

Antonio Maña  
Volkmar Lotz

# Developing Ambient Intelligence



Proceedings of the First International  
Conference on Ambient  
Intelligence Developments (AmID'06)



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# Preface

This volume constitutes the proceedings of research track of the First International Conference on Ambient Intelligence Developments, held in Sophia-Antipolis, France, during September 20-22, 2006.

The road to real AmI systems is full of obstacles in the form of very heterogeneous research challenges, belonging to many disciplines, but yet strongly related. Given the importance and the impact that AmI can represent in the society, all challenges related to AmI are receiving an increasing interest from the research community. At the same time for AmI technologies to become a reality we need a strong industrial support. Industry has also shown an important interest in AmI. Finally, government agencies, standards bodies, and decision makers are also a key element in this road to the materialization of the AmI vision.

The AmI.d conference has been designed to bring together all these stakeholders and to promote and disseminate the advances in technologies related or supporting the AmI vision. The focus of this edition of AmI.d is on the enabling technologies for AmI. In particular, the development of new software engineering and security engineering practices especially adapted to the new challenges introduced by AmI ecosystems. However, AmI.d also addresses all other aspects and faces of AmI, as shown by its very interesting and wide-ranging program.

In order to suit the needs and interests of the different communities, AmI.d has been structured into two different tracks:

- On the one hand, the “scientific track” was devoted to both theoretical and applied research, covers the most leading-edge research and contains contributions that have been formally reviewed and selected by a selected International Program Committee.
- On the other hand an “open track” was devoted to cover the industrial aspects, along with other aspects (social, economic, standardization and regulation, etc.).

The AmI.d program was complemented by interesting activities, such as the AmI Labs tour, live demos and information booths and featured top-level keynote speakers and an interesting panel debate.

Finally, we would like to conclude this preface by expressing our gratitude to all people that contributed in some way to the creation of this conference, and through it to the creation of AmI.

September 2006

Antonio Maña  
Volkmar Lotz  
Program Co-Chairs  
AmI.d'06

# Organization

AmId is an international conference organized and implemented by Strategies Telecoms & Multimedia.

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# Seamless Home Services\*

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**Abstract.** The growing number of smart devices providing services in peoples' homes and the increasing number of services available via the Internet creates two separate worlds that have not been successfully integrated yet. To bridge these two worlds, we propose a Home Service Platform supporting the seamless integration of home-based and net-centric services in a smart home environment. A common Service Engine supporting inter-service communication and aggregation provides human accessible user interfaces via a Service Portal and allows representing devices through a Home Device Controller. The integration of the two worlds allows us to create a new type of service: Seamless Home Services.

## 1 Introduction

Peoples' homes are currently flooded with a growing number of intelligent devices providing more and more "useful" features. New smart home devices are introduced as well as additional house control and telecommunication systems, each loaded with numerous complex functions making the handling increasingly difficult for end-users and developers. At the same time the number of available net-centric services grows continuously, providing personalized and ubiquitous access to information. These two environments are yet still separated, but there is an increasing need for a new generation of services aggregating functionality and integrating home-based and net-centric services. We call this new class of services enabling access, configuration and usage in an intuitive way "Seamless Home Services".

Seamless Home Services provide the end user with simple to use functionality instead of hard to use device controls by concealing complex functionality in adaptive user interfaces and automating repeating processes.

In this paper we present our solution for the easy provisioning of seamless services in form of an integrated runtime environment, facilitating the work of service engineers by bringing services and devices together in a straightforward manner.

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\* The Seamless Home Services project is sponsored by the Deutsche Telekom AG.

The next chapter gives a summary of the related work in this area, followed by chapter 3 where we identify the challenges motivating the development of Seamless Home Services. Afterwards we describe our approach to face those challenges, the *Home Service Platform*, followed by chapter 5, introducing our home infrastructure and the services we implemented to test our approach. Finally chapter 6 summarizes our work and gives an outlook to future research work.

## 2 Related Work

The increasing number of home devices and home networks leads to heterogeneous home environments, consisting of different types of networks and incompatible devices. In the home automation area multiple vendor specific proprietary protocols compete with proposals for standardization like e.g. EIB, X10, OneWire and I2C or ZigBee and various standards like e.g. UPnP, DLNA, SLP, Jini and Havi have been proposed to enable interoperability between devices of different vendors. In addition, smart services for the home environment have been proposed on basis of OSGi [4] and several research efforts like UIUCs Gaia [14], Stanford's iROS [9] or MIT's Metagluue [5] aim for the development of platforms allowing service interactions based on software agents within intelligent environments. Several of the existing standards also try to address specific use cases for appliance aggregation [3] or service aggregation [15].

McGrath et al. describe a concept [11] to use semantic queries that refer to ontologies for a semantic service. The iCrafter service framework [13] focuses on an approach for automated service aggregation on the user interface level.

Different to these approaches, focusing on device control and device interoperability, we concentrate on the connection between home-based and net-centric services. We thus take the aggregation of services one step further and unite home-based device specific services and net-centric services considering three aspects: abstraction from device specifics, user interface integration and service interoperability.

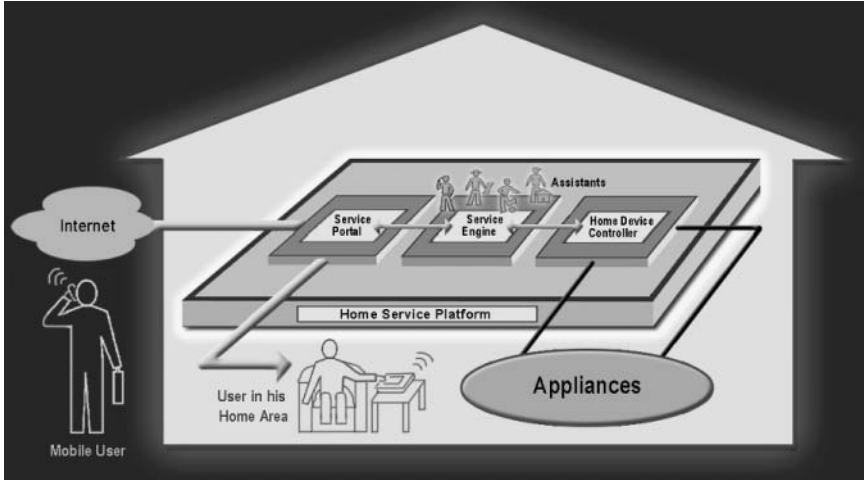
## 3 Challenges

We identified three challenging objectives that our approach has to meet to unite the home environment with the services offered by the internet for the creation of Seamless Home Services:

### *Interconnecting devices*

The first challenge to face is the integration of various devices from different vendors as our anticipated home environment has to be able to interact with the devices and services available in the home. This requires an open system allowing the integration of devices from different manufacturers, supporting different standards and communication protocols.

### *Merging home-based and net-centric services*



**Fig. 1.** Home Service Platform (HSP)

Once devices in the home are connected, the provided home-based services have to be merged with net-centric services to allow the provisioning of new and innovative services based on the available home infrastructure. This requires a home infrastructure mediating between home-based and net-centric services enabling both to expose their capabilities to each other.

#### *Accessing services*

Mediating between different services is one aspect of the anticipated architecture, mediating between the services and the user is another one. All provided services and devices have to provide a consistent user interface that can be personalized and integrated in the home environment, providing easy access to the various services.

Derived from these identified challenges, it appears that an integrated architecture uniting services, device controls and user interfaces is needed to benefit from the increasing range of functions and the convergence of modern devices and service providers. In the following we propose a solution for an architecture, targeting the identified objectives.

## 4 The Home Service Platform

We propose a common Home Service Platform (HSP) acting as a bridge between users and devices, providing the main service infrastructure in the home environment. This HSP aggregates the available services, supports developers with a common infrastructure for the integration of services and provides a common and consistent user interface to the end user. In our approach, the proposed Home Service Platform (3) consists of three building blocks, representing an architecture similar to a classic three-tier-architecture: