Dynamic Services for Assisted Living Environments

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Abstract. Software technologies for assisted living systems can be derived from the more mature domain of pervasive computing and the relative emerging ambient intelligence field. We present herein our position about the need for interoperability enablers extending the software service paradigm and for dependability as key elements of assisted living software systems.

Keywords: Assisted Living Systems, Software Technologies, Pervasive Computing, Ambient Intelligence, Service, Middleware, Interoperability, Dependability

1 Position

Assisted living systems aim at facilitating everyday life at home and potentially on the move for elderly people, thus allowing them to remain autonomous and conduct a normal life. Due to their specific target user group, assisted living systems are at the crossing of several disciplines and domains, both in human sciences and technological ones. Software technologies are a key element in assisted living systems, as they provide the base upon which all system elements are established and execute.

Assisted living software systems can benefit from evolutions in the more mature domain of pervasive computing and the relative emerging ambient intelligence field. In the pervasive home environment, networked devices provide functionalities and content, which can be conveniently modeled by using the service paradigm. Devices may vary considerably, coming from personal or mobile computing, consumer electronics or home automation[1]. The networked home environment is open, allowing new devices and services to be introduced, and to appear and disappear at any time and without prior notification. This desirable openness results inevitably in high heterogeneity of devices, services, content and service middleware, which calls for interoperability between services and between middleware platforms. A further effect is that there is no *a priori* knowledge of the services available in a specific home environment and this availability is dynamic. If we further consider the home environment at large, this may include, besides the home, connections between homes, and certain outdoor environments. In this extended home environment, we may find a multitude of possibly overlapping wireless networks, like cellular

[1] See the EU IST Amigo project, http://www.hitech-projects.com/euprojects/amigo/

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networks, WiFi hotspots and short-range personal area networks. Then, accessing these multi-networks by employing multi-radio devices and multiple middleware protocols – to enable service continuity upon disconnection, or service access in the best possible terms – becomes a key issue[2]. Besides the above functional considerations, extra-functional ones are equally important for an enhanced user experience, such as context-awareness in terms of user-, environment- and system-context, quality of service traded off with resource consumption – especially where available resources are limited –, and security and privacy issues.

Considering the above requirements, we argue that a key issue in assisted living software systems is interoperability. We have been working on extending the base service paradigm with interoperability enablers deployed at two levels. At middleware level, the two essential functions supported are service discovery and service interaction. Supporting interoperability between heterogeneous middleware platforms consists in providing interworking mechanisms between the respective discovery and interaction protocols. We have elaborated two solutions: one where interworking is done transparently for the involved platforms [1]; and one where service clients explicitly access services across different platforms and multi-networks [2]. At application level, interoperability between heterogeneous services can be based on semantic technologies, where both the meaning and the behavior of services are modeled. Service semantics are used for discovering services and for composing them to enable complex dynamic applications. However, reasoning on semantics is too costly – in terms of both performance and resource consumption – for the interactive, resource-constrained assisted living environment. Therefore, we have been working on solutions for efficient semantic service discovery and composition [3].

Compared with general-use pervasive environments, assisted living environments can be less open and more controlled. Nevertheless, interoperability is still essential in order to deal with the dynamics of the latter, in terms of responding to new situations and adapting to changing conditions. We argue further that, combined with this requirement for agility, there is an increased need for system dependability in terms of availability, reliability, safety, security and maintainability. Assisted living systems aim to support vulnerable user groups, which makes their mission critical. We have been conducting initial work in this direction.

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[2] See the EU IST PLASTIC project, http://www.ist-plastic.org/