actions such as exchanging clinical information, collecting heterogeneous data concerning a patient (e.g., results, current treatment, next recommended step, past history, etc.), or the management of pending actions, are performed autonomously by the agents without the direct intervention of the users of the platform.

The K4CARE Platform features the following functionalities:

Secure access to a patient's EHCR: the patient's Electronic Health Care Record, which is represented in a standard XML document, can be accessed and managed only by the allowed HC actors. Permissions are modelled explicitly within the APO, making the system automatically adaptable to different health care organisational structures and societies.

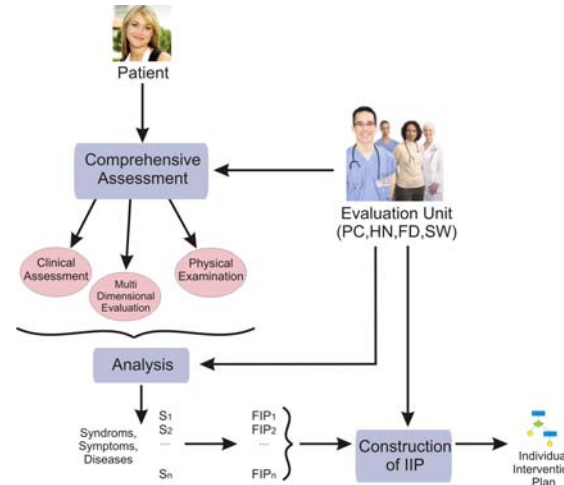
Execution of HC management activities: HC procedures specified in the SDA* formalism indicate the workflow to be followed and the activities to be completed by the different actors in order to execute HC management services.

Definition and execution of Individual Intervention Plans: each patient admitted for HC is assigned an Evaluation Unit, composed by a multidisciplinary team of four people. These actors can use a graphical editor embedded in the platform to define a customised Individual Intervention Plan (IIP) adapted to the patient's personal circumstances, via the combination and adaptation of several standard Formal Intervention Plans represented in the SDA* notation. The agents in the platform coordinate their activities to efficiently execute these treatments. The platform is responsible of making an intelligent dynamic assignment of the tasks included in the IIP among the available human actors.

Personalization: actors are also allowed to personalize their interaction with the platform by modifying some aspects of the HC model (namely, the APO). In this manner, the system can adapt automatically its behaviour to the preferences expressed by an actor for a particular aspect of the HC.

Web access: actors may have access to the platform using any Web browser. The graphical interface permits allowed users to request services, see pending actions, look up the electronic health care record of the patients, fill out documents, update their profile, work as part of a group, etc.

From the medical point of view, the creation and management of IIPs follows a complex procedure which is controlled by a multi-disciplinary team called Evaluation Unit (EU), which includes four actors: the Physician in Charge of the Home Care unit (PC), a Family Doctor (FD), a Social Worker (SW), and the Head Nurse (HN).

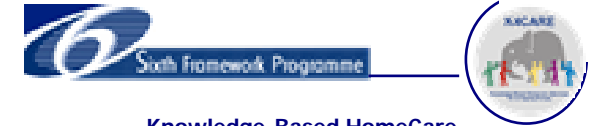


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Knowledge-Based HomeCare eServices for an Ageing Europe

The K4CARE Platform

www.k4care.net

The K4CARE project (IST-2004-026968) is an EU 6FP project aiming at the development, the integration and the use of several Information and Communication Technologies (ICT) and intelligent Computer Science (CS) technologies in the framework of Home Care (HC).

K4CARE is based on:

- a model for HC service which can be shared by the EU countries;
- an Electronic Health Care Record;
- a telematic and knowledge-based CS platform;
- an Actor Profile Ontology for representing the profiles of the subjects involved in the K4CARE model;
- a Case Profile Ontology for representing symptoms, diseases, syndromes;
- Computer-Based Formal Intervention Plans.

The K4CARE project is developed by thirteen EU partners: eight centres with geriatric, medical and healthcare competencies and five ICT and CS centres.

The K4CARE platform integrates the different data and knowledge structures which compose the K4CARE Home Care Model, offering an execution environment in which all the actors involved in HC can access the data and request services. The platform contains a persistent Multi-Agent system which models the actors involved in HC, a web interface from which actors can interact, a SDA*-based execution engine and several layers which abstract the data from the execution logic.