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1st workshop on standards and certifications in AAL

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Executive summary

On February 12th 2013, the AALIANCE2 workshop on standards and certifications in AAL took place in Frankfurt/Main, Germany, with 28 experts attending. In ten discussion groups on enabling technologies and cross-cutting topics the standards landscape and future development were discussed, the basis was the online repository of standards set up by the AALIANCE2 consortium. Apart from comments on missing standards and incomplete descriptions in the repository, central outcomes are:

- *Extending standards to AAL*: Some standards like EN 50134 (Social alarm systems), IEC 80001 (Application of risk management for IT networks incorporating medical devices) and the ISO/IEEE 11073 family of standards (medical/health communication) should be extended to an AAL context.
- *New standards needed*: Some fields were identified having no appropriate standards yet like indoor localization, privacy policies in residential gateways and AAL ontology that can be used in the reasoning components of AAL devices.
- *Standard high-level architecture*: this includes describing use-cases, interfaces, and system components leading to standardized reference architecture for AAL middleware (including APIs).
- *International standardization:* In general, standardization for the AAL sector should take place on European or international level, not on a national level.
- *Better integration of research communities:* Many activities relevant to AAL happen in other research areas (Smart Metering, Internet of Things). Interaction between these areas and AAL should be enforced.
- *Better access to and better knowledge about standards and standardization:* Access to standards and participation in standardisation activities is quite often very expensive and unaffordable by research projects. Access and participation at reduced rates are recommended as well as an implementation of a separate AAL category in the ICS (International Classification of Standards).
- *Integration profiles:* The development of use-case based integration profiles (similar to IHE, Continua and others) and appropriate organisational structures was recommended to accelerate interoperability and include industry, research and users.
- *Quality labelling and certification:* Quality labelling programmes for AAL systems should be established on European or international level to increase the market acceptance and visibility of AAL products and services.
- *Large scale pilots* will be needed to assess the maturity of the various middleware solutions and runtime environments for AAL systems such as universAAL, Persona, Embassi etc. The "REAAL" project, which aims at equipping 7,000 apartments in Europe with universAAL-based technology, is certainly a good example.
- *Reconfigurable user interfaces* are recommended to satisfy the specific needs of different groups of users (e. g. with reduced eye-sight, hearing or fine motor skills). Already existing standards on user interfaces and accessibility should be considered.

1 Introduction

One of the AALIANCE2 project's main objectives is to build consensus upon upcoming research priorities, standardization and certification needs in the AAL sector, to be published in the AALIANCE2 AAL Roadmap and Strategic Research Agenda. As a first step the project consortium set up an online repository with a collection of standards (see Deliverable D4.1: "Online Repository of existing standards and certifications in AAL and related areas for the R&D community – snapshot" and the online version of the repository available from http://nero.offis.de/projects/aaliance2/start). Some third-party comments on the repository of standards were gathered between the finalisation and distribution of D4.1 and the beginning of the workshop – these will be followed-up in the repository, but are not reflected in this report.

The 1st workshop on standards and certifications in AAL (likewise the 3rd stakeholder workshop conducted by the AALIANCE2 network) focussed on the topics of standardization and certification in the field of Ambient Assisted Living (AAL). The workshop on one hand reviewed the existing landscape of standards relevant for AAL as documented by AALIANCE2 and on the other hand discussed future needs in terms of new standards, certification programmes and organizational structures for promoting interoperability in the AAL sector.

The first session of discussion groups discussed the existing standards landscape relevant to the AAL sector, ordered by the five AAL enabling technologies: Sensing, Reasoning, Acting, Interacting (human-to-machine) and Communicating (machine-to-machine). The repository of standards established by the AALIANCE2 project was the basis for this discussion. Participants identified gaps in the standards landscape, shortcomings in existing standards and upcoming developments of relevance for standardization in the AAL field.

The second session of discussion groups discussed cross-cutting topics related to standardization and certification in the field of AAL: Integration Profiles, Process Standards (Quality management, service standards, business model standards etc.), Certification Programmes, Standards for Middleware Platforms and Accessibility.

The workshop primarily addressed experts in the field of standards of relevance for AAL (such as home automation, medical devices, telecare, consumer electronics, etc.) on national or international level (e. g. CEN/CENELEC or ISO/IEC) as well as well as AAL technology developers and industrial and academic researchers. 28 experts participated to the workshop, which took place at Frankfurt/Main (Germany) on February 12th, 2013.

2 Discussion Groups #1

This chapter contains the results from the discussion groups on the existing standards landscape relevant to the AAL sector, ordered by the five AAL enabling technologies: Sensing, Reasoning, Acting, Interacting (human-to-machine), and Communicating (machine-to-machine).

2.1 Sensing

2.1.1 Gaps
The expert group missed the following existing relevant AAL standard in the repository of standards: In the context of indoor localisation, there's a new approach in architecture for building plans where all information is integrated in one model for all stakeholders. The term is "building information models". Working as ISO 16739 "Industry Foundation Classes", the standard intends to support buildings over its whole lifecycle.

Furthermore, it was recommended to create cross-references concerning sensors that communicate using KNX, EIB, and ZigBee.

Moreover, the experts suggested that ISO IEEE 11073 should be a subgroup of sensors on the same level as Safety.

Finally, it was said that the description of standard EN 50134 was incomplete, compare "EN 50134: Alarm systems - Social alarm systems" in the following page:
http://nero.offis.de/projects/aaliance2/en_50130.

2.1.2 Shortcomings

The group of experts in sensing technologies detected some shortcomings, i.e. standards that needed to be adapted or extended for AAL.

One potential gap is related to indoor localisation. There are no standards, but indoor localisation is a barrier

- Wi-Fi – Skyhook, Cisco MSE, Insiteo's indoor GNSS
- CellID – Navizon (private), Opencellid (crowd sourced)
- In-location alliance is a special interest group on accurate mobile indoor positioning with over 22 members founded in August 2012.

Location of sensors in the building may become relevant as AAL develops. For instance, having several sensors along a corridor that monitor the time needed to pass it can be used as an indicator of Alzheimer's disease.

A feature proposal concerned EN 50134 Personal Alarm systems (Parts 1-7), in particular the system requirements. An abstraction layer for aggregation of data is missing, e.g. from single sensors. Furthermore, aspects of semantics are missing. In spite of much interest from potential users and the research community, the cost for mass deployment is too high. Moreover, there are no standards for tracking (e.g. for human motion systems) for the provision of feedback of how the user performs, even though there are new devices like the *Kinect*. Finally, the system does not "understand" concepts like where the bedroom is, where the user is etc.

Another comment on EN 50134 was that this standard was focused on care and did not address health issues. It was suggested to create a new sub-section to address AAL issues, which could describe the combination of care, health and home devices.

Another feature proposal was regarding self-localisation and navigation of robots (the robots should share their localisation). For instance, if a laser scan was needed, the scan should be associated with the building or resident and not the device. This would allow the scan to be used by several devices (rights management and privacy need to be considered in this context).

A third feature proposal was about a standard for interference monitoring in the home (which should be addressed by the Communication group in this Workshop), because peripheral devices communicating over Bluetooth, ZigBee or Wi-Fi might affect the transmission quality of other devices.

The standard IEC 80001 about Medical products in an IT network should be adapted for AAL.

Concerning privacy and security standards, ISO/IEC 10181 does not sufficiently address AAL issues.

An open question concerned standard for access rights, in particular AAA (authentication, authorization and accounting) standards for Electronic Health Records (EHR). There is probably no standard that addresses access rights to which type of function has which access right.

Identification and authentication standards must be checked if they are complete and existing standards might be adapted to AAL, because roles and rights have to be assigned

to the multiple stakeholders (which is a typical feature of AAL that there are many stakeholders involved), i.e. older people, family members, nurses, caregivers, homeowners) to decide who is accountable for what, and there must be a chain of communication of accounting data.

The accident reporting system *eCall* must be implemented in every new car by 2015. GST (Global System for Telematics) is a European initiative that should be adaptable for AAL.

There are shortcomings in standards for home appliances (oven, heating etc.). Even though there are agreements within some white-good manufacturers (e.g. the user can switch an oven remotely off, but not on), there was the question if this was already addressed in the wiki of AALIANCE2 about standards; there are some organisations on EU level which are working on standards on CECED and CENELEC and that adopt EN standards and do profiling for EU markets. One active example is the Working Group ISO/IEC JTC 1/SC 25/WG 1 that produces standards for Home electronic systems.

2.1.3 Outlook
There are some developments of relevance for standardization in sensing technologies, e.g. the work of BSI (*Bundesamt für Sicherheit in der Informationstechnik*, "*Schutzprofile*"), which is an institution that writes legal documents in Germany.

One trend that was seen by the experts was the work on replaceability e.g. for motion tracking and body posture, which affects sensing and reasoning ("local reasoning" or low level reasoning).

Furthermore, in the context of abstraction layers, there is a movement inside industry (e.g. OneM2M) to broaden requirements for machine-to-machine communication for AAL applications as well as backend processing and communication in-between.

Finally, it was observed that Continua Health Alliance was moving towards AAL. Therefore it was suggested that IEC should take some parts of Continua Health Alliance into their standards.

2.2   Reasoning

During the session about Reasoning, there was a discussion that started from the topic-questions suggested by AALIANCE2 promoters but that during the time evolved in a free debate about personal experiences and opinions about standardisation in AAL.

2.2.1 Gaps
Gaps: Are there standards of relevance for AAL that are missing in the repository of standards?

Analysing the list of standards identified for the area of "Reasoning" came out that there are gaps in the repository because there are more top-items missing.

2.2.2 Shortcomings
Shortcomings: Which of these standards need to be adapted/extended for AAL, and in which form? Which ones should be simplified or withdrawn?

Looking to the standards of the AALIANCE2 repository, the ISO/IEEE 11073 "Health informatics - Medical / health device communication standards", that currently focuses only medical and health devices for tele-monitoring, should be extended and completed considering the case of AAL technologies. This consideration is born from the idea that AAL

services integrate the tools for the care of elderly health but also systems supporting the senior persons in daily activities, so these standards should evolve including also the AAL aspects.

2.2.3 Outlook

Outlook: Which developments of relevance for standardization in this field are happening or do you foresee?

Thinking to this question, the group members agreed that there are not so relevant developments in standardization about AAL and in particular about reasoning aspects however emerged that several aspect should be faced and solved in order to arrive to standardisation and certification of AAL technologies, and in particular were discussed:

- The need for harmonization at European level between standards of each country, in order to allow industries and service providers to design tools able to work everywhere and satisfying regulations and policies of all European countries.
- Need of a common ontology for developing the reasoning components of AAL devices.
- Missing a smart "AAL-gateway-manager" able to manage information coming from AAL devices using different communication approaches (Bluetooth, ZigBee, etc.) and to interpret these data in order to recognize the probable event and /or context generating them.
- Need of standard/guideline for designing AAL devices and services in security and avoiding failures (a sort of "guidelines for dependable AAL systems").

2.3   Acting

2.3.1 Gaps

Gaps: Are there standards of relevance for AAL that are missing in the repository of standards?

The participants of the Acting Group did not find any particular gap in the AALIANCE2 repository of standards for Ambient Assisted Living. The Standard EN50134 was mentioned as a possible standard for acting enabling technologies, but the group soon realized that this standard was already included in the repository under the "Privacy and Security; Alarm Systems". It was highlighted that in the home automation field, there could be a gap of standards for actuators and any physical device that could operate on the house's components, i.e. system for opening windows, furniture's doors, etc. (see also some home automation protocols). In general the participants in this group were not so expert of some specific standards, but they had experience by a high level point of view. As a matter of fact they gave very useful recommendations and suggestions for the AAL field:

- The number of standards that could be included in the AAL field is very huge and, as consequence, AAL developers and companies could have several difficulties to access and use them in their activities of designing and producing AAL-related products and services. Therefore it would be very useful for companies to have a smart database on standards that can at least aggregate the most important standards to design and produce some particular AAL products and services.
- It would be useful to consider the EIT standards and translate and adapt them to the AAL field.

- Standardization is a key aspect that should be promoted for the development of the next H2020 plans, because it can really promote innovation and increase the AAL market and help to avoid some barriers related to standards.
- It could be useful to have a separate "AAL" category in the ICS (International Classification of Standards).

2.3.2 Shortcomings

Shortcomings: Which of these standards need to be adapted/extended for AAL, and in which form? Which ones should be simplified or withdrawn?

The first observation was that most AAL devices and systems for healthcare (clinical devices) and social care are already classified in some standards, rules and certifications. However this classification does not consider a full AAL perspective, which takes in account the changing characteristics of users and needs (pathology, place, habits, etc.). Therefore the recommendation is a tool that is able to identify and dynamically aggregate standards in a service and user centred design approach.

2.3.3 Outlook

Outlook: Which developments of relevance for standardization in this field are happening or do you foresee?

One of the most challenging scientific and technological research activities in the acting enabling technologies is the field of robotics. This could be considered at different levels, for example medical or service robotics. For medical robotics it is expected that appropriate standards will be developed in different applications, such as surgical, implantable prosthetic and rehabilitation robotic systems. It also is expected that some standards will be developed in the field of service robotics, above all in those services that could be provided in domiciliary environments for tele-medicine or tele-rehabilitation applications.

Nowadays another important scientific research topic concerns the integration of robotic systems and smart environments, which allows sharing intelligence among several agents to improve the quality of services provided to end-users. For these aspects there are not specific standards and those related to exiting standards are not appropriate to cover all developmental aspects, such as M2M with robots, etc.

2.4   Interacting

The discussion started with the general statement that it is difficult to find the appropriate standard(s) for a specific problem. There are a huge number of user interface standards available that are partly overlapping and contradictory, especially when they come from different application domains (e.g. medical – care – non-medical). The participants propose a) to consolidate overlapping or contradictory standards, and b) to produce easy-to-read guidelines and additional material (overviews, handbooks) how to choose the appropriate standard or set of standards. Finally existing standards should be used by neighbourhood domains.

Interaction flexibility and operation modes have been enhanced and enriched by mature progress in development and quality of new technologies, e. g. for gesture recognition or speech recognition. Forms and methods of interaction that are now possible, are not yet incorporated in upcoming new or existing interaction standards, in particular for physically handicapped persons.

Interaction standards should furthermore support the design concept to separate the application layer from the presentation layer. It was phrased that "the browser should do

the rendering and user interaction". Furthermore, the use of "individualized interfaces" should be reflected in standards and/or guidelines.

With respect to medical standards it was discussed that standards are still missing for the use of data from Ambient Assisted Living or Smart Home Applications for medical purposes, e. g. medical health records. Furthermore, procedures should be standardized how to check quality and accuracy of personal devices for medical purposes (e.g. a standard for check and re-calibrate "private" medical devices).

Furthermore, a standard that describes privacy policies to be implemented in new home gateways is missing with respect to features as follows:

- Service providers should have a standard or guideline a) how to describe their data privacy policies, and b) how to provide transparency on the use of the personal data of a customer, and c) how to control flow of data that leave the customer's home;
- Customers should know how to describe their privacy / security preferences, and how to display an overview on the use of his/her personal data.

Furthermore, a standard for handling of personal data in case of emergency is missing.

2.5   Communicating

While reviewing the AALIANCE2 Repository of Standards, where standards related to communication clearly comprise the largest group, the workshop participants noted that the usefulness of the repository to AAL system architects and developers could be improved by the following measures:

- The rather flat structure of the table of contents could be improved by ordering standards according to the different layers of interoperability as introduced in the opening lecture: "bit-level", "syntactical level", "semantic level". It should be noted, though, that many standards cover multiple of these levels.
- The choice of titles in the table of contents is confusing in some places, where instead of the well-known names and acronyms the official standard titles are used.

Furthermore, it would be very helpful if the repository would not only list the available standards, but actually *recommend* which standards (or stacks of communication protocols) to use which use case or application scenario. Such a "vertical view" of the standards that should be combined to address a certain use case is actually very similar to the concept of an "Integration Profile" as developed by organizations such as the Continua Health Alliance and Integrating the Healthcare Enterprise (IHE). References to these organizations and their integration profiles are actually present in the repository, but should be referenced in a more prominent way.

Finally, participants remarked that one key lesson to be learned from the repository of standards is that researchers and developers should try to refrain from developing a new standard for any field where standards already exist. Instead of producing the "big single standard that replaces them all", chances are very high that such a new standard will simply be one more entry in the list of competing standards.

2.5.1 Gaps

Gaps: Are there standards of relevance for AAL that are missing in the repository of standards?

The workshop participants identified the following standards as missing in the repository:

- *IHE Patient Care Devices PCD-01*, a specification based on the HL7 V2.6 ORU message that can be used to transmit vital parameters between IT systems and is used in the Continua Design Guidelines as the Wide Area Network (WAN) interface,

i.e. for forwarding vital data from the home environment to a backend server. Furthermore, also other IHE PCD transactions may be of relevance for AAL.

- *IHE Mobile Access to Health Documents (MHD),* an integration profile that specifies simple, HTTP-based transaction for a Restful access to a clinical document sharing environment (e. g. electronic health record).
- The specifications of project *hData* (http://www.projecthdata.org/), which are in the process of being standardized at HL7 and the Object Management Group (OMG). hData specifies a health IT exchange framework for the creation, storage, and exchange of health data that aims to be simpler than approaches like CDA and XDS.
- The *HL7 Fast Healthcare Interoperability Resources (FHIR)* specifications, a service-oriented Restful approach to exchanging health information.
- *WebRTC,* an upcoming W3C standard for web-based real-time communication including voice over IP and video.
- The *HL7 Consent Directive CDA Implementation Guide,* a structured, machine-processable document for describing a patient consent statement, and thus a competitor to the *IHE Basic Patient Privacy Consent (BPPC)* profile, which should perhaps also be mentioned.

The following minor corrections/additions were also suggested:

- The *HTTP* protocol should not be listed in the section on streaming protocols. While HTTP is the technical infrastructure for certain streaming protocols, it is not a streaming protocol as such.
- *Zigbee Home Automation* should be listed in the section "Wireless Home Automation Field Buses" and not in "(Wireless) Personal Area Networks".
- *UPnP* should also be listed in the list of home automation protocols, since it can and is used for this purpose.
- In the article describing LOINC, mention that LOINC is the terminology standard of choice for the U.S. "meaningful use" regulations.
- In the article describing ISO/IEEE 11073, mention that ISO/IEEE 11073 terminology (i.e. ISO/IEEE 11073-10101) is mandated for the description of medical device data in the U.S. "meaningful use" regulations.

Finally the participants noted that "family relationships" between standards should be shown more clearly in the repository. For example, the IHE XPHR document format is based on HL7 CCD, which again is based on HL7 CDA.

2.5.2 Shortcomings
Shortcomings: Which of these standards need to be adapted/extended for AAL, and in which form? Which ones should be simplified or withdrawn?

The workshop participants noted that discussion could only be performed on a per use-case basis, i.e. whether or not a specific standard fulfils the requirements of a certain AAL use case. The only concrete example discussed was the one already mentioned in the opening lecture, that is, that extensions to the Broadband Forum's Technical Recommendation TR 069 are needed to permit the remote maintenance of devices in the home, behind a residential gateway, over that gateway. Such an extension is, however, already under development.

2.5.3 Outlook
Outlook: Which developments of relevance for standardization in this field are happening or do you foresee?

The following developments were identified by the workshop participants:

- *DECT Ultra Low Energy (ULE):* a standard under development, with first hardware products already available. This standard is intended for the field of home automation and can be seen as a competitor to EnOcean.
- *OSGi abstraction API for home automation:* The OSGi alliance is currently working on standardizing a "device abstraction layer" in collaboration with the Home Gateway Initiative, the Broadband Forum, ETSI and the OneM2M initiative. This OSGi extension will be based on protocol adaptors and an abstraction layer with device classes, for which an abstract API will be defined, most likely also including home automation device categories. The requirements specification is currently publicly available from the OSGi website, the final specification is expected for early 2014.
- *The opening-up of residential gateways to third-party operators:* Traditionally, residential gateways are provided by a telecommunications vendor together with broadband internet access and only support services of that single vendor. This model seems to be changing, starting with the field of energy management, where services from an energy provider and telecommunications services merge. In the future it is likely that residential gateways will be able to support multiple services and vendors, given that the service quality issue (i.e. QoS guarantee with a shared device) can be appropriately addressed by virtual "partitioning" of gateways.
- *"Horizontal" communication between devices from different domains:* Today, smartphones are already communicating with home automation devices, permitting remote control of the home – a communication channel that was certainly not foreseen by either home automation or telecommunications vendors a few years ago. It is likely that further "horizontal" communication between devices that traditionally never communicated with each other will arise in the future.

Finally, participants noted that one thing that is missing today is a high-level architecture that can be used to describe different AAL use cases, interfaces, system components etc. in a way that promotes an understanding across projects, products and communities. For a "conventional" system architecture based on a central IT system (e. g. residential gateway) such as a reference architecture should be possible today, while advanced approaches based on distributed mesh architectures and semantic technology as foreseen in UniversAAL may take more time.

3 Discussion Groups #2

This chapter contains the results of the discussion groups on cross-cutting topics related to standardization and certification in the field of AAL: Integration Profiles, Process Standards (Quality management, service standards, business model standards etc.), Certification Programmes, Standards for Middleware Platforms, and Accessibility.

3.1   Integration Profiles

3.1.1 Status

Are there already standards in this field? Which ones?

The workshop participants identified the following organizations that are developing integration profiles that may be – at least in part – of relevance to the AAL community:

- The *Integrating the Healthcare Enterprise (IHE)* initiative (www.ihe.net) has since 1998 developed and published about 140 integration profiles as part of their

"technical frameworks". Most of this work is focused on the integration of IT systems within hospitals, but there are some profiles addressing the exchange of health information between health professionals or between patient and health professional. Furthermore, the IHE "Patient Care Devices" domain develops integration profiles describing how data from vital parameter sensors can be exchanged over local area or wide area networks, and these profiles may serve as "building blocks" in AAL scenarios. The most interesting integration profiles from an AAL perspective are the "XD* family" (XDS, XDR, XDM) and MHD (see section 2.5), the Patient Care Coordination document formats (in particular XPHR) and the Patient Care Devices profiles (see discussion of PCD-01 in section 2.5).

- The *Continua Health Alliance* (www.continuaalliance.org) annually publishes the Continua Design Guidelines, which can also be considered a set of integration profiles. The guidelines cover the fields of health and fitness, chronic disease management and living independently, and are thus of immediate relevance to the AAL domain. It should be noted that Continua is closely collaborating with IHE and HITSP (see below).

- The *Healthcare Information Technology Standards Panel* (HITSP, www.hitsp.org) is a U.S. specific initiative that aims at harmonizing and integrating standards that will meet clinical and business needs for sharing information among organizations and systems in the healthcare sector. HITSP publishes a comprehensive set of specifications that are freely available and, on a technical level, mostly based on the work done by IHE and Continua. The HITSP Interoperability Specifications describe many use cases and contain very useful high-level information that is mapped to requirements and, from there, to a selection of standards.

- The *Digital Living Network Alliance* (DLNA, www.dlna.org) develops interoperability profiles for multimedia applications, based on UPnP, and offers a certification program for compliant products. More than 18,000 different products have been certified, and there is an installed base of ca. 440 million certified devices. The DNLA Networked Device Interoperability Guidelines have been published as IEC 62481.

The workshop participants also discussed the topic of the upcoming *M2M (Machine to Machine)* standards, being under development at ETSI, promoted by the oneM2M initiative and other groups related to the "Internet of Things" community. The ETSI M2M specifications define a middleware ("service layer") that can be used by applications to connect to M2M enables or legacy sensors or. The M2M concept has some similarities to the architecture of the UniversAAL project, but aims at a larger scope. Nevertheless, these developments could be very relevant for the AAL community if taken up by the operating system vendors.

3.1.2 Foreseeable Developments

Which future developments do you foresee ("will happen anyway") in short-term (within 2 years), mid-term (within 5 years) and long-term (2020+)?

The participants discussed the following foreseeable developments, most of which are not directly related to the topic of integration profiles however:

- There will be a major disruption of the telecare market through the move from traditional telephony systems (POTS) to voice over IP (VoIP), which is unavoidable but reduces the reliability of current telecare (social alarm) systems that have been developed for operation over POTS. When moving from an analogue to a digital transmission medium, it makes sense for the telecare vendors to "re-think" the complete system architecture. A development in this direction is the Social Care

Alarm Internet Protocol (SCAIP) being defined in the context of the "Digital Social Alarms" project[1] of the Swedish Institute of Assistive Technology (SIAT).

- On the long term, the results of the EU Future Networks initiative[2] could be a major disruption for the field of communications.
- As societal developments, future generations of older people will be more tech-savvy and more willing and able to use technical devices (although there will always be "luddites" refusing technology that also need to be cared for). On the other hand, the cost of living is increasing while the spending power of pensioners is decreasing, which may limit the additional services pensioners will be able to afford.
- The Continua Health Alliance will increase the coverage of AAL related use cases in their Design Guidelines – many new use cases in the field of "living independently" (which is essentially Continua's term for "AAL") are currently under discussion in the Continua gremia.

3.1.3 Necessary Developments

Which further developments would be necessary (short/mid/long-term)?

The participants agreed that Europe should push for *open and publicly available specifications that are available at most available at moderate cost.* At the moment, the cost of standards and specifications is clearly a factor limiting the access to, and use of standards by the research community.

Furthermore, there is a significant lack of knowledge in the research community about the relevance of standardization for their work, how standardization works (organization, processes) and what level of openness has already been achieved today. For example, For example, all ISO and IEC working drafts and committee drafts are publicly available, and for all ISO/IEC standards a "preview" document containing the table of contents and the scope statement is freely available online, and that is often sufficient to decide whether or not a specific standard is applicable to a project. The Continua Health Alliance has started making their Design Guidelines freely available, and is planning to publish drafts for public comment of new versions of their guidelines. This lack of knowledge needs to be addressed. Researchers also need to learn and understand how research results can be brought to standardization. As one workshop participant strikingly explained: "You cannot just throw a project deliverable over the wall and hope that it will somehow become a standard". Standardization requires early contact with the relevant standards committee, an understanding of their timelines and work processes, and endurance to see a topic promoted from a concept to an agreed standard.

Finally, standards bodies and industry standard organizations such as the Continua Health Alliance need to be open for participation by researchers – often the organizational structure, required annual payments or simply travel cost make it very difficult for researchers to participate and collaborate.

3.1.4 Responsible Organisations

Which organizational structure could take responsibility for the development of AAL integration profiles?

The participants noted that setting up an organizational structure that can develop AAL integration profile, harmonize these with the AAL community, publish and maintain the specifications and perhaps even offer a certification program is a significant effort in terms

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[1] http://www.hi.se/en/Activities/Projects-Current-and-Ended-projects/Digital-Social-alarms/
[2] http://cordis.europa.eu/fp7/ict/future-networks/projects_en.html

of money, work and time, and should only be pursued if none of the existing organizations in this field are able or willing to "accommodate" the AAL community.

In particular, the Continua Health Alliance already addresses the field of "living independently" (although past versions of the design guidelines were mostly focused on health and care aspects), and many companies that are active in the AAL domain are Continua members. Furthermore, the certification and logo program already offered is an important asset. The workshop participants agreed that the Continua Health Alliance might be the best choice as an organization to develop and maintain AAL integration profiles. This may require changes in Continua's procedures, but Continua is already more and more opening up and certainly willing to discuss what is needed to "cater" for the AAL community[3].

3.2   Process Standards

It was stated that EN / ISO standards, because they are well accepted and applied in Europe, Asia and partly in Australia.

 The German Standards Institute DIN will provide a list of missing standards in the database to OFFIS to be incorporated, e.g. CEN TS 15224, application guideline of DIN ISO 9001 in medical areas. The participants proposed further to make the database publicly accessible in order to receive feedback from national and European standardization bodies.

With respect to the necessity for further standardization, the participants pointed out that End users should be made aware of relevant standards for specific applications in order to know where to look at when AAL technology and / or services will be used. European or international standards should be developed in particular where conflicting or national standards exist (in particular in the tele-health & telecare domain), and where interoperability could be improved. Overlapping standards within national regulatory domains should be at least harmonized, e.g. between medical and non-medical domains.

AAL quality labels should be established (short-term) – preferred to certification, because quality labels would provide a better market acceptance, visibility and enhance interoperability. However, quality labels should avoid any annotation of age („no ‚old people's product stick).

3.3   Certification Programmes

During this session, the discussion followed the topic-questions suggested by AALIANCE2 promoters.

3.3.1 Status

Are there already standards in this field? Which ones?

Currently the Continua Alliance is studying standardisation and certification process for devices for the tele-monitoring. The group members highlighted the necessity to define in short time the certification requirements and guidelines for both AAL technological components and AAL services.

3.3.2 Foreseeable Developments

Which future developments do you foresee ("will happen anyway") in short-term (within 2 years), mid-term (within 5 years) and long-term (2020+)?

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[3] A representative of the Continua Health Alliance participated in this discussion. Nevertheless, his opinions should not be taken as official statements of the Continua Health Alliance.

The general feeling was that maybe 5 years are still necessary to arrive to certification but it is necessary that AAL community should:

1. find an agreement about what defines "AAL";
2. promote between stakeholders the interest in providing AAL services;
3. define standards for AAL public for all.

3.3.3 Necessary Developments
Which further developments would be necessary (short/mid/long-term)?

The group identified as "necessary" the following developments:

- Different standards and certifications for AAL services and AAL components;
- Guidelines to design dependable AAL services and technologies;
- Detailed specifications on interfaces between different component classes.

3.3.4 Effects
Which effect would these developments have and how could they be actively initiated/ promoted?

The certification of AAL services should allow consumers/customers to choose the best service according to their necessity and with the certainty about the safety of these services.

The standardization and certification for AAL should be promoted not only at European levels but also worldwide. For this reason it is important to invest in communication and marketing touching all actors of AAL field.

In this context it is fundamental involving in this process the following subjects:

- People of AAL Joint Program and the relative national contacts
- Industries
- Care providers (acting as a community)
- Politicians
- Insurance companies.

3.3.5 Demand for AAL certificate
Do we need an AAL product and/or process certificate ("AAL-ready" or the like)?

The experts of the group were unanimous in agreeing that it is very important develop a certification process for AAL products and services in order to guarantee the reliability and dependability of these services.

3.3.6 Meaningfulness of AAL certification
What would such a certificate state about the certified product?

According to the group vision, the certification should establish the reliability of an AAL project for this reason this certification should have different levels/labels in order also to distinguish AAL systems with high quality from tools efficient but with a lower quality.

3.3.7 Range of AAL certification

National or international certificates?

Thinking to the market and the globalization, the group agreed that it is necessary a certification at international level (at least European) in order to allow AAL stakeholders to design devices and services suited and saleable in different countries. Furthermore, conscious that each nation has its rules and policies for the safety and wellness of its citizens, the AAL certification should also consider a part devoted to the single national rules.

3.3.8 Levels of AAL certification

Is a single yes/no certificate sufficient? Do we need bronze/silver/gold levels? Do we need detailed certification statements?

As anticipated in the Section 3.3.6, the experts of the group declared the necessity to identify different labels for the certification to AAL products and services in order to associate them to a specific level of quality distinguishable from the other ones.

3.3.9 Responsible organisations on AAL certification

Which organization could define rules, perform tests, and assign certificates (sponsoring body, test lab)?

One important aspect that emerged from the discussion was the necessity of provide for free guidelines for the right design and development of AAL systems and services and requesting the payment for the certification of these products.

3.3.10 Other considerations

During the discussion the work group realized some important aspects going beyond the guideline-questions suggested by the AALIANCE2 team and in particular the following aspects:

- Need of different certifications for AAL devices and services
- Necessity of a generalization and harmonization between standards and certifications developed in Europe and Worldwide
- Missing of certification for the data protection in the care sector for guaranteeing elderly users privacy (e.g. NEN 7510, Dutch standard)
- Necessity of a *vademecum* for the risk management for AAL services (considering both the overall system and the single components, from sensors to data store, etc.).

3.4 Middleware

3.4.1 Status

Are there already standards in this field? Which ones?

The discussion of this group started from a preliminary list of runtime environments and middleware. The participants soon observed that some items of the list are not properly runtime environments, but specifications of middleware. CORBA, DPWS, MHP, OSGi, UPnP are typical examples of middleware. While DPWS, UPnP, URC cannot be considered runtime environments at all.

The list of software infrastructures for AAL was considered adequate with the addition of the D-BUS, even if the term "software Infrastructure for AAL" is a very large definition that could be refined.

3.4.2 Foreseeable Developments

Which future developments do you foresee ("will happen anyway") in short-term (within 2 years), mid-term (within 5 years) and long-term (2020+)?

There are different software infrastructures, middleware and runtime environments that could be used in the field of AAL. These are developed and consequently standardized by single organizations, single companies, open source communities or industrial consortiums. Nowadays the UPnP and DPWS are good protocols widely used in the world that have a well defined data structure and will continue to be used.

3.4.3 Necessary Developments

Which further developments would be necessary (short/mid/long-term)?

Some further developments were identified in short, mid and long term:

- (Short Term) Nowadays some possible middleware that can be suitable for AAL applications, are already available. The first immediate development is to identify few of them and start a wide experimentation in large pilot sites, in order to test their practical interoperability in real cases. This should be achieved following an approach that highlights the usability, reliability and usefulness of the middleware and that is not limited only to the AAL field but that can cover other contexts.
- (Short Term) Another important aspect is to define ontologies for AAL.
- (Mid Term) Within 5 years it is expected to define those specifications to adapt already available standards to the different AAL environments (different application profiles).
- (Long Term) Similarly it is expected in long term the definition of semantic layers for data adaptation to AAL domain (the UniversAAL approach), considering the level of data and the level of sharing functionalities.

3.4.4 Stock-taking on middleware

Which AAL middleware systems do you know about?

- Persona
- Embassi
- UniversAAL
- Amigo
- OSGi
- Soprano
- OSGi (based) Smart Senior
- OSAmI

3.4.5 Middleware in use

Which AAL middleware systems have you ever used in practice?

- Persona
- Embassi
- UniversAAL

- Amigo
- OSGi
- Soprano
- OSGi (based) Smart Senior
- OSAmI

3.4.6 Recommendable middleware
Which AAL middleware systems would you recommend for future products/developments?

- UniversAAL (long term)
- OSGi (short term)

3.4.7 Demand on standardized reference architecture
Do you think a standardized reference architecture for AAL middleware (including APIs) is needed? Based on which system?

A standardized reference architecture for AAL middleware (including APIs) is absolutely required in the AAL field.

Actually there is not a reference system on which a reference architecture is built. However evidence based achievements on actual ongoing activities on middleware could help to define on which system build appropriate architecture for AAL middleware.

3.4.8 Promoting a standardized reference architecture
What is needed to stop people from permanently having to "re-invent" this wheel?

The main aspects that should be faced in order to avoid a continuous development of new middleware and "standardized" software infrastructures for AAL applications are:
- well established regulations from governments;
- the definition of appropriate Intellectual and Property Rights;
- a large scale deployment of software infrastructure that could be tested in large pilot sites with several customers.

3.5   Accessibility

3.5.1 Status
Are there already standards in this field? Which ones?

Some standards should be recognised as international standards, like W3C which should be used in public procurement for website for example. A very interesting standard on User involvement should be more highlighted and enforced: ISO 9241. Participants added that there are standards on design for all at national level that could be added, but they did not provided a specific reference.

The ongoing discussions on Standardisation Mandate 473 to include "Design for All" in relevant standardization activities are very interesting for the upcoming developments in AAL Accessibility.

3.5.2 Foreseeable Developments
Which future developments do you foresee ("will happen anyway") in short-term (within 2 years), mid-term (within 5 years) and long-term (2020+)?

The participants identified two main future developments that will or may happen in the future:

- Accessibility of information for users (i.e. what to do in case of a problem, how to use the device, etc.) will be a particular topic of interest
- Users increasingly look on Internet to get information. Upcoming developments on the long term will be online networks to fix problems and look for help, videos to know how to use a device, etc.

It was proposed to develop a standardized approach to online information regarding AAL: need for certified information on how to use the device, need for more easy to use informed, standardised user manuals

This development should also include support/inclusion of online communities around the use of AAL technologies.

3.5.3 Necessary Developments
Which further developments would be necessary (short/mid/long-term)?

The necessary developments in standards on accessibility were identified by the participants as the following:

- Easy reconfigurable interfaces according to the person's evolving needs
- Interfaces easily adapted to different sectors and flexible in adapting to these sectors (AAL, ATMs, transport ticket machines, etc.)
- Access to information should be facilitated, for example by promoting standardised (easy to understand) trainings and information on how to use AAL
- The digital skills of nurses are very important in the accessibility to information on how to use devices; therefore standardised training modules and/or standardised training curricula for nurses should include digital skills
- A guide to help which standards are the most relevant for ICT accessibility would be very helpful

3.5.4 Effects
Which effect would these developments have and how could they be actively initiated/ promoted?

Accessibility standards help to get in all EU countries usable devices that everywhere can be easily adapted and are evolutive.

A multi-stakeholder approach in developing the standards (like Mandate 473) is already developed and should promoted, so standards are not multiplied in different sectors but apply to all of them.

3.5.5 Meaning of accessibility
What does "accessibility" mean in the context of AAL? How do you define the difference between accessibility and usability?

The participants decided that accessibility in the context of AAL means 'ICT Accessibility'.

Usability is part of accessibility, as

- Usability is for all groups in a general sense
- Accessibility issues are addressed for specific groups (for specific impairments)

4 Conclusion

The goals of the workshop were two-fold: on one hand we tried to collect information that would lead to an improvement of the repository of standards, such as missing entries and errors in the collection. Quite a few standards were identified in the workshop as additional "candidates" for inclusion into the repository: ISO/PAS 16739, CEN/TS 15224, WebRTC, IHE PCD, IHE MHD, HL7 FHIR, HL7 CDA Consent Directive (CD IG), D-Bus, project hData. Furthermore, the participants suggested that the coverage of the various initiatives that develop use-case based integration profiles in the repository should be extended: IHE, Continua, HITSP, DLNA. Furthermore, the workshop participants identified a number of (mostly minor) issues in the repository: The description of EN 50134 is incomplete, HTTP should not be listed as "streaming protocol", Zigbee Home Automation should be listed in "Wireless Home Automation Field Buses" and not in "(Wireless) Personal Area Networks", UPnP should be added in the list of home automation protocols, and the articles on LOINC and ISO/IEEE 11073 should mention their use in the U.S. "meaningful use" regulations. Finally, CORBA, DPWS, MHP, OSGi, UPnP are not really runtime environments, but rather "middleware". Furthermore, the workshop participants suggested that the choice of titles in the repository should be improved, that the "family relationships" between standards should be shown more clearly, and that the flat structure of the table of contents is unsatisfactory (however, the online version of the repository already offers significantly more index options than the PDF "snapshot" reviewed by the workshop participants.)

The second goal of the workshop was to identify fields where standards are missing or unsatisfactory from an AAL perspective, and to discuss general recommendations for the AALIANCE2 roadmap and strategic research agenda. The results can be summarized as follows:

Standards that should be adapted/extended from an AAL perspective include EN 50134 "Social alarm systems" where an abstraction layer for data aggregation is missing, IEC 80001 "Application of risk management for IT networks incorporating medical devices", the ISO/IE 10181 family of standards "Security frameworks for open systems", TR 069 "CPE WAN Management Protocol", which is currently being extended to permit remote maintenance of devices behind a residential gateway, the standards governing the European eCall initiative, and the various access right standards for electronic health records. Furthermore, participants suggested that the ISO/IEEE 11073 family of standards ("medical/health communication") should be extended to include further technologies needed from an AAL perspective.

Fields where standards would be needed but no standards seem to be available yet include a measurement standard for radio interference in the home, a standard for indoor localization, a standard for privacy policies in residential gateways, a standard for the handling of access rights to personal data in emergency cases ("break-the-glass policy"), a standard for quality assurance and calibration of medical devices in the home environment, a standard on the use of data from the home environment for medical purposes, and a standard AAL ontology that can be used in the reasoning components of AAL devices. Furthermore, participants clearly expressed the need for a standard high-level architecture that can be used to describe use-cases, interfaces, system components etc. in a way that promotes an understanding across projects, products and communities. The logical next step would then be a standardized reference architecture for AAL middleware (including APIs), which participants considered also to be absolutely required.

The workshop participants came to the conclusion that the knowledge about, and access to standards also needs to be improved. Suggestions include the development of guideline documents and tutorials on how to select the appropriate set of standards for a certain

project or product, guidelines on the design of dependable AAL systems, and a "smart database" on standards that could support system designers and developers in choosing the appropriate set of standards (or requirements derived thereof) for a certain development. Finally, a separate "AAL" category in the ICS (International Classification of Standards) was proposed.

Recommendations

From the discussions during the workshop, the following draft recommendations can be derived, which need to be further examined by the AALIANCE2 project as candidates for inclusion into the roadmap and strategic research agenda:

- *International standardization:* In general, standardization for the AAL sector should take place on European or international level, not on a national level.
- *Better integration of research communities:* Many activities that may be important also for the AAL community are currently taking place in other fields, such as the "Internet of Things" community, where the oneM2M initiative develops generic middleware solutions for the integration of sensors and actors, and the Smart Metering community, where for example security profiles are being developed that could also be applicable to AAL. The impression of the workshop participants is that the different research communities often have insufficient knowledge of the activities of other sectors and communities, which may lead to fragmented/incompatible developments.
- *Better access to and better knowledge about standards and standardization:* Workshop participants noted a significant lack of knowledge in the research community about standards, their relevance, and the standardization processes. One problem is the limited access to standards that many researchers perceive due to the expenses. Workshop participants expressed the need for a push for open and publicly available specifications that are available at most at moderate cost. Furthermore, standards bodies and industry standard organizations such as the Continua Health Alliance need to be more open for participation by researchers – often the organizational structure, required annual payments or simply travel cost make it very difficult for researchers to participate and collaborate. Finally, a separate "AAL" category in the ICS (International Classification of Standards) should be implemented.
- *Integration profiles:* One solution (and perhaps the solution) to the interoperability challenge is the development of use-case based integration profiles similar to the works of IHE, Continua, HITSP and DLNA. Such integration profiles need to be developed as part of a consensus process involving industry, researchers and users, published and established on the market. This will require an appropriate organisational structure. Discussions will be needed in particular with the Continua Health Alliance to see if they are able and willing to extend their scope to "cater" for the needs of the AAL community, or if instead a dedicated body for AAL needs to be founded.
- *Quality labelling and certification:* Participants agreed that a quality labelling programme for AAL systems should be established (perhaps based on the concept of integration profiles as discussed above). This would provide a better market acceptance, visibility and enhance interoperability. Participants disagreed on whether this quality labelling should actually be implemented as a certification programme (i. e. independent validation of products by a third party) as opposed to a self-declaration by system vendors. In any case, participants noted that such a process should not be established on national level, but on European or international level.
- *Large scale pilots* will be needed to assess the maturity of the various middleware solutions and runtime environments for AAL systems such as universAAL, Persona,

Embassi etc. The "REAAL" project, which aims at equipping 7,000 apartments in Europe with universAAL-based technology, is certainly a good example.

- ▪ *Reconfigurable user interfaces:* AAL systems need to support reconfigurable user interfaces to satisfy the specific needs of different groups of users (e. g. with reduced eye-sight, hearing or fine motor skills). This requires a separation of the application layer from the presentation layer in the AAL system architecture. This separation needs to included into user interaction standards, into AAL middleware solutions (Universal Remote Console is a good example), and of course into the AAL systems being developed.