Platforms for AAL Applications

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1 Introduction

AAL – Ambient Assisted Living. When the topic "AAL" comes up, everybody thinks first of fascinating technology that is unobtrusively integrated in "smart home environments" and supports people in their daily lives. This thinking is surely be driven by the ongoing development of impressive services that was and is still provided by the AAL research community as well as the growing number of companies that bring these technology to market.

P. Lukowitz, G. Kortuem, and K. Kunze (Eds.): EuroSSC 2010, LNCS 6446, pp. 177–201, 2010.

In many projects - like MonAMI[14] - that deal with the integration of such mainstreaming services and sensor systems into a common architecture, it quickly became clear that a very important aspect was not sufficient considered: The need of a common platform for AAL systems.

This paper is a summary of articles addressing this issue. Twenty highly qualified experts dealing with the standardization of AAL platforms for many years present their experiences to the topics like “Why platforms are important to AAL”, “What features should be in a AAL platform” and “Why mainstream and open source solutions are important in AAL”.

2 Europe Support for AAL Systems

(Gunnar Fagerberg and Antonio Kung)

This chapter points out the importance of AAL platform in the action plan carried out by the European commission on ICT and Ageing.

2.1 ICT and Demographic Ageing

Ambient Assisted Living (AAL) systems refer to “intelligent systems that will assist elderly individuals for a better, healthier and safer life in the preferred living environment and covers concepts, products and services that interlink and improve new technologies and the social environment” [1]. AAL systems address socio-political issues created by the demographic development in Europe. Care and assistance needs to elderly persons will drastically increase in the future with a situation in 2050 where there will be two retired persons for one working person [2].

AAL systems can help support older people in various application domains [1]: at work, as persons will remain active and productive for a longer time, with an improved quality of work; in the community, by staying socially active and creative through ICT solutions; at home, byenjoying a healthier and higher quality of daily life for a longer time, assisted by technology, while maintaining a high degree of independence, autonomy and dignity.

AAL systems are not only a social necessity but also an economic opportunity. The wealth and revenues of persons over 65 in Europe is over 3,000 billion euro.

2.2 eInclusion in the Digital Agenda for Europe

eInclusion and therefore AAL systems are an integral part of the digital agenda for Europe [5]. Further to the 2006 Riga ministerial declaration on e-Inclusion policy [3], the European Commission has defined an ageing well action plan [4] as well as a series of measures that involve more than one billion euro in research and development between 2006 and 2013: the framework 7 program [6] help fund longer-term R&D; the AAL joint program [7] is dedicated to market oriented R&D; and finally the Competitiveness and Innovation framework program (CIP) within the ICT Policy Support Programme [8] supports initiatives with deployment priorities.

2.3 AAL Platforms

Initiatives funded with the help of the European commission in the framework 7 cover a number of area: mobility/falls, cognitive support, activities of daily light support, service and social robotics, and open platform and tools. In the latter area, projects such as Oasis, Persona, I2Home, MPower, OASIS, MonAMI have taken place, with various specific objectives. UniversAAL [9] is a recent undertaking which has the objective to integrate the various features developed in the previous projects and to make available to the R&D community an unified platform.

It is expected that this will be the starting point to an R&D ecosystem which will promote the development of the needed ICT applications for ageing, at work, in the community and at home.

3 Research Vision for AAL Platforms in Germany

(Reiner Wichert and Mohammad-Reza Tazari)

Despite the huge market potential for AAL products and services, the AAL branch is still on the cusp of a mainstream breakthrough. A lack of viable business models is considered almost consentaneously to be the main market obstacle to a broad implementation of innovative AAL systems. This short paper describes the pressing necessity to agree on a common AAL platform and the way how this could be achieved.

3.1 Establish a Joint AmI and AAL Community

The AAL-vision incarnated that one day sensors and systems give seniors a helping hand in their own home, e.g. by measuring, monitoring, and raising alarms if necessary. A lot of scientific research have been done in the past years to achieve this objective. Numerous projects has resulted in a considerable amount of applications and product concepts which ended up with a variety of prototypical isolated solutions [10]. Unfortunately the industry is still waiting to step into the huge market potential. Thus, the main question is now about the reasons for that and how we can motivate the industry to open their range of products to the AAL market.

A lack of business models as the foundation for a cooperation between developers, service providers, medical device manufacturers and the housing industry is almost unanimously named as the greatest marketing hindrance to a broad implementation of innovative assisted living systems. The high costs of the isolated solutions are the cause of this deficit which was highlighted in a very unfavourable cost-effect ratio in a BMBF-sponsored study of AAL market potential and development opportunities [11]. Here e.g. for cardiac insufficiency costs of 17,300 Euros per extended year of life expectancy were calculated.

Taking health assistance as an example, unfortunately older individuals usually have not only one medical illness, but rather are confronted with numerous symptoms and medical requirements. Only when covering the aging person’s entire clinical picture the costs can be minimised as then the people can remain longer at home and the unallocated funds gained from postponing nursing home stays can compensate the investments in AAL solutions. For this purpose, isolated solutions must become part of an overall solution and share resources. However, as the data exchange formats and protocols of these singular solutions are incompatible, the components of one application cannot be used by another without modification. Alterations by an expert system integrator are required to combine new and existing partial solutions, thereby making the total end solution prohibitively expensive [12]. Additionally, isolated solutions disregard possible overlaps so that share-able resources must be replicated and paid for repeatedly as the respective systems are only offered as complete packages. This results in an increase of expenses for private buyers, in long term even for care providers and health insurance companies.

As a consequence, research in Germany is coming to the conclusion that future AAL solutions must be based on few flexible platforms with ascertainable market shares that allow modular expansion, self-integration into the environment, and customisation to the individual's needs and health curve. Various AAL platforms have already been developed and largely validated within several projects, such as Amigo, PERSONA, and SOPRANO. They mostly focus on dynamic distributed infrastructures for the self-organisation of devices, sensors and services. Unfortunately, these solutions have not lead to the desired breakthrough, although each possesses substantial advantages as an AAL infrastructure. For this reason, the Eurpean Commission decided to fund a last research project within the current framework program, with the vision of a common Open Source platform for AAL. The research project selected was universal [13] which began in February this year with the goal to consolidate the state-of-the-art towards such a platform based on the most attractive middleware platforms of the recent years. Also German researchers are involved in this initiative. We believe that the consequent openness chosen by universAAL is the main means that can help to go beyond all boundaries, be it organizational, national or even EU. This openness isintended to include all aspects, from work processes to work results based on a permissive open source license model, from opening early results for discussion to incorporating external contributions until handing over the maintenance of the platform to an established AAL community after the project end. However, there is also a clear need to convince the technological industry of this vision. Only when the industry is ready to develop products and services based on a common platform, AmI and AAL will get a real chance for having success.

4 Building an Open Platform: The MonAMI Experience
(Bruno Jean-Bart and Gerald Bauer)

This chapter presents experiences and challenges encountered during the design of a new and open AAL platform based the OSGi and URC standards for the MonAMI FP6 project. The open platform is used to provide various services that help elderly and disabled people to manage daily tasks more independently. We describe the creation of an AAL system that includes more than twenty services developed by different service providers in a common system. The benefit of the MonAMI architecture is that the system can be easily enriched with new "smart" home services and "accessible" user interfaces without a deep knowledge of the underlying sensors, network, and services.

4.1 Introduction: The MonAMI Experience

Mainstreaming on Ambient Intelligence (MonAMI) [14] is an FP6 EU project that started in September 2006. Its overall objective is to investigate, specify, validate and promote an approach based on mainstream technologies whereby Ambient Assisted Living (AAL) applications can be deployed in a cost effective manner. One of the main objectives is to build an architecture that matches the needs of end users by providing useful and easy configurable services, a reliable and secure architecture that can be easily accessed or extended, and affordable hardware. The resulting architecture is depicted in the Figure 1 below.

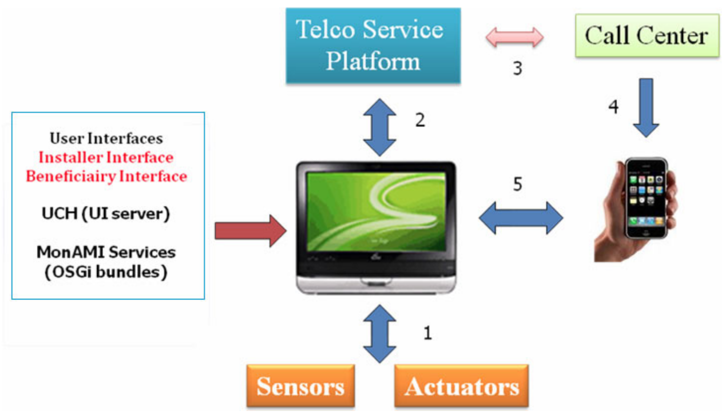

Fig. 1. The MonAMI Architecture

The equipment installed at home consists of a standard touch screen PC which is equipped with Wi-Fi and connected to a broadband Internet network. The PC displays simple and accessible web pages which enable the user to interact with MonAMI applications or services. These services are grouped into five packages:

- *AMICASA*: services for the remote control of lights, shutters, doors, etc. It also includes a set of automatic services, e.g. lights are switched on when a room becomes dark. The service *I go to bed* may include actions to switch off the lights in the living room and switch on the lights in the bedroom.
- *AMISURE*: services that improve personal safety, e.g. when an appliance remains on longer than expected, an alarm informs the user and the care center.
- *AMIVUE*: services which provide the means to observe the ambient environment of the flat. It can be used by the care giver to remotely check the current situation.
- *AMIPAL*: reminder services to inform the person about the meetings or actions to be taken on a given day (e.g. taking pills).
- *AMIPLAY*: a set of accessible and simple games to enjoy when the user is alone.

MonAMI is currently preparing the deployment of the implemented applications in a field trial involving 55 homes in Slovakia, Spain and Sweden in order to assess the usability and scalability aspects of the implemented services.

4.2 The MonAMI Architecture: An Open AAL Platform

The major goal for the MonAMI architecture is to identify the features which simplify the business environment for developing AAL services, which will in turn foster the creation of a business ecosystem. The business environment includes the stakeholders and decision makers involved in the development and operations of AAL services. Among the features identified, the most decisive one is the use of a set of common interfaces, called OSGI4AMI, in the home platform in order to create a separation between services and the rest of the environment (e.g. web server, home devices, user interface). As a result, the business environment for developing services is simplified. Figure 2 shows how the MonAMI implementation supports those features by using Java interfaces to connect bundles.

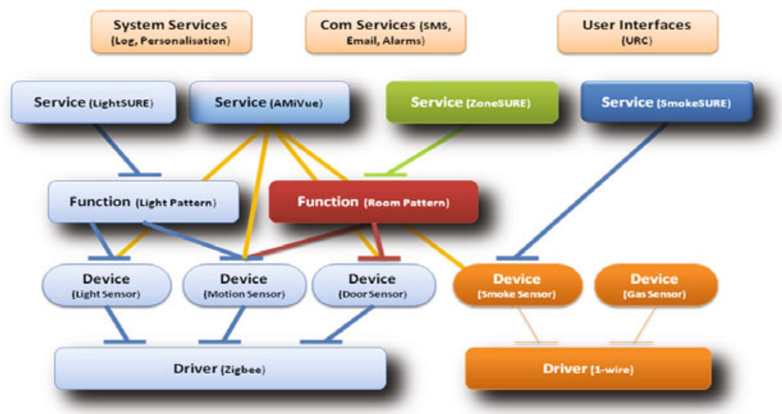

Fig. 2. MonAMI bundles connected via OSGi4AMI interfaces

The home platform is based on the OSGi framework [16]. OSGi enables a Java-based system to be remotely managed and is currently used in most smart home environment applications. OSGI4AMI [18] is based on a comprehensive ontology of devices and services which is mapped into a set of Java interfaces. The resulting architecture has the following advantages:

- it creates a clear separation between applications and the set of devices (e.g. sensors, actuators) used in MonAMI. Programmers of services do not have to adapt their code to specific devices and technologies.
- it includes facilities to configure and personalize the services,
- it enables the development of a rich set of AAL services based on standard interfaces which includes sensors, monitoring (e.g. temperature patterns), communication (e.g. SMS, email), and a generic connection to user interfaces.

Besides service applications, the user interface is another important and required feature. MonAMI services must be locally accessible to elderly and disabled people as well as remotely available to caregivers and relatives. In order to implement these requirements, MonAMI uses a second framework based on URC (Universal Remote Console) [17] that was developed by the I2Home project and fully meets the above requirements. Again, URC enables a complete separation between the service contents and the way of presenting information to the beneficiary of the service. The user interface can be changed, adapted, or personalized to the user without changing the contents of the applications.

4.3 An Ontology Mapped to OSGi : OSGi4AMI

An ontology is a representation of system elements and their relationships. In MonAMI, an ontology was developed to describe the devices and the basic AAL services. The devices and services definition form a set of interfaces used both for the bundle interactions and for user interfaces.

The result of this approach is called OSGI4AMI. All Java interfaces are included in one OSGi bundle that is imported by all other devices, drivers, and service bundles. At the bottom of the architecture in Figure 2, the driver plays a major role as it manages the links with devices. When a device is connected to the local network, the driver creates a new OSGi service (a virtual device), with the class name of the corresponding OSGi4AMI interface (e.g., *TemperatureSensor*, *LightActuator*).

This virtual device may be used by any higher level bundle, such as *LightPattern* or *AMIVue*. The reference object of this virtual device, a light sensor for instance, can implement the *LightSensor* interface as well as other interfaces of the ontology. For example, the *Configurable* interface makes the virtual device configurable, and the *Generic Communication Service* interface makes the device accessible from a remote client such as the user interface.

As a result of the architecture described above, the MonAMI platform enables service providers to develop innovative AAL services to help disabled and elderly persons live at home more easily. This straightforward approach makes it easy to design a component that is compatible with the MonAMI infrastructure. A service developer simply needs to know the OSGi4AMI ontology to use existing devices, the AAL basic service specification, and the user interfaces.

4.4 Accessible User Interfaces

The MonAMI service platform makes a clear separation between the two main functional blocks shown in Figure 3. The Human Machine Interfaces (HMI) block runs on a Universal Control Hub (UCH). The other block consists of AAL services which run on an OSGi framework. In the terminology of UCH, the AAL services are seen as a *multipletarget.* The UCH is an HMI server which implements the ANSI standard Universal Remote Console (URC). The UCH enables the development and execution of multiple, accessible, and flexible HMI clients on different targets such as a touch screen computer or an iPhone which are tailored to the user’s needs (e.g., an elderly person or caregiver) as seen in Figure 3.

Fig. 3. OSGI4AMI is used both for user interface and for the service definition

4.5 Conclusion

This paper introduces an open AAL platform that was designed by the MonAMI consortium. It shows how a full, functional smart home environment based on different mainstream technology was integrated in a common system. The approach based on the ontology of OSGi4AMI interfaces has proved to be efficient during service development, in which more than five team members worked on the development of over twenty MonAMI services. OSGi4AMI helped to develop and to integrate efficient new AAL services and to adapt or extend already existing services. OSGi4AMI could be the foundation of a standard for AAL, as it can be easily extended whenever new services need to be created. It could lead to the creation of a central AAL web store where new services or drivers could be downloaded on home gateways, in the same way as new applications are easily downloaded from Apple's App Store.

5 URC and WSDL – Towards Personal User Interfaces for Web Services *(Gottfried Zimmermann)*

This chapter introduces a concept of applying the Universal Remote Console (URC) framework to Web services, in particular to those described by the Web Service Description Language (WSDL). A new standardization effort is currently initiated under ISO/IEC JTC 1, Subcommittee SC 35, to extend the URC series of standards by a part on Web service integration. Both developers and users of Ambient Intelligence environments (including Ambient Assisted Living environments) will benefit: Developers will harness the power of Web services and pertaining development tools for the development of intelligent services, and the users can use the services through their preferred personal user interfaces.

5.1 Introduction

Web services are becoming increasingly ubiquitous in the form of public Internet-wide services and private services in protected environments, including Ambient Assisted Living applications. Even devices and appliances in the digital home are being made network-accessible by exposing them as Web services.

The Universal Remote Console (URC) framework, as defined in ISO/IEC 24752 [19], defines a mechanism for personal user interfaces that “plug” into networked applications of any kind. Thus a user can use any controller and user interface of their choice to access and control the applications. The applicability and usefulness of the URC technology has been demonstrated in various projects, including the Trace Center’s MyURC open-source projects [20], i2home [21], VITAL [22] and MonAMI [23].

For a Web service to adopt the URC concepts, it needs to expose its Web service interface as a composition of user interface socket elements. Both the User Interface Socket Description language and the Web Service Description Language (WSDL) [24] define suitable extension mechanisms for such integration.

It is expected that this approach will help adoption of the URC technology for Web services, and thus make personalized and pluggable user interfaces widely available for Web services.

5.2 Technical Work

A new work item proposal is currently being voted on in the Subcommittee SC 35 of ISO/IEC JTC 1. It proposes to add a part 6 to the multi-part standard ISO/IEC 24752, Universal Remote Console. Part 6 will define "syntax and semantics of mapping information that describes how the elements of the socket are to be mapped to the elements of a Web service interface. Such mapping information can be included either within a user interface socket description, as a separate mapping document, or within a Web service description language (WSDL) document."

This alignment of the URC technology to Web services gives rise to a variety of possible implementation scenarios, depending on whether the mapping happens on the Web service, on a middleware component, or on the URC.

Scenario 1. The Web service offers a networking interface for access to the socket, in addition to the Web service operations it provides (fig. 4). Such a socket interface could implement the URC-HTTP protocol [25] or any other protocol based on ISO/IEC 24752-2. Thus a URC can connect to the user interface socket on the Web service, and retrieve a user interface from the Web service or from any resource server. It should be noted that the socket interface could be expressed in terms of a WSDL interface with generic operations for accessing the socket elements, but this would still require an additional description of the socket elements, their dependencies and other properties.

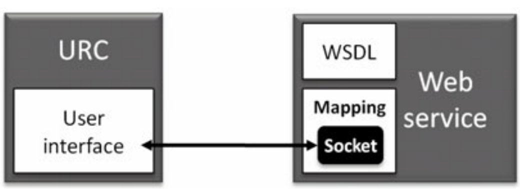

Fig. 4. Mapping resides on Web service

Scenario 2. There is a middleware component that translates the WSDL operations of the Web service into a socket interface (fig. 5). Also, the middleware can provide alternate user interface based on the socket interface for any controller to use. The user interfaces come from a local repository, or are retrieved from any resource server. Inthis case neither the Web service nor the controller need any knowledge of the URC framework. An implementation of such a middleware exists in the Universal Control Hub (UCH) [26].

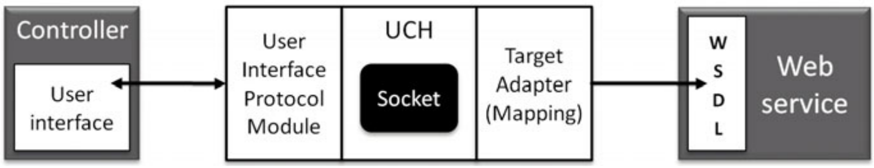

Fig. 5. Mapping resides on middleware (UCH)

Scenario 3. A URC connects to the Web service via the service's native operations, as specified in the WSDL document (fig. 6). It then maps these operations into a socket, thus exposing socket elements to any user interface running on the URC platform. User interfaces are either stored on the URC, or come from any resource server.

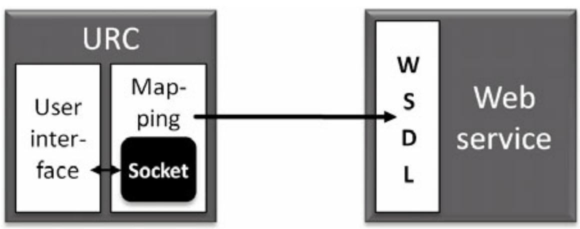

Fig. 6. Mapping resides on URC

5.3 Expected Benefits and Risks

A language for mapping between a Web service interface and a socket will close a gap and make the URC and Web service worlds more interoperable. Developers of Web services, including services in the context of AAL, will be able to harness the power of the URC framework to provide for personal user interfaces. The development of a standard will also spur the development of appropriate development tools.

Users of Web services will benefit as well, since they will be able to operate Web services with the device and user interface of their choice. Third parties will be able to provide supplemental user interfaces for existing Web services, thus making them more accessible and usable for particular user groups that have not been catered for by the Web service provider.

It is expected that any Web service will be able to present URC-based user interfaces in the manner described in this paper, if the developers think about its abstract user interface (socket) early in the development. There are, however, some

Web services already in use that will need a more complex mapping than can be expressed by a declarative language such as being developed within ISO/IEC 24752-6. In these cases the mapping will have to be implemented as manually written code, in order to make URC-based user interfaces available for these Web services. The mapping code will preferably run either on the Web service itself or on a middleware component (e.g. as target adapter of the UCH).

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6 Challenges for the Building of AAL Platforms

(Antonio Kung and Francesco Furfari)

AAL systems are ambient intelligent systems which need dedicated platforms because they have to support domain specific features and interfaces. This paper presents the service/platform interface approach, lists challenges to be solved, and suggests measures to facilitate the development of AAL platforms.

6.1 Need for an AAL Platform

A platform can be defined as a computing architecture including software and hardware that serves as a foundation to application programmers. Since it separates specific features implemented by a small community of system experts from application features implemented by a larger community of developers, it allows much faster development of applications.

Several initiatives specific to Ambient Assisted Living (AAL) have been launched to address the issue of creating service platforms, such as Soprano [27], Persona [28], MPower [29], MonAMI [14], OASIS [31], I2Home [32] or UniversAAL [33] projects. This paper briefly presents how the contributions on platforms from these initiatives can be harmonized.

6.2 The Service-Platform Interface

All initiatives mentioned above have converged towards home server with one clear interface: the service/platform interface. This single interface, if properly defined, could facilitate the transformation of the currently fragmented markets into a single unified market. It would also facilitate user centered design since application development iterations could be made possible by allowing faster implementation and modification of applications. Finally, it would ensure that applications would be technology independent. Note that the term interface is used generically in singular. In practice there might be many interfaces.

Harmonizing these initiatives does not mean imposing a single agreed platform. It means reaching an agreement concerning the interface between services and platforms so that various platform solutions can compete. This agreement is AAL specific, but to our knowledge there is not yet any discussion on the definition of common overarching interfaces which would enforce a clear separation between stakeholders developing applications and stakeholders developing platform elements. We believe this is a prerequisite for an AAL ecosystem.

6.3 Challenges

We cover now a number of key challenges that have to be addressed: the integration of innovation in platforms, the integration of transversal features, interoperability of interfaces, technology independence, and finally the support of multiple business models.

6.3.1 Integrating Innovation

While AAL platforms should be based on widely used technologies, they do include features that are specific and novel. The AAliance research agenda [34] provides an overview of such challenges in different contexts (at home, within a community, at work). It identifies technology challenges related to sensing, reasoning, acting, interacting, and communicating. Research is on-going, but results must be integrated in platforms. Thus the challenge is to maintain and coordinate two threads of development activities: on one hand the integration of research features into a platform, and on the other hand the integration of components in a platform that meets industry requirements.

6.3.2 Integrating Transversal Features

Future AAL platforms should take into account features that are transversal. Scalability issues will arise when millions of platforms are deployed and personalised. Quality of service issues will arise for specific applications with different dependability requirements, e.g., related to health monitoring or alarms. Liability issues will arise when the chain of applications and technology has not worked properly. Confidentiality and data protection issues could have negative social consequences. Solving these issues may have far reaching effects on application and platform design.

6.3.3 Interoperability

Interoperability is not easy to reach because it relates to many domain specific aspects. The Interoperability working group of the German BMBF/VDE Innovation Partnership on AAL [35] included experts from the following domains: Home/building automation, medical IT, household appliances, consumer electronics, network technology, AAL middleware platforms, sensor networks, robotics, cognitive systems, standardisation, and certification.

Furthermore, any attempt for standardisation will involve dedicated task forces involving the various competing stakeholders in a given domain. These working groups will focus on competitive issues, i.e., what is mandatory, what is optional, and what is proprietary, as well as on extensions issues, i.e., the impact of new features on interoperability. The definition of the CHAIN standard [36] is a good example. This group of more than 10 white goods manufacturers had to reach a consensus, taking into account competitive and extensions issues.

The AALiance project has also identified areas where there is no standard: "Remote Maintenance of AAL Systems, Connecting to Medical Sensors, AAL

Terminology, vocabularies, ontologies, AAL Middleware / Service Execution Environment, Emergency Calls, and Connection to Call Centres" [37, 38].

There are two approaches for successful standard adoption. Either we have industry-led initiatives with well defined but focused and narrower objectives, such as the Continua Health Alliance [39], or we have an overall consensus between all stakeholders within an application domain and technology stakeholders responsible for a given platform. We believe that this second approach is what is missing for AAL platforms.

6.3.4 Technology Independence

Technology independence serves indirect but important purposes. First of all, if there are several competing platforms it allows application stakeholders to switch from one platform to another without modifying applications. Secondly, it allows platform stakeholders to switch from one technology to another, again without modifying applications (for instance to another RF network solution).

The challenge is to specify interfaces in a technology independent manner. The CHAIN specification [36] made sure that interoperability specifications would consist of three parts: 1) a network technology-independent specification with semantic interoperability (e.g. the "start appliance" message is technology independent), 2) a network technology-independent specification of syntactic interoperability (e.g. the "start appliance" message is represented by value 6), and finally 3) a network-dependent mapping (e.g. the message is mapped on a Konnex network). A working group in CENELEC is working on IFRS, an Interoperability Framework Requirements Specification which provides the "language" for expressing semantic interoperability which is independent from the underlying network standard [35]. Such a framework could be used in the future for technology independent specifications.

6.3.5 Multiple Business Models

There could be several business models depending on national/regional specificities. In some countries, AAL applications could be subsidised at the public level (e.g., social security), and in other countries this could be at the private level (e.g., an insurance company). Local policies have an impact on the way AAL applications and platforms are procured and operated. The resulting different business models could have an impact on the service/platform interface requirements. For instance different technology features would be needed depending on whether sharing data between different domains (e.g. care versus health) is possible or not. The challenge therefore is to ensure that the specified standards and interfaces be compatible with the various operating models. This could require configuration capability to select various AAL platform profiles.

6.4 Conclusion

To make such platforms a reality, we suggest two measures: first, the launching of a research and industry initiative for an open source platform [42, 43], and secondly, the launching of an EC policy supported long-term process for the definition of AAL solutions and standards.

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7 The AAL Open Association Manifesto

(F. Furfari, F. Potortì, S. Chessa, M.-R. Tazari, M. Hellenschmidt, R. Wichert, J. Gorman and Antonio Kung)

AAL (Ambient Assisted Living) has great potential for positively influencing the lives of many people. But impact so far has been less than hoped, partly due to fragmentation of research efforts and the lack of a standardised approach for developers. To address this, we are forming the AALOA (AAL Open Association), and invite you to join in our efforts.

7.1 AAL - Promising But Problematic

The abbreviation "AAL" stands for Ambient Assisted Living [44] and is about making smart use of technology to support well-being in the preferred living environment for people who might otherwise find this difficult (e.g. infirm or very elderly people who want to continue living in their own homes). Research in the area is motivated by socio-political issues of the ageing population, and offers a promising approach with potentially wide-reaching benefits. It involves many ICT-related R&D disciplines in an application field that has attracted much attention. Several initiatives have emerged to tackle the challenges involved [45][46][47], and significant incremental progress has been achieved on many fronts. But a major AAL breakthrough, leading to a standardized approach and thereby to widespread adoption, is still not in sight. A way of doing things that has general acceptance and can almost be assumed, like the Apache Server is in the web world, is missing in the world of AAL.

Why have there been no AAL breakthroughs? From an R&D perspective, part of the answer is to be found in fragmentation of research efforts in the area of AmI (*Ambient Intelligence* [48] - also referred to as Ubiquitous and Pervasive Computing [49][50]). AmI is the key research discipline that underpins the domain of AAL, and many innovative ideas and approaches have emerged from research projects, conferences etc. in recent years. The field has matured over time – but so far with no converging conclusions.

From a market perspective, there are two obstacles. The first arises from the lack of technical convergence: this leads to development of very different technical solutions that are difficult to compare, so there is no baseline against which to assess user experiences in the types of scenarios envisaged by AmI. It's hard to market something whose benefits you can't clearly quantify. The second obstacle is market fragmentation. The whole concept of "ambience" is all about making use of everything around you as part of a single overall solution. But today's commercial reality is that the growing number and types of devices around us (mobile phones, home theatres, games consoles, media servers, home gateways etc.) are treated as separate market segments – even though the devices themselves have the potential to interact. A paradigm shift is needed, but who will risk the investments and changes in business models needed in the absence of a precise model adopted by a large ecosystem of artifacts?

The concept of *co-opetiton*[51] - collaboration among competitors - has been put forward as a way to achieve commoditized infrastructures and been successfully deployed in some cases. But for there to be any chance of a real paradigm shift, a transversal cooperation over diverse market segments with the involvement of many stakeholders is needed. That is one of the key things that the AALOA aims to achieve.

7.2 AALOA – An Open Association Promoting AAL Research, Development Uptake and Impact

The signatories of this manifesto consider that the time has come to do something about the problems hindering progress in the area of AAL. We believe that this is something that transcends individual projects or organizations, and needs a long-term approach, with broad involvement from all types of stakeholders. This manifesto is intended as an invitation to join us in our mission, which is to:

- Bring together the resources, tools and people involved in AAL in a single forum that makes it much easier to reach conclusions on provisions needed to achieve AAL progress;
- Make sure that all technology providers, service providers and research institutions involved in AAL are either directly involved in AALOA or (as a minimum) aware of decisions it promotes;
- Involve end-user representatives in all work of AALOA;
- Identify key research topics in AAL, and reach agreement on prioritization of these;
- Design, develop, evaluate, standardize and maintain a common service platform for AAL.

Our mission is founded on a long-term technical vision. This will evolve over time, but gives an indication at the initiation stage of the direction in which we want to go. In our vision, ordinary hardware resources such as displays, keyboards and storage devices that nowadays need drivers integrated into Operating Systems (OS) will evolve into pluggable networked resources. We foresee the emergence of new programming languages, based on resource and service discovery paradigms, facilitating the development of AmI applications.

There will be a shift away from the idea of developing applications that run on different PCs and OSs towards the concept of developing applications for "AAL spaces". Middleware [52] will be widely used, and help developers to identify the features available in the environment (sensors, other devices, services) and write programs which can exploit large classes of them effectively, without needing to know their actual whereabouts or be concerned with low-level configuration details.

This will involve more than just developing pluggable components: it will mean that developers will effectively be able to contribute to several distributed applications - without even knowing all of them beforehand. "AAL Spaces" will become the equivalent of today's PCs (in terms of widespread availability, standardization and acceptance) and new markets will emerge for software and hardware products, involving houses, cars, airports, hospitals and public spaces..

7.2.1 Getting Started: Defining a Reference Architecture

The hardware specification of the original IBM PC of the eighties, when several independent manufacturers started to produce peripherals and compatible hardware thanks to the standardization of connector interfaces and the availability of specifications, was one of the key enablers that led to the ubiquity of PCs we know today.

One of the first tasks of the AALOA will be to do something similar for the AAL domain: define a *reference architecture* to standardize the resources available in AAL environments, and how to integrate them. This will encourage the creation of new brands and the coalition of firms around new business opportunities.

7.3 Your AALOA Needs YOU

To achieve our mission, and contribute to bringing about this long-term vision, the signatories of this manifesto started to incubate the AALOA – the Ambient Assisted Living Open Association. As its name suggests, anyone can join the AALOA, and this manifesto should be considered as a direct invitation to do so.

The AALOA can only achieve its mission if its membership represents a significant proportion of the people and organisations involved in AAL/AmI, in one way or another. We invite you to join the association, and to participate in its activities: to bring fresh ideas, to propose workshops and projects and to contribute actively to the growth of the association. For details of how to join, please visit the web site: <http://www.aaloa.org>

The detailed organisational structure of the AALOA is in the process of being formalised in a set of statutes. These are still under development, and people responding to the invitation to join will have the opportunity to influence their development.

We envision a not-for-profit organization, with two boards that nominate common elective offices: a Governing Board following common best practices of open source communities and an Advisory Board composed of industry and user communities. The latter will be organized into working groups whose role is to advise AALOA's open source community about emerging technical and market challenges.The following challenges have to be addressed: the integration of innovation in platforms, the integration of transversal features, interoperability of interfaces, technology independence and finally the support of multiple business models.

7.3.1 The Open Source Policy

The importance of open source software in the industry has risen to prominence in recent years, especially in the development of software infrastructures. Closed, proprietary approaches become less attractive as standardised infrastructure software becomes a commodity: high development costs due to the complexity of such software, uncertainty due to the "winner-takes-all” effect and diminishing marginal returns make the market for infrastructure software a risky business. The open source approach, on the other hand, promises easier software maintenance, allows cooperation between competitors and helps spread production costs over a multiplicity of stakeholders [53] [54].

7.4 Call for Project Proposals

The association will be organized as a federation of projects, one representative of each project being a member of the Governing Board.

Proposals for new projects can be submitted to the Governing Board, whose main role will be their evaluation with respect to the association’s mission, while still encouraging the emergence of diversity, and avoiding monoculture. Projects will autonomously organize their governance rules. Over time common rules suggested by practice may be formally adopted.

As one of the association’s objectives involves building an open source community working on service platforms for AAL, projects related to software development are to be expected. But we emphasise that other types of projects are also welcome. The next section describes an example of one such.

We are setting up resources for building and managing projects. You can access these resources by submitting a project proposal with a list of individuals or organizations that support your project idea. Visit the web page at http://www.aaloa.org/projects for details.

7.4.1 The EvAAL International Competition

EvAAL has been the first project proposed to AALOA promoters and it is a paramount for the AALOA purposes. In fact, an important action for the assessment of the research results in this area is based on the analysis and comparison of the existing solutions provided by the research community [55]. To this end, we intend to promote an international competition called EvAAL (“Evaluating AAL Systems through Competitive Benchmarking”). The competition is intended to raise awareness of and interest in AAL, and to spread knowledge about the state-of-the art to a large audience. To do this, we will issue an annual “Call for Competition Ideas”, in which we will invite practitioners and experts to propose the topics and rules for that year’s competition. The idea received will be assessed and possibly merged, before the competition itself is announced. The competition itself will invite people to compete by developing hardware/software artefacts supporting the selected topic.

Generally, the competition will be organized around one or several of the functions enabling AAL spaces, such as:

- sensing
- reasoning
- acting
- interacting
- communicating

In order to stimulate the participation of PhD students, a cash prize will be awarded to the competition winner(s) each year. We would like this to be something significant, such as an amount equivalent to a research grant for one year at an international university. All participants in the contest will have the opportunity of publishing a peer-reviewed paper describing their system. For details about the contest please visit the EvAAL web site at http://evaal.aaloa.org

7.5 Acknowledgments

The idea of forming the association arose from discussions between some of the institutions involved in the projects PERSONA and universAAL, funded respectively in FP6 and FP7 (the Sixth and Seventh Framework Programme of the EU), but similar ideas were also discussed by partners of other projects who had recognized the need for a common effort in the field of AAL/AmI, as well. Today, the Manifesto is a dissemination effort of the EU projects MonAmI, OASIS, OsAmI-commons, PERSONA, SOPRANO, universAAL and WASP. The subscribers listed below are people who support the ideas promoted by the Manifesto and are willing to participate in the life of the association.

In addition to the subscribers, there are few promoting organizations (details to be found on the Web site) that have allocated resources for carrying out the tasks in the incubation phase of AALOA, until its bylaws are finalized and the association itself is established as a legal entity. Nevertheless, more effort and voluntary contribution is still needed. Hence, we encourage you, as the reader of this manifesto, to get involved in this open process!

7.6 Subscribers

Francesco Furfari, CNR-ISTI, Italy; **Francesco Potortì**, CNR-ISTI, Italy; **Stefano Chessa**, University of Pisa, Italy; **M. Tazari,**Fraunhofer-IGD, Germany; **Michael Hellenschmidt**, Fraunhofer-IGD, Germany; **Reiner Wichert**, Fraunhofer-IGD, Germany; **Joe Gorman**, SINTEF, Norway; **Sergio Gustavo GuillenBarrionuevo**, ITACA Univerity Polytechnic Valencia, Spain; **Juan Pablo Lázaro Ramos**, TSB, Spain; **Marius Mikalsen,** SINTEF, Norway; **Antonio Kung**, Trialog, France; **Bruno Jean-Bart**, Trialog France; **Gunnar.Fagerberg**, SIAT, Sweden; **SilvioBonfiglio**, FIMI, Italy; **Jesus Bermejo**, Telvent, Spain; **StenHanke**, AIT-HBS, Austria; **Andreas Hochgatterer**, AIT-HBS, Austria; **Michele Amoretti**, R&S Info, Italy; **Sergio Copelli**, R&S Info, Italy; **Richard Dapoigny**, University of Savoie, France; **Milan Petkvic,** Philips, The Netherlands; **Susan Schwarze**, Prosyst, Germany; **Kai Hackbarth**, Prosyst, Germany; **César Iglesias Díaz-Bastien**, dbtlex, Spain; **Peter Wolf**, FZI, Germany; **Andreas Schmidt**, FZI, Germany; **Armando Roy Delgado**, University of Zaragoza, Spain; **Anastasia Garbi**, Exodussa, Greece; **Elena Avatangelou**, Exodussa, Greece; **MartijnBennebroek**, Philips, The Netherlands; **François Letellier**, OW2, France; **Thomas Karopka**, IT Science Center RügengGmbH, Germany; **VicençSoler**, University of Barcellona, Spain; **Ricardo Serafin**, TSB, Spain; **Paolo Bellavista**, University of Bologna, Italy; **Antonio Corradi**, University of Bologna, Italy; **Juan Carlos Naranjo Martinez**, Univerity Polytechnic Valencia, Spain; **Laura BelenguerQuerol**, Univerity Polytechnic Valencia, Spain; **Jorge Falco**,University of Zaragoza, Spain; **Roberto Casas**,University of Zaragoza, Spain; **Jose Ignacio Artigas**,University of Zaragoza, Spain;**FabioPaternò**, CNR-ISTI, Italy; **Marco Eichelberg**, Offis, Germany; **Antonio Maña**, University of Malaga, Spain.

8 Injecting the Universal Remote Console Ecosystem: The Open URC Alliance[1] *(Jan Alexandersson, Jürgen Bund, Eduardo Carrasco, Gorka Epelde, Martin Klima, Elena Urdaneta, Gregg Vanderheiden, Gottfried Zimmermann and Ingo Zinnikus)*

As a consequence of the large interest in standardized open platforms that can implement scenarios and requirements posed by the AAL and eInclusion communities, the ISO/IEC 24752 standard Universal Remote Console has emerged from a single project infrastructure within the FP6 project i2home into a steadily growing ecosystem with parties ranging from more technology oriented over business but also stakeholders that represent users. In order to coordinate and make trans- parent activities as well as provide a meeting place for different stakeholders, we have started building up the OpenURC Alliance. In this talk, we present the time line and construction of the Alliance, point at some current and future activities.

8.1 Introduction

Mostly scoped within the areas of Ambient Assisted Living (AAL) or eInclusion, we witness in the last decade many initiatives both on domestic as well as on European eleven aiming at developing ICT platforms that are used to implement scenarios for persons with special needs. Prominent motivations for these are the desire to make it possible for elderly to stay longer in their homes as in the EU funded project MonAMI [60], live an independent life as elderly citizens as in the German project SmartSenior [62] or at an extreme make possible for paralyzed persons to interact with their environment via Brain Computer Interfaces (BCI) as in the EU funded FP7 project Brainable, see [63].

In the EU-funded project i2home[59], we answered the question how to make interaction with ICT in general accessible for everyone by implementing the Universal Remote Console (URC) standard. In the course of the project an improved version of URC was standardized under ISO/IEC 24752 [58].

Following a user-centered design methodology [56, 57], the i2home project developed, implemented and evaluated different user interfaces for four user groups: persons suffering from mild Alzheimers disease, young persons with mild cognitive impairments, elderly and partially-sighted and blind persons.

8.1.1 The Two URC USPs

One intuitive view point of the URC technology is the middleware approach called Universal Remote Console (UCH) as depicted in figure 7. In line with many other middleware solutions, the UCH includes the heterogeneous appliances and services (targets) and display them as abstract user interfaces (Socket Layer in the figure). A socket is an abstract description of the input/output behavior of the target.

[1] This work has been partially funded by the European Commission under the grant FP6-033502 (i2home) and FP6-030600 (VITAL), the Saarland funded SensHome project, the BMBF funded project SmartSenior and by the National Institute on Disability and Rehabilitation Research (NIDRR) US Dept of Education grant # H133E090001/ H133E080022 to the Trace R&D Center, University of Wisconsin- Madison. The opinions herein are those of the author and not necessarily those of the funding agencies.

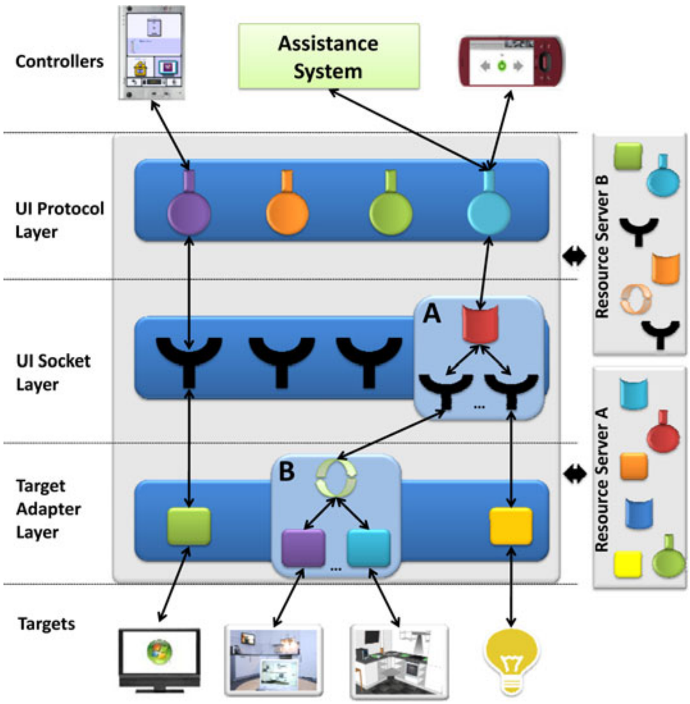

Fig. 7. The URC framework with its different layers (from the bottom): Target Adaptor Layer, Socket Layer, UI Protocol Layer. In the figure, two additional plugin extensions are depicted: A) A CEA-2018-based Task-Model Engine; B) A Synchronization Module used for implementing synchronized scenarios.

URC does not pose any requirements on the targets other than being controllable over a network. Currently, UCHs can interact with UPnP devices, ENOCEAN, WSDL services, ZigBEE, bluetooth just name a few technologies. User interfaces ranges from simple automatically generated HTML pages, accessible HTML pages, flash-based UIs, multimodal speech- and gestures-based UIs (on iPhones, Android phones, ...), TV-based, etc. have been used in diverse scenarios, like comfort, security, information services, peer-to-peer gaming within the Smart Homes, i2home implementations of the URC approach additionally allow for plugins, e.g., a CEA 2018 task model engine, e.g., [65] which can be used to combine services forming compositions thereof.

Apart from the separation of concerns which allow user interface developers to focus on the development of user interfaces rather than technical issues, there are two unique selling propositions of the URC technology not present in most other frameworks:

– *Pluggable user interfaces* meaning that there is a clear separation between the appliances and services on the one hand and the user interfaces on the other. With this approach it is possible to dynamically replace UIs with the same functionality.We strongly believe that this approach should be incorporated into ICT in general since it provides the necessary ingredients for personal and thus potentially accessible user interfaces.

– *Resource Servers* A resource necessary for connecting a target with a UI is available via resource servers. In the last years, special forms of this concept has been instantiated by, for instance, Apple with its app store. The URC approach, however, allows sharing arbitrary resources necessary for connecting a target with a user. Also, a UCH can interact with several resource servers thus allowing providers to maintain their own resources on own resource servers

8.2 Injecting the URC Ecosystem

During the course of the project, i2home provided parallel running EU-funded projects, such as, the VITAL [61] and MonAMI [60] projects with access to the URC implementation. In fact, MonAMI's field trials (50 flats) include the i2home URC implementation. But also industry has started showing interest in the URC technology and so at this year's CEBIT, German Telekom demonstrated a scenario where the URC technology serves as a middleware (in the cloud) for three different UIs (in car, PC-based and mobile-phone based) within a traveling scenario. In addition to India and the US, we also observe an adoption within academic research in Australia. Accumulated, we count projects using URC technology with about 100 partners and EURO 80 Mi, see figure 8.

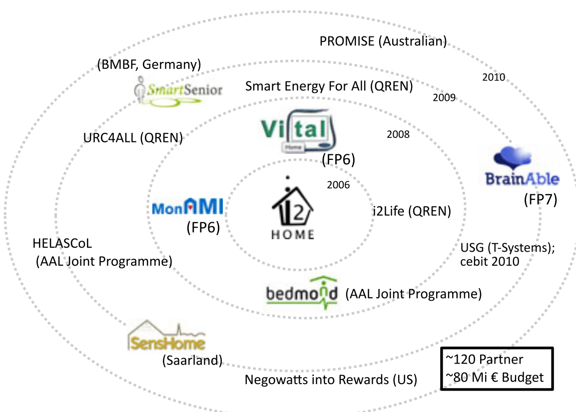

Fig. 8. International projects using URC technology

This has encouraged us to form the international OpenURC Alliance, see http://www.openurc.org as an international platform for fostering the ecosystem that will be necessary for further the knowledge about and usage of the URC technology. The OpenURC Alliance provides a meeting place for different stakeholders interested in this technology.

Currently we are investigating what role the URC approach can play in the AALOA[2] initiative and the UniversAAL project, see [64].

8.3 Structure and Timeline of the OpenURC Alliance

At the time of writing, the OpenURC Alliance consists of three Committees:

- **Governance.** Here, the work consists of structuring the alliance as a whole. Also, work include the writing of membership rules and By-Laws.
- **Marketing.** This committee develops material for presentation and marketing, organizes presentations at conferences and fares.
- **Technical.** The technical committee further the URC technology by producing technical documents and perform standardization work. This committee maintains open-source reference implementations and technical documentation.

We are currently developing a fourth committee called the User Committee whose purpose it is to add to the alliance the perspective of the users, such as ethical considerations and how to execute user-centered design for persons with special needs, e.g., within gerontological scenarios.

8.3.1 Time line

The OpenURC is already up and functioning as an ad hoc group. We are targeting a launch of the OpenURC Alliance as a legal body in 2010-11 timeframe. The launch of a new web site is planned for early 2011. In the meantime we continue to use the current http://myurc.org web site of the current Universal Remote Console Consortium, which will fold into the new OpenURC Alliance.

8.4 Conclusion and Outlook

We have argued and showed that the Universal Remote Console approach should play a role in any framework that takes accessibility seriously in the area of ICT. The URC approach provides an open standards-based fundamental functionality for any framework or platform where the diversity of users are to be supported and where accessibility is addressed. In order to provide a platform for different stakeholders within the AAL community to communicate and collaborate in this area, we are starting the OpenURC Alliance. The Alliance will provide a meeting place for providing information about the URC, exchanging ideas, meeting other stakeholders interested in the URC technology and, finally, manage open source resources.

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