# AAL Joint Programme

# Template for Part B for proposals submitted to the Call for Proposals AAL-2012-5

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# Template for proposal description (Part B, Call 5) IM
# Cover Page

**Application areas addressed:** Self-Care @ Home; Assistance in moving objects and in localization of objects (keys, mobile, glasses). Enabling older adults to sustain and continue managing daily life activities in their home

Proposal full title: Augmented Hearing Experience and Assistance for Daily life
Proposal acronym: **AHEAD**
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List of participants:

| Participant no.* | Participant organisation name | Participant short name | Organisation type | Country |
|---|---|---|---|---|
| 1 (Coordinator) | Atos | ATOS | Large Enterprise | Spain |
| 2 | Tecnalia | TEC | NP Research | Spain |
| 3 | Innovationsmanufaktur | IMA | SME | Germany |
| 4 | Center for Usability Research and Engineering | CURE | Research | Austria |
| 5 | Johanniter | JOH | End User Organisation | Austria |
| 6 | Cosinuss | COS | SME | Germany |
| 7 | AuditData | ADA | SME | Denmark |
| 8 | Bruckhoff | BRU | SME/BE | Germany |
| 9 | Forschungszentrum Informatik am Karlsruher Institut für Technologie | FZI | Research | Germany |

** Please use this numbering in all parts of your proposal.*

# Section 1: Relevance - Ideas and Models

## 1.1 A short summary description of the overall idea and implementation of the proposal in relation to AAL technology and the end-user(s)[1].

"Augmented Hearing Experience and Assistance for Daily life" project (AHEAD) aims at increasing the quality of life of elderly by assisting them for keeping an active and independent life. Hearing, eye-sight, memory, and coordination all decrease as a person is getting older. To improve quality of life of elderly, their lost senses could be technologically enhanced but unfortunately, most elderly have **reservations regarding technology**. Therefore, this proposal aims to make use of **devices** that elderly people **have already adopted**: eyeglasses and hearing aid. The integration and combination of advanced and innovative sensing as well as ICT based modules will result in a completely new and innovative product (and services). Both the eyeglasses and the typical hearing aid will embed **a microphone**. The hearing aid will not only be voice-controlled but will also become a communication device. As health management is important, the modified hearing aid will be able to measure **vital signs** such as heart rate, oxygen saturation and core body temperature. These measurements could also be used for detecting the emotional state of the user and act against depression. Finally, a **3D inertial sensor** would record general activity and risky postural behaviours. Our assistant will be wirelessly connected to a **smart phone** and be a part of a **smart living environment**. This can be used for **compliance** or for **connecting the hearing aid to home automation systems** and provide complementary services such as personal alarms (extension or replacement of the social alarm button), medication reminders, house warning, cooking and financial management assistance verbally conveyed into the wearer's ear. Applying a **user-centred design approach (UCD)**, a high level of usability, accessibility, user experience, technology acceptance and business aspects of AHEAD will be achieved involving all user groups (primary, secondary, tertiary) during the whole project. **Primary users** are persons older than 55 and optionally suffering from hearing loss. **Secondary users** will be non-formal carers. Furthermore, hearing aid audiologists will be involved in the project. **Tertiary users** are represented by future solution (e.g. Bruckhoff, AuditData) and service providers (e.g. Johanniter).
The design and development of the AHEAD technologies will take 36 months at the end of which the consortium expects to have an integrated system of refined prototypes ready for commercialization. The commercialization cost will be defined according to the market analysis and business plans developed in WP5 and they will be highly dependent on the geographical area addressed, regional, local or European and the proposed solutions. Roughly estimated, the commercialization would need an initial inversion of 150.000 € per region/country per year.

## 1.2 An example scenario

Lucy is 78 years old and lives alone in her little cottage in the suburbs. Although she is fit for her age and likes to be independent, she realizes that senses are fading and that it has become more and more complicated to remember where she put her glasses or whether she wanted to visit the hairdresser's today or tomorrow. Each morning, she dons her hearing aid and puts on her pretty necklace with a microphone. After breakfast, Lucy is just leaving the kitchen, distractedly wondering what she wanted to do next, when her virtual lifestyle assistant whispers in her ear, "Please take your meds." So that was what she could not remember! Afterwards, the assistant informs Lucy that she has an appointment with the hairdresser but that it is in an hour so she has time yet. Lucy likes to watch TV but somehow she always misplaces the remote control. Just where did she put it the last time? Again, Lucy relies on her assistant. Since it is voice-controlled, she just has to ask and it finds the remote control by using RFID. The assistant guides her to her couch – she would never have found the remote control that fast under the cushions. Since Lucy can receive the TV programs directly in her hearing aid, the TV does not have to be unbearably loud for her to hear and her neighbours are not disturbed. After half an hour of TV, AHEAD aid warns Lucy that she has been sitting in an unhealthy position for too long, it is time to move around a bit. As she is leaving the house for the hairdresser's, the assistant warns Lucy: The bedroom windows are open and the washing machine is still running. Shaking her head, Lucy lets the washing machine continue but goes back in and closes the windows. Already at the door, Lucy gets another warning: She is about to leave without her keys and her purse. How lucky that she has her lifestyle assistant! The last two times the assistant also helped her find the way to her new hairdresser but by now she knows the way – she even arrives early. Lucy takes a newspaper but cannot read the tiny print. Quickly, she asks her assistant for a news podcast instead. Lucy is not the only one to be happy about her intelligent hearing aid. Her care provider gets the information that all Lucy´s vital signs are quite good. Heart rate, body temperature, oxygen saturation, really astonishing what kind of data can be taken and transmitted via a hearing

[1] For the definition of end user categories (target base) of the AAL programme please see call text.

instrument. Even emotional status can be checked. And her care provider only has to get into contact with Lucy if she really is in need of help or support. In this way Lucy can keep her independency but is still on the save side. The care provider also benefits from less staff costs and more accurate background information.

## 1.3 The aimed service models

In the old service-models, hearing aids are fitted individually by hearing aid acousticians. Health insurance companies pay a part of it but have little to do with the reality of hearing aid-fitting

The new service model would link the proposed devices with the smart phone, running the AHEAD application. By this, it is possible for the user to connect to the Ambient intelligence system of AHEAD which will provide a panel of services supporting **self-care** and/or **remote care** (online hearing aid calibration, personal alarms). In addition the AHEAD System will provide critical health information from physiological sensors to be either provided to the user (**self-check**) or analysed by other application within the AHEAD system. This data would also be accessible for homecare staff or telemedicine services to improve the quality of care for the clients. By keeping the data up to date, it is even possible to detect radical changes in the health status of the client (e.g. heart attack, vertigo or even a sudden exacerbation of dementia). Former Hearing Aids increase the ability of the user to hear. Some systems are even linked to mobile phones. But using the AHEAD System gives the hearing aid new dimensions and comfort for its user. AHEAD not only improve senses but to also safety and independence for an effective active ageing.

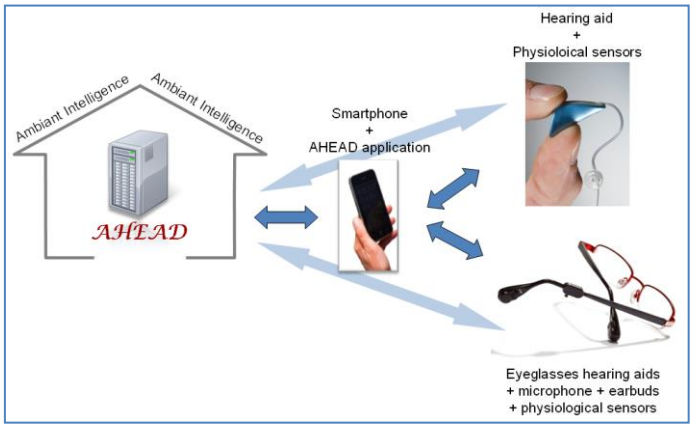



**Figure 1** Schema of the services models. Users will take advantage of ambient intelligent services at home. Mobile communication will serve for interacting with the sensorised hearing aid and eyeglasses hearing aids**.**

## 1.4 The business case

| | |
|---|---|
| What product/service will you offer? | Online hearing test (service package,ADA); upgraded product (Cosinuss); New product technology (COS); An on-line hearing test developed in WP3 will make it possible to monitor the hearing loss and thereby offer new services adapted tot the actual hearing of the patient/elderly. |
| What main problem(s) does the product/service solve or what benefits does it provide to the customer? | In the home alert system of the Johanniter, in daily routine, we are confronted with the problem of hearing loss and false alarms. They are produced by missing proper reactions to the alarm sound and the follow up call by the Johanniter Dispatch Center for Emergencies. We benefit from AHEAD in terms of reducing false alarms by auto adaptation of our system by increasing the volume of our alert system and by adapting the hearing aid to the new requirements of the user. This makes the home alert system of the Johanniter more efficient. Cooking; reminders (medications, appointment; Support independence prevention of falls Health related data for self-management (Cosinuss )or to send to health professionals |
| Who are your competitors? | Those developing similar hearing aid devices and those developing hearing devices fit to eyeglases For the partners developing services: Those developing AAL services for monitoring seniors |
| What is the added value of the product/service versus that of competitors and/or existing solutions on the market (unique selling proposition)? | Business models: (1) to insurance company (2) services<br>Target people with small hearing loss<br><br>Comfort<br><br>Social alarm through eyeglasses |
| Who will buy the product/service (target group)? | Younger seniors (55+), relatives (see social alarms) and hearing impaired people |

| | |
|---|---|
| Who are the different stakeholders in the value network and how are they connected? | Manufacturer, relaters.; services/care providers/ end-users/ |
| Health system? | Devices will be classified as Class IIa, since they will be used for palliating some deficiencies. Additionally, physiological sensor will be used |
| How will the product be sold? | It will be sold via the usual channels that hearing aids are sold through, thus utilizing and expanding already existing structures.<br>The Johanniter will add the hearing aid to their offer for seniors as additional module and will offer AHEAD by their upcoming webshop for AAL products. |
| Who will provide products/ services? | For the normal services (battery change, installation etc.) the Johanniter will provide this service within the usual service of installing the home alert system. |
| Who will pay for the product/service? | The products and services offered by the AHEAD partners can either be acquired by the public health authorities (for the retired persons), while the elderly themselves or their relatives will be offered these services through the normal dispensers either being for hearing aids or glasses. |
| What is the estimation of the size of the market? | An estimation is done in section 4.1 |
| Which consortium members are involved in the customer value proposition? | All |
| What are the roles of different partners in the market implementation of the product/service? | Johanniter will provide access to the target group in Austria and install the service within the homes of the clients. We are acting as service provider and service broker for additional applications. ATOS will provide their commercialization channels for commercialization of the AHEAD services. |
| Do partners have market experience/position? | BRU, ATOS, ADA, COSINUS, JOHANNITER have an extended experience and a consolidated position in the AAL market. All the project's end-users have several years of experience in working with AAL services. E.g ADA has been providing systems integrating medical devices and services since 1992. The systems concentrate on the provision of on-line telemedicine solutions for audiology centres, clinics and hospitals.<br>The Johanniter have been providers of care solutions and home alert systems for more than 10 years now. |
| How will partners, especially business, draw benefit from the project results? | ADA will add the on-line hearing test service as a module to their integrated hearing management system. Thereby data will appear into the Electronic Patient Journal system currently being used throughout Scandinavian and the UK.The Johanniter are expecting to improve the efficiency of existing services, such as the home alert system, and to go into new market segments by using new technologies. One branch is the augmented hearing sector. Connecting the AHEAD System to the home alert system is a benefit |
| What/which external stakeholder(s) will be necessary for the proposed product/solution to succeed on the market? (e.g. manufacturing, investments, designer, service provider, etc.) | The Johanniter are already acting as service provider. AHEAD would fit into the portfolio of the Johanniter perfectly. |
| What are the market risks and barriers? | (1) Economic crisis leads to less investment in products for elderly. (2) Acceptance of the final product by the elderly. (3)Compatibility / dependence on external systems / solutions. (4)Competition with other outside Europe equivalent technologies. |
| What is the estimated cost to enter the market with the developed product/service and how will this be financed? | The commercialization cost will be defined according to the market analysis and business plans developed in WP5 and they will be highly dependent on the geographical area addressed, regional, local or European and the proposed solutions. Roughly estimated, the commercialization would need an initial inversion of 150.000 € per region/country per year. |

## 1.5 The exit strategy

We are quite sure that the proposed -AHEAD solution has the potential of significantly increasing the quality of life for hearing impaired people -without any life -threatening situations arising. This could result in a user's dependency on the system and for these reason, the finalization of the pilot could have a negative impact on the newly improved quality of life of the users. As palliative action, final users will continue using the provided devices and some of the developed services. Moreover, there will be a close connection to the hearing aid audiologist who can still be contacted after the end of the project. These actions will fill the short time gap between the end of the project and the start of the commercialization.

## 1.6 Success parameters of the proposal

Partners in the consortium are aware that the success of AHEAD will be only possible by encouraging and motivating end-users to participate and provide feedback from the very beginning. End-users involvement during the project will allow us to develop the right solution for the right problem. Moreover, end user involvement in the pilot allows us to assess the benefit of the proposed solution. Scattered or lack of evidence for benefit of the proposed solutions and insufficient involvement of end users are identified as two major barriers for deployment of AAL solutions[2]. Therefore, during the pilot phase training and encouragement will be provided to the users in order to increase the acceptance of the proposed solutions. In the following table we provide criteria aiming at measuring the success of the project mainly based on the feedback provided by the users.There are many different methods to calculate the effects of hearing impairment, in accordance with the expected results we will use the HDHS and IADL scale for objectively measuring the success of the provided solutions.

| Indicator | Success criteria |
|---|---|
| Quality of life and independency | Questionnaire before and after the pilot for measuring the benefits of the platform as the increment of independence of hearing impaired adults in managing the daily life activities in their home |
| Functional status elderly | The IADL[3] scale is used to measure the functional status of older people. A score of less than 1 indicates that the person is independent, if it is greater than 1, it indicates dependency. It is expected than at least 50% of older people who initially scored >1 , will score <1 by means of comparing AHEAD results |
| User's psychological status | GDS Geriatric Depression Scale (GDS): affect (mood, or depression). The GDS is a 15 item scale, scored from 0 to 15, A score under 7 represents lesser dysfunction. |
| Hearing improvements | There are a number of scales used to assess benefits of, satisfaction with, and various aspects of functioning using hearing aids. We would use the Hearing Disability and Handicaps Scale (HDHS)[4] for assessment of hearing aid benefits. This scale will provide an objective measurement for quantifying the user improvement. The questionnaire will measure perceived handicap and disability |
| User's social isolation | Comprehensive Assessment and Referral Evaluation (CARE) (Weinstein and Ventry, 1982) The CARE scale is used to assess social, emotional and physical problems of elderly individuals in order to measure social isolation. It comprises 38 scales that measure various dimensions such as physical disorders, psychiatric disturbances and social problems The higher the score the more isolated the individual. |
| Easing the tasks of formal or informal carers | Questionnaire before and after the pilot |
| Number of users who are satisfied using the platform during the pilot | Positive rating of the platform |
| Percentage of participants who want to continue using the platform after the pilot | > 65% |
| Number of mentions in Google searches, blogs, social networks | > 30 entries in a simple Google search using keywords as hearing aid, elderly, well-being, ambient assisting living. |

[2] Synthesis report on the public consultation on the European Innovation Partnership on Active and Healthy Ageing. Prepared by the European Commission DG Health and Consumers and DG Information Society and Media

[3] Carabellese *et al*, 1993

[4] Hallberg, 1999

| | |
|---|---|
| and so on. | |
| Number related publications and papers in proceedings and conferences | More than 5 publications in relevant journals ( impact index over 5) |

## 1.7 Ethical and legal issues

**Ethical watch:** All user involving activities within the AHEAD project will be supervised and controlled by the Ethical Advisor of JOH, Dr. Robert Brandstetter of JOH who is member of the ethics committee of the city of Vienna, pastor of the Lutheran Church and president of the evangelic hospital of Vienna. Any user participation in the AHEAD project will be voluntary. Users themselves decide whether to participate or not. To guarantee that the participants are able to decide whether to participate or not written informed consent (IC) forms will have to be signed by the participants. ICs include detailed information about the project, the purpose of the study, personal rights, risks and benefits, privacy and confidentiality issues and contact information of the responsible person. All necessary legal regulations for conducting field trials in the home of users will be identified in T1.3 and controlled by the Ethical Advisor throughout the whole project.

**Personal data management:** Information gathered within the AHEAD project may include some kind of sensible data as physiological data, user's personal data. To assure the confidentiality of the collected information, the consortium will use its previous experience in managing software for services for elderly people regarding the ethical and legal rules of any country contributing to the project. European Directive 95/46/EC defines personal data as "all information on an identified or identifiable person, considering an identifiable person as anyone whose identity might be determined, directly or indirectly, in particular by means of an identification number or one or several specific elements, characteristics of his physical, physiological, mental, economic, cultural or social identity and attributes special protection to health data". This European Directive has its own replications in the other AHEAD partner countries and will be applied within the whole duration of the project. All user involving activities will be performed respecting the Helsinki Declaration, the Oviedo Convention and the EU Charter of Fundamental Rights.

**Inclusion Criteria:** *Primary users* will be of both genders, over 55 years old, showing no fine motor skill or cognitive impairments exceeding the expected level due to old age and have little or no experience with modern ICT – optionally suffering from hearing loss,. For the *secondary users* the main criterion for inclusion is being a contact person (e.g. relatives, friends) of at least one older person fulfilling the role of a primary user. A balance between gender and age will be considered.

**Written Informed Consents (IC)** will be obtained from each participant before any study (study plan and IC will be submitted to the project's Ethical Advisor). All project activities will exclude persons not capable of making decisions about their voluntary participation because of high distinct cognitive restrictions. Project results are reported in a way that people can stay anonymous.

### 1.7.1 Ethical "declaration" table

| Ethics declaration of proposals in the AAL-Joint-Programme | Described on page or "not relevant" |
|---|---|
| • How is the issue of informed consent handled? | 8;12 |
| • What procedures does the proposal have to preserve the dignity, autonomy and values (human and professional) of the end-users? | 8;12 |
| • If the proposal includes informal carers (e.g. relatives, friends or volunteers) in the project or in the planned service-model - what procedures exist for dealing with ethical issues in this relationship? | 8 |
| • If the proposal includes technology-enabled concepts for confidential communication between the older person and informal and formal carers, service providers and authorities – what procedures are planned for safeguarding the right to privacy, self-determination and other ethical issues in this communication? | 8 |
| • What "exit" strategy for the end-users involved in the project does the proposal have (in terms of end-users leaving the project during its implementation and after the project's end)? | 7; 12; 36 |
| • How are the ethical dimensions of the solution targeted in the proposal taken into account? (Brief description of distributive ethics, sustainability et.al.) | 8 |

During the course of the project should any ethical issues arise which require careful consideration and upon which the consortium may require an informed opinion, the partners will consult with appropriate ethics committees.

# Section 2: Scientific and technological excellence – the project workplan

## 2.1 Technology methodology

From the user perspective, AHEAD is designed to achieve usefulness and simplicity in supporting daily life activities. This is why development of the system will follow a user-centred approach based on an incremental and interactive software development methodology where user requirements and their intermediate evaluations are considered in each development stage (more details in Section 2.3). This is especially important since it is known that hearing instruments are not worn all the time (especially at home) due to imperfect calibration and possible discomfort.The overall system architecture is based on the openAAL[5] middleware: a distribution based on the EU-funded project universAAL. It consists of core modules developed in universAAL and adds modules developed by FZI. Technically the middleware can be divided in two important subsystems. On one side developers can use the so called context bus which allows them so send and receive context events. These context events can be everything in the range between low-level sensor events (e.g. a light was switched on) and high-level events (e.g. the person X entered room Y). On the other side the middleware provides the service bus which allows developers to offer and consume services created by them or other developers.

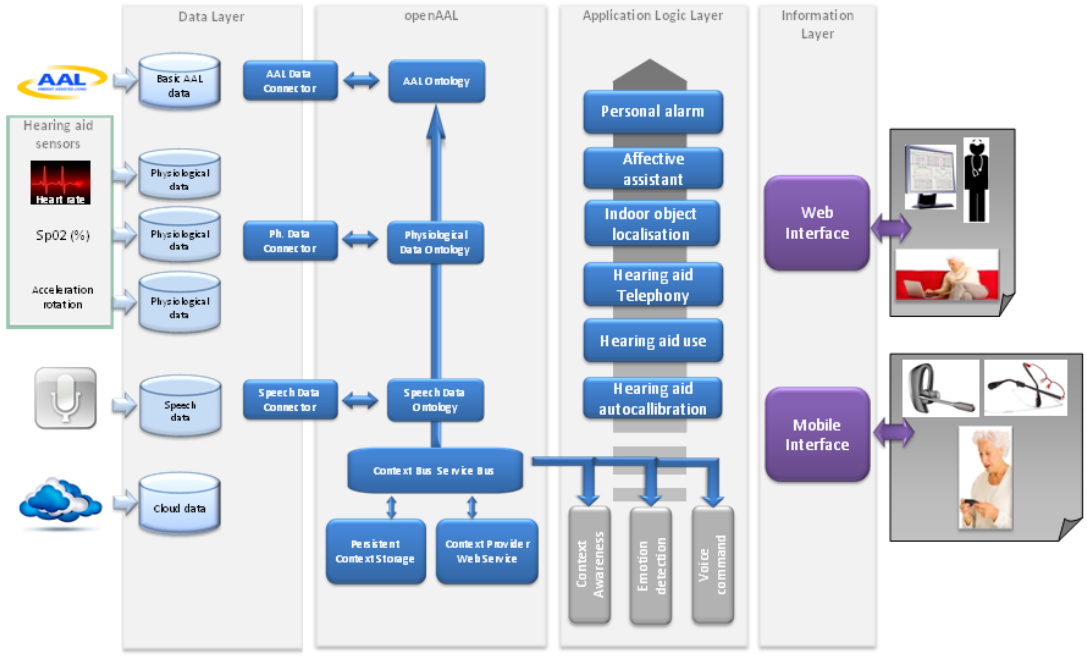



**Figure 2 -** AHEAD System Architecture

Both systems, the context and the service bus, share a common understanding of the data the system has to handle. This common understanding is provided by ontologies which can be loaded into the middleware in the form of modules. The system architecture is then comprised of three layers, as shown in the figure below.The **data layer** collects, formats and saves, in a secured manner, the heterogeneous and multidimensional data coming from various sources. In addition to the *typical "AAL" sensors* (contact door, pressure sensors, passive infrared sensors, body scale, etc), AHEAD will also gather personal and/or generic data coming from the *cloud* (personal: calendars, emails, medication; generic: whether forecast, geolocation, news). Different interaction modalities will be available for the users (smartphone, laptop computer, voice commands). In the data layer, speech data is considered as a particular input and will be used to command difference services (e.g. triggering alarms) (see Application Logic Layer).

The **application logic layer** is composed of several modules that allow the system to provide the general services. Firstly, a C*ontext Awareness Module (CAM)* will provide information on the current status of all elements connected to the home network. In addition and using the ontology-centred design of the openAAL framework, the various sensors' data as well as the user input are transferred to the ontology and rule management system where the "context manager"[6] will identify the user's situation in terms of the temporal, personal, organizational, environmental conditions Secondly, an

[5] http://wiki.openaal.de/index.php/Main_Page

[6] Klein, M.; Schmidt, A. & Lauer, R. (2007), Ontology-Centred Design of an Ambient Middleware for Assisted Living: The Case of SOPRANO, *in* Thomas Kirste; Birgitta König-Ries & Ralf Salomon, ed., 'Towards Ambient Intelligence: Methods for Cooperating Ensembles in Ubiquitous Environments (AIM-CU), 30th Annual German Conference on Artificial Intelligence (KI 2007), Osnabrück, September 10, 2007'.

***Emotion Detection Module*** **(EDM)** will be developed and implemented. The area of physiological emotional detection is based on the idea that emotional states are associated with specific patterns in biological activity. Hence, it is possible to identify the emotional state by continuously analysing changes in a number of physiological signals, primarily from the autonomic nervous system (heart rate, skin conductance). The EDM module will implement methods for emotion change detection and valence classification. Elderly people living alone at home with health problems and sometimes disabilities (such as hearing loss) are subject to depression. Depression leads to a reduction of daily activities. Therefore, monitoring emotional valence will serves as an input for an affective assistant and/or specific care provided by informal and informal carers. Finally the *Voice Command Module* (VCM) will be selected from available speech recognition software (e.g. Dragon dictation (Siri), Google voice, MeMeMe Mobile[7]).

From these three basic modules, 6 services will be offered to the users in order to assist them in their daily life activities: **1) The *Hearing aid autocalibration service***. Modern digital hearing aids have a lot of functionalities that the patient is only briefly introduced to as part of the hearing aid delivery. It is well known that a high fraction of delivered hearing aids are only being used a few times before they end up in a drawer. This service will allow a distance learning session introducing the patient to the functionalities of the hearing aid as well as simple hearing check and automatic system acoustic adjustments. **2) *Hearing aid use*.** Based on the inertial data collected within the hearing instrument, the AHEAD system will determine whether the hearing aid is worn or not. Several (six or seven) RFID readers distributed in the house will allow a rough localisation (1 meter) of the passive RFID tag embedded into the hearing instrument using the received signal strength indicators (RSSI) technique. This service can be automatically activated when the hearing aid is not worn by the user. In that case the AHEAD system can remind and help the user to locate and use it. **3) The *Hearing aid user telephony*** will allow the user to phone someone by using the hearing instrument as a regular Bluetooth headset. Together with user input, a design investigation will be performed to identify the where to locate the microphone (e.g. like a Bluetooth headset or mounted into glasses). Dialling the number will be done either through the smart phone or using voice commands. **4) The *Indoor object localisation*** *service* will be made possible by the same RFID techniques described for the *Hearing aid use.* In this case, we will give the opportunity to the user to put passive RFID tags in the objects he or she wants to locate. **5) *Affective assistant.*** Based on both contextual information and the end user emotional state, the AHEAD system will either (1) support the current daily activity or (2) propose a new action (e.g. meet a friend, go for a walk, take medications, and perform an aerobic activity). **6) *Personal alarm*.** This service will be similar to current social alarms (push button). It will be executed by (1) triggering an alarm through voice commands and/or (2) automatic risky signal patterns (e.g. a risky postural situation extracted from the ear inertial sensor + context information or an abnormal heart rate). The **Information Layer** The top layer of the AHEAD architecture consists of the user interfaces especially adapted to the needs of the elderly. Information is not simply “dumped” on the user but adapted to the needs of the user and presented in an accessible fashion (uncluttered screen, using big buttons and intuitive representations. Even if the end users will be the primary users, a web interface will be available for professionals to provide remote support and services.

## 2.2 Resources (expertise, infrastructure, etc.)

The project uses already existing technology and combines it in a new and innovative way. Therefore, the project consortium consists of a wide range of specialized enterprises.

### 2.2.1 Scientific Resources :

**Interface design and Accessibility:** CURE and ATOS have expertise in designing and implementing usable and accessible interfaces. During the development process the single interfaces and interactions will be iteratively improved and enhanced based on the results of accompanying evaluations. **Know-How in User Centred Design and Service Evaluation:** CURE and IMA have expertise in user requirements, business model evaluation, usability, accessibility and technology acceptance research and in conducting field and lab trials and user-centred methodology in general.
**Emotion detection and classification:** TECNALIA has extensive experience in the area of physiological emotional detection. In this proposal we will make use of connectionist[8] models and change point detection[9] that have been developed to classify physiological sensor data. **Semantic technologies:** FZI has a strong expertise in this field, especially ontologies. FZI will contribute its

[7] http://www.mememomobile.com/

[8] E. Leon, G. Clarke, V. Callaghan, and F. Sepulveda.,“A user-independent real-time emotion recognition system for software agents in domestic environments,” Engineering Applications of Artificial Intelligence, vol. 20, no. 3, pp. 337-345, April 2007.
[9] Leon, Enrique, Montalban, Iraitz, Schlatter, Sarah, and Dorronsoro, Iñigo; “Computer-mediated emotional regulation: Detection of Emotional Changes using Non-parametric Cumulative Sum”. In: Proceedings of the of the 32nd Annual Conference of the IEEE Engineering in Medicine and Biology Society, Buenos Aires, Argentina, August 2010.

knowledge on integrating ontologies methodologically into software and also its knowledge on the refinement and enhancement of ontologies. **Reasoning enginery:** ATOS has a wide experience in applying Artificial Intelligent algorithms for support system and machine learning solutions. **Monitoring of vital signs:** Cosinuss develops highly precise sensors for measuring heart rate, body core temperature and oxygen saturation, these will allow a continuous and convenient in the ear. A patented sensor apparatus makes sure that the sensing elements for the three vital signs are not only brought in contact with the skin of the inner ear but also held in place. This way a disturbance free measurement is guaranteed

### 2.2.2 Technical Resources

**Service development:** FZI has expertise in connecting AAL systems with the help of semantic middleware technology. This knowledge will be used to integrate the different use cases in the project. Furthermore FZI has expertise in context management which accounts for the development of context-aware use cases during the project. TECNLIA Health Technologies Unit (50 experts from the Health Division) is focused on ICT application to Assistive, Rehabilitation and eHealth Technologies mostly for disabled and elderly people, developing solutions and services for autonomy, safety, independence and quality of life at home. Regarding the framework of AAL, Tecnalia is working on regional, national and European R&D&i projects: ten European projects on AAL and companion robotics: SOPRANO, AmiE, DUSBOT, COMPANIONABLE, HAPTIMAP, BEDMOND, HMFM, TECFORLIFE, FLORENCE; FLUENT. Since 1992, AuditData has been developing systems integrating medical devices and services. The systems concentrate on the provision of on-line telemedicine solutions for audiology centres, clinics and hospitals. Current systems include Electronic Patient Journals, audiology test systems and ear fitting systems including a portable audiometer and real ear measurement unit and an innovative hearing instrument test unit. The systems are based on advanced embedded systems technology, communications and user friendly human interfaces. The systems are widely deployed in the public as well as the private healthcare sector.

### 2.2.3 Market Expertise

ATOS is a large enterprise with commercial channels across the world. Ambient assisting living and eHealth are now among their priorities, establishing strong links between Atos Research and Innovation and Atos Healthcare for commercialization of research and innovation projects as AHEAD.
Bruckhoff is a high technology manufacture in charge of providing the eyeglass hearing aid device. Their main interest is the commercialization of this device around the world. AHEAD is a precious added value for Bruckhoff's device exploitation in the very specific segment market that is the elderly. Moreover, development to be done during the project will add to customized solutions for other target groups.

## 2.3 The perspective of the end-users

The perspectives of end-users (primary, secondary and tertiary) will be involved by applying user driven methodologies for research, development and innovation. This means that in AHEAD, research activities will start with user requirements, and that the users will give the directions and be the driving force of the technological development and research on a continuous basis throughout the project.The primary end-users, i.e. older persons living independently at home, are defined here as the main end-users. The secondary user-group is defined as informal caretakers, normally a relative or a friend, that will experience an impact on quality of life thanks to the AHEAD application. Further, formal caretakers and tertiary end-users will also be involved in AHEAD represented by lead users or experts. Within the AHEAD consortium, the end-users are represented by JOH (AT). JOH is a well-known and respected organization and has access to the defined target groups. In addition to end-user organizations, IMA and CURE are responsible for user-centred design (UCD) methods and evaluation of accessibility, usability, and user acceptance. JOH will work under the guidance of IMA and CURE as well as with the technical partners in their countries. JOH together with IMA and CURE will conduct several studies with end users during the project in order to ensure end-user acceptance of the developed solutions and business models involving users with diverse age-related restrictions as defined within the proposal. A hearing aid audiologist will be involved (subcontracted by IMA) in order to provide expert knowledge and support lab- and field trial activities.

## 2.4 The Intellectual Property Rights management (IPR) of the project and beyond. Are there any other legal issues within the project?

The AHEAD consortium is sensitive to the importance of issues relating to intellectual property rights (IPR) and such issues have been the subject of preliminary discussions during the development of the proposal. As with any research and development initiative, it is difficult to generate a detailed IPR agreement before it is known precisely what will be the object of such an agreement. This is to be expected and so the partners have planned a formal and binding agreement to be finalised by month 14, as part of the work to be carried out in work package 5. In advance of completing that formal agreement, the partners have reached some informal conclusions to their discussions on the issue.

### 2.4.1 IPR Issues during the course of the project

With respect to the protection of knowledge during the course of the project, the partners have reached an informal agreement as follows: If, in the course of carrying out work on the project, a joint invention, design or work is made (and one or more partners are contributors to it), and if the features of such joint invention, design or work are such that it is not possible to separate them for the purpose of applying for, obtaining and/or maintaining the relevant patent protection or any other intellectual property right, the partners concerned agree that they may jointly apply to obtain and/or maintain the relevant right together with any other partners concerned. The partners concerned shall seek to agree between them, and the other partners concerned, arrangements for applying for, obtaining and/or maintaining such right on a case-by-case basis. Subject to the terms and conditions contained within the consortium agreement which will be concluded should the consortium enter into a contract for funding, access rights to pre-existing know-how needed for carrying out the project shall be deemed granted, as of the date set out in the contract for funding, (should it be granted), on a royalty-free basis to and by all Partners.

### 2.4.2 IPR Issues following project completion

Following preliminary discussions with respect to IPR issues following project completion, the partners have agreed that once decisions relating to exploitation strategy and planning have been taken and the AHEAD proposition has become more robust, an IPR agreement will be negotiated and agreed to by all partners. As mentioned above, this is planned for month 14. At this early stage, discussions on IPR during proposal development have focused on reaching an informal agreement as to a mechanism by which the rights to intellectual property of each partner should be commensurate with the amount of effort each partner will contribute to the development of exploitable outcomes. As such, the IPR agreement will be considered as a process of refinement during the first 14 months of the project.

### 2.4.3 Non Disclosure Agreements and Memoranda of Understanding

Members of the Market Advisory Panel will sign a non-disclosure agreement with the AHEAD consortium once they become members. Each member of the User Interest Community will sign a memorandum of understanding.

### 2.4.4 Patents

There will be a number of patent applications arising from project AHEAD, ownership of which will be discussed and agreed as part of task 5.4 (See WP5 description below).

As regards literature, i.e. papers originated from work in the project, there will be two categories: **1)** Project-endorsed publications, requiring notification to the Project Board of intention to submit a paper, approval by the Project Board of the preliminary version to be forwarded to a conference or journal. They should contain an acknowledgment of support by the Project Consortium. **2)** Project-related publications requiring only notification to the Impact Director, the Technical Director and the Project Coordinator. These should contain an acknowledgment of support by the project together with a disclaimer that the views are not necessarily those of the Consortium. Most of the technical and business information related to the project is protected by patents or is in the application process.

## 2.5 Work plan (organisation of the project)

The AHEAD work plan consists of 5 elements, corresponding to the work package breakdown described below. First, the consortium's ***project management*** activity has been designed to ensure that project objectives are met in an efficient manner and to agreed standards as detailed in the AHEAD project implementation manual. ***User requirements*** – The second element establishes, through an extensive program of user consultation, clear user criteria which should be included in the AHEAD technology in terms of user interface and functionality. This applies both to the AHEAD environment itself and the application. ***System development*** – The third element focuses on the system design and technical development. The project involves an extensive program of technical development which will include environment, interaction systems and related devices. **Lab and Field Trial Evaluation** – The fourth element of the work plan will be to run test cases of the AHEAD technology, involving both primary and secondary users both in a lab environment as well as in a more natural setting such as user community and home environment. Finally, the ***dissemination and exploitation*** **strategy** of the work plan will involve the development of the consortium's awareness raising campaigns and business planning as well as its user community management and IT governance issues.

## 2.6 Contingency plan

AHEAD will implement a risk management plan based on a rigorous and continuous risk analysis methodology involving all consortium members. The project coordinator will assess the global risks based on the information delivered by the WP leaders and reports by the Project Board members. The WP leaders will take the responsibility to identify and to report risks which threaten the achievement of the WP objectives within the planned time and financial budget. Furthermore, WP leaders will prepare on an ongoing basis an analysis of possible consequences for the AHEAD future achievements and develop proposals for managing the risk which will be discussed in Project Board meetings. Based on

the results of the analysis and of additional factors such as the probability of the identified risk to occur and the importance of its prospective impact, the PB will provide the consortium as needed and in order of priority with one or more of the following plans, which shall be implemented by the AHEAD partners: 1) Avoidance plan proposing solutions to prevent the anticipated problems 2) Mitigation plan with workaround to lower the impact on the foreseen technological and commercial objectives 3) Contingency plan with strategies how to minimize the risk impact once it has occurred 4)Therefore prior to beginning a major technological activity, a documented risk analysis will be carried out by the WP leader in charge. This analysis will focus on time allowed, cost, functionalities, quality, and mobilization of resources. The following table presents a selection of possible global risks for the appropriate development of the project together with probability evaluation, assumed impact on the project progress/achievements, and contingency strategy to avoid the occurrence of the anticipated problems. The table will be continuously updated during the entire life-time of the project.

| Risk Event | Prob | Severity | Contingency |
|---|---|---|---|
| Deviations from the work plan | Med | Med | The consortium has defined a comprehensive approach to project management, complete with communication policies and conflict resolution procedures. |
| Common standards of performance and success in the accomplishment of objectives are not maintained | Low | Med | Indicators for success will be clearly defined which will set the benchmark for performance norms throughout the project. |
| Unclear expectations and norms with respect to partner interactions | Med | Low | Relationships between partners and expectations in regard of partner interactions laid out in the Project Implementation Manual and Consortium Agreement. |
| Primary end users are not fully engaged and involved in design and development | Med | High | Clear parameters set around the level and depth of engagement with primary end users. Involvement monitored throughout. |
| Insufficient involvement, throughout, from secondary end users | Low | Med | Secondary end users are part of core project consortium and involved in all key project decisions. WP coordinators to maintain consistent dialogue with secondary end users. |
| Results of user requirements phase are not adequately reflected in prototypes developed | Low | High | Process of user requirements, product design & development to be iterative. Ongoing opportunities for end users to input into the design/development process. |
| End-user centres are unable to adequately support the testing phase with seniors due to technical or skills problems | Low | High | Considerable effort to be put into the training of all staff to support the testing process. Each testing centre to be 'mentored' by a project partner, including face to face support during testing sessions & evaluation meetings. |
| The profile and selection of primary end users does not meet with the requirements of the project objectives | Low | Med | Project plan allows for repeated testing sessions with the same users as well as the recruitment of new users as and when required. Extensive end user profiling to be undertaken prior to the testing phase and in collaboration with secondary users. |
| Interfaces not accessible for all profiles of end-user, rejection of the technology by users | Med | High | User-driven design methodology to be used in the project. In addition, internal and external validation to be carried out to address this; iterative design process will support incorporation of end-user feedback into final prototype. |
| Project development does not match some user requirements. | Med | High | Involve users and collect requirements from the beginning of the project. Continuous communication with end-users and mid-term validation to acquire comments and critics of end-users working with the early platform |
| High deployment complexity of the final project outcome because of necessary changes for many components. | Med | High | Deployment of intermediate results will at early stage help to detect problems and present solutions. Different integration phases simplify the problem. |
| Conflicts between project partners | Med | High | The main approach to conflict resolution will be the dialogue between the involved partners. Only if thereby a solution to the problem cannot be found the PMB will search for a workaround, if necessary by inviting an |

| | | | |
|---|---|---|---|
| | | | independent referee. Finally, the PB will propose a solution |
| Awareness of the results of the project will not reach the right targets in the market | Med | High | Partners have a strong expertise in disseminating and commercializing results. All the commercial channels will be activated in order to reach the target market. |
| The results of the project are not exploited optimally by all project partners | Med | High | Commercial partners in the consortium to agree on the structure and formation of a joint venture company providing the vehicle for sales beyond the project finish. This will form part of the IPR agreement signed by Month 14. |

## 2.7 Pilot application

For piloting the AHEAD system, extensive field trials will be conducted in Austria (JOH in cooperation with CURE). These trials are scheduled to last 4 months and will involve at least 10 participants. During the trials, the general usability and accessibility of the system is surveyed. Additionally, long term studies regarding the users' acceptance and their user experience of the AHEAD system are conducted.

**Success Evaluation - methodology:** The methodology to evaluate the success and the applicability, as well as the impact on the users is a mixture of qualitative and quantitative measures (method-mix). In order to get adequate feedback and data material, there are methods that involve the user face to face (e.g. post-trial interviews) but as well methods that gather feedback from the field (directly after interaction with the system). However, before applying the AHEAD system in the field the single mobile services are evaluated in a pre-field evaluation setup. This secures the quality of the services before handing it out to the users. In this way a good overall user feedback is generated: The following methods and measurements are applied:

*User Experience evaluation using non-verbal feedback:* The users are given the PrEmo[10] during their interactions with the system. This instrument gives feedback on emotional experiences of the implemented services. *Post-Experience evaluation:* User experience evaluation by narration is analyzed by post-task interviews. Here it is analyzed which positive and negative points of experience of interaction are evoked and remembered. *Acceptance measurement:* The evaluation partners will apply technology acceptance methodologies in order to evaluate how participants are likely to accept (in field trials and later) the implemented services. Main approach in this area is to apply UTAUT[11], the Unified Theory of Acceptance and Use of Technology. *Usability evaluation:* End-users are given pre-defined tasks and are asked to "Think-Aloud"[12] while performing. This qualitative method gives direct user feedback on usability issues and user interaction behaviour. *Usage Analysis:* By usage analysis (e.g. by log-files) the consortium gets feedback on usage behaviour during the used services during the trial (e.g. date and time of service usage, increasing or decreasing number of usage over time etc.). *Experience Sampling Method[13]:* Experience Sampling provides small mobile questionnaires that are presented to the participants on regular basis or just after interaction with one of the services offered by AHEAD. In this way it is possible to extract contextual feedback just after the point of experience.

### *Individual workpackage (WP) description*

| **WP number** | **1** | | **WP duration:** | M1 – M36 | | | | |
|---|---|---|---|---|---|---|---|---|
| **WP title** | **Project Management** | | | | | | | |
| **Activity type** | *Management* | | | | | | | |
| **Participant no. (lead partner first)** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **Participant short name** | **ATOS** | **TEC** | **IMA** | **CURE** | **JOH** | **COS** | **ADA** | **BRU** | **FZI** |
| **Person-months per participant** | **28** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** |

[10] Desmet, P.M.A. (2003). Measuring emotion; development and application of an instrument to measure emotional responses to products. In: M.A. Blythe, A.F. Monk, K. Overbeeke, & P.C. Wright (Eds.), Funology: from Usability to Enjoyment (pp. 111-123).

[11] Venkatesh, V., Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. Decision Sciences, 39, 273-315.

[12] Nielsen, J., Clemmensen, T., Yssing, C. (2002). Getting access to what goes on in people's heads? Reflections on the think-aloud technique. Proceedings of the Second Nordic Conference on Hum.–Comp. Int.. ACM Press, Toronto, 101–110.

[13] Larson, R., Csikszentmihalyi, M. (1983a) The experience sampling method. New Directions for Methodology of Social and Behavioral Science 15, 41-56.

**objectives of the WP**

The principle objective of this work package is to ensure that the project is managed efficiently throughout its life cycle. Specifically, the objectives are as follows:

- Efficient project management and project organization, including the development of a project implementation manual with guidelines for deliverables, presentation standards, time targets, information flow etc.
- Co-ordination of consortium communications
- Controlling of project results at each milestone based on determined performance indicators, as well as establishing and maintaining the technical plans of the project and the organisation of project meetings and reviews.
- Financial coordination.

**Description of work** *(possibly broken down into tasks) and role of partners*

This work package will be developed through the following stages:

**T1.1 – Project Implementation Standards. (M1)** This task aims at developing a project implementation manual which will act as a reference for all performance standards and indicators by which the AHEAD consortium will determine whether it is achieving its objectives in terms of quality assurance, efficiency and value on all levels.

**T1.2 - Partnership Management (M1-M36)**. Overall project co-ordination by minimised internal progress reports every month, including risk forms (delays and cause of delays). These short reports are summarised into interim reports to funding bodies every six months and followed by the official annual Project Progress Report (PPR). The daily project management will be structured and supported by techniques for project planning and organisation, e. g. Netplan, MS project, etc.

**T1.3 – Financial and Schedule Management (M1-M36). This task involves the** planning of project activities, as well as the co-ordination, organisation and maintenance of project schedules. The work also includes risk and contingency management as well as coordination of progress assessment and lessons learned coordination.

**T1.4 - Activity Planning and Reporting (M1-M36).** Creation and control of detailed work plans for each work package and creation of reports to the AAL funding bodies based on contributions from all partners. The coordination of the project will be led by partner ATOS with the remaining partners in support.

**Deliverables of the WP:** *no., brief description and project month of delivery*

D1.1 – Project Implementation Manual (M1)
D1.2a – D1.2e – Periodic Progress Reports (M6/12/18/24/30)
D1.3 – Final Report (M36)
D1.4 – Public Final Report (M36)

| **WP number** | **2** | | **WP duration:** | | *M1 – M7* | | |
|---|---|---|---|---|---|---|---|
| **WP title** | **User Requirements & Context Analysis** | | | | | | |
| **Activity type** | *Research* | | | | | | |
| **Participant no. (lead partner first)** | **3** | **1** | **2** | **4** | **5** | **7 ADA** | **8** | **9** |
| **Participant short name** | **IMA** | **ATOS** | **TEC** | **CURE** | **JOH** | **ADA** | **BRU** | **FZI** |
| **Person-months per participant** | **16** | **3** | **5** | **11** | **12** | **2** | **4** | **2** |

**Objectives of the WP**

The principle objectives of this work package are to:

- Gather input through consultation with the target base as to the fundamental requirements in terms of functionality upon which to base the design and integration of the AHEAD system and related applications.
- Identify specific end-user interests as input to the development of content
- Develop a sound system vision of how hardware, software and services are connected and used by primary and secondary end users.
- Generate consolidated user specifications as input to work packages 3 and 4.

**Description of work** (possibly broken down into tasks) and role of partners

This work package will be developed through the following stages:

**T2.1 – User Consultation Process Protocol and Tools (M1 – M3, Lead: IMA).** This preliminary task will involve the design of the consultation process and development of the various tools which will be used to gather feedback, e.g. questionnaires, interview templates, and process guidelines for focus group management. The protocol will be divided into 2 parts, namely, one that will focus on system functionality as far as the actual hearing aid and its technological components are concerned

and one which will focus on content, i.e. the software.

**T2.2 – User Requirements (M3 - M4, Lead: IMA).** This task will involve a consultation process with primary users (hearing impaired and non hearing impaired elderly people), and secondary users (audiologists and service providers like Johanniter) to determine the functionality requirements for development and integration in WP3. The User requirements can be divided into

- **"hardware" requirements** which deal with the users' demands concerning wearing comfort, size, energy consumption, connectivity
- **"software" requirements** which cover everything pertaining to usability and services.

**T2.3 – Context Analysis (M1 - M6, Lead: IMA)**

In order to develop innovative products and services not only user requirements have to be taken into account. Further comprehensive analyses include:

**- technological analyses** to provide insights into future possibilities for the new technologies

**- business and service analyses** to determine the marketability of the newly developed product, for hearing aid producers, audiologists, and service providers respectively

**- stakeholder analyses** to take into account how the different partners interact with each other and with the innovation and how each partner can profit from the innovation

**- prestudy usability analyses**: to determine the appropriate operating concept of the hearing aid, according to the end users' wishes and to feasibility.

**T2.4 – Results User Requirements (M6 - M7, Lead: CURE)**

If all aspects of this work package are taken into account, scenarios (for enhanced hearing aids and service concepts) with the best chances of success can be developed. This task can again be divided into two – partially overlapping – sub items:

**- Scenario development**: Based on the results of T2.2 and T2.3 the use-cases requested by the users as well as of standard functionalities are defined. The single functions and their corresponding use-cases are ranked regarding their priority for identified key features. Building on the catalogue of use-cases, several scenarios are created for the AHEAD user groups including the identified business opportunities from T.2.3.

**- Technological requirements:** Socio-technological aspects are transferred into technical requirements: The users' wishes and requirements are implemented. The results of the user requirements (T2.2) and context analysis (T2.3) as well as the user scenarios and technological requirements (T2.4) will be reported in D1.2.

**Deliverables of the WP:**

D1.1 – User Consultation Protocol and Tools Report (M3)

D1.2 – User Requirements and Context Analysis Report (M7)

| **WP number** | **3** | | **WP duration:** | | *M1 – M36* | | |
|---|---|---|---|---|---|---|---|
| **WP title** | **System development** | | | | | | |
| **Activity type** | *Development* | | | | | | |
| **Participant no. (lead partner first)** | **2** | **1** | **3** | **4** | **6** | **7** | **8** | **9** |
| **Participant short name** | **TEC** | **ATOS** | **IMA** | **CURE** | **COS** | **ADA** | **BRU** | **FZI** |
| **Person-months per participant** | **66** | **48** | **2** | **10** | **25** | **14** | **25** | **18** |

**Objectives of the WP**

Apart from the hardware developments, AHEAD architecture design and implementation is a key aspect responsible for the seamless connection of home and body sensors, sensor data fusion, context management, execution of services, user interaction and communication to the hearing instrument while ensuring the privacy and security of the user's personal data.

**Description of work**

**T3.1 – Hardware development (M7 – M36) (Lead:COS)**

In order to augment hearing instrument functionalities, physiological sensors such as heart rate, SpO2, core temperature (T3.1-a; COS) will be embedded as well as tri-Axial 6 Degree-of-Freedom inertial sensor (T3.1-b, COS) and a microphone (T3.1-c, BRU) that could be either mounted like Bluetooth headset or inside the user eyeglasses.

**T3.2 Data layer implementation (M7 – M36) (Lead:TEC)**

T3.2-a Vital signs (COS): this task will produce the appropriate signal conditioning (filtering and formatting) for Heart Rate (HR), Oxygen Saturation (SpO2) and Core Body Temperature (T).

T3.2-b Hearing instrument motion (TEC): this task will produce functions to extract Meta information from inertial sensor (3D accelerometer and gyroscope) measurements. The Meta information will be (1) indication whether the hearing instrument is worn or not, (2) basic human postures and walking events.

T3.2-c Context awareness module (FZI): based on the sensor data connected to the AHEAD server and an ontology reasoning; warnings and general user activities will be extracted.
T3.2-d Emotion detection and classification (TEC): From some of the physiological data measured inside the ear; this task will provide a module for (1) detecting emotional changes and (2) classifying (positive, neutral or negative) the emotional state of the user.
T3.2-e Voice command (BRU): a commercially available software will be selected and integrated into the AHEAD system. It will allow the user to launch and interact with the new services that AHEAD is offering.

**T3.3 Application logic implementation (M7 – M36) (Lead: ADA)**

T3.3-a On-line hearing test (ADA). In this task we will set up a distance learning session introducing the user to the functionalities of the hearing aid. This session will be extended with a user guideline focusing on the augmented hearing services provided in the AAL project. This task could also provide a simple hearing check (by means of non-calibrated pure tones) that could act as a continuous monitoring of the patient's hearing loss. The latter will enable a personalized adaptation of the AAL services offered.
T3.3-b Hearing aid - Use (TEC). This task will provide a method for detecting if the hearing instrument is worn or not. Using indoor localisation technologies, the AHEAD system will help the user to localise it.
T3.3-c Hearing Aid - telephony (TEC). We will implement the required communication protocols (e.g. VoIP) in the hearing instrument in order to establish a regular voice communication
T3.3-d Indoor object localization (TEC) will be available using home distributed RFID readers. The user will then put a passive RFID marker on the object he/she wants to locate in the future.
T3.3-e Affective Assistant (ATOS). Based on both contextual information and the end user emotional state, the AHEAD system will either (1) support the current daily activity or (2) propose a new action (e.g. meet a friend, go for a walk, take medications, and perform an aerobic activity).
T3.3-f Personal alarm (ATOS). We will develop a service which will (1) trigger alarms through voice commands and/or (2) automatic risky signal patterns (e.g. a risky postural situation extracted from the ear inertial sensor + context information or an abnormal heart rate).

**T3.4 Information adaptation and accessible user interface implementation (M7 – M36) (Lead: CURE)** In this task the user interfaces (UI) and the design of the interaction for the AHEAD services will be developed. A special focus lies on the integration of accessibility and usability standards for older users coming from science and industry. Direct feedback from iterative evaluation studies with older persons coming from T4.2 will be used to optimize UI and interaction concepts towards the final AHEAD UIs for the field evaluations. The outcome of this task will be the UI specification (delivered in D3.1) and low-fi interface prototypes for the 1st lab trials in T4.2 (delivered in D3.2)
T3.4-a Development of web interface (Lead: CURE) This task aims at developing an accessible UI for the access and configuration of the AHEAD services by primary and secondary end-users.
T3.4-b Development of mobile user interfaces and multimodal interaction techniques (Lead: CURE) Within this task novel user interfaces and interaction techniques for accessing the AHEAD services will be developed. The mobile interface is based on speech interaction (via hearing aid or hearing aid glasses) and additional graphical user interfaces (smart phone).

**T3.5 Service Oriented Architecture (SOA) set-up and integration (M7 – M36) (Lead: FZI)**

In this task, the actual AHEAD SOA will be implemented. The different software components developed in the previous tasks will be integrated into a consistent system.
T3.5-a Basic AAL infrastructure (FZI) this task involves the setting up of the basic AAL home sensors as well as the AHEAD local server that will contain aggregated data..
T3.5-b Complete system integration (FZI) This task will integrate all components developed in T3.1, T3.2, T3.3, T3.4 and T3.5 in order to provide either partial functional prototypes for lab trials (T4.2) or complete system for field trials (T4.3).

**T3.6. Overall System Conceptualization (M1 – M36) (Lead: IMA)**

All results and prototypes will be evaluated with the help of usability studies. The conceptual work will be based on the methodology of the Holistic Innovation.

**Deliverables of the WP:** D3.1 User Interface and Interaction Specification (M11, M16, M31)
D3.2 Low-fi Interface Prototypes (M11) ; D3.3 First integrated prototype (HW, adapted UIs + first Services) (M18); D3.4 Final system prototype (M25)

| **WP number** | **4** | | **WP duration:** | | M8 – M34 | | | |
|---|---|---|---|---|---|---|---|---|
| **WP title** | **Lab and Field Evaluation** | | | | | | | |
| **Activity type** | *(e.g. research, development, demonstration, management, etc.)* | | | | | | | |
| **Participant no. (lead partner first)** | **4** | 2 | 3 | **1** | 5 | 6 | 7 | 8 |

| Participant short name | CURE | TEC | IMA | ATOS | JOH | COS | ADA | BRU | |
|---|---|---|---|---|---|---|---|---|---|
| Person-months per participant | 16 | 3 | 17 | 3 | 9 | 2 | 5 | 2 | |

**Objectives of the WP**

- **Evaluation Methodology:** Definition and description of a comprehensive evaluation strategy used throughout all phases of project by all involved evaluation partners
- **User evaluations at labs:** Evaluation of AHEAD services and solutions in controlled environments to provide ongoing development feedback
  **User evaluations in the field:** Evaluation of AHEAD services and solutions in real environments involving older persons

**Description of work** (possibly broken down into tasks) and role of partners

**T4.1 Development of an assessment and evaluation plan** (M7-M29) (Lead: CURE)

As a basis for all evaluation studies within the AHEAD project a comprehensive evaluation and assessment plan will be developed (D4.1). This plan will describe the development and realization of methods, ethical issues and guidelines, metrics, criteria for the selection of users and the time and resource plans for the single lab and field evaluation phases. The features and tasks evaluated are based on the scenarios defined in T2.7. For the field evaluation, an exit strategy will be established.

**T4.2 Lab Trials** (M17-M27) (Lead: CURE)

In this task the AHEAD system components, user interfaces (UI), services and business models will be evaluated in lab trials with primary users focusing on usability, accessibility and user experience. There are three iterative evaluation/development phases:

- 1st Lab Trial: Evaluation of low-fi user interface prototypes and the interaction concept implemented in T3.4 (lead by CURE)
- 2nd Lab Trial: Evaluation of the first integrated prototype (HW, adapted UIs + first Services) (lead by CURE)
- 3rd Lab Trial Evaluation of the final system prototype (lead by JOH)

Each Lab Trial will involve at least 15-20 primary users. After each lab trial feedback is given to the development partners in order to adapt the system prototypes (WP3). The results of the evaluations and suggestions for optimizations will be reported in D4.2.

**T4.3 Field Trials** (M30-M34) (Lead: JOH)

For the field evaluations representative users will be recruited according to the inclusion criteria defined in T4.1. Field trials will take place in Austria and Germany. Prior to the field trials the hearing aid prototypes will be adapted exactly to the requirements of the single user by an audiologist. In addition the AHEAD services will be demonstrated in a workshop to ensure that the users are able to handle the system. The duration of the field trials will be 4 months. . The trials will involve at least 10 primary users. The evaluation will focus on usability, accessibility, user experience and acceptance of the AHEAD system. In addition the acceptance of the developed service delivery models will be evaluated. Users will get play money that can be swapped for single services, service packages or other delivery concepts. The amount of assigned play money for different services, delivery and business models deals as indicator of the acceptance. Results of the field trial user and business model evaluations will be reported in D.4.3.

**Deliverables of the WP:** D4.1 User assessment and evaluation plan (M10, M24)
D4.2 Lab Trials Evaluation Report (M13, M22, M28); D4.3 Field Trials Evaluation Report (M29)

| WP number | 5 | | WP duration: | | M1 – M36 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| WP title | Dissemination & Exploitation Strategy | | | | | | | | |
| Activity type | (e.g. research, development, demonstration, management, etc.) | | | | | | | | |
| Participant no. (lead partner first) | 1 | 2 | 3 | **4** | 5 | 6 | 7 | 8 | |
| Participant short name | **ATOS** | TEC | IMA | **CURE** | JOH | COS | ADA | BRU | |
| Person-months per participant | **22** | 5 | 6 | **4** | 10 | 2 | 2 | 10 | |

**Objectives of the WP**

The principle objectives of this work package are to:

- Manage the IPR generated throughout the project by means of an IPR working group. The initial strategy for management of the IPR and exploitation of the project results will be defined in the Consortium Agreement.
- Establish the means for achieving market awareness.
- Establish a 'Market Advisory Panel (MAP) to advise on approaches to business development.
- Establish a consolidated business model for commercial exploitation

- Build and manage a user interest community.
- Conduct an ongoing market research effort in relation to commercial exploitation.

Generate a consolidated commercial exploitation strategy.

**Description of work** (possibly broken down into tasks) and role of partners

This work package will be developed through the following tasks:

**T5.1 – Establishment and Manage Market Advisory Panel (Lead:IMA) (M1 to M6 & M13 to M18 ).** This initial phase will establish a steering group of relevant industry professionals which will advise on development and refinement of the business model for the AHEAD technology based on market research gathered by the consortium. The consortium Impact Director (ID) will assume responsibility for coordinating the activities and liaising with the MAP on behalf of the project consortium.

**T5.2 – Establish Business Development Approach (Lead:BRU) (M1 to M6 & M13 to M18 & M22 to M36).**

Following establishment of the Market Advisory Panel an initial approach to business plan development and commercial exploitation will be developed. This will initially involve a critical review of current business models. This review will analyse the success of different business models, at national and international level, in the target markets for the AHEAD technology. This initial report will also cover the success of various pricing strategies.

Following presentation of conclusions from this initial analysis to the MAP, a consultation exercise with the MAP will be coordinated by the ID and a business development strategy will be established.

T5.2a Extended Hearing aid business

AHEAD will only be a success if all stakeholders are aligned and both qualitive and quantative effects are taken into account. A stakeholder analysis will look at drivers and barriers per stakeholder. To make the benefits of AHEAD explicit for all stakeholders a business evidence model will be developed that takes into account costs, benefits (not only financial ones), reimbursement.

T5.2.b Service Development

This task will follow the four phases of method Johnson's methodology14 which represents a progression of planning, analysis and execution activities. The aim is to provide new services: (1) enhancing the profitability of existing offerings, (2) attracting new customers to the firm, (3) improving the loyalty of existing customers, and (4) opening markets of opportunity.

**T5.3 – Market Research (Lead : ATOS)**
**(M14 to M34). Stage 1 (M14 – M16)**

This phase, falling at the midpoint of the project, aims at producing an analytical report regarding developments within the proposed target markets for AHEAD. This task will involve a re-analysis of product positioning within the target market and identify additional areas for potential commercial exploitation of the AHEAD technology. Issues around the potential for 'scalability' of the AHEAD technology will also be examined.

Following presentation of this report to, and consultation with, the MAP a set of recommendations will be produced for a further iteration of the initial business development strategy.

**Stage 2 (M32 to M34)**

This phase, falling towards the end of the project, aims at producing a final analytical report regarding the proposed product position within the target market for AHEAD. This task will involve an analysis of product positioning within the target market at the end of the project and finalise additional areas for potential commercial exploitation of the AHEAD technology.

**T5.4 – IPR Management (Lead : ADA) (M1-M14) .** The consortium will establish a framework for drafting an IPR agreement which will be negotiated in line with the commercial exploitation strategy developed under tasks 5.2, 5.3 and 5.5. This framework will also be based on the specific interests and plans for exploitation of each individual partner and will be the focus of the IPR working group. Negotiations on the IPR framework and resulting agreement will be carried out according to the provisions outlined in the Consortium Agreement. The IPR Agreement will detail a formula which will be used to determine the share distribution amongst the partners.

**T5.5 – Consolidated Commercial Exploitation Strategy (M35 - M36) (Lead :BRU).** Following presentation of this report to and consultation with the MAP, a report outlining the intended commercial exploitation strategy for the AHEAD technology, including markets for exploitation and pricing strategy within these markets at both national and international level. This report will also identify proposed commercial exploitation actions and ROI management following the conclusion of the project.

**T5.6 Project Website. (M1-M36) (Lead: ATOS)** project website will be designed, populated and continuously updated for providing all the information related to the project. The website will also offer

[14] Johnson, S.P., Menor, L.J., Roth, A.V., Chase, R.B., 2000. A critical evaluation of the new service development process: integrating service innovation and service design. In: Fitzsimmons, J.A., Fitzsimmons, M.J. (Eds.), New Service Development—Creating Memorable Experiences. Sage Publications, Thousand Oaks,CA, pp. 1–32.

the possibility to download all the public information generated during the project.

**T5.7 Scientific and public dissemination (M1 – M36) (Lead: CURE)** All scientific and general publishing on the AHEAD project is encouraged. As a basis a detailed dissemination plan (D5.7) will be created, which describes, schedules and distributes all activities on scientific, public and general publishing. All material to be published will be checked in order to take care that no confidential material is published or IPRs are violated. This task covers the publishing of public Deliverables produced by the consortium via a project website as well, which will provide general information on the project, goals, partners, activities and results.

**Deliverables of the WP:**

D5.1 – Business Development Model Analysis (M6)
D5.2 – First Business Development Strategy and Plan (M8)
D5.3 – Intermediate Business Development Strategy and Target Markets Development (M16)
D5.4 – IPR Agreement (M14);
D5.5 – User Interest Community Updates (M6/12/18/24//30/36)
D5.6 –Consolidated Commercial Exploitation Strategy and Business Plan (M36);
D5.7 – Dissemination Plan (M6/24/32)

### *Work package (WP) overview list*

| WP no. | WP title | Type of activity | Lead partic. no. | Lead partic. short name | Person months | Start Month | End month |
|---|---|---|---|---|---|---|---|
| 1 | Management | Management | 1 | ATOS | 36 | 1 | 36 |
| 2 | User Requirements | RTD | 3 | IMA | 55 | 1 | 7 |
| 3 | System development | RTD | 2 | TECNALIA | 208 | 1 | 36 |
| 4 | Lab and Field Trial Evaluation | RTD | 4 | CURE | 57 | 7 | 34 |
| 5 | Dissemination & Exploitation strategy | RTD | 5 | JOH | 61 | 1 | 36 |

### *Deliverables overview list*

| Del. no. | Deliverable name | from WP no. | Nature/type of deliverable | Dissemination level (Public or restricted) | Delivery date (project month) |
|---|---|---|---|---|---|
| D1.1 | Project Implementation Manual | 1 | Report | R | M1 |
| D1.2a | Periodic Progress Reports | 1 | Report | R | M6, M12, M18,M24, M30 |
| D1.3 | Final Report | 1 | Report | R | M36 |
| D1.4 | Public Final Report | 1 | Report | P | M36 |
| D2.1 | User Consultation Protocol and Tools Report | 2 | Report | R | M3 |
| D2.2 | User Requirements and Context Analysis Report | 2 | Report | R | M7 |
| D3.1 | User Interface and Interaction Specification | 3 | Report | R | M11, M16, M31 |
| D3.2 | Low-fi Interface Prototypes | 3 | Prototype | R | M11 |
| D3.3 | First integrated prototype | 3 | Prototype | R | M18 |
| D3.4 | Final system prototype | 3 | Prototype | R | M25 |
| D4.1 | User assessment and evaluation plan | 4 | Report | R | M10, M24 |
| D4.2 | Lab Trials Evaluation Report | 4 | Report | R | M13, M22, M28 |
| D4.3 | Field Trials Evaluation Report | 4 | Report | R | M29 |
| D5.1 | Business Development Model Analysis | 5 | Report | P | M6 |
| D5.2 | First Business Development Strategy and Plan | 5 | Report | P | M8 |
| D5.3 | Intermediate Business Development Strategy and Target Markets Development | 5 | Report | R | M16 |
| D5.4 | IPR Agreement | 5 | Report | R | M14 |
| D5.5 | User Interest Community Updates | 5 | Report | R | M6, M12, M18, M24, M30, M36 |
| D5.6 | Consolidated Commercial Exploitation Strategy and Business Plan | 5 | Report | P | M36 |
| D5.7 | Dissemination Plan | 5 | Report | P | M6, M24, M36 |

### *Milestones overview list*

| No. | Milestone name | WP involved | Expected date (project month) | Means of verification |
|---|---|---|---|---|
| M1 | User Requirements | 2 | M6 | Deliverable D2.2 |
| M2 | First Integrated and operational Prototype | 3 | M24 | D3.5 |
| M3 | System Installation | 4 | M26 | D4.1 |
| M4 | Final Refined Prototype | 3 | M34 | D3.7 |
| M5 | Pilot Evaluation Conclusions | 4 | M36 | D4.3 |
| M6 | Socio-economic Assessment | 4 | M32 | D4.4 |
| M7 | Consolidated Commercial Exploitation Strategy and Plan | 5 | M36 | D5.6 |

### *Summary overview of staff effort in person months (pm)*

| Partic. no. | Participant short name | WP1 | WP2 | WP3 | WP4 | WP5 | Total pm |
|---|---|---|---|---|---|---|---|
| **1** | **ATOS** | 28 | 3 | 48 | 3 | 22 | **104** |
| **2** | **TEC** | 1 | 5 | 66 | 3 | 5 | **80** |
| **3** | **IMA** | 1 | 16 | 2 | 17 | 6 | **42** |
| **4** | **CURE** | 1 | 11 | 10 | 16 | 4 | **42** |
| **5** | **JOH** | 1 | 12 | 0 | 9 | 10 | **32** |
| **6** | **COS** | 1 | 0 | 25 | 2 | 2 | **30** |
| **7** | **ADA** | 1 | 2 | 14 | 5 | 2 | **24** |
| **8** | **BRU** | 1 | 4 | 25 | 2 | 10 | **42** |
| **9** | **FZI** | 1 | 2 | 18 | 0 | 0 | **21** |
| **Total** | | **36** | **55** | **208** | **57** | **61** | **417** |

## Pert Chart – WP Interdependencies

In the chart below you can see the interdependencies between the work packages.

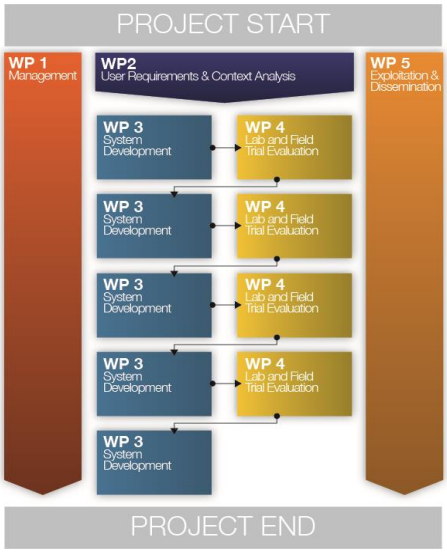
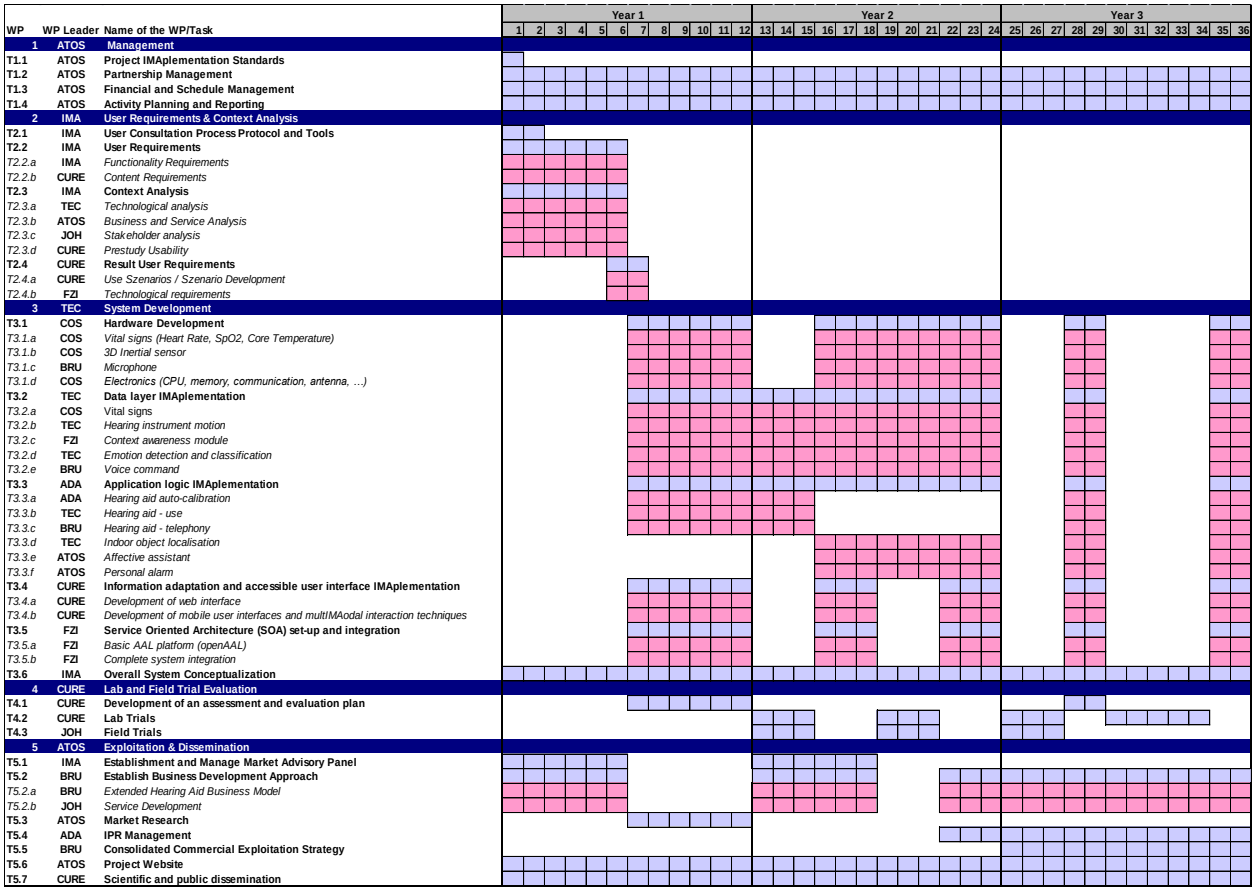



**Figure 3 –** *Pert Chart*

**Gantt Chart – WP Sequencing**




| WP | WP Leader | Name of the WP/Task |
|---|---|---|
| 1 | ATOS | Management |
| T1.1 | ATOS | Project IMAplementation Standards |
| T1.2 | ATOS | Partnership Management |
| T1.3 | ATOS | Financial and Schedule Management |
| T1.4 | ATOS | Activity Planning and Reporting |
| 2 | IMA | User Requirements & Context Analysis |
| T2.1 | IMA | User Consultation Process Protocol and Tools |
| T2.2 | IMA | User Requirements |
| *T2.2.a* | IMA | *Functionality Requirements* |
| *T2.2.b* | CURE | *Content Requirements* |
| T2.3 | IMA | Context Analysis |
| *T2.3.a* | TEC | *Technological analysis* |
| *T2.3.b* | ATOS | *Business and Service Analysis* |
| *T2.3.c* | JOH | *Stakeholder analysis* |
| *T2.3.d* | CURE | *Prestudy Usability* |
| T2.4 | CURE | Result User Requirements |
| *T2.4.a* | CURE | *Use Szenarios / Szenario Development* |
| *T2.4.b* | FZI | *Technological requirements* |
| 3 | TEC | System Development |
| T3.1 | COS | Hardware Development |
| *T3.1.a* | COS | *Vital signs (Heart Rate, SpO2, Core Temperature)* |
| *T3.1.b* | COS | *3D Inertial sensor* |
| *T3.1.c* | BRU | *Microphone* |
| *T3.1.d* | COS | *Electronics (CPU, memory, communication, antenna, …)* |
| T3.2 | TEC | Data layer IMAplementation |
| *T3.2.a* | COS | Vital signs |
| *T3.2.b* | TEC | *Hearing instrument motion* |
| *T3.2.c* | FZI | *Context awareness module* |
| *T3.2.d* | TEC | *Emotion detection and classification* |
| *T3.2.e* | BRU | *Voice command* |
| T3.3 | ADA | Application logic IMAplementation |
| *T3.3.a* | ADA | *Hearing aid auto-calibration* |
| *T3.3.b* | TEC | *Hearing aid - use* |
| *T3.3.c* | BRU | *Hearing aid - telephony* |
| *T3.3.d* | TEC | *Indoor object localisation* |
| *T3.3.e* | ATOS | *Affective assistant* |
| *T3.3.f* | ATOS | *Personal alarm* |
| T3.4 | CURE | Information adaptation and accessible user interface IMAplementation |
| *T3.4.a* | CURE | *Development of web interface* |
| *T3.4.b* | CURE | *Development of mobile user interfaces and multIMAodal interaction techniques* |
| T3.5 | FZI | Service Oriented Architecture (SOA) set-up and integration |
| *T3.5.a* | FZI | *Basic AAL platform (openAAL)* |
| *T3.5.b* | FZI | *Complete system integration* |
| T3.6 | IMA | Overall System Conceptualization |
| 4 | CURE | Lab and Field Trial Evaluation |
| T4.1 | CURE | Development of an assessment and evaluation plan |
| T4.2 | CURE | Lab Trials |
| T4.3 | JOH | Field Trials |
| 5 | ATOS | Exploitation & Dissemination |
| T5.1 | IMA | Establishment and Manage Market Advisory Panel |
| T5.2 | BRU | Establish Business Development Approach |
| *T5.2.a* | BRU | *Extended Hearing Aid Business Model* |
| *T5.2.b* | JOH | *Service Development* |
| T5.3 | ATOS | Market Research |
| T5.4 | ADA | IPR Management |
| T5.5 | BRU | Consolidated Commercial Exploitation Strategy |
| T5.6 | ATOS | Project Website |
| T5.7 | CURE | Scientific and public dissemination |

Figure 4 – *Gantt Chart*

# Section 3: Quality of the consortium and efficiency of the implementation

**The total length of section 3 is recommended not to exceed 8 pages.**

## 3.1 Quality of the Consortium

**Partner No. 1: ATOS Research & Innovation, Spain**

Atos is one of the major international information technology services company. Atos employs 75,000 professionals in 42 countries. Atos is the Worldwide Information Technology Partner for the Olympic Games and has a client base of international blue-chip companies across sectors including CPG/Retail, Discrete Manufacturing, Financial Services, Process Industries, the Public Sector, Telecom, Utilities and Media. Atos participates in technology platforms like the European and Spanish platform of Nanomedicine, eMOV for mobility, eSEC for security, PROMETEO for embedded systems, INÉS for software and services Atos Research & Innovation (ARI), node of Research & Development of Atos, is a point of world reference in innovation for the whole Atos group. It is focused on project accomplishment, combining the most advanced Technological developments and the economic exploitation of results in Research & Development. Further information is available at http://www.atosresearch.eu The Health sector within Atos Research & Innovation builds on the experience of the former Biotechnologies & Healthcare(B&H) Unit, and is composed of a group of engineers, biologists, bio-informatics, mathematicians, and doctors specialised in applied research and development of bio and health related projects. This group has a very wide experience on project management counting among their professionals with IMR certified personnel. Moreover, Health Sector of ARI has participated in many different projects related to Health, e-inclusion and AAL as Technical partner counting with great experience in project management as well as to fill the gap between research and innovation and commercialization of R&D outcomes.

**Manuel M. Pérez Pérez** He is Forestry Engineer by the Universidad Politécnica de Madrid, Genomic Engineer by the Columbia University and Master of Science in Bioinformatics and Computational Biology by the UCM. Before joined Atos, he worked on microarray data processing at the Memorial Sloan Kattering Cancer Center (NY), and at the Spanish National Center of Biotechnology. He joined Atos in April 2006 as a health consultant participating since then in the realisation of international projects delivering consultancy, software solutions and system integration, working on several projects for the European Commission where Atos has consolidated a strong partnership with many public and private institutions from all European Countries. He has developed both administrative and technical work mainly in the LOCCANDIA and DAPHNet projects. He is currently working on managerial tasks for MovingLife and REACTION Project.

**Partner No. 2: TECNALIA Research & Innovation, Spain**

**Tecnalia Research and Innovation** (www.tecnalia.com) is the leading private research and technology entity in Spain and the fifth largest in Europe, employing 1,500 people (164 PhDs). Tecnalia operates in all the fields of Industry and Transport, ICT, Sustainable Development, Innovation Systems and Health and Quality of Life. Tecnalia's Health & Quality of Life (THQoL) Unit is focused on ICT-based applications of assistive technology for older and disabled people, developing solutions for autonomy, safety, independence and quality of life at home. THQoL also works in Ambient Assisted Living (AAL) and smart home technologies in regional, national and European R&D and innovation projects: SOPRANO (FP6-AAL call), BEDMOND (AAL-2008-1 call), HMFM (AAL-2008-1), ASSISTANT (AAL-2011-4)

**Key personnel: Dr. Pierre Barralon** received the M.Sc. degree in signal, image, and speech processing and the Ph.D. degree in Electrical and Computer Engineering from Joseph Fourier University, France, in 2005. He was for three years a Postdoctoral Research Fellow at the University of British Columbia, Canada. In 2008 he joined the Health Technologies Unit of Tecnalia foundation to work on the improvement of quality of life of elderly and disabled people by addressing mobility and stability problems using embedded sensors for kinematics and physiological measurements.

**Contribution:** TEC will lead the workpackage System Development (WP3) with a strong focus on the mobile android platform and its interaction with both the local AAL home network and the hearing instrument together with the services it will offer. In addition Tecnalia is proposing its expertise in emotion detection based on physiological sensors

**Partner No. 3: Innovationsmanufaktur, Germany**

The core competences of Innovationsmanufaktur GmbH are the development and application of methods for the stimulation and organization of innovation, for innovation management in complex settings, and for the integration of user needs and motivations into innovative projects. This is achieved by:

- The dynamic utilization and constant further development of Innovationsmanufaktur's own innovation methodology (Holistische Innovation, Springer-Verlag 2009, see also www.holistic-innovation.org).
- The application and integration of theoretical and applied knowledge in user motivation, contextual embedding, system visioning, and determination of technological opportunities.
- The reliable access to a world-wide theoretical and social experts´ network.
- More than ten years of team experience in handling innovation projects.

The team of Innovationsmanufaktur is experienced in the management of interdisciplinary, complex and multinational innovation projects. Over the last decade they have initiated, coordinated and managed a large number of innovation ventures with partners from industry (see references below), and academia around the globe, several of them funded by regional, national and international institutions. Our **VISION** is to be frontrunner in holistic innovation and as such to realize new solutions that meet the needs of mankind and to actively help shape a desired future. Our **MISSION** is the systematic development of systemic solutions that meet the demands of society and industry. Our **PASSION** is to live and to love innovation – with creative disobedience, competence and fun. Our **CORE COMPETENCE** includes the development and application of methods for the stimulation and organization of innovation, the innovation management in complex settings, and the integration of user needs and motivation into innovative projects.
We successfully apply our method of holistic innovation in the German and international markets. Our clients are diversified in different branches like automotive, engineering, industrial production, materials, healthcare, food & beverage, sports, lifestyle and tourism. We support enterprises like BMW, BOSCH, DAIMLER, TRUMPF, HEAD, MAN, ADIDAS, VOLKSWAGEN and many more in their innovation process and developments. Projects have been funded by German, Japanese, and Mexican Ministries, the EU, and others.

**Partner No. 4: Center for Usability Research and Engineering, Austria**

**CURE – Center for Usability Research & Engineering** is one of Europe's leading organizations in the area of User Experience Research comprising the fields of Usability Engineering, Human-Computer Interaction (HCI), User Interface Design, User Centred Design and Persuasive Interaction Design. CURE has been working on the development and application of user centred design methodologies, innovative user interfaces, natural interaction environments and persuasive interfaces for several years. CURE comprises a highly interdisciplinary team assembling all skills of contributing disciplines such as computer science, psychology, sociology, pedagogy, didactics, industrial design, communication science or management science.

Over the years CURE has been involved in and led more than 150 projects and several national and international initiatives. Research topics within these projects are focused on advanced interaction modalities, mobile systems, advanced web environments and multichannel platforms. Among these projects, CURE leads (vAssist) or is partner in (i.e. Bedmond, AMCOSOP, ELDERHOP, FoSIBLE, SeniorEngage, 3rdLIFE, T&Tnet) several projects of the AAL-Joint-Programme. Further, CURE is involved in the national AAL program "benefit" as well as in related Objectives of FP7 (Coordinator: HERMES (finished), uTRUSTiT; Partner: Chronious, CompanionAble, Maseltov).

CURE's research concerning usability, accessibility and user experience ensures that the user needs and end-user acceptance are properly addressed throughout the entire project. CURE is equipped with a leading edge and highly flexible user experience laboratory (lab based as well as mobile) comprising the whole range of most advanced user research and demonstration facilities. CURE takes a leading role in the evaluation field trials in Europe, and particularly setting up and leading trials taking place in Austria.

**Partner No. 5: Johanniter, Austria**

Johanniter-Unfall-Hilfe in Österreich (JUHÖ) was established in 1974 as a non-governmental charity organization. Legally, JUH is acknowledged as registered charitable (non profit) association ("Verein", registered in Vienna, Austria, Zentrales Vereinsregister Nr. 269856203). Historically, the foundation of JUH links back to the 11th century. The JUHÖ is active across Austria and part of the international active Order of St. John. The core competences are rescue- and ambulance service, care activities, disaster

relief. A part of the care activities is fall detection as it is a service sold by the JUHÖ. This particular section of the JUHÖ is a secondary end user type with direct contact to primary end users.
The JUHÖ also provides First Aid Lectures and diverse social activities for seniors with a focus on healthy active and social ageing. The R&D Dept. of JUHÖ has as one focus, fall prevention and fall detection along with additional technological developments for healthy active ageing. The JUHÖ is the major distributor for AAL Technology on the Austrian Market. It is part of the Austrian eHealth Initiative for AAL, preclinic emergency treatment and chronic disease management. JUHÖ has 45,071 members Austria-wide. Johanniter-Unfall-Hilfe in Österreich operates partly through subsidiary enterprises. The JUHÖ will provide contact to primary end users and secondary end users and offer expertise in topic related research, access to their training facilities and training resources in Austria, access to the international network of St. John and national and international dissemination channels. The JUHÖ is also eager to integrate the results of the project as a new service branch in its structure.

Robert Brandstetter is chief executive manager of the Johanniter-Unfall-Hilfe in Österreich; since 2007 JUHÖs federal chief executive manager; responsible for business, legal, organizational affairs at JUHÖ, experienced in project work from MORE project (3006 DE) and SILC (IST-2000-27524). He studies Law at the University of Vienna and formerly worked at the Austrian Foreign Exchange Service at the University of Vienna.
Robert Heindl is organizational manager of JUH´s training center, since 2007 general manager of JUHÖs Vienna branch, experienced in ambulance and emergency systems, service centers, knowledge experienced in project work from MORE project (3006 DE) and SILC (IST-2000-27524); trainings for quality management, responsible for quality management of JUHÖ.
Mag. Georg Aumayr is Head of the R&D Dept. of JUH, since 2007 member of the JUH as volunteer emergency medical technician, researcher and project manager at the Research Institute of the Red Cross and experienced in EC project work - project manager on SOFTCARE (AAL Joint Programme), Personal Emergency Card and PIK (national security research program KIRAS), as well as a researcher in CAST (FP7- Security), Sicher Aktiv, SimRAD, ORESP and part of eHealth Initiative for AAL.
Mag.a Belinda Schneider is Head of the Marketing and Communication Dept. of JUH. She works for JUH for a couple of years now and is responsible for the quarterly newspaper of the Johanniter and for the advertisement of new products and services. She is an expert for B2P (Business to private) communication and eventmanagement.
Friedrich Drechsler is an emergency medical technician, trainer for emergency medicine, scientific staff in the FP7 Project Quest City and the R&D Dept. and Key account Manager for the JUHÖ in the region of Vienna.
Michael Bredl is the Head of the service Dept. for Akkontel, the personal emergency system of the JUHÖ. He is more than 20 years in the business and the leading expert for businessrelations in the AAL Field of the Johanniter.

**Partner No. 6: Cosinuss, Germany**

cosinuss° GmbH (www.cosinuss.com) is a small german enterprise with its core competence lying in the development of highly precise sensors that can monitor vital parameters in the ear. cosinuss° was founded in September 2011 with its head quarters in Munich and is now heading toward exploitation of its technology. Currently it employs five people and is also strongly connected to universities and research centers.
cosinuss° develops a new cutting edge sensor technology that enables the mobile, continuous and convenient measurement of vital signs in the ear. First prototypes were developed within the framework of the research project InPrimo that was funded from the Federal Ministry of Economics and Technology in the program next generation media. With the competence of cosinuss° it will be possible to not only assist the elderly in everyday life but also to pay attention to their health. By enabling the continuous monitoring of heart rate, body core temperature and oxygen saturation a very close surveillance of health status will be possible.

Key Person. Dr. Johannes Kreuzer.Co-Founder and CEO of cosinuss° received his diploma and Ph.D. Degree at the Technische Universität München in electrical engineering with a focus on medical devices. Dr. Kreuzer already has over 8 years of experience with the development and production of the new sensor amongst others in the framework of another research project called InPrimo. He is thus the ideal person for contributing technical resources in this project.

**Partner No. 7: AuditData, Denmark**

**AuditData A/S,** Back in 1992, Auditdata was founded as a joint venture between Danavox (now GN ReSound) and Claus Bak Petersen. The company was dedicated to the development of software applications for the health sector - modules for programming digital hearing instruments and technical and administrative software systems covering all functions in a hearing clinic.
Soon Auditdata had developed the AuditBase System, which provided advanced software for hospital-based audiology clinics. Today, this system is the leading software system for audiology clinics in public hospitals and interfaces client records, scheduling and audiological diagnostics with central medical record systems. Most hospital hearing clinics in Denmark, Sweden, Norway and Great Britain now use AuditBase for storing all audiologic and hearing instrument data. In fact, in Great Britain alone, there are more than 150 AuditBase installations and in excess of 2,500 users.
In 1999/2000, Auditdata went on to develop a similar system for use by hearing aid dispensers. Aimed exclusively at the German market, Mirage System was supported by a German subsidiary.
In 2010, Auditdata entered a new chapter in its history with the acquisition of Real Ear A/S. The Real Ear Fitting System is an innovative fitting system that includes everything needed within audiometry, real ear measurements, client counselling and hearing instrument testing.
Today, Auditdata develops and supports total solutions in audiology. 2009-2011 partner in ARTEMIS project on the development of system level modeling tools (SYSMODEL).

**Role in the project**: ADA will lead the application logic implementation and in this respect provide an on-line hearing test solution enabling the monitoring of the hearing loss of elderly people and thereby adapt the AAL services accordingly.

**Claus Bak Petersen** Since 2006 president for AuditData A/S. In 1987 Co-founder and Director for consulting company specialized in guiding a technology project from its inception, through the complete design stage to the final commercially available solution (TechnoData A/S). From 1992-2000 CEO for the joint venture audiology software company between Danavox (now GN ReSound)and TechnoData A/S. In 1991 Claus Bak Petersen graduated M.Sc. (EE) from the Technical University of Denmark. Honorary appointments includes Member of the Board of several IT-companies, Member of the Board of AOPA Denmark (1999, from 2001-2008 as Chairman), Member of the board of Danish Flight Safety Council (2003, from 2004-2008 as Chairman).

**Partner No. 8: Bruckhoff, Germany**

bruckhoff hannover is a specialist for the development and production of innovative hearing systems “Made in Germany“. Their innovative hearing instruments have been setting standards in terms of technology, comfort and design for decades. This is especially the case with their hearing glasses. Product development is the strength of bruckhoff hannover. From the optimization of existing technology to a complete new development, the company provides skilled support from one source. bruckhoff is not only a specialist for hearing glasses but also for combining innovative product design with an elegant and simple handling.
Because of its know-how and modern technology, bruckhoff hannover is also a sought-after partner for industry as regards the design of products or special accessories, for example:

- Hearing instruments
- Components
- Headsets
- RIC-hearing instruments
- Design Products.

bruckhoff's constructions of hearing glasses have been appreciated by customers for decades and are highly recommended by the hearing instrument industry. Using a range of state-of-the-art external and internal products, the customer's individual demands are realized – ranging from standard solutions to special requests.
In October 17, 2011, the ZDH e.V. (Zentralverband des deutschen Handwerks) honored bruckhoff hannover’s hearing system “la belle” as the "Masterpiece of the week". The ZDH appreciates in this campaign German companies with excellent and innovative products.

**Partner No. 9: FZI Research Center for Information Technologies, Germany**
**The organisation:** FZI is a technology transfer center for information technologies which is closely linked to the Karlsruhe Institute of Technology (KIT), which is one of the universities of excellence in Germany. FZI covers a broad range of information technology topics. For the project, the Information Process Engineering (IPE) research division will be involved, which

is renowned for its research in the area of ontologies, Semantic Web technologies and context-aware systems (e.g., in the fields of AAL, and learning, knowledge management). FZI is W3C member and actively involved in the standardization of the Ontology Web Language (OWL).
FZI has a strong record of transferring research results into industrial practice, both through its spin-off companies and by contract research with industrial partners. FZI additionally is the focal point of a network of more than 100 IT companies within the high-tech region of Karlsruhe.
**Relevant skills/experience/technologies:** FZI participates in (some of them as coordinator) in several European initiatives in different fields. Among them, the most relevant for CHI are:

- In the project UNIVERSAAL (http://www.universaal.org) FZI is involved in the activities around the semantic configuration of AAL services as well as the ontological representation of concepts for the management of AAL application. Parts of the universAAL project have been used by FZI in the House of Living Labs where different hard- and software have been integrated into the middleware.
- Within the SOPRANO IP (FP6, http://www.soprano-ip.org) on Ambient Assisted Living, FZI has shaped the ontology-centered design approach of SOPRANO, which brought together the diverse stakeholders in the project, has guided the ontology development and plays a major role in the ambient middleware (especially context management under uncertainty as an extended form of user modelling and adaptive system behavior). Together with CAS and the University of Jena, it has initiated an open source ambient middleware project (openAAL), which makes outcomes of the SOPRANO project publicly available.
- The eInclusion FP6 project AGENT-DYSL (http://www.agent-dysl.eu) has built an adaptive reading support application for children with dyslexia. In this project, FZI is work package leader for the ontology development, ontology-based infrastructure and adaptation.

**Role in the project:** FZI will guide the ontology development as the development of a shared understanding, will be work package leader for user modelling and user context management, and will contribute to descriptive specification of adaptation knowledge
**Key Personnel**
**Oliver Strnad (Scientific Programmer openAAL Context Manager), Tom Zentek (Researcher Contect-Based Configuration of AAL systems) and Dr. Asarnusch Rashid (Department Manager Health Care Logistics)** are experienced with context management in AAL environment and the implementation of AAL use cases. They already worked in different EU-funded AAL projects like myUI, SOPRANO, UNIVERSAAL, AMICA, and they successfully implemented and evaluated several AAL systems for patients with multiple sclerosis (MS FIT), with COPD (AMICA), with stroke (Stroke Manager/Inspire) and with high-risk of falling (Sensormatt/Inspire).

## 3.2 Project management

*Describe in short, how the management structures are set up and utilized in the project, e. g. the organisational structure, decision making structures, and conflict resolution. Map the competences of project coordinator and partners involved in management to the tasks to be done. Describe how RTD performers grant access to background knowledge of other consortium partners (e.g. the users/user organisations) and also describe how the innovative potentials of consortium partners - not accustomed to innovation activities - are mobilized and utilized. Relevant other management duties - such as how the daily operation of the test environment will be sustained – can be included in this paragraph.*

The following section provides an overview of the way in which the consortium plans to structure the implementation of the project plan.

3.2.1 Overview

The project management structure in AHEAD is illustrated in the following diagram.

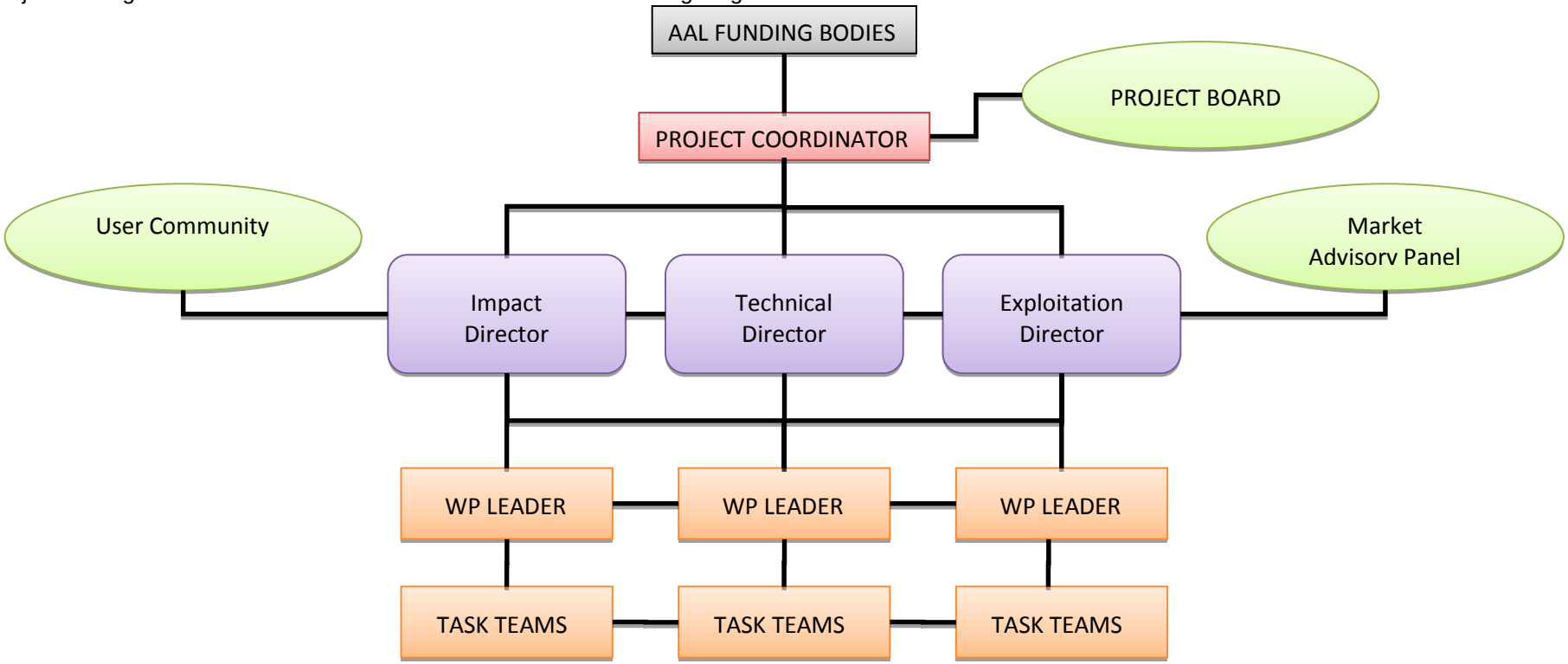



*Figure 7* – Augmented Hearing *Project Management Structure*

### 3.2.2 Roles and Responsibilities

The key roles and responsibilities within the project team are as follows:

***Project Coordinator ( ATOS) -*** *The Project Coordinator (PC) will be responsible for ensuring that all the project's requirements are fulfilled in terms of scheduling and that project progress is in line with the project plan. The PC will act as the coordinator of all project activities, thus ensuring that the overall project schedule is adhered to and objectives are met.*

***Project Board (PB) -*** *The Project Board (PB) has the overall responsibility for the success of the project and in relation to the Commission. It will meet at least twice per year (unless more frequent meetings become necessary) during the course of the project and will be chaired by the Project Coordinator. Any and all conflicts in the project are resolved by the PB. The board's specific tasks are to: 1*) Decide on the strategy for conducting the project and assess the progress of the project, decide on corrective actions if necessary and authorize appropriate amendments to the work plan. 2)Review the policy and strategy for dissemination and publicity, authorize the project dissemination strategy and its eventual revisions as necessary. 3) Assess the impact of any change to the contract which may be necessary during the course of the project and respond accordingly.

Each contracting partner will nominate a senior representative to the PB who will represent the interest of his/her organization and will ensure that its duties in regard of the project (technical, administrative or financial) are properly fulfilled. The PB decisions will be taken by consensus. If such consensus cannot be reached, decisions will be taken by majority vote, where each partner has one vote.

***Technical Director (TEC) -*** *The Technical Director (TD) will be responsible for overseeing all technical developments during the course of the project.*

***Impact Director (ATOS) -*** *The Impact Director will be responsible for monitoring, managing and measuring the consortium's strategies and implementation plans for assuring successful impact of the AHEAD technology in the market place. The areas of importance for the ID will involve coordinating the consortium's dissemination and awareness raising activities as part of WP5. This will include overseeing the development of the AHEAD Market Advisory Panel. Furthermore, the ID will coordinate the consortium's socio-economic assessment activities in WP4.*

***Market Advisory Panel ( IM) -*** *The* Market Advisory Panel *(MAP) will consist of a panel of representatives from the target base who will provide advice on the consortium's plans and activities aimed at building critical mass of interest and impact in the market. The panel will be composed of 2 primary users, 2 secondary users and 6 tertiary users. The representatives will be individuals who are known to the partners and who have been identified as having the relevant knowledge of the market. Panel members will sign a non-disclosure agreement once they join. The ID will manage the establishment of the Group and coordinate consortium communication with its representatives. Input from the Group will guide the consortium's dissemination and exploitation efforts.*

***Exploitation Director (BRU) -*** *The Exploitation Director (ED) will be responsible for coordinating the activities related to the definition and implementation of the exploitation plans for the project results. The ED will also coordinate the establishment of the IPR agreement among the consortium members.*

***User Interest Community (UIC), (CURE) -*** *The ongoing development and coordination of the* ***Augmented Hearing*** *user interest community is a critical activity which will be an important determinant of the viability of* ***AHEAD*** *particularly after the period of AAL funding has come to an end. Although all partners will have a responsibility for ensuring the growth of the UIC, partner JIBS will coordinate communication with the community as part of task 5.7 in WP5.*

***Work Package Leader -*** *Each Work Package Leader is responsible for the co-ordination of all activities and tasks within the work package for which he/she is responsible. This includes keeping the PC informed of all technical problems, which may arise within the WP, and preparing all deliverables planned for the WP.*

### 3.2.3 Conflict Resolution Procedures

Attempts at arbitration will be performed in increasing order of authority within: 1) The team of each work package, under the management of the WP leader. 2) The PB, under the management of the project coordinator.Should the need arise, a meeting will be held with all representatives of the respective level. During the meeting agreements will be sought through dialogue and mutual concession. In the event of failure to reach agreement, a meeting at an upper level will be arranged. Requests for meetings must include suggestions for possible solutions and answers will be required within a specified timeframe. Should a situation arise where parties to a conflict find themselves deadlocked and the prescribed measures fail to achieve resolution, in the interests of the project as a whole, the project coordinator shall have the final say always taking into account the contractual rules and the Consortium Agreement.

### 3.2.4 Quality Assurance and Control

As part of the work carried out in WP1, at project commencement the Project Coordinator will prepare the **Project Implementation Manual** which will detail all procedures to be used by the consortium partners during the course of the project. The manual will establish the performance and management

standards to be adopted during the project, document control mechanisms to be used and measurement of success indicators.
With respect to performance monitoring and quality assurance in particular, work package leaders will be required to submit a progress or task status report to the WP1 leader at 3-monthly intervals. The report will provide summary information regarding the technical progress, results achieved as well as any deviations from the work schedule that may have occurred. The status report will also include details of resources spent during the 3-month period so that possible deviations from the original schedule of estimates can be anticipated and managed accordingly. Should any conflicts or disputes with respect to performance standards arise during the course of the project; these will be handled according to the guidelines outlined in section 2.1.3.

### 3.2.5 Partner Competencies to Tasks Mapping

All partners participating in the project have specific competences and their expertise, technical and intellectual capability are essential in order to reach the objectives established which will guarantee success.
With respect to quality assurance and control procedures, the consortium's approach involves the following key inputs: ***Consortium Agreement*** – The consortium agreement will be signed by the partnership in line with AAL requirements should the proposal be approved for funding. ***Project Implementation Manual*** – This reference manual, deliverable D1.1 will be the first task of WP1. The manual will specify performance standards and working practices to be adhered to during the course of the project. The content of the project implementation manual will be discussed and agreed during the kick off meeting should the project be approved. ***IPR Agreement*** – the IPR agreement will the focus of task T5.4. The partners will sign a negotiated IPR agreement by month 14, at stage in the project at which developments will be sufficiently mature. ***Deliverables, schedules and deadlines*** – Should the project be approved, the deliverable schedule specified below will be translated into concrete deadlines. The management of deliverables scheduling will be the responsibility of the project coordinator. ***Risk and contingency planning*** – A key element of the quality assurance and control procedures, risk and contingency planning is a complex exercise in technology development projects and must be managed as an ongoing process, subject to continuous assessment and revision. At proposal stage, a preliminary schedule is detailed below in section 2.6. ***Lessons learnt assessment*** – The AHEAD project is an iterative learning process to which the partners are committed. The lessons learned assessment process will be an important element of the quality assurance and control procedures and will be a part of the formal task completion and internal review process.

# Section 4: Project impact - exploitation of project outcomes

## 4.1 Demonstration of European wide exploitability

**The legal/regulatory framework:** Europe is facing a number of health related issues as the huge increase in patient numbers and the growing number of chronic diseases related to elderly people as well as the ever increasing demand for a good quality healthcare assistance. Therefore, the health related costs are expected to grow dramatically in the next coming years boosted by the demographical change. It is estimated that developed economies spend currently around 10% of GDP on healthcare. If this trend continues expenditure would climb to 15% of GDP by 2020[15]. Clearly, in the current economical context government, health authorities will not be able to sustain this financial burden. In order to help Member States the EU has launched some initiatives for identifying and sharing best practices: **The Digital Agenda** is part of the Europe 2020 strategy and aims at identifying the needed measures to be put into place or proposed over the next 2-3 years. It includes measures to use technology to address rising healthcare costs and help Member States cope with their ageing populations. **The i2010 action plan** had a particular focus on the development of ICT related strategies and defined an interoperability roadmap for boosting the use of technologies and services. **The European Health Strategy** aims at providing an overarching strategic framework in the field of health and lists as strategic themes: ***Fostering Good Health in an Ageing Europe****, Protecting Citizens from Health Threats, and Dynamic Health Systems and New Technologies*. **The European Committee for Standardization** aims to develop European standards for a growing number of issues in the healthcare sector. The European Union also works in achieving technical harmonization of the medical directives that specify the conditions that any medical devices have to meet before to be marked as CE. According with the **Medical Device Directive 2007/4/EC (MDD)** aid hearing are medical devices since they aims at alleviation of or compensation for a handicap and specifically they are classified as medium-risk devices **Class IIa** . As any other medical devices, hearing aids must comply with the essential requirement specified in the MDD as well with the specific Class IIa requirements. Aid hearing manufacturers are the responsible for the product quality, before and even

15 National Health Expenditure Projections 2010-2020

after utilization of the product. CE marking is needed for devices in classes IIa, national certification bodies are authorized to assess the conformity of the device with the CE mark. The aim of this certification is clearly identify in the European market those devices that are in conformity with the MDD directives. In spite of the European directives, legislation and policies related to health are responsibilities of the governments of the EU Member States. National governments also set the overall financial framework for the healthcare sector, although with varying degrees of control of the management of the allocated financial resources for healthcare services. Financing and reimbursement schemes for health services vary greatly among the EU Member states. Based on this fragmented picture, business models and business cases for AHEAD must be tailor-made for every Member State.

**The socio/economic impact:** The EC defined in 1996[16] the grades of hearing impairment establishing 5 grades: normal, mild, moderate, severe and profound. Mild and moderate hearing impaired individuals account for 16.9% and 4.6% of the population respectively. The estimated total number European citizens suffering from serious hearing loss is around 70[17] million. The number is approximated since some countries have not official statistics, such as Bulgaria[18] and Croatia[19] where is estimated live ~50.000 and ~12.000 personas with hearing loss greater than 25 dB, that is the threshold according the World Health Organization (WHO) for diagnosis of hearing impairment. There are higher percentages of people with moderate and severe hearing loss in the elderly than the youth since hearing loss increases with age. It is reported[20] that 42% of the hearing impaired people are over 65, although elderly only account for 12% of the population. Current demographical changes in Europe, with an ever increasing ageing population, will lead to a higher numbers of hearing impaired people in the next coming decades. Therefore, it is needed to develop hearing aid solutions that improve hearing impaired people quality of life focusing on real patients needs. From **Error! Reference source not found.**5, we clearly see that the hearing aid adoption rate of the "young elderly" segment (55-64) is much lower (around 25%) than the group 65-74 (34%) and >74 (48%). It is strategic for hearing aid manufacturers (and associated services) to increase the adoption rate of the segment 55-64. The AHEAD (sub-) system is a clear element of success. Indeed its mechanical design and functionalities attenuate stigmatization and bring new services.

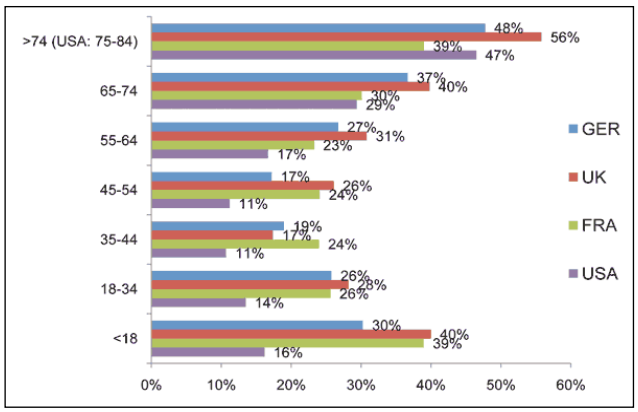



**Figure 5** Hearing aid adoption rates by age and country. Hearing aids adoption rates within the elderly segments are considerably higher. Source (EuroTrak I: A Consumer Survey About Hearing Aids in Germany, France, and the UK)

There is not much evidence relating to the socio-economic impact of hearing loss. O'Neill[21] establishes a negative correlation between income and the level of the loss hearing, reflecting that incomes decrease according the severity of the loss of hearing. It also stated the negative impact that loss of hearing has in old mature persons living alone. A European level, there are not many studies that investigate the cost of hearing impairment. M.A. Joore (Joore et al, 2003)[22] considered the impact of hearing aid which would have a positive economic impact by means of improving individual independence and reducing caring associated costs. In the same study is mentioned that hearing aid also implies positive changes in health and quality of life, reducing the use of medical services and improving social relationships. These results were assessed using scales and questionnaire but they were not translated into monetary costs. In the US, Ruben et all (Ruben 2001)[23] estimates a cost between $154 and $186 billion per year associated to communications disorders, that was the 2.5% to

16 A Martini (ed). European Working Group on genetics of hearing impairment, European Commission Directorate, Biomedical and Health Research Programme (HEAR) Infoletter 2, November 1996 www.gendeaf.org

17 Evaluation of the social and economic cost of hearing impairment. Hear-it organization

*18 (January 2010), Union of the Deaf in Bulgaria factsheet, EUD.eu.*

*19 ," (January 2010), Croatian Association of the Deaf and Hard of Hearing, EUD.eu.*

21 21 G. O'Neill. Hearing loss a growing problem that affects quality of life. Profile 2. National Academy on an Aging Society, December 1999. www.agingsociety.org

22 M A Joore, D E M Brunenberg, M N Chenault and L J C Anteunis. Societal effects of hearing aid fitting among the moderately hearing impaired. International J of Audiology 42, 152-160, 2003

23 R J Ruben. Redefining the survival of the fittest: communication disorders in the 21st century. Laryngoscope 111(6), 1115-1116, 2001

3% of the 1999 GNP. Ruben considers that Western countries' economies are based on communication rather than manual skills, therefore the negative economic impact of communication disorders are more significant in developed countries. Mohr[24] studied the societal costs of severe to profound loss of hearing estimating that the cost for the US society of just one individual with severe hearing loss is over 297,000 USD. For this calculation the authors took into account not only medical costs associated with hearing loss, such as diagnosis, medical visits, audio testing, assistive devices, fitting of hearing aids but also non medical cost, such as special education and rehabilitation costs.

The aid hearing market:

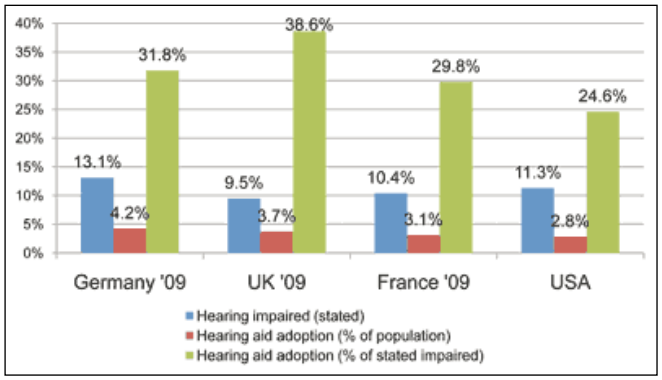



**Figure 6** Hearing loss prevalence and hearing aid adoption rates from Hearing Review 2001[1]. Source (EuroTrak I: A Consumer Survey About Hearing Aids in Germany, France, and the UK)

According to the report European Markets for Hearing Aids and Audiology Devices, the retail European hearing aid market would be valued at over €3.5 billion in 2010, while the whole world market would be valued at over €1 billion[25]. The aid hearing market is considered a growing but underserved market is associated, obviously close linked with the increasing of hearing loss, as it is shown in the figure below. According to statistics provided by the Hearing Industries Association (HIA), the number of hearing instrument sold in 2007 increased by 3.5%, therefore it is estimated that the European market for hearing devices is expected to grow rapidly by 2017 due to two main features: 1) the current low penetration since only 18.5% of the potential hearing aid users actually use them 2) the adoption of new technologies such as wireless hearing. Retail hearing aid markets are highly fragmented across Europe as they comprise a mixture of private retail chains and public healthcare institutions that dispense hearing aids. The figure below shows the key reason for purchasing a hearing aid.

As stated in figure 6, the growth of the hearing device market is largely dependent on a number of factors, including the reimbursement policies of each country, the technological innovations that are offered by the manufacturers. Moreover, Denmark, U.K, Norway, Sweden and the Netherlands, had the highest penetration rates due to favorable reimbursement in these countries.

| HA-Owner | GER '09 n=503 | UK '09 n=513 | France '09 n=501 | USA '08 (first time purchasers only) n=293 |
|---|---|---|---|---|
| Hearing loss got worse | 59% | 48% | 51% | 55% |
| ENT/ Ear Doctor | 59% | 23% | 57% | 18% |
| Hearing aid dispenser / Audiologist (US:+ specialist) | 45% | 41% | 40% | 35% |
| Spouse, relative, child, friend | 39% | 34% | 41% | 51% |
| GP /Family doctor | 26% | 36% | 16% | 7% |
| Free (Insurance, hearing aid free of charge) | 10% | 15% | 5% | 9% |
| Safety concerns | 10% | 6% | 12% | 5% |
| Another hearing aid owner (word of mouth) | 9% | 7% | 11% | 7% |
| Price of hearing aid | 9% | 4% | 11% | 6% |
| Financial Situation improved | 3% | 3% | 4% | 4% |
| Co-worker or boss | 3% | 2% | 4% | 4% |
| Hearing loss article or literature | 3% | 2% | 5% | 2% |
| Internet | 3% | 3% | 3% | 1% |
| Newspaper advertisement | 2% | 4% | 2% | 3% |
| TV advertisement | 2% | 2% | 3% | 2% |
| Direct mail piece | 2% | 2% | 0% | 4% |
| Magazine advertisement | 2% | 1% | 2% | 1% |
| Telemarketing phone call | 1% | 1% | 1% | 0% |
| Radio advertisement | 0% | 1% | 0% | 0% |
| Celebrity or public personality | 1% | 0% | 1% | 0% |
| Rounded values; limited comparability USA (fist time purchasers only) | | | | |

**Figure 7** Key reasons for purchasing a hearing aid, in descending order for the three European countries. Source(EuroTrak I: A Consumer Survey About Hearing Aids in Germany, France, and the UK)

It is estimated that average cost of a simplest hearing aid is $1,370[26] , this price increase to over $3,000 for most sophisticated ones. It is worthy to mention that cost doubles for those impaired people, around 83% of the total, that need to purchase two aids for binaural listening. Therefore, the price of the hearing aid could be seen as a barrier since the benefits of using hearing aids could not be justified by the high cost, especially for elderly people. In general, this perception does not change until their hearing loss becomes severe enough to interfere with social interactions, at which time the cost is justified.

AHEAD will take into account all these issues and will provide a comprehensive analyses of the wholesale and retail hearing aid markets in order to define a clear business plan with the final end of commercializing the results of the project by 2017. AHEAD proposed solution will have a multidimensional impact on the users involving many more factors than just improvements in listening, there will be also improvements in various physical, social and psychological areas, all of them will contribute to increment the users' quality of life.

24 P E Mohr, J J Feldman and J L Dunbar. The societal costs of severe to profound hearing loss in the United States. Project Hope Center for Health Affairs, H Series 2(1), April 2000a

25 European Markets for Hearing Aids and Audiology Devices 2012 - Executive Summary, iData Research

26 Syfx Marketing Data. http://syfx-tekworks.com/Hearing_Loss_Market.html

## 4.2 Dissemination, exploitation capability and time to market

### 4.2.1 Dissemination and exploitation measures

A measure of exploitation is the request of the end user. The Johanniter have a direct link through their members (near to 43.000 in Austria) to the target group. By collecting data from the response to articles and project descriptions there is an indicator for the interest in the target group. Furthermore by the request through our telecaresystem (home alert system called AKKONTEL) and the evaluation of false alarms there can be given a direct measurement in counts and money.

An exploitation and dissemination plan will be developed in WP5 in order to set up activities to disseminate information during the project. The strategy of this plan is to disseminate knowledge about the project and its partners among end users in order to create trends in the media and to create awareness on the AHEAD concepts and usability. The objective of this plan is to create awareness and demand in the market augmented hearing solutions. The activities will be based on a number of tools as described below:

**Press releases and publications:** Press releases with the findings of the project will be sent to a world-wide media list (together the partners have at hand a list of approximately 300 news contacts) and editorials will be submitted to leading publications. The partners will pursue publication of relevant project results, both at international conferences and in scientific journals. Several conferences have been identified for possible presentations, for example: AAL Forum[27], AMI[28], CHI[29], ICCHP[30], AAATE[31], ASSETS[32], mobile HCI[33] and RAatE[34].**Internet / www:** General project descriptions will be made available through the AH web with links from the web sites of the other partners. Major results, international knowledge requirement descriptions and application roadmaps will also be announced on the web. **Exhibitions:** During the end of the project the AH application demonstrator will be displayed at two exhibitions. The major aim is to show the applicability of the system and to show the video. In order to monitor the impact and dissemination level of the AHEAD project a number of Performance Indicators (PIs) will be utilized. Most PIs can be presented in tabular form and therefore statistical information can be derived about the project's performance. From M18 the PIs will be collected on a six monthly basis. The PIs will include among other things: PI-1: Number of end users involved: PI-1.1: Number of end user organizations; PI-1.2: Number of elderly people PI-2: Efficiency of dissemination/promotion: PI-2.1: Coverage of press releases PI-2.2: European coverage of promotional e-mail lists PI-3: Collaboration with other projects PI-3.1: Cooperation with other EU/AAL funded projects PI-3.2: Cooperation with national projects, PI-3.3: Cooperation with non-project partner entities The list of PIs will be adjusted during the project in order to comply with the deliverables. The Performance Indicator report will form an essential part of the progress report delivered for each review meeting. A measure of exploitation is the request of the end user. The Johanniter have a direct link through their members (near to 43.000 in Austria) to the target group. By collecting data from the response to articles and project descriptions there is an indicator for the interest in the target group. Furthermore by the request through our telecare system (home alert system called AKKONTEL) and the evaluation of false alarms there can be given a direct measurement in counts and money.

## 4.4 Other user segments

In order to address as many different user segments as possible the solutions developed within the AHEAD project follow a multi-platform approach. In addition to the eyeglasses and hearing aids used in this project, AHEAD services could easily be deployed to a multitude of other platforms (e.g. TV sets, watches, navigation devices, headsets). On the other hand AHEADs innovations in the field of hearing-aids and hearing-aid glasses establish the basis to further use these devices in fields of application not addressed in this proposal (e.g. mobility, training or therapy purposes). Hearing-aids are widely used and accepted among older people and therefore have the potential to reduce technical, social and economic barriers to the access of modern ICT. In this way AHEAD contributes to innovations that address many other AAL-related target groups as well as younger users. E.g. people that show visual or fine motor restrictions will also benefit from the speech-based interaction techniques developed in AHEAD. Younger users could benefit from AHEAD innovations in situations

[27] http://www.aalforum.eu/
[28] http://hiis.isti.cnr.it/ami2012/
[29] http://chi2012.acm.org/
[30] http://www.icchp.org/
[31] http://www.aaate.net/
[32] http://www.sigaccess.org/assets12/
[33] http://www.mobilehci2012.org/
[34] http://www.raate.org.uk/

where hands-free interaction is necessary (e.g. when driving) or as a way to preserve their own privacy (e.g. when using ATM or kiosk systems).

## 4.5 Standards

**User involvement, usability and user centered design (UCD) standards:**

*ISO 9241 Ergonomics of Human System Interaction:* Is a multi-part standard covering a number of aspects for people working with computers, originally for office work with visual display terminals (VDTs) but now retitled to a more generic interaction by ISO. ISO9241-11 regarding Usability: "Usability refers to the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use". *ISO 9241-210* regarding User Centred Design (UCD) which is characterised by the active involvement of users and a clear understanding of user and task requirements; an appropriate allocation of function between users and technology; the iteration of design solutions; multidisciplinary design. Concerning the design of user interfaces the consortium will ensure the compliance with all relevant guidelines, in particular the recommendations of the *W3C Web Accessibility Initiative (WAI).*

**Technical standards:** The following table reports a preliminary list of relevant standards which will be monitored by the AHEAD partners all over the duration of the project.

| | | |
|---|---|---|
| System intelligence, data acquisition, secure data storage | **W3C Semantic Web Coordination Group,** RuleML, CLIPS,Jena | Modelling languages: PDDL2.0<br>The goal of the Semantic Web initiative is to create a universal medium for the exchange of semantically grounded data. It is envisaged to smoothly interconnect personal information management, enterprise application integration, and the global sharing of commercial, scientific and cultural data. |
| User System Interface | **W3C Multimodal Interaction Activity** ISO 13407 Web Accessibility Initiative, ETSI Human Factors (HF) | Multimodal Interaction Activity seeks to extend the Web to allow users to dynamically select the most appropriate mode of interaction for their current needs ISO 13407: Human-centred design processes for interactive systems ETSI Guide 202 132: "Guidelines for Generic User Interface Elements for Mobile Terminals and Services", ETSI TR 102 068: "Human Factors; Requirements for assistive technology devices in ICT", ETSI EG 202 116: "Human Factors (HF); Guidelines for ICT products and services; "Design for All", ETSI TR 102 279: "Human Factors (HF); Two surveys on assistive technology", ETSI ETR 095: "Human Factors (HF); Guide for usability evaluations of telecommunications systems and services" or ETSI TR 102 415 V1.1.1 (2005-08) Technical Report, Human Factors (HF); |
| User Profiling, Rule description, Pattern Analysis | **W3C RIF,** RDF, OWL ISO Common logic **OMG PRR**, SBVR | The Semantic Web is a vision for the future of the Web in which information is given explicit meaning, making it easier for machines to automatically process and integrate information available on the Web. In particular, close links exist with the ISO Common Logic standardization, W3C RIF and OMG PRR committees, which can help standardize and disseminate the de facto collaboration patterns developed in Coach-me. |
| Telemedicine, medical equipment | OpenECG | Informatics standards related to telemedicine services (like OpenECG, SCP-ECG, DICOM)<br>Standards related to measurements of vital signs of ECG, Heart rate, SPO2, Glucose, blood pressure… |
| Ambient intelligence devices, robot, domotics | KONNEX, OSGI Alliance, **UpnP**, DLNA | Standard for domotics applications (its mission is to provide a powerful yet lightweight communication protocol for general-purpose distributed control networks ("bus systems") in intelligent homes and buildings). The OSGi technology is designed to ease the development of new and exciting services and applications for the latest generation of networked devices SOAP and WS related technologies XML based notation languages: RDF, XSD… |
| Home Gateway | DVB, IETF | Middleware used in the home gateway can be compliant with the DVB-MHP (Multimedia Home Platform) and integrate the IP Stack. |
| Wireless Communications | IEEE 802.11.x,IEEE 802.15.1,IEEE 802.15.2,IEEE 802.15.3, IEEE 802.15.4,IEEE 802.16, Bluetooth, WiFi WiMedia, ZigBee,- IMS | Standardization of WLAN (IEEE 802.11.x, WiFi) and WPAN communication (IEEE 802.15.x, WiMedia, Bluetooth and Wimax), standardization of low power short range, short data rate communication suitable for sensor networks and ambient intelligence (IEEE 802.15.4, ZigBee). IP Multimedia Subsystem represents a 3GPP and 3GPP2 effort to define an all IP based wireless network as compared to the historically disparate voice, data, signalling, and control network elements. |
| Usability Tests | ISO 25062 | Software Engineering: Software Quality and Requirements Evaluation: Common Industry Format for Usability Test Reports |
| Interoperability trough defined interfaces (syntax and semantics) | CEN 13606 HL7 TOGAF | Semantic interoperability of health information systems;<br>Health level 7, exchange and storage such as semantic and syntactic information modeling;<br>Architectures for Health Information systems |
| Medical Devices Interoperability | ISO 11073 Continua Alliance | It defines the overall architecture of the organization and relationships among nomenclature components and provides specifications of semantics and syntaxes. Useful in the capture and interpretation of Vital Signs information from any source. |