Track F
Technology, Platforms, Standards, Interoperability

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Abstract

As a multidisciplinary technological approach, AAL involves (too) many different standards at diverse levels of hardware, software (architectures and interfaces), processes and services, data and content, etc. Considering that even simple sensors and actuators from a single domain are not interoperable by themselves, it should be obvious that the complexity increases dramatically when several different domains, such as health, well-being, comfort, entertainment, home automation, and energy efficiency, are considered in a combined way for creating AAL applications and services. Hence, Track F was organized to investigate two closely related questions: the role of standards and platforms in coping with the challenge of interoperability in AAL as well as the obstacles to their wider adoption by technology providers.

Since neither the creation of AAL platforms nor the development of related standards is in the focus of the AAL Joint Programme per se, it was expected that this track would play a bridging role between AAL JP, on one side, and the more long-term industrial activities towards standards as well as the strategic research on AAL platforms in the context of the Framework Programmes of the European Commision, on the other side.

Consequently, Track F was organized in four preparatory sessions for looking at the standardization and platform scene and collecting views on obstacles and possible strategies for overcoming them. In a fifth session, this track finished its work by a panel discussion for summing up the collected info and making recommendations to the AAL community and its Joint Programme.

Track Chairs: Saied Tazari (Fraunhofer IGD), Ad van Berlo (Smart Homes), Peter Wintlev-Jensen (European Commission)

F1. Technical standards for AAL: Achievements and obstacles

Session Chair: Michael Strübin, Continua Health Alliance

In the spirit of the main question in Track F, the presentations in this session (cf. Table 1) introduced different standardization efforts related to AAL. They provided an overview of the specific fields of activity and the important achievements to date, while addressing any obstacles encountered on the way of wider adoption in RTD.

The presentations and the discussions in this session showed that the number of standards relevant for the realization of the different AAL use cases is indeed very high, many of them even competing with each other in the sense of dealing with the same (or very similar types of) problems. For this reason, the strategy of the Continua Health Alliance, according to which no new standards are

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developed but appropriate ones selected and promoted, was estimated as a very suitable pragmatic approach.

Table 1: Overview of the presentations in Session F1

Title	Presenter	Summary / Conclusions
The AAL Standardization Scene	Luca Odetti from FATRONIK-Tecnalia (Italy) representing the AALIANCE project (www.aaliance.eu)	The AAL Standardization aims at facilitating interoperable systems beyond singleton special-purpose solutions and across several domains (not only health but also assistance, social integration, safety, etc.). In addition to connectivity / protocols, important standardization areas are: self-organization, standard messaging formats across all sub-domains, and semantic interoperability based on standard ontologies for understanding message contents.
The Role of CEN TC251 / WGIV in Interoperability Standards for Health	Thomas Norgall from Fraunhofer AAL Alliance / Fraunhofer IIS (Germany) representing CEN TC251 / WGIV (www.cs.tut.fi/sgn/wgiv/)	The history of developments on interoperability of medical devices (functionality, settings, measured data and alert information, remote control, patient information, etc.) towards ISO/IEEE 11073 health standards.
Introduction to HL7: the Health Level Seven Standards for Healthcare	Robert A. Stegwee from Capgemini Healthcare (Netherlands) representing HL7 International Council (www.hl7.org)	An overview of healthcare-related standards at the level seven of the ISO/OSI reference model, hence enabling the sharing and re-use of healthcare information (e.g., clinical trials, research, administrative, financial, resource utilization, public health, and supply chain) using messaging and clinical documents, and services and providing functional models to ensure interaction
Continua Health Alliance – The Next Generation of Personal Telehealth is Here	Rick Cnossen from Intel Corporation (USA) representing Continua Health Alliance (www.continuaalliance.org)	An introduction to the Continua Health Alliance emphasizing its trade-off policy (e.g., simplicity ↔ complexity, international ↔ regional, expediency ↔ additional capability, interoperability ↔ flexibility, guidelines ↔ standards) and its work on an end-to-end architecture that helps to choose certain industry standards with a focus on individuals.
Open Health Tools (OHT)	Stefan Ohlsson from IBM Nordic (Sweden) representing Open Health Tools (www.openhealthtools.org)	OHT is an open source community of healthcare providers, related standardization bodies, and related vendors aiming that users have increasingly better and affordable access to (and use of) comprehensive health information. OHT implements recognized industry standards and best practices as open software in order to facilitate their uptake, on one hand, and provide feedback to SDOs, on the other hand.

From another perspective, the presentations in this session were classified according to the different dimensions of standardization: CEN and HL7 are defining standards, Continua is about using them, OHT provides open implementations for them, and the Continua guidelines "constrain" them by defining styles of using them. The two last dimensions (open source implementation and constraining guidelines) can be seen as the right work to achieve more pragmatic and widespread adoption of standards.

Finally, it is worth mentioning that despite the health-related focus of the presentations in this session – that helped to gain a process view on the different dimensions of standardization – the recommendation by the AALIANCE project in the first presentation (not to leave the other AAL-related domains orphans) was acknowledged as very important (see Table 1).

F2. Major AAL platform projects: achievements and obstacles – part 1

F3. Major AAL platform projects: achievements and obstacles – part 2

Session Chair: Sergio Guillen, ITACA @ Universidad Politécnica de Valencia

As a matter of fact, standards concentrate on very specific problems so that no single standard can handle the whole interoperability issue in such highly distributed and heterogeneous environments as smart homes for providing ambient assistance. Consequently, additional means are needed that provide holistic support for the development of AAL applications. AAL platforms are supposed to take such a holistic approach. Hence, the presentations in these two sessions (see Table 2) were dedicated to the major platform projects of the Framework Programmes of the European Commission in order to examine how the AAL Joint Programme can use and transfer experience from them. The presenters were requested to not only give an overview of the exploitable results from their projects but also discuss how the effective transfer of results could work and which barriers the projects see in this transfer.

Table 2: Overview of the presentations in the Sessions F2 and F3

Title	Presenter	Summary / Conclusions
Benefits of platform-based approaches for AAL (an initial motivating presentation)	Reiner Wichert from Fraunhofer IGD (Germany) representing Fraunhofer AAL Alliance (aal.fraunhofer.de)	The lack of business models for AAL was traced back to the problem of interoperability that causes vendors to provide only isolated packaged solutions for specific problems which in turn leads to higher costs for end users. Platforms usually map several "low-level" interoperability standards to a unifying high-level interoperability solution and hence reduce costs by facilitating resource sharing across several packaged solutions and by eliminating the need for separate maintenance contracts for each isolated package.
The HYDRA Project	Atta Badii from University of Reading (UK) and Mario Hoffman from Fraunhofer SIT (Germany) representing the HYDRA project (www.hydramiddleware.eu)	HYDRA has created an open source middleware for intelligent networked embedded systems that enables secure semantic interoperability of heterogeneous embedded devices distributed in smart environments. The project also provides several tools that account for ease of use. It is being used in successor projects as the underlying platform. Hence, the strategy for promoting project results includes the open source approach, tooling, and enlarging the community through successor projects.
i2home	Jan Alexandersson from DFKI GmbH (Germany) representing the i2home project (www.i2home.org)	i2home realizes a unified model (based on URC – the ISO/IEC 24752 standard called Universal Remote Console) for creating user interfaces for accessing distributed capabilities made available through a network, with a focus on home environments. The implemented middleware is being used in successor projects as the underlying platform. An international consortium of companies has been established (openURC) that commits to the promotion of the URC standard based on the i2home outcomes. One of the running action points in the successor projects is about tooling.
Netcarity – Ambient Technology to Support Older People at Home	Petr Křemen from Czech Technical University in Prague representing the Netcarity project (www.netcarity.org)	Netcarity develops an end-to-end HW/SW infrastructure supporting delivery of social, health, protection and entertainment services to homes of older people involving also service centres, family members, and acquaintances. An important feature of the solution is its support for privacy protection based on the P3P standard of W3C.
MPOWER – Challenges and Opportunities	Sten Hanke from the Austrian Institute of Technology (AIT) representing the MPOWER project	MPOWER has created a middleware platform for the development of smart home systems by encapsulating services through SOA architecture, based on model-driven development and using standards, such as ISO/IEEE 11073 and HL7, the

	(www.sintef.no/mpower)	SOA4HL7 methodology, the IBM SOA reference architecture, and the IBM software service UML profile. The project results have been made available as open source. A lightweight community building approach is being followed up through Sourceforge for further development but the main exploitation strategy relates to acting as an input project for univerAAL.
Major AAL Platform Projects – The OASIS case	Pilar Sala from ITACA-TSB (Spain) representing the OASIS project (www.oasis-project.eu)	OASIS aims at providing a Common Ontology Framework that makes it possible to define a Hyper-Ontology, which can be stored, accessed, and maintained within an Ontology Repository. Additionally, a Concept Anchoring and Alignment Tool is supposed to facilitate the integration of external Web services. The interoperability between services that use different ontologies is ensured by support for ontology mapping. OASIS has joined the community building efforts started by PERSONA and universAAL and is currently one of the eight projects supporting AALOA. It is also an official input project for universAAL.
PERSONA: AmI distributed platform for the delivery of AAL Services	Juan Pablo Lázaro Ramos from ITACA-TSB (Spain) representing the PERSONA project (www.aal-persona.org)	PERSONA treats an AAL Space as an open distributed self-organizing system that evolves over time according to individual needs as they arise. Consequently, it abstracts an AAL Space as a dynamic ensemble of networked nodes and provides a distributed middleware solution for discovery of such nodes and exchange of messages between them while hiding the distribution and heterogeneity. On top of this communication middleware, support is provided for context-awareness, service-based interoperability, adaptive user interaction, and integration of special-purpose devices. This whole framework has been made available under the Apache License 2.0. PERSONA was an initiator of AALOA and has provided its software to it for any further development. It is also an official input project for universAAL. Lack of development tools and the extreme openness of the platform (with its highly generalized approach that treats AAL Spaces as ecosystems of independently developed HW and SW components) were seen as possible barriers for the adoption of PERSONA software.

To summarize, different strategies are followed up by the above projects for facilitating the usage of their respective platforms: providing the software as open source possibly with permissive licenses, broadening the developer base by reusing the platform in new projects with new consortia, providing development support especially via development tools, and ensuring maintenance and improvement either by continuing the work on them in new projects or by building communities that take over the further development. What seems to be an obstacle on the way of wider adoption is the lack of consensus building processes that help to reduce the number of parallel solutions to just few basic ones, quite similar to the operating system market. Therefore, it was recommended that the AAL Joint Programme should encourage the usage of existing platforms in its Calls so that no money is spent to redo things already done, on one hand, and speed up consensus building in this important ground work, on the other hand.

F4. universAAL – Consolidation, Open Source, & Community Building

Session Chair: Reiner Wichert, Fraunhofer AAL Alliance c/o Fraunhofer IGD

As shown in the sessions F2 and F3, the production of software infrastructures supporting AAL has been the core topic of a number of EU projects. The legacy of these projects should not be allowed to die after the end of the projects; rather, their further maturation should be promoted and supported. With the goal to achieve this, universAAL, an FP7 project started in February 2010, is applying different processes and tools: A consolidation process of existing architectural designs in order to converge to a common reference architecture; an open source reference implementation of a consolidated platform with permissive licenses (e.g., MIT and Apache License 2.0) based on such reference architecture and reusing existing software as much ass possible; and a consensus building process to be carried forward by a large community composed of representatives of AAL stakeholders. In this session, these tools and processes were introduced briefly.

Table 3: Overview of the presentations in Session F4

Title	Presenter	Summary / Conclusions
universAAL – UNIVERsal open platform and reference Specification for AAL	Joe Gorman from SINTEF ICT (Norway) coordinator of the universAAL project (www.universaal.org)	An overview of the objectives, results and planned approach of the universAAL project was provided. universAAL is an EU-funded project which aims to consolidate earlier research results in AAL, and to develop a standardized approach to developing AAL services. It started in February 2010 and will run for four years. The project will provide a reference architecture for AAL, and run-time support as well as support for developers. Adoption of these results as a standard approach is of crucial importance in the project, and to that end the project includes activities aimed at community building: to gather together people involved in this area, and make sure their needs and opinions are included in the platform being developed.
Consolidation: The technical challenge in universAAL	Saied Tazari from Fraunhofer IGD (Germany) responsible for the implementation of the universAAL platform	As probably the last AAL platform project with EU-IST funding, a major goal of universAAL is the provision of an open and scalable technological platform that facilitates the development and deployment of a broad range of AAL services. The main approach to achieve this is the consolidation of the state-of-the-art results from both existing standards and existing projects and initiatives and incorporating them into the design and implementation of the universAAL platform. In this talk, the applied consolidation methods in the different stages, such as use case and requirements specification, architectural design, and implementation, were reviewed. Furthermore, the achievements so far and the further plans as well as the engineering challenges linked with the chosen approach of consolidation were reported. The main focus in the presentation of the achievements was on the first versions of a reference model for AAL and a component and a distribution view on the architecture of AAL Spaces.
AALOA – The AAL Open Association	Francesco Furfari from CNR-ISTI (Italy), the first signatory of the AALOA (www.aaloa.org) manifesto (www.aaloa.org/manifesto)	Described the ongoing initiative of founding an AAL Open Association that is supported by an increasing number of European projects: BRAID, MonAmI, OASIS, OSAmI-Commons, PERSONA, SOPRANO, universAAL, and WASP. The mission of AALOA is to create a shared open framework for developers, technology and service providers, research institutions and end-user associations to discuss, design, develop, evaluate and standardize a common service platform in the field of Ambient Assisted Living. Rationale and purposes of the association were presented together with the roadmap for the next years.
EvAAL – Evaluating	Stefano Chessa from CNR-	Evaluation of AAL systems is particularly challenging due to

AAL Systems Through Competitive Benchmarking	ISTI (Italy) representing the Steering Board of EvAAL (evaal.aaloa.org)	the complexity of such systems and to the variety of solutions adopted and services offered. This problem is clearly related to the evaluation of pervasive and ubiquitous systems that has been the focus of many researchers in the recent years and that still awaits solutions. On the other hand, analyzing and comparing AAL solutions is paramount for the assessment of the research results in this area. EvAAL (Evaluating AAL Systems Through Competitive Benchmarking) is a recently established international competition that aims to address this problem in order to let benchmarking and comparison methodologies of AAL systems emerge from the experience. This talk described the framework under which EvAAL operates and presented the EvAAL objectives, strategy and organization.

F5. Concluding Discussions

Session Chairs: Joe Gorman (SINTEF ICT) and Ad van Berlo (Smart Homes)

The idea was to use this session to further discuss the issues addressed in the previous four sessions (the chairs of this session, as the moderators of the discussions, were responsible to gather them all) and argue to which extent the universAAL approach introduced in F4 could be promising for coping with the challenges addressed in F1 to F3; which advices can be given to universAAL on its way towards its goals; and, which complementary arrangements could be added to the agenda of EU-IST Framework Programmes and the AAL Joint Programme.

For the sake of well-organized discussions and better time management, a panel was organized which was formed from:

- Niels Boye, AAL Joint Programme Central Management Unit
- Sergio Guillen, ITACA @ Universidad Politécnica de Valencia
- Gaby Lenhart, Senior Research Officer, ETSI
- Mário Romão, Continua Health Alliance c/o Intel Corporation
- Reiner Wichert, Fraunhofer AAL Alliance c/o Fraunhofer IGD
- Peter Wintlev-Jensen, Head of Sector, European Commission

The session chairs had gathered 21 concrete questions from the sessions F1 to F3. Due to time limitations, however, the panellists had to choose one specific question from among 21. In the following, some recorded statements are summarized.

Mr. Boye had an analysis of AAL in the health-related market and criticized that currently AAL is often being associated only with very old people who suffer from some diseases; but the truth is that the treatment of diseases is a specialized matter and the corresponding market is already occupied by telemedicine solutions. The consequence is that only a small market niche remains (elderly in the beginning phases of getting health-related problems) that is hard to penetrate due to low level of demand. Hence, the recommendation is that in health-related issues AAL should widen its scope to include aspects related to prevention and life style, on one hand, and chronic disease management, on the other hand. In both cases, it is also possible to attract younger people and probably eliminate age-related boundaries for AAL.

Mr. Guillen questioned the supposed “vision” as if in future people would go to the market to buy sensor nodes. Sensors become meaningful only in the context of a more comprehensive service that provides people with something of value concretely demanded. This is the other side of the coin compared to the idea of separating the applied usage of data from the device providing the data. It is true that if this separation takes place, the same device can be used in the realization of several different services which has benefits for both the producer (more copies of the same product can be sold) and the consumer (resource sharing and hence cost reduction). However, end users might not be able to imagine the value of the device per se if it is not associated with an application. For this reason, service delivery packages must be built in which devices are optional items and must be bought only if you haven’t acquired a similar device in the context of another service delivery package before.

Ms. Lenhart took standardization in energy efficiency as an example and stated that even if such specific standardization efforts might seem to proceed faster, they do not affect the opportunities for AAL negatively. AAL should make use of synergies. However, the reality is that currently the interoperability problems resist and working service packages still have to rely on proprietary solutions, even if individual parts might rely on certain standard protocols, such as ZigBee or KNX. She also emphasized that in parallel to technical work on solving the problem of interoperability with the help of technical standards and platforms, special attention should be paid to user acceptance as the average citizens might not be so much excited about technology as assumed by the engineers.

Mr. Romão advocated the policy of the Continua Health alliance in creating guidelines supported by a large number of companies with regard to the promotion of certain standards because of two reasons: firstly, there are a lot of competing standards and it might be difficult to pick the “right” one; secondly, many of the standards are just too diverse and flexible. Guidelines do not replace standards, they narrow down and define working sets that have been tested in plug fests. Another point that should be highlighted is that Continua started from very specific needs, very specific use cases. A use case is as simple as a blood pressure gauge sending data out to somewhere else. He suggested that universAAL should also follow this successful strategy by working on the basis of simple use cases. Similarly, universAAL should involve much of industry, especially big players, just like Continua did, in order to speed up the process of reaching the critical mass. Last but not least, universAAL should try to find the right balance between prescription, on one hand, and flexibility, on the other hand, both in the specification of the reference architecture and in the realization of the platform in order to allow for creativity, innovation and competition.

Mr. Wichert stressed that although a platform approach helps to reduce costs, e.g. by facilitating resource sharing for different applications, but it is not enough for the market penetration. We also need to distribute the costs over the time. People, irrespective the age, do spend some money for safety, comfort, fun, and luxury; if AAL platforms are flexible enough and support evolve-ability of AAL systems, each individual could start with investments in his/her own AAL system already in younger ages according to his/her own needs, preferences, and financial power. Energy efficiency is one of the domains with connections to AAL and it is possible to wow people for it regardless of age. It’s simply “cool” for younger people to live in a smart home and hence they will also spend money for it. Here, the construction industry is starting to make all building installations controllable through programming interfaces. Open platforms can help to speed up this process; if they solve the interoperability problem at a semantic level and support evolve-ability, then the costs

can be distributed over time and application. Other financing mechanisms can then facilitate this process, e.g. conditional reduction of insurance fee and taxes. Sometimes, like in case of energy efficiency, over time you might even save more money than you invest. So, my motto is (1) certain platform approaches and based on that (2) breaking out of the restrictions, such as age and health.

Also Mr. Wintlev talked much about the importance of platform approaches for AAL. In case of energy efficiency, for example, politicians will provide a lot of incentives for saving energy that is also an opportunity for the platform approach because we are not going to have 20 different platforms with which people cannot cope due to complexity and / or cost. Besides, a lot of the needed functionality is actually very similar, when not the same. Incidentally, starting with energy efficiency applications in younger ages in smart homes is one of the most likely scenarios for deploying AAL platforms. Another important argument in favour of platform approaches is the user interaction. Sometimes, it is difficult enough to use even the interface of one device or service. With the increase in the bunch of functionality available in networked environments, it will get crucial to provide consistent interfaces with support for hiding complexity. Adding functionality to smart homes should have some analogy to receiving yet another channel on your TV (the interface of the TV remains the same no matter how many new channels you receive). Once you have the basic cost and you have a consistent user interface that the user is able to use then it should be fairly easy to add more and more features to such a system.

In addition to UI, important challenges for AAL platforms include reliability, privacy protection, evolve-ability and adaptability. AAL technologies will really impact people's lives. The very frail people addressed by AAL have multiple needs that are changing very quickly; consequently, it must be possible to change the functionalities quickly in an easy way. In the CIP programme of the European Commission (ec.europa.eu/cip/), for example, one of the assumptions is that roughly 80% of the requirements will be the same all over Europe, but you need to be able to adapt or localize the remaining 20% to the given organizational and cultural context. Regarding reliability, if you want to put a person with hard conditions at home rather than in an intense care unit and nevertheless expect that for example the doctor takes the liability if something happens to that person, then you must at least guarantee that the system won't fail. On the other hand, it is inevitable that home care involves new actors that share information about the assisted person. Depending on the societal culture, people might react differently to this fact; that is, the level of sensibility with regard to privacy protection might differ significantly. Also for solving ethical issues, the system should have the flexibility for adaptation.

Concerning open source, Mr. Wintlev ranked it as a kind of intermediate step to get to a platform because a single company will hardly be able to develop an AAL platform in midterm. Through an open source approach, in first place the knowledge will be captured, which is very important for the EC because it is not acceptable any more to fund projects that spend about 60-70% of the project resources just to get to a common level in order to be able to start with the project-specific add-on. This is a repeating pattern; every project does exactly the same things, even the same mistakes. Therefore, capturing the knowledge is very important, the same as with Linux: you don't develop an operating system every time you want to use a computer, and the operating system captures the good knowledge and the experience so that you can concentrate on your specific solutions.

In the end, the participants agreed that at least a summary of these discussions is published on the AALOA Web site.