CALL FOR PROPOSALS

2010

Project Acronym
AmiQual

SCIENTIFIC SUBMISSION FORM B

Project Acronym	**AmiQual**	
Titre du projet en français	Systèmes AMbIants pour la QUALité de vie	
Project title in English	Ambient Intelligence for Quality of Life	
Coordinator of the project	Name : **James L. Crowley** Institution : **Grenoble INP** Laboratory :**LIG - Laboratoire Informatique de Grenoble** Research unit number : **UMR 5217**	
Requested funding	Phase 1 € 14 847 888	Phase 2 € 4 948 400
Disciplinary field	☐ Santé, bien-être, alimentation et biotechnologies / health, well-being, nutrition and biotechnologies ☐ Urgence environnementale et écotechnologies / environnemental urgency, ecotechnologies **X** Information, communication et nanotechnologies / information, communication and nantechnologies ☐ Sciences humaines et sociales / social sciences ☐ Autre champ disciplinaire / other disciplinary scope	
Scientific Domain	Informatics	

Organization of the coordinating partner

Laboratory / Institution(s)	Research Unit Number	Parent organization
CNRS INS2I		CNRS

Organization of the partner(s)

Laboratory / Institution(s)	Unit Number	Parent organization
CNRS LAAS (Laboratoire d'Analyse et d'Architecture des Systèmes)		CNRS
Ecole Polytechnique PREG (Pôle de Recherche en Economie et Gestion) et PREG-CRG	UMR 7176	Ecole Polytechnique (ParisTech)
Grenoble INP G2Elab (Laboratoire de recherche en Génie Electrique)	UMR 5269	GINP
Grenoble INP G-SCOP (Laboratoire des Sciences pour la Conception, l'Optimisation et la Production de Grenoble)	UMR 5272	GINP

INRIA Research Center Grenoble Rhône-Alpes		INRIA
INRIA Research Center Lille-Nord Europe		INRIA
INRIA Research Center Paris-Rocquencourt		INRIA
INRIA Research Center Sophia Antipolis-Méditerranée		INRIA
Institut Telecom ParisTech LTCI (Laboratoire de Traitement et Communication de l'Information)	UMR 5141	Telecom ParisTech (Institut Telecom)
Institut Telecom SudParis SAMOVAR (Services répartis, Architectures, MOdélisation, Validation, Administration des Réseaux)	UMR 5157	Telecom SudParis (Institut Telecom)
Université Joseph Fourier LIG (Laboratoire d'Informatique de Grenoble)	UMR 5217	UJF (Grenoble I)
Université Lille II CERAPS (Centre d'Études et de Recherches Administratives, Politiques et Sociales)	UMR 8026	Université Lille 2
Université Nice-Sophia Antipolis I3S (Laboratoire d'Informatique, Signaux et Systèmes de Sophia-Antipolis)	UMR 6070	UNS
Université de Technologie de Troyes ICD (Institut Charles Delaunay)	UMR 6279	UTT
Universités de Toulouse I et II MSHST (Maison des Sciences de l'Homme et de la Société de Toulouse)	MSH9	Universités de Toulouse I et II
Université Toulouse III IRIT (Institut de Recherche en Informatique de Toulouse)	UMR 5550	Univ. Paul Sabatier (Toulouse III)

Entreprise(s) / Etablissement Public (s)	**Field of Activity**	**Staff size**
ALTRAN	Technology and Innovation	17000 (26 countries)
CEA LETI: Laboratoire d'Electronique et des Technologies de l'Information	EPIC	450
CEA LIST: Laboratoire d'Intégration des Systèmes et des Technologies	EPIC	450
Centre e-santé	Association	3
CHU de Toulouse	Grande Etablissement	12 800
CSTB: Centre Scientifique et Technique du Bâtiment	EPIC	850
Fondaterra: Fondation Européenne pour des Territoires Durables	Environmental sustainability	
ICR: Institut Claudius Régaud	Private non-profit hospital	800
MEDES: Institut Médecine Physiologie Spatiale	GIE	25
MEDETIC: Médecine Et Développement des Technologies de l'Information et de la Communication	Association under 1908 law	
POLESTAR SA	SA	200

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1. SUMMARY

The goal of the equipment project AmiQual is to provide a national distributed research facility for the sustainable development of Ambient Intelligence and its application to societal problems.

Context and motivation. AmiQual is motivated by the following observations: (1) While Ambient Intelligence is fundamentally interdisciplinary, much of the fundamental research is currently carried out within individual disciplines, in ignorance of human needs and values, and in a manner that is not compatible with the holistic vision required for providing effective services to society. (2) Key concepts and technologies are currently evaluated by simulation or under highly controlled conditions. Such isolated validation does not address the opportunistic and multi-scale nature of the real world. (3) Recent programmes to address individual societal problems with highly specialized, isolated technological initiatives create the risk of a lack of impact due to a dispersion of efforts over a large number of closed projects. (4) Ambient Intelligence has been selected as one of the national priorities by the French Ministry of Research (MESR) as well as by SNRI (Stratégie Nationale de la Recherche et de l'Innovation).

Objectives. The objective is to provide the academic and industrial communities with:

1) A geographically distributed, open, experimental facility that enables coordinated scientific research to address a range of societal problems in the areas of habitats, healthcare and home-care, aging in place, mobility, and commerce. This facility will provide an infrastructure that will enable experiments with innovative human-centered systems and services under both controlled laboratory environments and real world conditions. The facility will be distributed over five geographical sites (called AmiLabs): Grenoble (AmiLab1: Smart Habitats), Toulouse (AmiLab2: Smart HealthCare and HomeCare), Lille (AmiLab3: Smart Commerce), Saclay (AmiLab4: Smart Mobility), Nice (AmiLab5: Smart Buildings).

2) A Coordination Facility (CF) that will provide the resources (equipment and personnel) necessary to support coordinated transversal activities such as capitalization of research efforts as well as cross-fertilization between Information & Communication Technologies (ICT) and Social and Human Sciences (SHS), commercial exploitation of the resulting technologies, and promotion of the experimental facility at the national and international levels. The shared open resources managed by the CF will include: a technology repository including hardware and software, experimental data and benchmark (i.e. ICT capitalization); resources for addressing ethical and legal issues as well as guidance for design and experimental methods and practices in the development of systems and services (i.e. SHS capitalization); resources for training and education; resources for commercial exploitation and intellectual properties, as well as resources for communication and dissemination (e.g., a professional, updated web site).

Originality: The AmiQual facility will enable a new form of coordinated research that is not currently possible on the national scale in France. The AmiQual consortium brings together expertise from ICT and SHS joined together with actors from the socio-economic and healthcare sectors to develop and evaluate novel systems and services for societal challenges. The confrontation of solutions from these different disciplines is expected to lead to the emergence of a common, generic foundation for Ambient Intelligence that can then be applied to other domains. The initial multidisciplinary consortium will progressively develop interdisciplinary expertise with new concepts, theories, tools and methods for Ambient Intelligence. In addition, the involvement of very distinct socio-economic sectors opens the opportunity for transdisciplinary research.

Work programme and organization. The AmiQual facility will be developed in two phases. Phase 1 (duration 4 years) is dedicated to the construction of the equipment for the five AmiLabs and for the Coordination Facility. The component subsystems will be specified, designed, implemented, tested and evaluated using professional practice. This will also lead to the emergence of common set of concepts, problem examples and solutions that can be shared between partners from different disciplines and capitalized by the Coordination Facility. In Phase 2 (duration 5 years),

the AmiQual facility is operational for *in vivo* experimentations, consolidation of results and for exploitation and dissemination, training and education.

Management. The management structure of AmiQual is comprised of an Executive Committee whose members are involved in the construction and exploitation of the EquipEx, and of a Governing Board and a Scientific Board, whose members oversee and advise the project. The Executive Committee, chaired by the coordinator, includes the AmiLab leaders (one per geographical site), the cross-activities leaders (each one in charge of a cross-activity such as ICT capitalization, SHS capitalization, training and education, valorization, etc.) and the administrative staff responsible for budget and finance. Each AmiLab leader is assisted by an AmiLab team composed of scientific experts, engineers and administrative support.

Access to the experimental facility. AmiQual includes 3 types of participants: partners, affiliates, and clients. Partners are organizations that provide resources (human, material, software, or financial) during either the construction of the AmiQual facility (Phase 1) and/or providing resources to ensure operation of the facility (Phase 2). Partners are part of the Executive Committee and have free access to the facility as well as to scientific results. Affiliates are organizations that participate in the definition of the AmiQual facility, but do not provide resources for the deployment (Phase 1) or the operation of the facility (Phase 2). Affiliates participate in the Scientific Board and have access to scientific results. Clients are organizations that do not participate in the AmiQual facility, but wish to use the facility to carry out specific research. They have access to the AmiQual Facility for a fee that shall be determined based on the duration and the number of AmiLabs used. Clients are expected to be mainly private companies, non-profit associations and research consortium requiring high quality equipment for experiments. AmiQual is opened to the integration of new partners and affiliates as decided by the Executive Committee, and recommended by the Governing Board.

Expected impacts include: (1) The emergence of a new research community based on open cooperation between experts from the informatics and social science domains, (2) A national open facility for experiments enabling creation and refinement of human services, while avoiding a dispersion of efforts within isolated closed initiatives, (3) Creation of a new technology that harnesses rapid technological progress to improve the overall quality of life and respond to impending social challenges, (4) Creation of new curricula for bachelor (Licence), Master's and Doctoral education (5) Training and education for professionals (6) New SME's and StartUp as well as enhanced private-public partnerships for addressing societal challenges.

2. SCIENTIFIC ENVIRONMENT AND POSITION OF THE EQUIPMENT PROJECT

- *Ambient Intelligence*

Ambient Intelligence is an interdisciplinary research paradigm that has emerged over the last 15 years from the ideas of Weiser [Weiser 91], and a variety of other authors [Aarts 01, Aarts 06a, Zelkha et al. 98]. Scientific and technical challenges of Ambient Intelligence are currently addressed in the scientific communities that have emerged under the names of Ubiquitous Computing (UbiComp), Pervasive Computing (Percom, IEEE Pervasive) and Ambient Intelligence (EUSAI, AMI), as well as in a large number of more established communities ranging from distributed computing to human-computer interaction. A defining characteristic of this new paradigm is the progressive integration of informatics into all aspects of human society. The emergence of Ambient Intelligence is driven by the continued exponential growth in the number of interconnected devices with embedded sensing, actuation, communication and/or interaction in human environments. *The core idea of the research that the AmiQual facility will support is to harness this growing number of interconnected devices to provide new forms of systems and services that respond to a number of looming societal challenges while at the same time improving the quality of life of ordinary people in every-day environments.*

• *The Nature of Research on Ambient Intelligence*

Ambient Intelligence is a form of integrative research. To make possible new forms of systems and services, Ambient Intelligence must build on social sciences as well as on the integration of emerging technologies for sensors and actuators, mobile devices, ad-hoc networks, component oriented systems, robotics, computer vision, dynamic service composition, and person-system interaction. Integrative research goes beyond multi-disciplinary research. Multidisciplinary research involves several researchers from different academic disciplines, with different research paradigms, working together on a theme or problem but with multiple disciplinary goals [Tress et al. 06]. Participants exchange knowledge, but do not aim to cross boundaries between disciplines to create new shared knowledge and theory. In contrast, interdisciplinary research involves researchers from several unrelated academic disciplines, working together on a problem that forces them to cross subject boundaries to create new knowledge and theory and solve a common research goal. Participatory research involves academic researchers and non-academic participants working together to solve a common problem. Transdisciplinary research combines interdisciplinary research with a participatory approach to involve both unrelated disciplines and non-academic participants to create new knowledge and theory to address a common goal. Integrative research may be interdisciplinary or transdisciplinary. *The AmiQual facility will support both integrative research and multidisciplinary research*.

• *Challenges of Ambient Intelligence*

The design and development of effective human-centered ambient systems and services raises a variety of scientific challenges. In Gaine's BRETAM[1] phenomenological model of how science technology develops over time [Gaines 99], Ambient Intelligence has hardly reached the second stage (i.e. Replication). Available technology is limited in scope, works only for predefined contexts of use and, more importantly, does not place the human at the center. Ambient Too often, informatics researchers assimilate the promise of Ambient Intelligence as "system autonomy" where users are "conveniently" kept out of the loop. The scientific challenge is then to develop secure, multi-scale, multi-layered, virtualized infrastructures that guarantee service front-end continuity. Although service continuity is desirable in many circumstances, with this interpretation of Ambient Intelligence, end-users are doomed to behave as mere consumers. *By contrast, the AmiQual facility will support research that empowers end-users with the capacity to reshape and build their own ambient spaces.*

Therefore, the scientific challenge of Ambient Intelligence is to develop theories, concepts, models, technologies, and tools for the design and development of human-centered systems and services that bring together the physical and the digital worlds, that can dynamically adapt to heterogeneous environments and unexpected situations, are autonomous and emerging but under human control, are secure, reliable and respect ethical values by design, and that interact appropriately with end-users. *The AmiQual facility is designed to support integrative research that will address these scientific challenges.*

• *Ambient Intelligence as a National and European Priority*

The potential impact of Ambient Intelligence on societal problems has been clearly identified and documented by the SNRI (Stratégie Nationale de la Recherche et de l'Innovation) as well as in specific research programs operated by both the European Commission (e.g., PCRD VI and VII, e-Health, e-inclusion and Ambient Assisted Living programmes[2]), the ANR (e.g., Verso and TECSAN programmes[3]), and the similar funding agencies in many EU member states. More recently, Ambient Intelligence has been selected as one of the national priorities for the Groupe de Concertation Thématique (GCT) Maths STIC. This GCT, created in March 2010, has been formed to provide recommendations to the French Ministère de l'Enseignement Supérieur et de la Recherche (MESR) about the orientations for the next phase of SNRI.

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[1] BRETAM stands for Breakthrough, Replication, Empirism, Theory, Automation, Maturity.
[2] http://www.aal-europe.eu/ with projects like PROCARD, CALIOPE, EPSOS, NETCARD
[3] http://www-tecsan.cea.fr/scripts/home/publigen/content/templates/show.asp?P=149&L=FR

In 2008, the Groupe de Concertation Sectoriel (GCS3) of Direction Générale de la Recherche et de l'Innovation (DGRI A3) of the MESR, in concertation with the Department ST2I of CNRS, have formed a working group on Ambient Intelligence. In its report [Coutaz et al. 08], the working group has documented the potential impact of Ambient Intelligence on a number of societal problems (e.g., aging society, energy efficiency, healthcare services, environmental protection, public security, and transportation), and identified a number of core scientific and technological challenges that must be met to fully respond to these societal problems. Among the observations of this report was that scientific research on Ambient Intelligence tends to be compartmentalized, focusing on individual scientific problems. Researchers in sub-disciplines of informatics too often exclude the human as an unpredictable factor to be eliminated rather than placed at the center of the design and development process. Research efforts on individual societal problems tend to redevelop solutions to technological challenges that have already been addressed in other areas. The ministerial working group recommended the creation of a large research instrument for integrative research on systems and services based on Ambient Intelligence and its application to societal problems. *The AmiQual facility project is the direct result of these recommendations as explicitly cited in the EquipEx 2010 in the form of "plates-formes distribuées sur l'intelligence ambiante" [EquipEx Call, pp. 6]*.

- *Research on Ambient Intelligence in Europe*

According to the report "Plan intelligence ambiante" [Coutaz et al. 08], in the Framework VI Programme of the European Commission, 29 funded research projects respond to the search criteria "Ambient Intelligence". Of these 29 projects, only 16 include participation by a French partner. This situation has seriously worsened for Framework VII as the number of French participants in EU projects related to Ambient Intelligence has continued to decline.

Four general observations can be made concerning French involvement in Ambient Intelligence research [Coutaz et al. 08]:

1. The French community is present on the international scene but is not leading world-class actions. France is represented in committees for conference programmes and European calls for proposals but solely due to the efforts of a small number of individual researchers and experts.
2. Research programmes concerning Ambient Intelligence have typical durations of 3 to 4 years, a period which is too brief for sustainable initiatives. In particular, consortia are able to develop demonstrators for the final project review. However, these demonstrators are generally concept demonstrations with very short lifetimes, and cannot be used for real-world evaluation.
3. Multidisciplinary research has been encouraged for years with limited success. Public research organizations place priority on excellence within well-established individual disciplines, and are not organized to promote multidisciplinary or interdisciplinary research.
4. Industry driven research too often focuses on improving existing technologies to protect existing market share. Such research tends to ignore or suppress technological rupture, and is rarely responsive to the needs of individuals or society.

The AmiQual facility will support integrative research that will propell the French Ambient Intelligence community to the leading edge of international research.

- *Existing Experimental Facilities for Ambient Intelligence*

Research platforms related to various aspects of Ambient Intelligence may be observed around the world. Most of these are single-purpose closed facilities that serve primarily as technology demonstrators operated by a single organization, rather than distributed, open, coordinated facilities for integrative research.

Proprietary Platforms

Experimental platforms from industry such as the emblematic Philips Research **HomeLab** created in 2002 as well as the **Creative Commons** from OrangeLabs in Rennes, or the **EDF experimental research facility** in Clamart, are motivated by the proprietary development of human centered services. Often such platforms are primarily designed as concept demonstrators or as "show rooms", and are not open for experiments by the larger scientific community. Similar observations may be made about platforms developed specifically for R&D projects such as the **HOMES** platform coordinated by Schneider, the **Microsoft Home**, and the Danish **Home for Life**.

Microsoft Home is a smart home technology demonstrator located on Microsoft Corp.'s Redmond, Wash. campus. Built as a full-scale model home, the Microsoft home is used to exhibit prototype technologies around three themes: natural interaction, smart objects, and confluence of the physical and digital worlds. The Microsoft home was first opened in 2004, and is periodically renewed by project teams that specify, integrate and demonstrate innovative technologies for home environments.

Home for Life is a carbon neutral "Active Home" constructed by a consortium lead by the Danish company Velux, used for field tests. A family of 4 has lived in the Home for Life for 12 months from July 2009 to June 2010, revealing a number of interesting lessons about the advantages and challenges of living in an active home (for example, "To bring in more fresh air, the skylight slides open with a hiss". "It's fun to listen to," the children report, but also: "The windows are open even though we feel cold. There is a draft, so we wrap ourselves in blankets and close the windows with the remote control...but alas, half an hour later they open automatically again!") [Hansen 10].

Public Domain Platforms

In Singapore, the A*Star SERC has constructed smart-home technology demonstrator within its research building in Fusionopolis. The A*Star **Starhome** is a complete apartment equipped with a wired and wireless network infrastructure connecting together a large variety of systems and services for external entrance, living room, kitchen, media room and bedroom. Among the technologies are: voice command control, RFID based smart cabinets, intelligent monitoring, smart bed, voice verification, and self-cleaning surfaces. As with Microsoft home, it serves uniquely as a technology demonstrator.

The **Aware Home** Research Initiative (AHRI) is a multidisciplinary research project at the Georgia Institute of Technology that addresses challenges facing the future of domestic technologies. The AHRI has constructed a three-story, 5040-square-foot house that functions as a laboratory in four areas: Design for people, distributed sensing and perception, software engineering, and social impacts. The aware home serves both as a technology integration testbed and as a facility for scenario based data collection. The Aware Home includes technologies for indoor location services, activity recognition, context aware computing, and experience capture. These have been used to demonstrate social communications technologies for the family, memory aids for such tasks as cooking, finding lost objects and everyday tasks, and home assistance for aide in interaction with appliances.

The **DOMUS** laboratory is a multidisciplinary research facility for DOmotics and Mobile Computer Science located at the University of Sherbrooke in Canada. Research at the facility addresses technical problems in the area of human-computer interaction and distributed systems as well as problems related to ethics, psychology, healthcare and assisted living. The 4 principal research subjects area (1) a Cognitive assistance for activities of daily living (ADL) (2) Outdoors cognitive assistance (3) Cognitive modeling (4) Infrastructure development.

In Germany, the Fraunhofer institute has demonstrated a strong interest for assistive electronics (i.e. "the electronic guardian angel"). In particular, the Fraunhofer **inHaus** innovation center has developed application laboratories for living, office, tele-service, hotels, events, hospital and nursing homes in two research facilities to serve as interfaces for the market: inHaus1 (residential properties) built in 2001, and inHaus2 (commercial properties) whose construction has started in 2007 to develop new technological solutions for the area of residential and commercial properties in cooperation with private partners such as, Hochtief, T-Systems, Berker or Lindner-Hotels[4]. These two platforms are designed to serve German industry rather than to enable interdisciplinary or transdisciplinary research. Nevertheless, these are a good example of how successful integrative

[4] http://www.inhaus-zentrum.de/site_en/

research can be conducted with a public-private partnership, achieving world-wide prominence. *This is a potential model as well as a possible partner for AmiQual*.

In France, academic platforms such as the LIG-Domus experimental facility developed by LIG laboratory in Grenoble is a small scale in vitro smart home. The Smart Environments platform at INRIA Grenoble and the Ubiquarium developed by the I3S Laboratory in Sophia Antipolis, are small scale "smart rooms". These facilities could be better exploited if *integrated into a national initiative such as AmiQual*.

Networks of Platforms

In 2008, the European Commission has launched the Future Internet Research and Experimentation initiative (i.e. the FIRE initiative) based on "open coordinated federation of testbeds" to conduct research for new networking and service paradigms, and provides an example of an initiative, *like AmiQual, to create a large-scale distributed facility*. Although FIRE is concerned with experimentation and testing in large-scale environments, it is primarily focused on computing networks. *In contrast to FIRE, AmiQual explicitly addresses the problems of human centered services and spans a larger spectrum of scientific disciplines*.

Living Labs

The concept of Living Lab has been originated at MIT to provide a user-centric research methodology for sensing, prototyping, validating, and refining complex solutions in multiple and evolving real life contexts. Living labs were proposed as a form of open-ecosystem, operating within a territorial context and favoring concurrent innovation. They are often cited as a tool for pluridisciplinary development of methods and tools, bringing together researchers in ICT and the Social Sciences [Pallot 08].

During the Sixth Framework programme, the European Commission has created the strategic programme 2.5.9 "Collaborative Working Environments", specifically directed to create Living Laboratories. The concept has been included in the i2010 initiative. Meanwhile, at the Media Lab, Professors William Mitchel, Kent Larson and Sandy Pentland have formed the first US based Living Lab research consortium.

As the concept has gained popularity, the term Living Lab has taken on a variety of different meanings and uses. A summer school has been organized in August 2010 to clarify the many aspects of a Living Lab[5]. For example, in some contexts, the term "Living Lab" has been used to describe a residential home research facility where usage patterns are collected by researchers observing residents. In such a case, residents are used only as test subjects, and are not engaged in the process of co-creation. PlaceLab at MIT and ExperienceLab at Philips Research are typical examples of such research facilities.

The AmiQual facility resembles Living Labs in that they are to foster interdisciplinary and experimental research on scientific challenges to human centered services. The Ubiquarium created by the I3S laboratory at the University of Nice is part of the physical and informatics infrastructure of the ENoLL ICT Usage Lab proposed by Orange Labs in cooperation with three of the AmiQual partners (CSTB, INRIA, University of Nice).

To conclude, for France to participate in world-class integrated research on Ambient Intelligence, it is necessary to create a dedicated and durable research facility for the development and experimentation with new systems, services and enabling technologies that respect human values. This is the motivation for the AmiQual EquipEx.

[5] http://www-sop.inria.fr/teams/axis/LLSS2010/ecoleLL/

3. TECHNICAL AND SCIENTIFIC DESCRIPTION

3.1. ORIGINALITY AND INNOVATIVE FEATURE OF THE EQUIPMENT PROJECT

The AmiQual consortium brings together expertise from **Information & Communication Technologies (ICT) and the Social and Human Sciences (SHS) together with socio-economic actors** from the building design, electrical equipment, commerce and healthcare sectors to develop and evaluate novel systems and services that assist ordinary people. Participatory design [Jacko et al. 03] and the confrontation of solutions from ICT and SHS joined together with actors from the socio-economic and healthcare sectors are expected to lead to the emergence of a common, human-centric foundation for Ambient Intelligence.

The AmiQual facility **will enable progressive integrative research** by supporting a wide variety of experiments ranging from the evaluation of mono-expertise solutions to the transdisciplinary development and evaluation of systems and services. Figure 3.1 illustrates the articulation between the sources of expertise (from scientific knowledge to socio-economic knowledge), the experiments that the AmiQual facility will make possible, and the iterative feedback loops on knowledge sources that will result from experiments, along with the socio-economic impact including knowledge transfert for training and education as well as industry transfert (e.g., standardization and creation of start-ups).

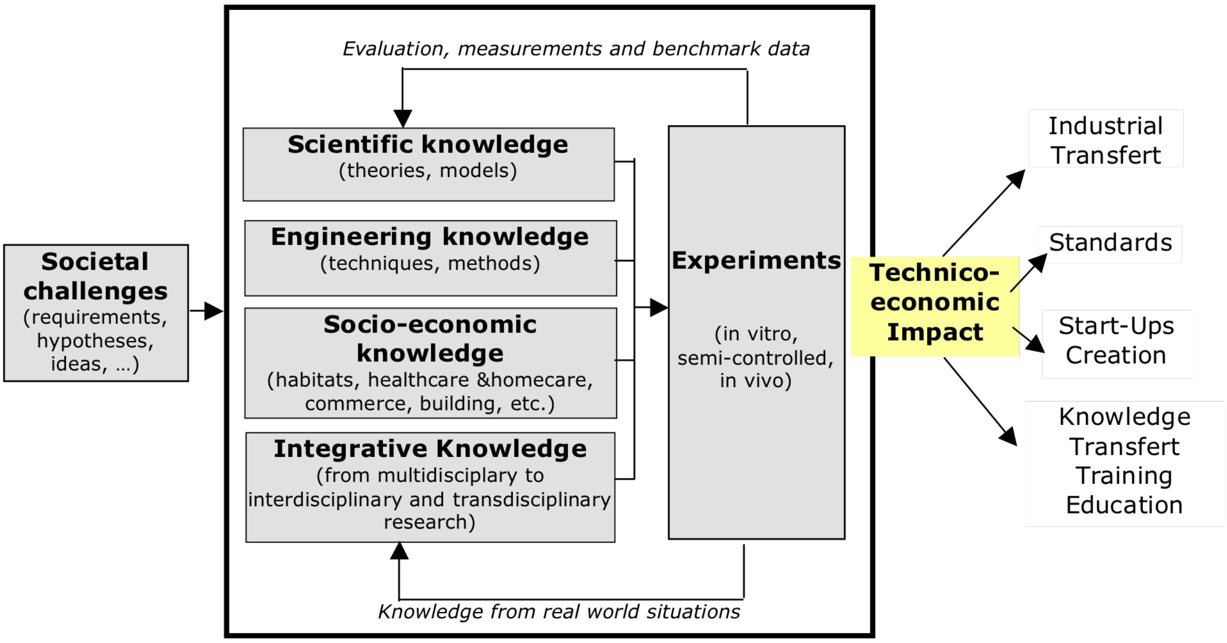


Figure 3.1. Information flow supported by the AmiQual facility.

The AmiQual facility **will enable long-term research in Ambient Intelligence** to produce scientific, technical, and methodological solutions that are generic, enabling, and moldable: **generic** solutions in order to have wide applicability to multiple socio-economic sectors; **enabling** solutions in order to facilitate the rapid prototyping and development of systems and services by professionals; **moldable** solutions in order for end-users to be able to compose, reorganize and transform these services at will, all of this in heterogeneous, dynamic and multi-scale environments. The goal is to create a technology for human services[6] that can be appropriated, shaped and controlled by ordinary people to assist them in their everyday tasks. These human

[6] A human service denotes a subsystem that is useful to people in their everyday lives. It is not a unit of computing functionality as developed in Software Oriented Architecture (SOA) although the implementation of a human service may be based on the assembly of SOA computing services. Thus, in the context of AmiQual, a human service, simply noted service, does not denote an SOA service unless otherwise specified.

services will include tools services (i.e. services designed to perform specific tasks or functions as robustly as possible such as a service that integrates control of heating, air-conditioning, lighting, windows, window-shades, etc.), companion services (i.e. services that behave like advisors such as a service that observes the activities of humans and appliances within the home to suggest ways to reduce living costs), and media services that provide communication means between humans such as seamless telepresence with friends [Mackay 07, Crowley 08].

AmiQual **will provide a nationally distributed facility composed of 5 AmiLabs (Grenoble, Toulouse, Lille, Saclay, Nice)** to take advantage of unique socio-economic conditions within each of the regions involved (demographics, local industries and competitivity poles, local small and medium enterprises, regional governments) as well as availability of suitable subjects to participate in service development and evaluation. The nature of the research requires experimentation "where the action is" to create appropriate technologies for services to diverse populations.

AmiQual will avoid duplication of efforts, and favor sharing and reuse of technologies and research results through a national Coordination Facility (see Sections 3.2.1 and 3.3.1 for details).

AmiQual is an open facility: The technologies and research results are made accessible to the community through the Coordination Facility. In addition, the consortium is opened to new members, affiliates and clients. The conditions for accessibility are described in Section 4.3.

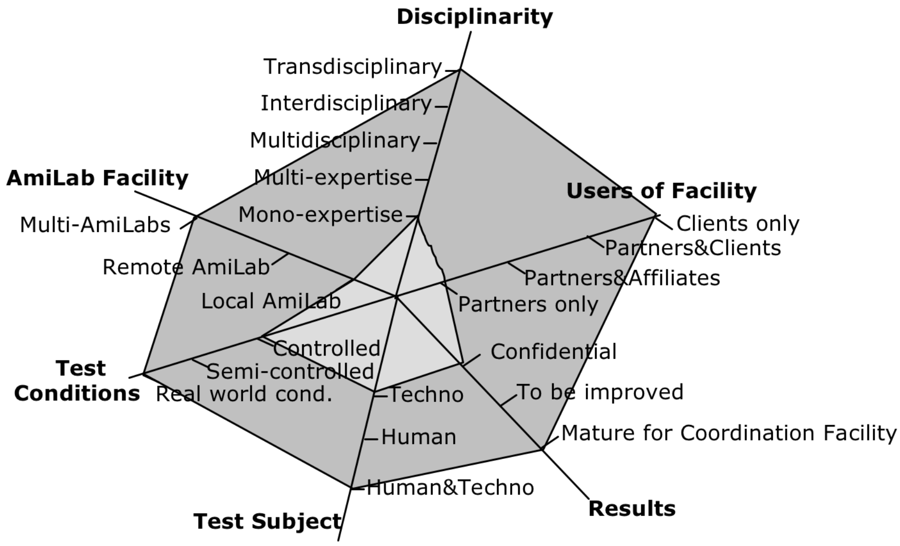


Figure 3.2. The Kiviat diagram of the experimental space supported by the AmiQual facility, from simple pilot experiments in the early construction of the EquipEx (light-grey surface) to complex experiments during the exploitation phase (dark-grey surface).

AmiQual will provide experimental equipment that is unique in both scale and scientific coverage. Figure 3.2 makes explicit the multi-dimension space of experiments that will be supported by the AmiQual facility. Values on each axis are ranked from the center according to increasing complexity:

- **Disciplinarity** expresses the level of knowledge integration that has been necessary to conduct the experiment: mono-expertise when a single sub-discipline is involved (e.g., sensor network only). Multi-expertise when multiple sub-disciplines of a discipline are involved (e.g., sensor network and middleware within informatics). Multi-discipline when more than one discipline is involved (e.g., sensor network that respects human values and legal issues), but no new novel concepts and theories have emerged yet. Etc.
- **Users of facility** indicate who are the experimenters. This may range from a close set of AmiQual partners to an open set of AmiQual clients.
- **AmiLab facility** corresponds to the AmiLabs used for the experiment: This may be the AmiLab located in the same site as the experimenters (e.g., AmiLab 2 located in Toulouse used by experimenters located in the Toulouse area), a remote AmiLab (e.g., AmiLab 2

located in Toulouse used by experimenters located in Nice), or an experiment that needs multiple AmiLabs at the same time.

- **Test subject** denotes the nature of the entity to be tested with the experiment. This may be a technology-centered experiment, a pure human behavior observation, and a mix of both.
- **Test conditions** may be fully controlled (*in vitro* experiments), semi-controlled, or may be conducted in real world conditions (*in vivo* experiments).
- **Results** characterize the actual outcome of the experiment: These may be confidential, open but needs iterative improvement, or mature enough for capitalization in the Coordination Facility.

3.2. DESCRIPTION OF THE PROJECT

3.2.1 SCIENTIFIC PRESENTATION OF THE AMIQUAL FACILITY

The key motivation for the AmiQual facility is to **enable long-term research in Ambient Intelligence** by providing researchers and practitionners with the appropriate conditions for conducting **large-scale experiments in real world conditions for real world societal challenges**. The hypothesis is that the confrontation of solutions applied to very **distinct socio-economic sectors** will lead to **generic**, **enabling**, and **moldable** solutions (by contrast with small scale, adhoc, concept demonstrators as developed currently to validate research results).

In order to promote and coordinate research results at a large scale, the AmiQual EquipEx includes a **Coordination Facility** that brings together AmiQual cross activities and reinforces the coherence of the research community. Because one single geographical site cannot realistically cover multiple socio-economic sectors, the AmiQual EquipEx also includes five experimental sites called **AmiLabs.** Constructing the AmiLab facilities and producing generic solutions will require integrating technologies and expertise from at least **seven scientific disciplinary fields, each with their own research challenges**. Figure 3.3 illustrates how the Coordination Facility, the AmiLabs and the scientific challenges fit together.

• *Coordination Facility*

The Coordination Facility (CF) will provide resources for the following transversal activities:

- Knowledge capitalization for, and from, research activities.
- Training and Education.
- Commercial exploitation and intellectual property management.
- Communication and Dissemination of results.

Each cross-activity is animated by a working group chaired by a pair of co-leaders.

Knowledge capitalization will be supported by creation of a technology repository and a social sciences repository. Both repositories will be open, publicly accessible resources to encourage uptake and re-use.

- The technology repository will provide on-line documentation for technologies that are investigated by the different AmiLabs as well as catalogs of sensors, actuators and other devices that can be of mutual interest to the network of AmiLabs. The technology repository will include an open-source system for publishing software source code (source forge) that will encourage sharing of resources, as well as a data-base of benchmark data.
- The social science repository will provide documentation for methods, protocols, and data analysis related to experiments with human centered services. In addition, guidelines will be provided for ethical and legal practices.

Support for **training and education** will work to assist use of Ambient Intelligence in both formal degree-oriented educational programs as well as training and certification programs for professionals. Core curricula and courseware will be developed and published for individual courses and for specialized degree programs at the Masters and Bachelors levels. Continuing education programs will be developed for professionals. In particular, training and certification will be offered in areas such as healthcare and homecare, electrical equipment installation, building maintenance, and communications services to enable rapid uptake of new technologies into critical sectors.

Support will be provided to facilitate documentation, protection and exploitation of **intellectual property** of technologies and services developed. While the dominant philosophy of AmiQual is to promote an Open Systems approach, the nature of the systems and services to be studied are likely to create a variety of opportunities for commercial exploitation. **Exploitation services** will provide assistance to AmiQual partners and affiliates seeking to license or patent novel systems and services. Consultation will be made available for identification, incubation and nurturing of proposals for **creation of enterprises** seeking to develop products and services with potential for technology rupture.

Support will be provided for **public dissemination and communication** of AmiQual results. Public demonstrations will be organized in conjunction with larger public manifestations such as "Fete de la Science", ITEA and ICT summits. Support will be provided for organizing scientific workshops, conferences, and jamborees.

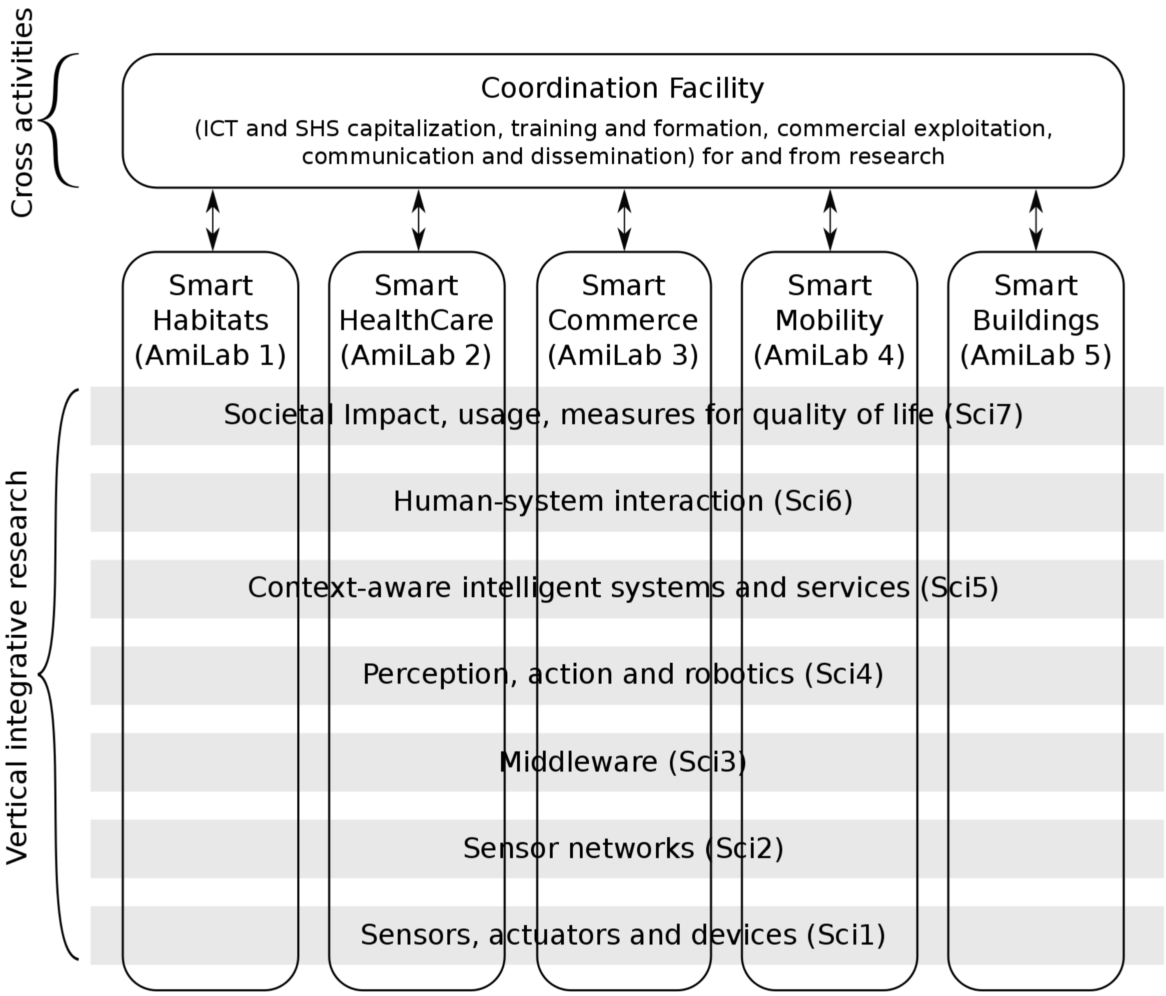


Figure 3.3. AmiQual supports both vertical transdiciplinary research on societal challenges and horizontal multidisciplinary research on enabling technologies.

- *AmiLabs*

AmiLabs provide the experimental apparatus to evaluate ambient systems and services that result from integrative research activities to respond to societal challenges in the areas of:

- Smart Habitats (i.e. AmiLab 1 located in Grenoble).
- Smart HealthCare and HomeCare (i.e. AmiLab 2 located in Toulouse).
- Smart Commerce (i.e. AmiLab 3 located in Lille).
- Smart Mobility (i.e. AmiLab 4 located at Saclay).
- Smart Buildings (i.e. AmiLab 5 located in Nice).

Each of the AmiLabs has **a dominant theme** based on a particular class of societal challenge adapted to the local socio-economic situation of each of the AmiLabs, as a well as **a number of secondary themes** developed in collaboration with other AmiLabs. In addition to individual experiments on their dominant theme, pairs and even triples of AmiLabs may work together on challenges that combine their themes and that will serve to encourage the genericity of the scientific and technological results. For example, the Smart HealthCare & HomeCare AmiLab (Toulouse) will work with Smart Buildings AmiLab (Nice) to develop building architectures suitable for mobility-restricted patients. The Smart Habitats AmiLab (Grenoble) will work with the Smart HealthCare & HomeCare AmiLab (Toulouse) to develop informal communication services that maintain social presence between families and hospitalized family members. This is illustrated in Figure 3.4.

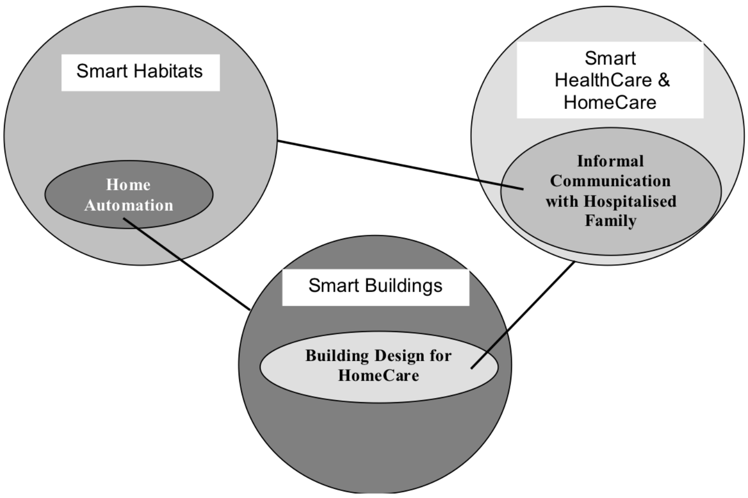


Figure 3.4. Examples of pairs of AmiLabs working together on human services to adapt the technology from one area to the needs of another in order to deliver generic solutions.

Constructing the AmiLabs will require integrating and installing components from the following ICT layers (*cf.* Figure 3.5): (1) Physical Hardware, Sensors and actuators; (2) Operating systems (e.g., Windows/Linux/MacOS/Android), Virtual Machines (e.g., JVM), User Interface Toolkits (e.g., Swing); (3) Network facilities (e.g. sensor networks); (4) Middleware framework technology (e.g., OSGi, .Net, SCA); (5) Service-oriented Middleware (e.g., iPojo, WCOMP, FraSCAti); (6) Perception and action components using a large variety of sensors and actuators ranging from electrical circuit activity, environmental sensors, acoustic perception, computer vision and robotics; (7) Context modeling to enable services that are situated (behave appropriately) with respect to human activity; (8) Mediation facilities to insure communications between software services (e.g., semantic alignment of data and functional descriptions); (9) Human services that are situated and appropriate to changing individual needs and social activities; (10) Experimental utilities (e.g., monitoring tools and data bases to collect technical and human behavioral data for subsequent analysis); (11) User interfaces that enable humans to interact, understand and control service and service behaviours. All these ICT layers will have to take into account **SHS-informed transversal concerns** for privacy, trust, ethics and legal issues.

As shown in Figure 3.5, the dark grey bottom-level layers will primarily be constructed from off-the-shelf technologies. They will provide a stable system foundation for the AmiLabs. The top level of the system (shown in light grey) will be based on more recent research results, drawing from laboratory prototypes and concept demonstrations for which commercial products may not yet be available. Components at these levels may require researchers to work with professionals to specify, design and integrate industrial quality versions. As experience is gained, the enabling technologies for the upper layers will evolve, driving maturation of Ambient Intelligence as a commercial technology. This development process of the AmiQual Facility is presented in the two-phase work programme described below where **Phase 1** is dedicated to the **construction** of the AmiLabs, and **Phase 2** to the **exploitation** for experiments with ambient systems and services for societal challenges.

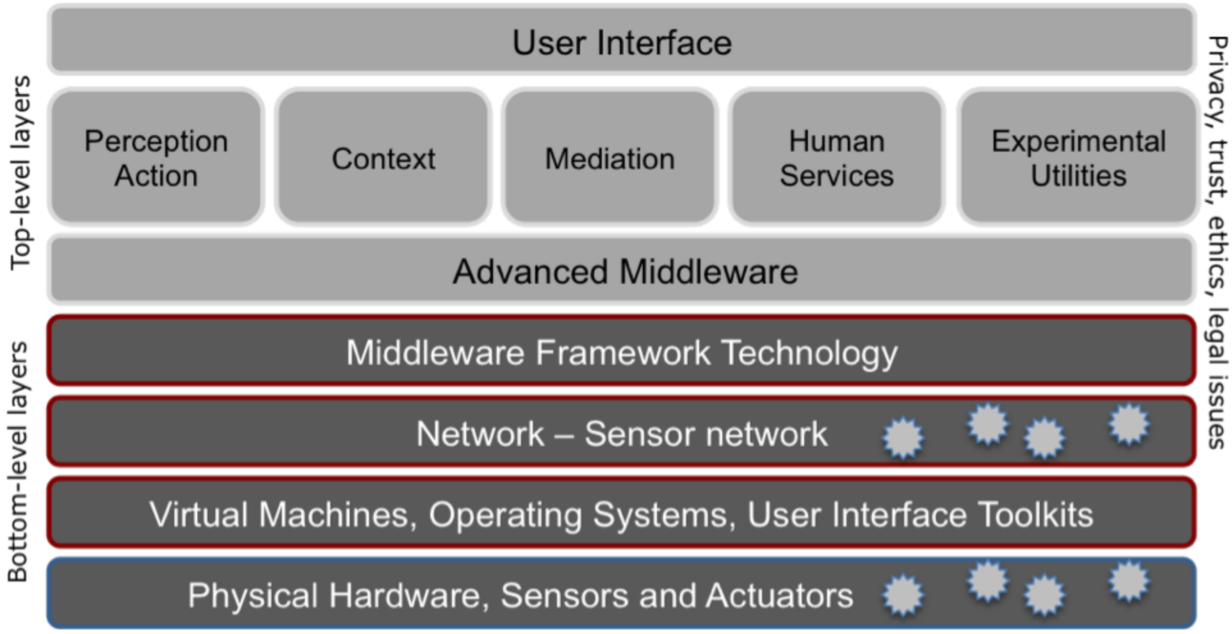


Figure 3.5. Functional layers for AmiLabs. Dark grey bottom-level layers will be constructed from off-the-shelf components and provide a system foundation (core, baseline) infrastructure. Light grey top-level layers will require constructing industrial quality implementations of research prototypes. Light grey "Bubbles denote the potential integration of new solutions (e.g., new sensors/actuators/physical devices and sensor networks) that will result from research.

- *Scientific Challenges*

Description of the state of the art and scientific challenges for each of the sub-domains involved in Ambient Intelligence is provided in Annex 7.2. The following is a brief summary of the available technologies and challenges to be addressed during the two-phase development process of AmiQual. To favor re-use and progress between the AmiQual partners, **each challenge is addressed in a coordinated way within a Sci Working Group** chaired by a pair of scientific co-leaders.

Sci1: Sensors, Actuators and Devices. To the extent possible, the Phase 1 AmiLabs (construction) will employ off-the-shelf commercial products for such requirements as sensing environmental conditions, sensing human presence and activity, actuation technologies for climate control, access control systems, and interaction technologies such as smart pads, interactive displays and web based interfaces. During Phase 2 (exploitation), the complete system will allow comparative experimentation with such technologies as integrated visual sensors for visual and acoustic recognition of human activities and events, active building environmental control, variable transparency windows, reconfigurable interactive surfaces, and new interactive devices.

Sci2: Sensor Networks. The Phase 1 systems will employ a number of existing or emerging communications technologies such as CPL, Zigbee and other emerging wireless standards. Communications will draw on existing protocols such as UDP, 6loWPAN, IPV6 and AES. Bridge technologies will be implemented to integrate coexisting network technologies in each AmiLab. During Phase 2, the complete system will provide a testbed to allow experiments with ad-hoc network technologies, self-configuration, IPv6, IPSec and TCP as well as ultra-low power devices, and scalable network technologies.

Sci3: Middleware. Human-centered services raise fundamental challenges that go beyond the current practices in Service Oriented Computing (SOC). Typically, Service Oriented Architecture (SOA) provides a paradigm for organizing software into components with well-defined interfaces that obey a service "contract". While we will use SOA to construct the AmiLabs, a well-defined interface generally requires abstracting away or eliminating the uncertainties that arise from humans and their activities. An important scientific advance will be theories and models for services maintaining human at the center, adapting to humans and their context. AmiLabs will require SOC middleware to put services at work. The main challenge for Sci3 will be to define and implement the AmiQual middleware stack that will 1) match the requirements of each AmiLab (e.g., efficiency, privacy, security, dependability), 2) integrate the best of standardized SOC technologies (e.g., WS-*, SOAP, BPEL, REST, .Net, OSGi, SCA), and 3) facilitate the interoperability between our research middleware platforms (e.g., iPOJO, WComp, FraSCAti). During Phase 1, each AmiLab will select the most appropriate Middleware Framework technology, and programming support tools, making possible comparative evaluations of the strengths and weaknesses of different middleware frameworks. During Phase 2, the AmiLabs will be used for experiments with advanced technologies for dynamic component discovery and integration, autonomic control and reconfiguration of components and federations, integration of hetereogeneous components and alignment of descriptions of data types and services.

Sci4 Perception, Action and Robotics. Computer vision, acoustic perception and personal robotics have made dramatic advances over the last few years, and a variety of commercial products are now available for integration. In the area of computer vision and acoustic perception, embedded technologies originally developed for visual surveillance can now be found in low cost products for observing and tracking people for commercial and service applications. Off-the-shelf vision systems are available for 3D reconstruction, localization and mapping, faces and gesture recognition, and visual navigation. Navigation technologies for mobile robot platforms are now used for commercial products for wheel chairs, cleaning robots, and autonomous vehicles. Relatively low-cost and reliable platforms for social robotics include humanoid robots such as Aldabaran's Nao as well as more fanciful creations. During Phase 1, off-the-shelf technologies for vision, acoustic sensing and robotics will be acquired and integrated into the AmiLabs. The dominant vision will be to use robotic platforms as peripheral devices that can be integrated and controlled as components of AmiLab Services. During Phase 2, experiments will investigate novel services that can be provided by robotic devices, as well as questions concerning the relative autonomy of robotic devices.

Sci5 Context Aware Systems and Human Services. Context awareness is a key challenge to providing human services that are useful and non-disruptive. This requires that systems have the ability to dynamically adapt to the temporal, spatial, social, task and activity context of people, as well as to the available resources for computing, communication, and interaction. While a number of theories and laboratory prototypes have emerged over the last few years, no commercial technology for context aware systems is currently available. For Phase 1, the AmiLab designers will work with software professionals to construct industrial quality Context management tools that are reliable and maintainable. These will be used to deploy and evaluate initial context aware systems and services. We currently believe that no single model for context awareness will prove adequate. Thus, in phase 2, we will study methods for mediation for semantic alignment to dynamically assemble compositions of domain specific context models.

Sci6. Human-System Interaction. A variety of competing paradigms exist for interaction between ordinary human and systems. Many believe that spoken language interaction with personified simulation of a human head would provide the most natural interaction technology. However, speech recognition with distant field microphones remains a difficult research challenge, and speech synthesis for other than canned expressions is not yet realistic, and spoken interaction in natural languages requires background knowledge and cultural context that is currently unattainable in artificial systems. The Phase 1 AmiLabs will employ commercial technologies in human computer interaction, including post-WIMP technologies using large scale interactive surfaces and mobile devices such as SmartPhones. During Phase 2, the AmiLabs will allow comparative experiments with different families of interface technologies as well as with reconfigurable user interfaces, and new services for end-user control and development of ambient spaces. A fundamental challenge concerns the nature of the interaction between ordinary people and human centered services.

Sci7. Societal Impact, Usage and Measures for Quality of Life. Technical innovation impacts societal environment and modifies socio-organizational context. Innovation changes lifestyles, human relationships and the way in which people define quality of life. Devices and artefacts transform the organization of individual and collective activities and the structure of professional and social interactions. Assimilating innovation can often require the acquisition of conceptual and instrumental knowledge, but may sometimes provoke atrophy of skills. Assessing societal impact of new systems and services based on ambient intelligence will require consideration of ethical and legal issues related to things such as privacy, confidentiality, ownership of information, trust, and respect of individual values. It will require definition of concepts for the sociocognitive utility and efficiency as well as the impacts on quality of life. During phase 1, societal impacts will be analysed in connection with the context of implementation. Ethical guidelines will be provided concerning what can be measured, who owns the data, and the control that subjects and participants can have over what can and cannot be recorded. During the second phase, we will study how people adapt and are influenced by systems and services. During both phases, the facility will assure that participants respect the appropriate legal and ethical guidelines.

3.2.2 Overview of the Work Programme

The work programme is comprised of two phases:

- **Phase 1**, duration **4 years**, is dedicated to the **construction** of the equipment.
- **Phase 2**, duration **5 years**, corresponds to the **exploitation** of the equipment.

For both phases, we will adopt an incremental approach.

Phase 1: Construction of the Equipment

The construction of the equipment includes the following tasks that will be conducted in parallel during the first four years:

- T1: Construction of the Coordination Facility
- T2: Construction of the AmiLabs

T1- Construction of the Coordination Facility (CF)

In Phase 1, the consortium will be concerned with the construction of the equipment for the Coordination Facility. This equipment includes two types of resources:

- The CF computing system will be acquired to support all AmiQual cross-activities. This will include repositories (for ICT and SHS capitalization, education and training, day-to-day management of the project), and notably, web-based solutions for publicizing AmiQual world-wide. The primary focus in Phase 1 will be on specifying the functional requirements of this equipment using an iterative and incremental approach. The partners will work together to forge a common vision for the services expected from the CF computing system.
- Expensive specialized devices that are of interest to the AmiQual community and beyond (e.g., a 3D printer), and/or mobile devices that can be lent between the partners (e.g., GPS mobile tracking system). These devices, whose use will be shared and whose geographical location may vary, will have to be managed, traced, and maintained. This will be supported by the CF computing system.

T1 is decomposed into the following sub-tasks:

- T1.1 Installation of Computing Hardware for the CF.
- T1.2 Specification of the ICT and SHS repositories.
- T1.3 Specification of the CF computing system.
- T1.4 Development of the CF computing system including evaluation with representative end-users (e.g., partners, affiliates and potential clients).
- T1.5 and T1.6 – Incremental provision for ICT and SHS content, respectively.

Phase 1 of T1 is composed of 4 milestones, one per year:

<u>YEAR 1</u> - Milestone 1 (M12): Minimal V0 CF computing system operational.

YEAR 1	1	2	3	4	5	6	7	8	9	10	11	12
T1.1- Installation of CF Computing Hardware	■	■	■	■	■	■	■	■	■	■	■	■
T1.2- Spec. of the V0 SHS & ICT repositories	■	■	■	■	■	■						
T1.3- Spec. of the V0 CF computing system				■	■	■						
T1.4 Dev. of the V0 CF computing system							■	■	■	■	■	■

M1 – V0 of the CF Computing System available

During the first 12 months, the four Working Groups of the Coordination Facility will specify the requirements for the enabling tools that will be integrated into a set of services uniformly accessible via Web browsers with the appropriate access rights (T1.3). Competitive bids will be organized for implementation by software professionals. Specific attention will be dedicated to the specification of the SHS and ICT repositories, which are at the core of pluridisciplinarity (T1.2). At the end of the first year, services with high priority, but simple to implement, will be available (at minima, a professionnal informative AmiQual web site) (T1.4).

<u>YEAR 2</u> - Milestone 2 (M24): V1 version of the CF computing system operational.

YEAR 2	13	14	15	16	17	18	19	20	21	22	23	24
T1.1- Installation of CF Computing Hardware	■	■	■	■	■	■	■	■	■	■	■	■
T1.2- Spec. of the V1 SHS & ICT repositories	■	■	■	■	■	■						
T1.3- Spec. of the V1 CF computing system				■	■	■						
T1.4 Dev. of the V1 CF computing system							■	■	■	■	■	■

M2 –V1 of the CF Computing System available

During the second year, prototypes of the repositories will be integrated into the first version of the CF computing system. Because the SHS repository will be useful primarily to non-SHS researchers (and vice-versa for the ICT repository), the development of the repositories will require the partners to move progressively from a "multidisciplinarity attitude" to a "transdisciplinarity attitude". As a result, the development of the repositories will be based on a rapid prototyping approach along with formative evaluations. Working under the supervision of the Working Groups leaders, industry professionals will construct and integrate maintainable versions of the CF computing system.

<u>YEAR 3</u> - Milestone 3 (M36): V2 version of the CF computing system.

YEAR 3	25	26	27	28	29	30	31	32	33	34	35	36
T1.1- Installation of CF Computing Hardware												
T1.4 - Dev. of the V2 CF computing system												
T1.5- Content for SHS repository and test												
T1.6- Content for ICT repository and test												

M3 –V2 of the CF Computing System available

During the third year, the focus will be placed on the content of the repositories. The quality and usefulness of the content will be tested by representative end-users.

YEAR 4 - *Milestone 4 (M48): V3 version of the CF computing system available*.

YEAR 4	37	38	39	40	41	42	43	44	45	46	47	48
T1.1- Installation of CF Computing Hardware												
T1.4 - Dev. of the V3 CF computing system												
T1.5- Content for SHS repository and test												
T1.6- Content for ICT repository and test												

M4 –V3 of the CF Computing System fully operational for Phase 2.

Last tests and revisions are performed. At the end of the fourth year, all of the functionalities of the CF Computing system are stable and fully operational for Phase 2.

T2- Construction of the AmiLabs

During Phase 1, the consortium will be concerned with installing hardware and integrating contributions from a variety of subdisciplines of informatics and social sciences in order to provide an initial complete system for each of the AmiLabs. The primary focus in Phase 1 will be on selecting and integrating available enabling technologies to provide robust usable state-of-the-art facilities for experiments. An important objective will be to create initial components that will serve as a core for incremental development and expansion of human-centered services. The partners will work together to forge a common vision for human centered services based on Ambient Intelligence including a reference architecture that can be used for a variety of societal sectors.

The AmiLabs will be constructed incrementally, starting from an early implementation of a robust core of components chosen to demonstrate an early success. Each year, we will extend from this core, iteratively adding, testing and refining additional components at all levels of the AmiLab stack as technologies become available, as illustrated in Figure 3.6. This incremental approach will make it possible to conduct experiments of increasingly complexity as the technology matures.

Human Centered Services						Y4	Y3	Y4					
Components, Context, Interaction					Y4	Y3	Y2	Y3	Y4				
Middleware				Y4	Y3	Y2	Y1	Y2	Y3	Y4			
Networks and sensor nets			Y4	Y3	Y2	Y1	Y1	Y1	Y2	Y3	Y4		
Virtual Machines, OS, UI TKs		Y4	Y3	Y2	Y1	Y1	Y1	Y1	Y1	Y2	Y3	Y4	
Sensors, Actuators, & Hardware	Y4	Y3	Y2	Y1	Y1	Y1	Y1	Y1	Y1	Y1	Y2	Y3	Y4

Figure 3.6. The AmiLabs will be developed incrementally, by successively robustifing enabling technologies. During the first year (Y1) a central core of technologies will be implemented at the lower levels of the AmiLab Stack. The successful integration from each year will be used as a foundation to add new components at higher levels in successive years (Y2, Y3, Y4). Darker color indicates earlier integration.

T2 is decomposed into the following sub-tasks:

- T2.1 Installation of the equipment for each AmiLab.
- T2.2 Selection of enabling technologies.
- T2.3 Robustification of research prototypes (i.e. top-level layers components).
- T2.4 Implementation of the AmiLab stacks.
- T2.5 Human-centered experiments.

Phase 1 of T2 is broken down into 4 milestones, one per year:

YEAR 1 - Milestone 1 (M12): Architecture and equipment specified and designed. System foundation infrastructure operational.

YEAR 1	1	2	3	4	5	6	7	8	9	10	11	12
T2.1- Installation of physical equipment												
T2.2- Selection of enabling technologies												
T2.3- Spec. to *robustify* research proto.												
T2.4- System foundation infrastructure												

M1 – Architecture and equipment specified and designed – System foundation infrastructure operational for each AmiLab

During the first 12 months, AmiLabs experimentation sites will be retrofit and equipped with sensors, actuators, and networks installed by services professionals (e.g., plumbers, electricians, building contractors, etc.) (T2.1). Each multidisciplinary AmiLab team (ICT, SHS and Socio-economic experts) will select enabling technologies to be used for the technology layers of Figure 3.5 suitable for their research plan (T2.2). A joint working group between the AmiLabs software experts will elaborate a common reference architecture for all AmiLabs to facilitate comparative evaluation, technology sharing as well as technology evolution. Specifications and designs will be prepared for industrial quality implementations for research prototypes of the top-level layers advanced system components (T2.3). A team of AmiLab engineers (including a highly qualified chief engineer) will be hired for each AmiLab to implement and integrate components and systems for the different technology layers of each AmiLab (T2.4). At the end of the first year, each AmiLab will be equipped with an initial version of the system foundation infrastructure enabling test and validation of basic components of the top-level layers of AmiLab stacks during Year 2.

YEAR 2 - Milestone 2 (M24): Initial version of top-level technology layers implemented and integrated.

YEAR 2	13	14	15	16	17	18	19	20	21	22	23	24
T2.1- Installation of physical equipment												
T2.2- Selection of enabling technologies												
T2.3- Robustification of research prototypes												
T2.4- Implementation of V0 AmiLabs stacks												
T2.5- Spec. of initial experiments for Year 3												

M2 – Version 0 of complete AmiLab stack operational for each AmiLab – Initial in vitro human-centered experiments specified

Working under the supervision of the AmiLab leaders, the AmiLab engineers will construct and integrate maintainable versions for the initial top-level components of the AmiLab stacks (T2.3). Installed components will be tested, and pilot experiments will be performed with logging and simple experimental scenarios in order to expose problems or unreliable components. Validation tests will be performed to guarantee that bottom-level layers components meet specification (T2.4). SHS and Socio-economic sectors will specify experimental methods and propose initial *in vitro* human-centered experiments to be conducted in Year 3 (T2.5).

<u>YEAR 3</u> - Milestone 3 (M36): First version of AmiLabs tested, improved and made functional.

YEAR 3	25	26	27	28	29	30	31	32	33	34	35	36
T2.1- Installation of physical equipment	■	■	■	■	■	■	■	■	■	■	■	■
T2.2- Selection of enabling technologies	■	■	■									
T2.3- Robustification of research prototypes				■	■	■	■	■	■	■	■	■
T2.4- Development of V1 AmiLabs stack	■	■	■	■	■	■	■	■	■			
T2.5- *In vitro* experiments										■	■	■

M3 – Version 1 of complete AmiLab stacks
– First results from in vitro experiments

During the third year, pilot *in vitro* experiments will be performed with systems and human centered services. Implementations of human-centered services will be evaluated. Tools and methods for conducting experiments will be evaluated and improved. These will be corrected, yielding functional platforms for participatory design and development of human services (T2.5) that will serve both to validate and evaluate the design of each AmiLab stack (T2.4), as well as to provide experience to SHS scientists with the use of the AmiLab facilities. Testing during the third year will invariably expose weaknesses. Problems with components systems will be identified and corrected and new components will be prepared for the following year (T2.3).

<u>YEAR 4</u> - Milestone 4 (M48): Second version of AmiLabs available for in vivo experiments.

YEAR 4	37	38	39	40	41	42	43	44	45	46	47	48
T2.1- Installation of physical equipment	■	■	■	■	■	■	■	■	■	■	■	■
T2.2- Selection of enabling technologies	■	■	■									
T2.3- Dev. to *robustify* research prototypes				■	■	■	■	■	■	■	■	■
T2.4- Development of V2 AmiLabs stack	■	■	■	■	■	■	■	■	■			
T2.5- *In vitro* exp. and spec. of *in vivo* exp.				■	■	■	■	■	■	■	■	■

M4 – Version 2 of complete AmiLab stacks available for Phase 2 in vivo experiments
– second results from in vitro experiments
– in vivo experiments for Phase 2 specified.

Experience shows that robustness is a strong requirement for conducting *in vivo* experiments. During the fourth year, additional pilot experiments will take place to improve the robustness and the functional coverage of the AmiLabs so that *in vivo* experiments can take place in Phase 2. Testing during the fourth year will expose new requirements such as technical interoperability between AmiLabs for experiments that requires the simultaneous use of multiple AmiLabs. At the end of Phase 1, the consortium will have obtained a set of five fully functional AmiLabs.

Phase 2: Exploitation of the Equipment

During Phase 2, the AmiLabs will be available as testbeds for research on component technologies and systems as well as for real world experiments and participatory development of services where the human is at the core. The Coordination Facility has all of the equipment available to conduct its activities in an effective manner. In Section 7.1, a number of scenarios make explicit the use of the AmiQual facility.

The challenge for transdisciplinary scientific research during this phase will be to provide theories and models for services that are:

- Composed of large numbers of heterogeneous components.
- Capable of automatic configuration, regulation and repair.
- Capable of accommodating and adapting appropriately to human context.
- Reliable, trustable, and secure, and more generally

- Respectful of human ethical values and legal issues.

3.2.3 Risk Assessment and Contingency Plans

In this section, we will examine some of the threats that may challenge successful construction and operation of the AmiLabs. For each threat, we will propose both mitigation efforts to minimize the risk, and corrective actions to perform if the threat materializes. We will concentrate on a few, most likely threat scenarios that have the highest impact on integration and operation.

Threat 1: Integration failure for an AmiLab

Description: Integrative research is inherently risky, particularly in the face of heterogeneous technologies and lack of standards. The integration efforts of an AmiLab may fail because of selection of incompatible technologies, mistaken design assumptions, or reliance on immature technologies. In some cases, fundamental enabling technologies such as communication networks or middleware can prove to be unusable due to reliability problems.

Threat Mitigation: The ICT working group of the Coordination Facility will organize regular workshops to experiences with technologies at each of the levels of the AmiLab stack. The existence of collaboration between pairs of AmiLabs on specific subject (Majeur/mineur) will expose AmiLabs to alternate technologies.

Contingency Plan: The integration team of the threatened AmiLab can fall back on alternative technologies that have proven successful in other AmiLabs. Teams building human services can call on partner AmiLabs while their home AmiLab is repaired.

Threat 2: Incompatible evolution of enabling technologies

Description: The AmiLabs are based on integration of emerging technologies from as many as seven distinct technology layers. Succesive refinements of technologies such as devices interfaces, network protocols, operating systems or middleware, can involve elimination of functions that have been employed at higher layers.

Threat Mitigation: The software *architecture* used for deployment and the design of the *components* will use adaptation and evolvability as a first class concept in such a way that the design enables on-line reconfiguration and hardware replacement. This design work should conclude with some technology proposals, architectural frameworks, modelling techniques and guidelines to design adaptable and evolvable ambient systems. Software development will make extensive use of software engineering technologies that support reconfiguration (e.g., service oriented architectures, component-based software engineering, aspect oriented programming).

Contingency Plan: Iterative development over the four year period will provide opportunities to update technologies during deployments. During the second, exploitation phase, operating partners will provide engineering support to maintain and update the core technologies.

Threat 3: Rejection by end-users due to loss of privacy

Description: Technologies for ambient intelligence are inherently intrusive. Participants in experiments may reject or even sabotage technologies because of concerns of loss of privacy.

Threat Mitigation: Participants will be drawn from volunteers, who are engaged not only as subjects but as co-designers. Experiments will be subject to pre-approval by an ethics review panel, similar to that used in medical research, as well as review by a legal issues panel. Subjects will be informed in advance of experiments and asked to provide prior approval for participation. When technologies are deployed in private spaces such as homes or offices, the occupants of the space will be given complete visibility and control over all collected data.

Contingency Plan: If a participant objects to an experiment, data collection will be immediately halted, and the subject will be given control of any personal data. If the issue is not resolved, it will be brought to review by the ethics panel as well as the legal issues panel.

Threat 4: Failure of a partner to meet obligations

Description: Changes in internal priorities may lead to failure of a partner to fulfil engagements during the phase 1 or phase 2.

Threat Mitigation: None of the AmiQual partners are irreplaceable. Sufficient overlap in competences exists that any partner can be replaced if need be.

Contingency Plan: A partner that fails to meet his engagements will be formally notified of the failture and asked to take corrective action. A partner that fails to comply with such a request will be removed from the Executive Board, and if need be, a substitute partner will be named. Any resources transferred to such a partner will be recovered for use by the project.

Threat 5: Failure of an AmiLab to share Technology or experimental results

Description: Competitive pressures may lead an AmiLab to fail to fully share technologies and results.

Threat Mitigation: Each AmiLab is organised around a unique dominant theme. Each AmiLab integrates partners with unique competences.

Contingency Plan: A consortium agreement will be signed during the first year of AmiQual exploitation. This consortium agreement will document the requirements of partners to share technologies and results of experiments, and will set forth procedures for conflict resolution in the case where an AmiLab fails to meet such engagements.

3.2.4 Expected Results

Both the construction phase and exploitation phase will provide results that can be measured by objective performance indicators. These indicators will be monitored by the tools of the computing system of the Coordination Facility.

In the area of research, performance can be measured by:

- Number and impact of scientific publications,
- Number of patents of technologies, systems and services,
- Number of ICT solutions and SHS guidelines, benchmark data published on the AmiQual repositories along with the number of "downloads" and "visits",
- Number and size of participation in scientific workshops,
- Number and impact of scientific studies performed using the AmiQual facility.

In the area of technology innovation, results can be measured by:

- Number of start up companies created,
- Number of software licenses signed for AmiQual technologies,
- Number of new products created,
- Number of jobs created to commercialise AmiQual technologies,
- Number of new members, affiliates, and clients,
- Number of new links and collaborations created with other international experimental facilities,
- The rate of use of the AmiLabs.

In the areas of education and training, results may be measured by:

- The number of bachelors ("licence"), masters and doctoral thesis performed using AmiLabs equipment,
- The number of academic programs created around AmiQual,
- The number of students trained in AmiQual affiliated programs.

The most important results are not always easily measurable. For the construction phase, the most important result will be the delivery of five fully functional AmiLabs and of a fully operational Coordination Facility. For the exploitation phase, the most important result is the capacity to conduct *in vivo* experiments successfully (e.g., AmiLabs are robust enough to be deployed in real life settings). This result will be documented in performance evaluation experiments, and demonstrated to both the ANR and the general public through open demonstrations. Another result will be the capacity for the AmiQual facility to be economically self-sustainable and to be entitled to serve as a "Tres Grand Instrument de Recherche" (TGIR).

3.3. STRUCTURE AND COMPOSITION OF THE EQUIPMENT

The following describes the Coordination Facility and each of the AmiLabs in details.

3.3.1 COORDINATION FACILITY (CF)

Geographic Location

The Coordination Facility will be located within the INRIA Building in Montbonnot (Grenoble) as well as within the ENSIMAG building of Montbonnot. Specialised components for fabrication of prototype devices (FabLab) and Technology Assessment (TAC) will be located at the CEA-LETI in Grenoble, because of the need of proximity of highly trained personnel. Equipement for SHS experiments will be located at UTT, and made available for deployment at the AmiLabs. Scenarios of use for the CF are presented in Section 7.1.1.

Challenges and Mission Statement

Challenges. The main challenge of the CF is to provide AmiQual partners with the logistics equipment and staff to optimize and promote the AmiLabs in a consistent way, to ensure the capitalization, cross-fertilization, and openness of ICT and SHS research efforts, to monitor the use of the AmiQual facility, and to provide physical equipment items that can be lent between the partners or rented to clients.

The core vision is capitalization, sharing, cross-fertilization, self-monitoring, and promotion to create an effective scientific community for Ambient Intelligence.

Scientific and Technical Objectives

Phase 1

The scientific objective for the Coordination Facility in Phase 1 is the development of a common understanding (e.g., concept vocabulary) between the disciplines as well as within a discipline. In particular, the exposition of ICT specialists with knowledge from experts in legal issues will be particularly challenging.

The technical objectives in Phase 1 include the installation of the physical equipment in the appropriate sites as well as the construction of the computing system that will integrate the subsystems that support the AmiQual cross-activities. This is detailed in the description of the work programme in Section 3.2.2. The following subsystems will be of particular importance:

- **The ICT repository** will be a central technical resource for the AmiLabs. It will provide **documentation for technology solutions** adopted by the different AmiLabs as well as **catalogs** of sensors, actuators and other devices that can be of mutual interest to the network of AmiLabs. The technology repository will include a system for publishing software source code (**source forge**) that will encourage sharing of resources. It will provide a publicly available resource for **generic solutions** that are common to a variety of application domains as well as **bench-mark data** for testing technological components.

  The ICT repository will be animated by an engineering staff whose personnel is provided by AmiQual partners. This staff will organize technology sharing workshops that examine solutions to common problems addressed by AmiQual partners (e.g., software architecture for the AmiLabs stack).
- **The SHS repository** will be a very unique resource made available to the ICT experts involved in Ambient Intelligence. The enabling technologies for Ambient Intelligence are highly

intrusive by nature. Experiment with systems and services where the human is at the center will require proper guidance concerning usability, ethics and legal issues (cf. report from CNRS COMETS [Mariani 09]). The need for ethics and legal guidance goes beyond experimental practice. Accommodating ethical and legal constraints as an integral part of the design (**"privacy by design" principle** [Le Métayer 09]) and development process makes it possible to convert a possible liability into an advantage. Systems that respect the user and inspire trust are much more likely to be adopted rather than rejected by the target user community.

The SHS repository will structure and provide access to the **human-centered data collected by the control resources of the AmiLabs**. It will include **usability and experimental methodology guidelines** produced by the AmiQual partners experts in psychology, ergonomy and sociology. It will also gather **legal rules guidelines** produced by the AmiQual partners experts in law and ethics. The normative space covering the legal aspects cannot be narrowed to a classic compilation of texts relative to technologies and public liberties, but must be contextualized according to the legal framework (location, implied individuals, users) and to legal environment (country, recipents of the use) strictly necessary to the technology beneficiaries. It will also include an international dimension given the societal dimension (medicalised housing, railways stations, airports areas). International laws, EU laws, both linked to security and liberties problematics (privacy, data protection, interoperability) of people, significantly enlarge the fields of legal interactions, and add a notable complexity level in an enlarged legal framework (commercialisation problems, international concerns for responsability).

The SHS repository will be animated by an ethics and legal committee whose personnel is provided by AmiQual partners.

At the end of Phase 1, the computing system is operational for effective use by the community.

Phase 2

In Phase 2, the Computing Facility is dynamically improved by new content that results from the AmiQual cross-activities as well as from the research supported by the AmiQual facility.

Physical Equipment: Installation and Description

The physical equipment of the Coordination Facility will be installed at CR INRIA-Rhône-Alpes, CEA-LETI (Grenoble), and Institut Charles Delaunay (ICD, Troyes). The existence and availability as well as the monitoring of this distributed equipment will be made possible by the CF computing system.

CR INRIA Rhône-Alpes. The main server of the CF computing system will be located at Montbonnot and operated by CR INRIA Rhône-Alpes.

CEA-LETI. The CF equipment installed at CEA-LETI is expensive and requires to be operated by expert personnel. It includes the FabLab[7] equipment to design and create new interactive devices and a Technology Assessment Center (TAC). TAC will provide equipment and know-how for the functional characterization of sensors and actuators. The aim of this center is to obtain reliable data about the behavior of front-end subsystems in controlled operation conditions (bias, non-linearity, drift, accuracy, etc.). Such information is rarely available, especially for OTS (Off-The-Shelf) low cost devices, and is a key knowledge, as it determines the interaction between Ambient Intelligent Systems and the environment. The TAC will be set up at CEA LETI Grenoble within the System Department where experts will take responsibility to provide a complete sensor evaluation thanks to the equipments for the AmiQual partners and for other industrial requests.

Institut Charles Delaunay. The capture devices (video, audio, behavioral, eye-trackers,…) and the event logging platform for the collection, analysis, and presentation of observational data will be located at UTT Troyes. By nature, most components of this equipment are portable. It will be possible to transport them to any AmiLab for experimental assessment sessions.

[7] "A **Fab Lab** (**fab**rication **lab**oratory) is a small-scale workshop with an array of computer controlled tools that cover several different length scales and various materials, with the aim to make "almost anything"."(wikipedia). The concept has begun as an outreach project from MIT's Center for Bits and Atoms.

The components of the physical equipment. Table 3.1 makes explicit the components of the equipment for the CF. Section 6.1.1 provides details about the individual elements along with their cost.

Item	Component function	Location	Origin
Web Server Software	Technology Repository Wiki, Catalog and Source Forge	Montbonnot	Devis IG Technology
Web Server Computers	Technology Repository Wiki, Catalog and Source Forge	Montbonnot	
3D Printer	Fabricate Metal and plastic prototypes in 3d	CEA LETI-FabLab	Phenix Systems
CAD Design Tool	Prototype Design	CEA LETI-FabLab	AMC
Climate Control System	Precision temperature and humidity for device measurements	CEA LETI-TAC	
3 Axes Table for Climate Control System	Precise movements for measurements	CEA LETI-TAC	
Motion Measurement System	Device characterisation	CEA LETI-TAC	
Multi-channels recording/editing digital video systems	Digital video editing	Troyes (ICD)	AMC
PC/Linux servers	Computing facilities	Troyes	Dell
Mobile eye-trackers	Mobile eye tracker for capturing automatic, low-level natural user behavior	Troyes	Tobii
Observer XT software system	Collecting and editing rich behavioral data for the assesment of ambient intelligence appliances	Troyes	Noldus
GPS tracking systems	Tracking of mobile behavioral data	Troyes	AMC
Glass-cameras	Subjective view recording	Troyes	AMC
Video sensors	Behavioral tracking	Troyes	AMC
Digital camera	Mobile Behavioral tracking	Troyes	
Hard-disks	Storage units	Troyes	
LCD displays		Troyes	

Table 3.1. Components of the physical equipment for the Coordination Facility.

3.3.2 AmiLab 1. Smart Habitats: Systems and Services for Smart Habitats

Geographic Location

The AmiLab 1 Smart Habitats will be located in two buildings in the ZIRST Montbonnot (near Grenoble), with two satellite test facilities on the campus: Predis (UMR G2Elab) and LIG-Domus (UMR LIG).

The core of AmiLab 1 Smart Habitats will be located in the ENSIMAG extension building in Montbonnot along with a rented block of 7 apartments in the adjacent TempoLogis residence building. Both buildings are located in front of the INRIA Grenoble Rhône-Alpes research center (See Figure 3.7). Two satellite facilities are currently available on campus for controlled experiments in energy management (G2Elab-PREDIS) and living at home (LIG-Domus). These satellites will be included in the AmiLab 1 facility and used for development and initial evaluation of technologies prior to real world testing in the Montbonnot core facilities. Scenarios of use for AmiLab 1 are presented in Section 7.1.2.

Figure 3.7. The core buildings of AmiLab 1 is the ENSIMAG research building and the TempoLogis residence located in front of the INRIA Grenoble Rhône-Alpes Research Center in Montbonnot.

The overall challenge is to create an environment where the habitants actively participate in the invention, deployment and evaluation of services. In particular, participants must be sufficiently competent and engaged in the process to accommodate and maintain experimental services, and to understand and control data collected from their living space. For this, we propose to draw on a readily available population of students in the Masters and Doctoral programs on Informatics and Applied Mathematics at Grenoble University.

Societal Challenges and Mission Statement

A habitat is any form of structure that provides security for people and their possessions. The Smart Habitats AmiLab will provide experimental facilities for research on systems and services for improving the quality of human habitations. Its mission is to stimulate innovation and evaluate the impact of human services provided by habitats using Ambient Intelligence.

Societal challenges. The AmiLab 1 Smart Habitats is motivated, but not limited to, societal challenges related to human services for comfort and energy efficiency, family cohesion, communications, and family every-day activities and entertainment. Many of the challenges in this area concern responding to exceptions [Davidoff et al. 06]. Family services include energy efficient comfort management, information communication between family members, as well as management of possessions (laundry to be launched because of a business trip planned in a couple of days, food on the point to be past its consumption date, medicine close to expiration date), decision-making (what to buy, what to wear today), reminders (appointments, activities), security (door and windows locked), energy consumption and resource sharing among family members (for example, hot water and bathroom occupation in the morning), etc.

Primary and secondary themes. Although the primary theme for AmiLab 1 is habitat as provider of services, proximity to the educational facilities and active participation by Masters and Doctoral students will enable this AmiLab to include a secondary theme related to services for education and mobility in cooperation with the Smart Mobility E-Campus AmiLab in Saclay. AmiLab 1 will also engage in collaboration with Smart Buildings AmiLab in Nice on problems related to design of habitats for inclusion of robots, with the Smart Healthcare and HomeCare AmiLab in Toulouse on social communications and family cohesion between families and hospitalized family members, and with The Smart Comerce AmiLab to explore commercial services related to home logistics and supplies.

The core vision is the concept of the human habitat as a provider of dynamically reconfigurable services under human control, where habitats include private homes as well as commercial and public buildings. Reconfigurability, dynamicity and heterogeneity are key to address **legacy**

buildings as well as the **incremental development of smart homes** over several years (for the foreseeable future, a smart home will not be built from scratch and will depend on the socio-economic context).

Scientific and Technical Objectives

Phase 1

The scientific objectives for AmiLab 1 in Phase 1 include the development of theories, models, tools and methods for:

- Automatic installation, automatic configuration, position estimation and automatic maintenance for sensors and actuators retro-installed in legacy buildings.
- Design of system components that declare both state and functionality as well as semantic alignment in order to be dynamically recruited for human services.
- Context aware modeling to recognize and adapt to users and their daily lifestyles, individual human activity and social roles, and social context.
- Design of building management systems with life cycles measured in tens of years that can employ computing, sensing, actuation and interaction technologies with life cycles of 2 to 3 years.
- Mechanisms for user interface plasticity so that user interfaces can adapt dynamically to the context of use (social situation, human activity, interaction resources available) while preserving human values.
- Novel interaction techniques such as 3D interaction, and design of new devices for the home (for the wall, in the hands, in the furniture).
- Mechanisms for end-user programming so that end-users can observe, control and build their own smart spaces and can be kept in the loop.

The technical objectives of AmiLab 1 in Phase 1 is to support the above scientific objectives by providing the experimental infrastructure to be installed in the two Montbonnot core buildings of AmiLab 1 (ENSIMAG research building, and Tempologis apartment) according to the work programme presented above. This will include:

- The installation of physical equipment (hardware) completed with the baseline "*bottom layers*" of Figure 3.5 that satisfy the requirements of AmiLab 1 Smart Habitats for Phase 2.
- Development and integration of a first version of the "*upper layers*" of Figure 3.5 that are necessary for the scientific objectives and primary theme of AmiLab 1 Smart Habitats.

At the end of Phase 1, the core buildings of AmiLab 1 Smart Habitats in Montbonnot will be able to support *in vivo* experiments. In parallel, the two satellite facilities on campus will be used for specialized small-scale controlled experiments in energy management (G2Elab - Predis) and living at home (LIG-Domus).

Phase 2

The scientific objectives of concern for AmiLab 1 Smart Habitats in Phase 2 are the design, development, and evaluation of human centered services that

- Are based on hardware and software componens that are reliable, affordable and cost effective
- Can be easily deployed in both new and legacy buildings,
- "Make sense" and provide "value" for end-users.
- Improve the quality of life of people.

These scientific objectives will build on the scientific and technical results from Phase 1 and will use AmiLab 1 Smart Habitats for a series of *in vivo* experiments in the Montbonnot facilities (concrete examples of experiments are provided in Appendix 7.3). In particular, the apartments of the TempoLogis building will be occupied by Graduate students and their families who act as both experimental subjects and innovators. Student volunteers will have access to the rapid prototyping workshop in the adjacent ENSIMAG research building for creation and or repair of new devices and technologies. Other experiments will be conducted for systems and services for collaborative work between researchers of the LIG laboratory, as well as for education. Occupants will have full transparency and control over all data to respect privacy and personal dignity.

Physical Equipment: Installation and Description

The bulk of the physical equipment will be installed in the AmiLab1 core buildings in Montbonnot (i.e. the ENSIMAG extension building and the TempoLogis apartments).

ENSIMAG building. The ground floor of the ENSIMAG building currently includes three classrooms, a social area, a central interior courtyard, a student laboratory, and an augmented reality room for educational exercises. This floor is used by students from the MoSIG international Masters program (Master of Science in Informatics at Grenoble) option Graphics Vision Robotics for course work and laboratory exercises, as well as ENSIMAG 3 option Image and Virtual Reality students for laboratory exercise. The two other floors are used by two research groups of LIG.

The ground floor of the ENSIMAG building will be equipped with:

- A control room for supervising experiments and recording experimental data.
- An integrated comfort management system. A team of engineers from Schneider Electric is currently working with the Grenoble INP Service de Patrimoine (Physical plant services) and the ENSIMAG building maintenance staff to specify the suite of sensors and actuators to be installed (sensors for temperature, humidity, CO_2, ambient noise, ambient light levels, activity monitoring of electrical circuits, window and door state and human presence; Actuators for controlling heating, air-conditions, lighting and well as operation windows on the inside courtyard, and exterior window shades and interactive display devices).
- A robotics experimental area for use in construction and test of robots for habitats.
- A smart classroom facility for experiments with use of Ambient Intelligence for coursework and remote training. This will operate as an antenna of the Smart Campus AmiLab in Saclay and will be used to test devices and services prior to deployment at Grenoble University.
- A "creativity lab" workshop for opportunistically constructing or repariring systems and devices (sensors, actuators and other components). This workshop will operate as a local extension of a fab-lab at the CEA where additional equipment for creative construction of devices will be installed (3D printers, 3D lasers, etc.) whose utilization requires specific training.

The ENSIMAG building will continue to provide classroom and laboratory space to students of the MoSIG Masters program, and Masters and Doctoral students will be recruited to serve both as technology innovators and as test subjects. A smart classroom will be outfitted to enable experiments in the use of Ambient Intelligence for education and training (in cooperation with AmiLab 4 Smart mobility e-Campus).

The TempoLogis apartments. A floor of six unfurnished apartments will be rented for use as a living lab for participating Masters and Doctoral students and their families. In addition, a furnished apartment will be rented on a separate floor for use for experiments with services for healthy seniors.

Masters and Doctoral students participating in research related to AmiQual will be offered the possibility of living in the AmiQual apartments. Student inhabitants will serve both as experimenters and test subjects, with full participation with the specification, design, deployment and operation of experimental systems and services. Student participants will be given access to the control facilities and workshop in the adjacent ENSIMAG building and be encouraged to be creative in inventing new services and devices.

A club of retired techno-phylic seniors will be recruited from recently retired engineers and scientists from local industries or research labs to participate in experiments in the furnished apartment. This club will be invited to work with researchers and students to define and test devices and services that can help seniors overcome the handicaps that accumulate with age.

Members of this club will serve as subjects, inhabiting the test apartment for periods of days or weeks to evaluate systems and services.

A key concept in all of these experiments is that subjects have control over all data that is collected and participate in all phases of the experimentation.

The PREDIS satellite facility is located on campus in a building currently used by G2Elab and G-SCOP. The facility provides meeting and study spaces for students and faculty, and has been instrumented with sensors and actuators for integrated control of environmental conditions.

The LIG-Domus satellite facility is a 60m^2 space arranged as a small apartment composed of a living room, kitchen and bedroom, connected by a hallway. The facility is equipped with sensors, actuators, cameras and microphones that are wired to a control room located in another part of the building. It is designed for use in controlled "scenario" based experiments in which one or more persons are observed and recorded as they enact the scenario. The facility cannot be used as a real-world living space as it is in a restricted poccess area, and lacks toilet facilities.

The components of the physical equipment. Table 3.2 makes explicit the components of the equipment for AmiLab 1. Section 6.1.2 provides details about the individual elements along with their cost.

Details	Component function	Location	Origin
Table A1.1	Rental cost of TempoLogis Living Lab Apartments	TempoLogis Building	Long-Term Lease
Table A1.2	Environmental Comfort Measurement and modeling	ENSIMAG Building, Tempologis, PREDIS	Commercial products, Professional Installation
Table A1.3	Energy usage Measurement	ENSIMAG Building, Tempologis	Commercial products, Professional Installation
Table A1.4	Network Infrastructure	ENSIMAG Building, Tempologis	Commercial products, Professional Installation
Table A1.5	Building Automation and actuators for Integrated Comfort Control	ENSIMAG Building	Commercial products, Professional Installation
Table A1.6	Human Activity observation sensors (Blue-Eye Video)	ENSIMAG Building, Tempologis	Commercial products, Professional Installation
Table A1.7	Human Activity observation sensors	ENSIMAG Building, Tempologis, PREDIS	Constructed from Components
Table A1.8	Human Interaction devices and software tools	ENSIMAG Buildings, Tempologis	Commercial products, Professional Installation
Table A1.9	Human Interaction devices and software tools (HiLabs)	ENSIMAG Building, Tempologis	To be constructed from Components
Table A1.10	Acoustic Sensors, microphones	ENSIMAG Building, Tempologis, Domus	To be constructed from Components
Table A1.11	Service Robots	ENSIMAG Building	Commercial Products
Table A1.12	Control Room for Experiments	ENSIMAG Building	Commercial products, Professional Installation
Table A1.13	Creativity Lab	ENSIMAG Building	Off the shelf
Table A1.14	Classroom of the Future	ENSIMAG Building	Commercial products, Professional Installation
Table A1.15	Speech Recognition System	ENSIMAG Building, Tempologis Apartment	Commercial product

Table 3.2. Components of the physical equipment for AmiLab 1 Smart Habitats.

Technical Environment

The AmiLab1 core buildings in Montbonnot (i.e. the ENSIMAG extension building and the TempoLogis apartments) are available for installing the physical equipment. The PREDIS and LIG-Domus satellite facilities on campus are partially instrumented.

AmiLab 1 will be jointly operated by INRIA Grenoble Research Center and the CNRS DR 11, in cooperation with Grenoble INP, the University Joseph Fourier and the Laboratoire Informatique de Grenoble (UMR LIG).

By 2015, a new building, the PILSI building, will be constructed on campus to house the entire informatics and applied mathematics community in a single site. The University of Grenoble 1 has proposed to provide a section of this building as well as resources to extend AmiLab 1 for *in vivo* experiments with services for research and education.

Local Context

The AmiLab 1 Smart Habitats will be constructed within the socio-economic context of a strong local industry and research communities in the area of Micro-electronics, informatics, and Energy Management, and communication services within the Grenoble Isere Valley. Grenoble is home to one of the largest University communities in France, as well as a very large applied physics research community. ST microelectronics maintains several product development and silicon fabrication facilities, including the largest integrated circuit fabrication facility within Europe. Schneider Electric maintains numerous product development and manufacturing facilities throughout the city, with a major research facility on environmental systems. Orange Labs maintains a large research facility within the Meylan Inovallee technology and industry park. The CEA maintains a major research facility in central Grenoble including extensive facilities related to energy research, sensors and nano-technologies. The Grenoble Universities boast a large integrated research community in the area of Informatics and Communications Technologies, boasting over 2000 researchers and doctoral students.

The Grenoble Isere valley is home to four “poles de compétitivité”, including the Minalogic Nano and Microelectronics pole, as well as the Tenerrdis Smart Energy pole. The local University and Research communities have a leading position within France for creation of new companies to market technology related products, supported by the GRAVIT/GRAIN technology incubation services. The Grenoble Isere valley boasts a vibrant community of small and medium enterprises in informatics and communications technologies represented by the Grilog association as well as the regional "Cluster Edit" association. The Smart Habitats research facility will fully exploit this fertile local environment.

Grenoble University, in concertation with the CNRS, INRIA, and the CEA, is proposing the creation of a common "Laboratory of Excellence" (LABEX) for research in the areas of Mathematics, Informatics and Human Sciences. This proposal establishes the Mathematics and ICT community of Grenoble as one of the two top clusters in France in terms of critical mass, publications and industrial transfer. The Grenoble LABEX proposal constitutes a cornerstone of the "initiative of excellence" submission of Grenoble. Internationally recognized researchers of the Grenoble LABEX will address socio-economical challenges by building upon the existing collaborative research with socio-economic partners, such as Orange labs, Schneider Electric, STMicroelectronics and the City of Grenoble. The AmiQUal facility will constitute an important component of the Grenoble Univeristy LABEX.

3.3.3 AmiLab 2. Smart HealthCare and Homecare: Continuity of Services between Hospital and Home

Geographic Location

The Smart HealthCare and HomeCare AmiLab 2 will be deployed in:

- Four satellite facilities on the campus of Toulouse for *in vitro* experiments at La Grave Gerontechnology Laboratory-Gérontopôle (CHU Toulouse), IRIT, LAAS, and MSHST,
- One space clinic for semi-controlled experiments of MEDES,
- Three locations for *in vivo* experiments in (i) the CIC (Centre Investigation Clinique), the gerontology service located in the CHUT, (ii) the CUC (Clinique Universitaire du Cancer) in the cancéropôle of Toulouse, and (iii) the flats/houses used by the Centre e-Santé.

Scenarios of use for AmiLab 2 are presented in Section 7.1.3.

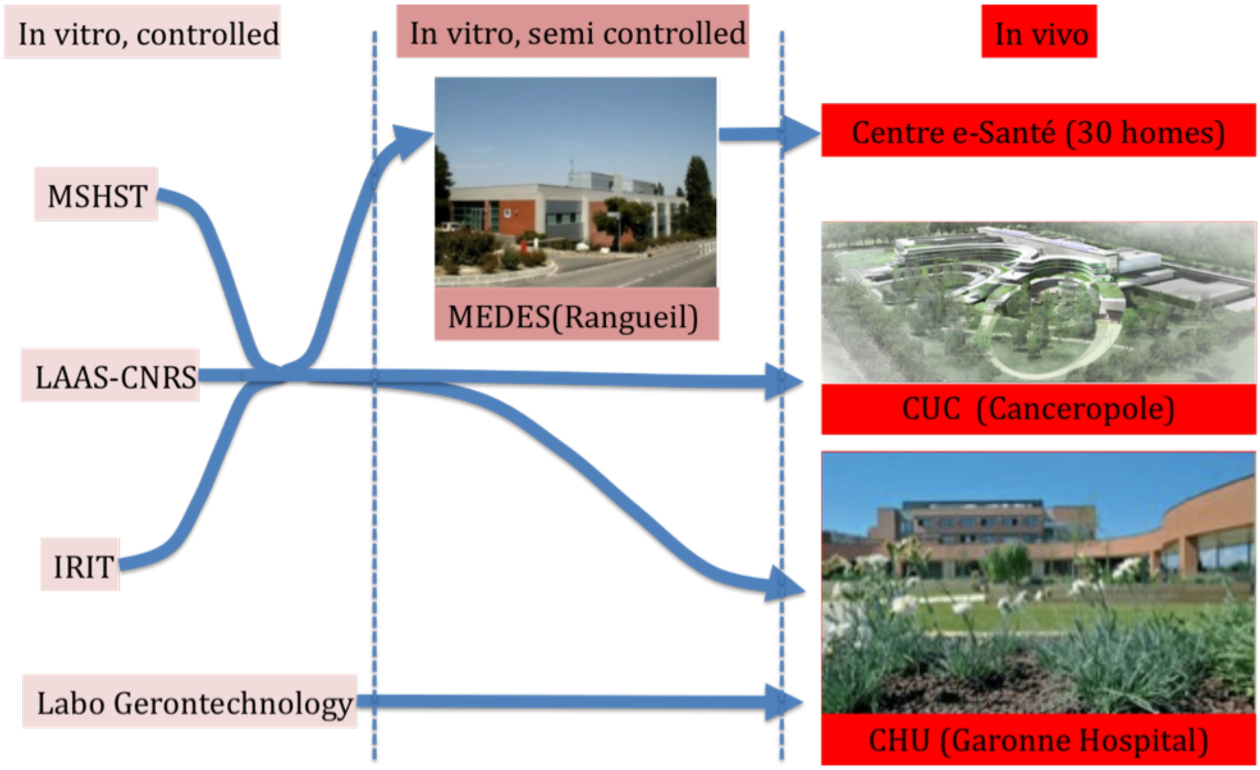


Figure 3.8. The Smart HealthCare and HomeCare AmiLab 2 geographical location.

Societal Challenges and Mission Statement

The AmiLab 2 Smart HealthCare and HomeCare is primarily concerned with health applications of ambient intelligence. Health applications impose particularly stringent requirements in terms of reliability, safety, usability, information security and respect for human privacy and dignity because of the human factors importance (weakened patients often old, not well familiarized with ICT), of its critical nature (bring into play patients life) and of security and confidentiality constraints on exchanged informations. The introduction of systems and services based on Ambient Intelligence into the healthcare environment requires active participation and validation by healthcare and medical personnel.

Societal challenges. AmiLab 2 is concerned with the continuity of medical and healthcare services between the hospital environment and the home for end-users (patients, medical staff, etc.). The applications developed with this AmiLab will answer to the following requirements: improve the quality of life for patients at home and in care facilities, ensure a better health follow-up by medical staff, ensure an optimized management of resources inside the hospital. The main challenge is to facilitate and to reinforce the health follow-up and security of patients (aging, disabled, hospitalized,…) by the medical staff at home or within care facilities: on one hand, by enabling the medical staff to access to more relevant and more information about the patient and on other hand in improving the patients' life in enabling him with assisted living, and increasing the comfort of care facilities. The four main challenges focus on: the ambient assisted living at home, the health follow-up inside care facilities, assisted living with robots and quality of life at the hospital.

Primary and secondary themes. Although the primary theme for AmiLab 2 is concerned with health, disabled, fragility or aging persons and because these persons are not restricted to home or in care facilities, AmiLab 2 has some relations with the life on a campus and some services will be developed in the context of the Smart Mobility E-Campus AmiLab in Saclay. AmiLab 2 will also have natural links, with Smart Buildings AmiLab in Nice and Smart Habitat in Grenoble on problems related to design of habitats and conditions of life for health, disabled, frailty or aging person. Amilab 2 and Amilab 3 can also share technological solutions for resources retrieval.

The core vision is to ensure continuity of medical and healthcare services beyond the hospital environment, and into the home and improving the quality of life of end-users (patients, doctors,…) in a less intrusive way. The hospitals, the personal houses and the body of the patients itself, provide heterogeneous locations to be equipped and require interoperability of devices, different ways to interact with the end-users and scalability of technical solutions. The non simulated environment will show unexpected events the system will have to take into account to self adapt. Because of the huge of entities, designer cannot foresee all events that can happen and the services must be really learned and the composition and collaboration of existing services must be able to provide new services not previously designed.

Scientific and Technical Objectives

Phase 1

The scientific objectives of concern for AmiLab 2 in Phase 1 are the development of theories, models, tools and methods for:

- Design/deploy/maintain… a body area network.
- Design/deploy/maintain/self-manage… a network between sensors merged in the environment, between the assistant robot and potentially between sensors and/or smart interactive devices worn by the patient.
- Perceive the end-users' environment, model and store their context, detect and store their activity.
- Develop and maintain a profile of the patient.
- Experiment adaptive real time methods for helping persons using self-configuring network of indoor and outdoor sensors and actuators.
- Ensure resilience of the system, namely by guaranteeing reliability, availability and security of the system, and by providing medical-level privacy-aware databases, including personal information on users' health and localization.
- Study the impact of the instrumentation, the acceptability and the ethics issues.

The technical objectives of AmiLab 2 in Phase 1 is to support the above scientific objectives by providing the necessary and sufficient experimental infrastructure to be installed in the different locations of AmiLab 2 (the 8 locations according to the work programme presented in Section 3.2.2). This will include:

- The installation of physical equipment (hardware) completed with the baseline "*bottom layers functions*" of Figure 3.5 that satisfy the requirements of AmiLab 2 Smart Healthcare and Homecare for Phase 2.
- Development and integration of a first version of the "*upper layers functions*" of Figure 3.5 that are necessary for the scientific objectives and primary theme of AmiLab 2 Smart HealthCare and HomeCare.

At the end of Phase 1, the core buildings of AmiLab 2 Smart HealthCare and HomeCare in the CHUT, CUC and some private houses will be able to support *in vivo* experiments. The MEDES will be also able to evaluate the impact of technological solutions on humans. In parallel, the 4 satellite facilities in laboratories (IRIT, LAAS, Gérontechnologie La Grave-Gérontopôle/CHU Toulouse and MSHST) will be used for specialized small-scale controlled experiments about the observation of activities, medical and biological parameters of a person, management of mobile resources, as well as tracking and guiding persons indoor.

Phase 2

The scientific objectives of concern for AmiLab 2 Smart HealthCare and HomeCare in Phase 2 are the design, development, and evaluation of services that:

- Identify, design and evaluate new interactions techniques,

- Propose a management tool for medical materials,
- Propose a distributed system to provide end-users with customized help,
- Optimize the resources of the hospital (e.g., apointments),
- Study patient in situation, usability of the technology,
- Execute robotics tasks safely in the vicinity or at the contact of the patient,
- Ensure privacy of stored data,
- Ensure reliability of the system,
- Provide new services by automatic self-organisation of existing ones,
- Model home care processes.

Physical Equipment: Installation and Description

The Smart Healthcare and HomeCare AmiLab will be installed in three locations for *in vivo* experiments: in the Gerontology Department in the CHU Toulouse, the CUC (Clinique Universitaire du Cancer) building, and the flats/houses used by the Centre e-Santé. The equipement for validating prototypes and few of the global equipment for user activity or medical parameters observation will be installed in the satellite test facilities and in the MEDES clinic space. The majority of the equipment dedicated to patients' observation will be installed in the *in vivo* experiment care facilities. The physical equipment is composed of:

- Mobile equipment which is expensive and can be easily moved in function of the needs (robots, embedded cameras,…).
- Mobile equipment less expensive but needed in numerous copies in order to be able to cover enough of the physical environment, to validate the scalability of solutions proposed and to ensure the medical norms of experiments.
- Non-mobile equipment, such as sensors, installed on walls.

The Gerontology Department in the CHU Toulouse. We plan to set up the equipment in the Garonne Hospital (Ancely) inaugurated last spring (March 2010). This new building is composed of 160 beds (40 rehabilitation beds, 100 long term care beds and 1 Alzheimer specific unit (20 beds) with a therapeutic garden), a rehabilitation and physiotherapy space and consulting rooms.

The required equipment includes sensors on the body of a patient or in the rooms and location where he lives. The sensors are body sensors for physiological and biological measurements, inertial sensors worn, modalities for patient monitoring, specific sensors to detect specific activities. Several interaction devices will equipped the room: off the shelf devices or innovative devices. Networks of sensors have to be deployed and the location will also require a computer or server to store the different observation data.

The centre e-santé will conduct experiments with 2 groups of patients in private houses or flats and on 30 patients in each group. The equipment will be almost the same as in the previous location. Due to the fact that ambient intelligence is here deployed in the patient home, so in a private environment, with less support than in an institution, equipments must be more autonomous (wireless), easier to deploy, less intrusive, e.g. Wifi smart micro-cameras, rather than a high-quality, but less compact sensor.

The CUC (Clinique Universitaire du Cancer) is a multi-partner specific entity which associates actors and institutions of the cancer research to share innovative tools and taking into care mode in the fight against cancer. The building will be finished in 2012 and will be composed of 312 beds and places, 97 consulting rooms, 1 surgical unit with 7 rooms, 7 radiotherapy rooms, surface : 65 000 m². The needed equipment consists of RFID tags and RFID readers to equip specific rooms in order to increase the security of patients and an indoor-WIFI system and adapted devices in order to guide and improve the welcome of patients inside the building. The corridors will be equipped with displays and loud speakers in order to help the navigation of persons. The main experiments performed on this site will concern the quality of life inside the hospital: the guiding of persons and the security of cares.

The "La Grave Gerontechnology Laboratory-Gérontopôle" satellite facility is a modular 100 m² laboratory dedicated to R&D. It is located on the ground floor of la Grave hospital and benefits from full accessibility to wheel chairs. A 16 m² room with a medical bed has been installed as a test-bed for activity sensors and fall detection. A second space of 15m² is dedicated for HCI. The Gerontechnology Lab is part of the ambulatory research center of the Gerontopôle, located at La Grave hospital of CHU Toulouse, in the center of the town of Toulouse.

The Space Clinic satellite facility of MEDES is a 1000 m^2 multipurpose facility located within the Toulouse Rangueil & Larrey Hospitals. MEDES-CRI configuration allows to suit several imperatives as required by the different protocols (modular zones can be equipped as rooms, laboratories or training areas). Within AmiQual, MEDES proposes its clinic, habilitated for clinical trials to enable *in vivo* clinical evaluations of ambient systems to make clinical tests between the laboratory tests and the real deployment. It plays a fundamental role between *in vitro* and *in vivo* experiments and it links technical with medical requirements.

The IRIT satellite facility is a 2000 m^2 space of corridors and offices that will be used to experiment the person guiding. Then, the experiments concerning patient observation will be done in 2 rooms: ULYSS, usage study laboratory and the smart room which is a room of 20 m2. The facility will be equipped with sensors, actuators, medical devices, cameras and microphones and enable to experiment human machine interaction, provided services in a controlled environment. Equipment for storing data resulting from experiments performed at CHUT will be done by IRIT.

The LAAS satellite facility is one of the biggest CNRS laboratories. A new instrumented 1200 m^2 building (ADREAM) will be available by the end of 2011, with the goal of studying cyber-physical systems, ambient intelligence, ubiquitous robotics, energy management, dependability of distributed systems, privacy protection… AmiLab 2 *in vitro* tests will be mainly done in this ADREAM facility, which will be equipped with sensors, actuators, cameras and indoor localization technologies and populated with mobile robots, mainly indoor and partly outdoor.

The MSHST satellite facility is a 500 m² of offices and lab rooms dedicated to *in vitro* experiments. It is divided into 3 sites: "smart home" of Blagnac IUT with centralized domotic and medical-technical devices (investment cost: 350 k€ for 120m²), usage study lab on the Mirail campus (audiometric room, 30 m², investment cost 98 k€; driving simulator room, 50 m², investment cost 200 k€; eyes tracking and EEG, 15 m², investment cost 80 k€) and offices in the Toulouse Capitole campus. Some of these devices are already used in medical science projects, for instance on the effect of aging and/or drugs on attention, or the production of speech and/or auditory perception in deficient subject.

The components of the physical equipment. Table 3.3 makes explicit the components of the equipment for AmiLab 2. Section 6.1.3 provides details about the individual elements along with their cost.

Equipment Component	Component function	Location	Techno Maturity	Links with Standards
Table A2.1	Human Activity Observation	CHU, Centre e-santé, IRC, IRIT, LAAS, MEDES, MSHST	Off the Shelf	Commercial products
Table A2.2	Human Activity Observation	LAAS	Constructed from Components	Laboratory Concept Demo
Table A2.3	Human Medical and Biological Parameters Observation	CHU, Centre e-santé, IRIT, MEDES, MSHST	Off the Shelf	Commercial products
Table A2.4	User Studies	MSHST	Off the Shelf	Commercial products
Table A2.5	Human-System Interaction	CHU, Centre e-santé, IRC, IRIT, LAAS, MSHST,	Off the Shelf	Laboratory Concept Demo
Table A2.6	Assisting Robot	CHU, Centre e-santé, LAAS	To be constructed from Components	Commercial products
Table A2.7	Computing and Data Collection	CHU, Centre e-santé, CUC, IRIT, LAAS, MEDES, MSHST,	Off the shelf	Laboratory Concept Demo

Table A2.8	Systems Integration	CHU, Centre e-santé, IRC, IRIT, LAAS, Polestar	Public Bid	none
Table A2.9	Installation Actuators, Network Infrastructure data collection	CHU, Centre e-santé, IRC, IRIT, LAAS, MEDES	Public Bid	Industry Norms
Table A2.10	Prototype Evaluation	MEDES	Off the shelf	Commercial Product
Table A2.11	Formation	MSHST, MEDES	Off the shelf	Commercial Product

Table 3.3. The components of the physical equipment for AmiLab 2 Smart HealthCare and HomeCare.

Technical Environment

The AmiLab 2 Smart HealthCare and HomeCare will be installed in new buildings to provide infrastructure to a part of the equipment are the ADREAM building (will be finished in 2011) at LAAS and the CUC (will be finished in 2012). In other locations, the buildings exist to install the equipment. Some of the MSHST facilities have (driving simulator) or are in demand (audiometric room, smart room) approval for medical use.

We have agreement from the directions of PRES (IRIT, LAAS, MSHST), CHUT IRC and Centre e-santé to provide the necessary support to install and operate the equipment.

Local Context

The Amilab 2 Smart HealthCare and HomeCare is in line with the scientific axes of IRIT, LAAS, MEDES and MSHST. It will be integrated within existing/to be built building/room dedicated to ambient assisted living for which some equipment currently exists including existing infrastructure (servers, computers).

AmiLab 2 will be constructed within the socio-economic context of a strong local industry and research communities in the area of health, robotics, embedded systems, and informatics within the Midi-Pyrénées region. A lot of enterprises are interested in the results and the work to be performed with this equipment as shown by the number of enterprises affiliated to AMIQUAL. This equipment is a very large equipment enabling a stronger synergy between medicine, social science and computer sciences, and between academic and industrials, the possibility for French teams to answer to national or European projects (AAL) and to be competitive with other countries.

Within the local context, this initiative is related to two competitivity poles: Cancer Bio-Santé and Aéronautique Espace et Systèmes Embarqués in which the laboratories involved in AmiLab 2 are already members. AmiQual is in line with the project to create a University Hospital Institute for aging and prevention of dependency in Toulouse. The initiatives in the fields of aging and disability receive strong support from our local authorities. The universities of Toulouse involved in the project cover all disciplines required to realize this equipment from the lower level of the AmiLab (sensors) to the higher levels (services and social studies).

3.3.4 AmiLab 3. Smart Commerce: Commerce of the Future

Geographic Location

The AmiLab 3 Smart Commerce will be located int the West side of the ground level of the INRIA Lille – Nord Europe research center building in the Haute Borne Science Park[8] at Villeneuve d'Ascq, near to the University of Lille 1 (see Figure 3.9). The AmiLab will be constituted of a 300m2 technical set, which will be flexibly modulable to create different *in vitro* experimental configurations of the Commerce of the Future (e.g., shopping arcade, market departments, shelves, warehouse, interactive shopwindows, kiosks, fitting rooms, smart commerce at home). Scenarios of use for AmiLab 3 are presented in Section 7.1.4.

[8] http://www.parc-haute-borne.fr/

Figure 3.9. The AmiLab3 Smart Commerce technical set will be installed in the West side of the ground level (right) of the INRIA Lille – Nord Europe research center building (center) situed in the Haute Borne Science Park at Villeneuve d'Ascq (left).

Societal Challenges and Mission Statement

The AmiLab 3 Smart Commerce will provide experimental facilities for research on systems and services for improving the quality of the Commerce of the Future. Its mission is to stimulate innovation and evaluate the impact of human services provided by smart commerce using ambient intelligence.

Societal challenges. The AmiLab 3 Smart Commerce is motivated, but not limited to, societal challenges related to human services for smart commerce. The challenges in this area include the definition of new digital services for smart physical commerces/shops, virtual shops, and new non anticiped forms of smart commerce; the improvement of the shooping experience (how people choose their products and purchase them, both into physical shops and at home); the management of product stock (what products are in stock, where they are).

Primary and secondary themes. The primary theme for AmiLab 3 is Smart Commerce, or Commerce of the Future. Secondary themes are focused on smart commerce at home in cooperation with the Smart Habitats AmiLab in Grenoble and Smart Healthcare and Homecare AmiLab in Toulouse. Here, the focus is to study and innovate on what commerce at home will be in the future, and how to help humans to do their shopping, especially handicapped and/or aging people.

The core vision is that ambient intelligence will be at the heart of the commerce of the future. Next generation of physical shops will be strewed of sensor networks to manage products, and of new interactive systems to enhance the shopping experience. Future virtual shops (e.g., Web-based shops) will require a new generation of service-oriented middleware to offer context-aware commerce services and new interaction techniques to support them.

Scientific and Technical Objectives

Phase 1

The scientific objectives for AmiLab 3 in Phase 1 are the development of theories, models, methods and tools for:

- Sensor networks and RFID systems
  - Automatic installation, configuration, position estimation and automatic maintenance for sensors and RFID systems installed in smart physical commerces;
  - Integration and interoperatibily of communicating object systems in Ambient Intelligence applications in real environment.
- Middleware for developing, deploying and running ambient intelligence applications, and supporting
  - Service-oriented and static/dynamic adaptation of both application and middleware levels;
  - Heterogeneity of programming languages (e.g., Java, C, BPEL, scripting languages), component and middleware frameworks (e.g., J2EE, OSGi, Spring, Fractal),

application interaction protocols (e.g., SOAP, REST, Google RPC, JSON-RPC), device protocols (e.g., UPnP, KNX), and non anticiped future technologies;
  - Not limited to smart commerce but useful for all other AmiLabs.
- Gesture-based interactions for interactive shopwindows, kiosks and fitting rooms
  - Evaluate the benefits and drawbacks of available gesture capture systems for generic direct and indirect pointing tasks in these contexts;
  - Design, implement and evaluate more complex gesture-based interactions for associated commerce-oriented services such as catalog browsing, orientation maps, clothes recommendation, etc.;
  - Evaluate the impact of selected hardware characteristics (e.g. size, orientation and resolution of the displays) on the above techniques (both generic and specific).

The technical objectives of AmiLab 3 in Phase 1 is to refit out the modulable technical set, and install physical equipments to support the above scientific objectives by providing the necessary and sufficient experimental infrastructure according to the work programme presented above. This will include:

- The refitting out of the 300m2 modulable technical set (e.g., compartmentalization, electricity, network, etc.).
- The installation of physical equipments (hardware) completed with the baseline "*bottom layers functions*" of Figure 3.5 that satisfy the requirements of AmiLab 3 Smart Commerce for Phase 2.
- Development and integration of a first version of the "*upper layers functions*" of Figure 3.5 that are necessary for the scientific objectives and primary theme of AmiLab 3 Smart Commerce.

At the end of Phase 1, the modular technical set of the AmiLab 3 Smart Commerce at Villeneuve d'Ascq will be able to support *in vitro* experiments.

Phase 2

The scientific objectives for AmiLab 3 Smart Commerce in Phase 2 are the design, development, and evaluation of services that:

- "Make sense" and has "value" for end-users.
- Support our core vision for Smart Commerce.

These scientific objectives will be built on the scientific and technical results from Phase 1 and will use AmiLab 3 Smart Commerce for a series of *in vitro* experiments (concrete examples of experiments are provided in Appendix 7.3). In particular, experiments will be conducted for ambient commerce systems and services for collaborative work between researchers of the INRIA Lille – Nord Europe research center, the LIFL laboratory, PICOM engineers, as well as for education.

Physical Equipment: Installation and Description

The AmiLab 3 Smart Commerce will be constituted of a technical set, which will be flexibly modulable to create different *in vitro* experimental configurations of the Commerce of the Future (e.g., shopping arcade, market departments, shelves, warehouse, interactive shopwindows, kiosks, fitting rooms, and smart commerce at home). The INRIA Lille – Nord Europe research center will provide the 300m2 area, and this area will be refited out during the Phase 1 of the AmiQual project. Then, a bulk of the physical equipments will be installed in this AmiLab 3 modulable technical set.

The components of the physical equipment. Table 3.4 makes explicit the components of the equipment for AmiLab 3. Section 6.1.4 provides details about the individual elements along with their cost.

Equipment Component	Component function	Location	Techno Maturity	Links with Standards

Table A3.1	Network of sensors	INRIA LNE building	Off the Shelf	Commercial products
Table A3.2	Fast wired and wireless network	INRIA LNE building	Off the Shelf	Commercial products
Table A3.3	Gesture capture systems (vision-based tracking systems, wearable and handheld sensors, tactile surfaces)	INRIA LNE building	Off the Shelf	Commercial products
Table A3.4	Output devices (flat screens, projectors, speakers)	INRIA LNE building	Off the Shelf	Commercial products
Table A3.5	A cluster of computation and storage servers	INRIA LNE building	Off the Shelf	Commercial products

Table 3.4. The components of the physical equipment for AmiLab 3 Smart Commerce.

Technical Environment

All the equipment components will be installed in the technical set, excepts the cluster of computation and storage servers that will be installed in an already existing climatized computer room at the ground level of the INRIA Lille – Nord Europe research center building.

We have agreement from the directions of INRIA to provide the necessary support to install and operate the equipment.

Local Context

INRIA Lille – Nord Europe (ILNE, http://www.inria.fr/lille) is one of the eight research centers of INRIA, the French *National Institute for Research in Computer Science and Control*. In accordance with the institute's strategic plan for 2008-2012, the center has set itself three priority research objectives to which most of its 13 teams contribute: *software infrastructures for ambient intelligence*, *modeling and interaction with living systems*, and *modeling and simulation*. Together with the LIFL and IEMN laboratories (CNRS & Lille 1 University), ILNE is a founding partner of the *Ambient Intelligence Campus*, an initiative that brings together most of the regional software and hardware players relevant to the field and comprises more than 1000 researchers.

The Nord – Pas de Calais region has six competitiveness clusters: I-TRANS (innovative transport), PICOM (mass retail industries), MAUD (materials & applications for a sustainable use), UP-TEX (innovative textiles), AQUIMER (seafood and aquaculture industries) and NSL (nutrition, health, longevity). Ambient intelligence is relevant to all of them and is already taken into account to various extents. ILNE is particularly involved in the PICOM and MAUD clusters. Ambient intelligence is a key strategic focus of the PICOM cluster, which led to several projects on the *internet of things* and *intelligent sales areas*. The PICOM also initiated the *Lille Métropole Ubiquitaire* project on mobile services and ubiquitous commerce, with the ambition to turn the Lille metropolitan area into a life-size laboratory on the commerce of the future. The MAUD cluster notably works on cardboard printed and biodegradable RFID tags.

ILNE is also a founding partner of the *Centre of Innovation for Contactless Technologies* (CITC - EuraRFID). Supported by the regional council and all the local competitiveness clusters, this initiative aims at facilitating the adoption of contactless technologies and supporting innovative research projects on this topic.

3.3.5 AmiLab 4. Smart Mobility: E-Campus

Geographic Location

The Smart Mobility – eCampus AmiLab will be deployed on the Saclay Technological Campus that gathers several academic institutions (Ecole Polytechnique, Telecom Paris Tech, Orsay University, …), research centers (CEA, INRIA, …), and companies (Danone, EDF, Thales, …).

The AmiLab more specifically involves 2 areas over which the AmiLab equipment will be deployed (See Figure 3.10):

1. A 200 m2 apartment that will be located in the Nano-Innov building,
2. An outdoor area covering a large part of the Polytechnique school campus (that will host several of the schools moving to Saclay) and going all the way to the Nano-Innov building.

Scenarios of use for AmiLab 4 are presented in Section 7.1.5.

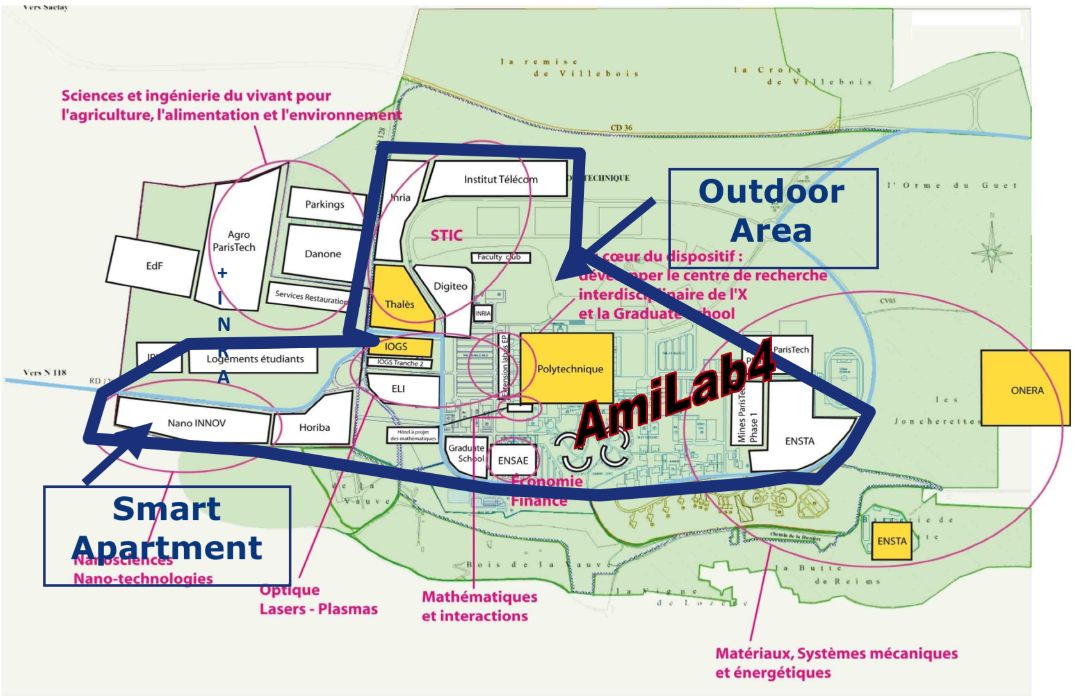


Figure 3.10. Smart mobility – e-Campus AmiLab in Saclay.

Societal Challenges and Mission Statement

<u>Societal challenges</u>. The Smart Mobility - eCampus will provide facilities for research on innovative ambient, pervasive, **nomadic and mobile services** and systems to assist the campus residents and visitors in their activities and movements during their stay on-campus and supporting continuity for the fixed-mobile delivery of services. This facility is motivated by societal challenges relative to collaborative work within and across organizations, to movements and security of people in districts such as the Saclay campus, to communication among and information of residents and visitors of such districts, to environmental and energy management of buildings and outdoor areas of such districts. All this should be done with users' privacy in mind: experimenting alternative solutions to enforce it and consequences on users' reactions and acceptability.

Examples of sets of services to be provided are the following:

1. Collaborative work (in particular around R&D projects)
    - Organization of work between multiple and possibly remote partners.

- Terms of geographical movement and meetings on campus, according to project tasks (creativity, development, research, documentation, completion, testing, prototyping, testing).
- Joint cooperation with the organization information systems and knowledge bases (networks of experts and laboratories contacted when needed).

2. Optimization of energy and transport arrangements
    - Analysis of multimodal transport arrangements usage on campus (walking, cycling, public transportation, carpooling, individual vehicle).
    - Linking with the location of business activities.
    - Coordination with the electric vehicle fleet and / or communicating the site.
    - Carpooling Service.
3. Portfolio of services for campus staff / students
    - Services for visiting researchers (apartment, campus life).
    - Student services: travel, courses, schedules ...
    - Information services (various events, expertise available ...).
    - Smart Café: browse menus, waiting time .... of campus cafes, cafeterias and restaurants. Organization of various games on the campus space, articulation with the structuring of communities and social networks.
4. Disability / health
    - Provision for continuous service to disabled users working on / visiting the campus.
    - Assistance in case of temporary disability.
    - Campus map to guide student's wheelchairs (taking real-time pedestrian traffic into consideration).
5. Smart Shared-study Spaces
    - Ambient light and temperature adjusted to students' preferences (presence sensed by RFID readers).
    - Seamless network-agnostic sharing of data (e.g., DropBox, but also with peer to peer possibility. See also iBICOOP from INRIA/ARLES).
    - Ability to record smart-whiteboard text, or entire study session using camera in room. Saving it to students' mobile devices.
6. Smart "spread-out" office: people working on-campus may have several offices in several buildings (e.g., a professor may have one office at the university and another one in an on-campus research center)
    - Communication capabilities automatically follow users between their various work locations.
    - Data "left in an office" remains accessible.

<u>Primary and secondary themes</u>**.** This AmiLab clearly has secondary themes that put it in relation with other AmiLabs: the **disability set of services** has clear link with the Smart Healthcare and HomeCare AmiLab in Toulouse; the **smart-shared study space** set of services above shares aspects addressed by the Smart Habitats AmiLab.

<u>The core vision</u> is the concept of campus or technopole as a provider of services that should ease the movements and activities of their users, stimulate cooperation among individuals and their organisations, animate on-campus life and contribute to a durable environment. It will turn users into actors instead of simple consumers by enabling interaction with their environment. A special attention will be paid to protecting users' privacy.

Scientific and Technical Objectives

The goal of the Smart Mobility – eCampus AmiLab is to create the conditions for an innovative research on Ambient Intelligence services and technologies to ease the movements and activities of campus (or districts) residents and visitors, stimulate cooperation among individuals and their organisations, animate on-campus life and contribute to a durable environment.

The Saclay Campus will be a highly technological area visited by many "digital natives" hopefully willing to experiment with innovative services and technologies. It should therefore be a privileged place to perform large-scale experiments and collect data on how these technologies and services are used. These data can then be exploited to provide precious feedback that can be used to improve existing technologies and services and design new ones.

The goals of AmiLab 3 can therefore be seen as:

- Design innovative Ambient Intelligence services thinking simultaneously about usage and technologies.
- Prototype, deploy and test these context-aware services and related software stack, first *in vitro*, then *in vivo*.
- Collect and analyse usage data on campus.
- Evaluate the users' acceptance in particular with respect to privacy issues.
- Hub on usage data for all facilities of Ambient Intelligence (holistic view).

The Smart Mobility - eCampus AmiLab has similarities with the City Sense project developed by Harvard University (CitiSense.net) that enables *in vivo* experimentation of distributed digital services and urban scale sensors networks; correspondingly, TU Delft and ETH Zurich developed unique research infrastructures Living lab houses. Such programs provide exceptional opportunities for future partnerships and international relations. Contacts have already been opened and suggest possible benchmarks and pooling of methodologies and results.

Phase1

The main scientific objectives for AmiLab4 in phase 1, are:

- To design a self-managed software platform to support:
  - The self-deployment of software systems and services to the PC network, sensors and actuators as well as to the interacting equipments (user terminals).
  - Mediation functions.
  - The instrumentation of systems and services in order to log and collect usage and execution data for further off-line analysis.
- To design experimental Ambient Intelligence services and systems corresponding to the above listed scenarii.
- To propose methodologies and processes to select and package services and software elements to be tested on the Equipex, as well as testing procedures.
- To propose methods, infrastructure and tools to track users (using video cameras) during their indoor and outdoor activities for a variety of purposes (eg. Security, comfort). This includes:
  - Processing and understanding of sensor captured information (vision, sound, etc.)
  - Understanding users' gesture, activities, posture, feelings
  - Identification of the persons, the biometrics
  - Continuity of the users' localization, mobility.
  - Decision-making support for release of alarms
  - Personalization of the services and the environment according to the user profile and situation with specific emphasis on users' privacy.
- To design methodologies and tools for data mining and analysis of usage data.

<u>Technical objectives. The technical objectives</u> of AmiLab 4 in Phase 1 is to support the above scientific objectives by providing the necessary and sufficient experimental infrastructure to be installed both in the apartment and on the outdoor campus. This will include: the configuration and deployment (indoor and outdoor) of a network of embedded PCs and a set of sensors and actuators. A special emphasis will be placed on the design of the network in such a way that experiments can take place using either a wifi mesh network, a wifi mobile ad hoc network, or a

long range LTE network. A platform for data mining and analysis as well as a platform for service and software operation will be installed.

An objective of phase 1 should also be to propose methodologies and processes to be followed when new services and system elements are to be deployed and operated.

Phase 2

Two kinds of scientific objectives are pursued in Phase 2:

(1) Design and evaluate a software architecture (covering the whole stack showed in Figure 3.5) that will be deployed and the infrastructure and provide support for the Ambient Intelligence services.

(2) Set and design alternative innovative services testing users' attitude and adoption regarding proposed solutions. In particular, the following dimension will be explicitly analysed and experimented:

- Conception of sustainable business models for disruptive services.
- Technical feasibility and social acceptability regarding the segmentation of customers-users and the supply of differentiated services (QoS, broadband, congestion…).
- Acceptability and adequacy of privacy rules according to the personal and public data required by the various services to be delivered efficiently: positioning; personal ID, etc.; typology of the various reactions and strategies elaborated by users.
- Improvement of the innovative process and support of technological design teams in the conception / prototyping / experimentation phase.

These scientific objectives will build on the scientific and technical results from Phase 1 and will use AmiLab 4 apartment and the outdoor area for a series of *in vivo* experiments.

Phase 2 will proceed with the design, deployment, large-scale test and usage analysis of innovative services such as those listed above and related software stack.

Physical Equipment: Installation and Description

Four categories of equipments are required:

(1) **Network nodes:** a set of "embedded PC" equipped with a variety of communication cards (WiFi, LTE, …) in order to provide coverage of the apartment, and the outdoor area and to execute the services and systems to be experimented with. Note that an access to the NEPTUNE LTE network to be deployed in the Saclay technopole will be provided.

(2) **Sensors and actuators:** a variety of sensors and actuators will be placed in the apartment (offices and rooms) as well as on campus. These include, but are not limited to video cameras, temperature/wind sensors, RFID Sensors,…

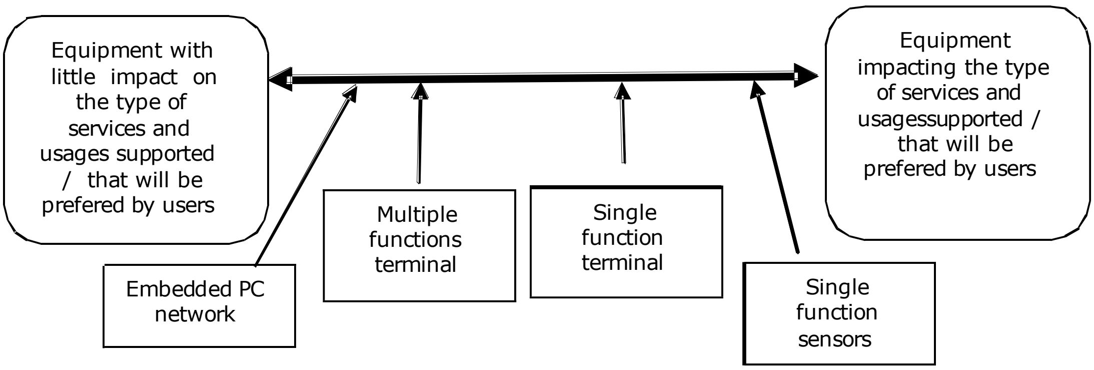
(3) **Interacting equipments:** a set of equipments such as smartphones, tablet PC, laptops as well as touch screens … that will be used to access the experimental services.

(4) **Computing and data storage facilities:** to execute services logic and to store related data, and to store collected data and perform simulations as well as data mining and analysis of data collected during service and system execution.

Note that equipment that will be deployed in the Smart Mobility – eCampus AmiLab, must have the ability:

- To evolve over successive generations of technology over a decade (the equipment will have to be renewed one or several times during the project and that equipment evolutions could lead to changes in the equipment chosen for renewal).
- Not to constrain and restrict the expression of user needs since the design of new services will require a freedom in the exploration of use.

The second constraint implies strong neutrality from the equipment with respect to the service usage and the diversity of such usages to be explored. Equipment that, by its nature or mode of provision, would immediately limit to a single type of possible use, could lead to strong interest or immediate disinterest from users. Neutrality of equipment should lead to a greater variety of users' responses and could enable finer equipment configuration. In terms of support equipment services, graduation can be sketched in an axis of neutrality of the equipment vis-a-vis the service:



Outdoor area. A network of embedded PCs equipped with a series of sensors will be deployed in the outdoor area. The PCs will be installed on the campus buildings or on pylons. They will be operated thanks to solar panels when there is no accessible electric power supply.

The topology retained will be a grid such that a mesh wifi network can be formed. Ad hoc wifi access will be provided. Access to the Neptune LTE network deployed on-campus will be provided for long range high bandwidth network access.

A variety of sensors and actuators will be connected to the PCs in order to experiment with all scenario listed above (whether energy management, information access, transport management, etc., oriented.

Apartment with offices and student rooms. In addition to network coverage described above, this 200 square meters apartment will include a number of offices equipped to experiment with Ambient Intelligence services related to office activity. This will be an area to experiment with the collaborative work scenarios, the smart shared-study spaces and the smart spread-out office scenario for examples. Another part of the apartment will correspond to student rooms equipped to experiment with services related to both studying and private life of student activities. Finally, a room will be dedicated to the computing and data storage facilities.

The components of the physical equipment. Table 3.5 makes explicit the components of the equipment for AmiLab 4. Section 6.1.5 provides details about the individual elements along with their cost.

Details	**Component function**	**Location**	**Origin**	**Cost (K€)**
Engineer	Management of acquisition, installation and integration of equipement	Saclay apartment	CDD	529
Engineer	Integration of networks, middleware, components	Saclay outdoor campus	CDD	254
Table A4.1	Campus Embedded PC network	Saclay apartment and campus	Commercial products, Professional Installation	2 490
Table A4.2	Campus Embedded PC network - Parts spécific	Saclay apartment	Commercial products, Professional	134

	to apartment and its garden		Installation	
Table A4.3	Interacting equipment (terminals)	Saclay apartment and campus	Commercial products	195
Table A4.4	Sensors and actuators for smart apartment and its garden	Saclay apartment	Commercial products, Professional Installation	388
Table A4.5	Sensors and actuators for outdoor campus	Saclay outdoor campus	Commercial products, Professional Installation	293
Table A4.6	AmiLab Control Center" (storage and processing of usage data)	Saclay apartment	Commercial products, Professional Installation	152,5
Table A4.7	PC platform for software and service operation and data storage	Saclay apartment	Commercial products, Professional Installation	152,5
			Total	4588

Table 3.5. The components of the physical equipment for AmiLab 4 Smart Mobility.

Technical Environment

AmiLab 4 Smart Mobility involves 2 areas: an apartment and an outdoor area. The apartment will be located in the Nano-Innov building that will be ready during the first trimester of 2011. The outdoor campus area is operated by Ecole Polytechnique.

Everything will therefore be ready to welcome the EquipEx equipments.

We have agreement from the directions of CEA, Ecole Polytechnique, Telecom ParisTech and the direction of the proposed SystemX IRT to provide the necessary support to install and operate the equipment.

Local Context

As mentioned before the Smart Mobility – eCampus AmiLab takes place in the context of Saclay technological Campus project. It could be an opportunity to turn the campus into a place for large scale experiments and a technological window.

The partners of AmiQual for AmiLab 4 Smart Mobility are:

- CEA LIST, that brings expertise in the area of smart buildings, video surveillance, sensor networks and usage.
- Ecole Polytechnique that brings the expertise in the area of economy and usage of digital services.
- Institut Télécom (with a Telecom ParisTech component and a Telecom SudParis component) will move to Saclay in the near future. It brings expertise in the area of ambient intelligence, smart buildings, video surveillance, networks and sensor networks, middleware, security and privacy and economy and usage of digital services
- INRIA Rocquencourt brings expertise in the area of ambient intelligence, middleware, and sensor networks.
- Altran brings the expertise on transport networks.

AmiLab 4 is closely linked with the IRT SystemX. Some of the research deployed on AmiLab 4 should be issued from the IRT SystemX technological groups and from the innovation lab whose goal is to enable the design of new innovative digital services.

The Saclay technopole is home to the system@tic "pole de competitivity" that brings together 480 key players in Ile-de-France, each of them working in the field of software-dominant systems with a strong social dimension. It is also home to Digiteo which is the first world-class research park in Ile-de-France dedicated to information science and technology. It hosts the Orsay University as well as several of the top French Grandes Ecoles among which Ecole Polytechnique and Télécom ParisTech areboth partners of this AmiLab. Several renowned research centers such as INRIA and CEA (again both partners of this AmiLab) are also located in the Saclay technopole.

The AmiLab 4 will fully exploit this rich environment.

3.3.6 AmiLab 5. Smart Buildings: Aging in Place

Geographic Location

The AmiLab 5 "Smart Buildings - Aging in place" is composed of an *in vitro* experimental facility and a ressource center, located in Sophia Antipolis. The experimental facility will be built within the area owned by CSTB. It is made of several zones having different roles such as storage, manufacturing, experimentation, meeting rooms for focus group and offices.

Experimentations will take place in real-life settings made of pre-built modules. The most frequently used modules - room, kitchen, bathroom, living room, office etc. - will be available and assembled according to experimental needs in order to create test configurations such as housing, part of a corridor in "medicalized" houses, etc. The systems to be tested will be integrated into these modules. Scenarios of use for AmiLab 5 are presented in Section 7.1.6.

Societal Challenges and Mission Statement

Societal challenges. In recent years, France has devoted several studies to appraise the impacts of a changing demography[9] onto habitat architecture and building technologies, as well as habitat refurbishment or construction processes [CNR 10, Lasbordes 09, Boulmier 09, Picard 10]. As in Europe and the USA, these surveys have shown that about 90 % of people 50+ wish to remain in their own homes indefinitely. Older homeowners overwhelmingly prefer to age in place, which means living in your home safely, independently and comfortably, regardless of age or ability level.

AmiLab 1 Smart Buildings is motivated to societal challenges related to "aging in place". Indeed, for people who are fragile due to aging, but also potentially because of some handicap or long-lasting illness, it is on one side about guarantying new forms of accessibility and safety in the built environment, on the other hand about preventing risks related to the loss of autonomy and a degraded perception of, and anticipation against dangerous situations of life accidents. Moreover, of paramount importance is to provide with easy access and communication for the family, assisting people, as well as nurses and doctors. All these considerations generate new constraints on the built environment, which require solutions to be identified at the design phase for new buildings, but also in the mandatory adaptation of existing buildings thanks to the use of new products, systems, robots and technical aids integrated in the building or its equipments.

Primary and secondary themes. Although the primary theme for AmiLab 5 is concerned with buildings for accessibility, safety and loss of autonomy, frailed and elderly people must not be marginalized or isolated. This is why keeping in mind the need for comfort and family links is so important and AmiLab 5 will work in close cooperation with Smart HealthCare and HomeCare in Toulouse, with the objective of optimising the setting of medical prescriptions with respect to specific conditions for living at home, adapted to each of fragility situation.

The core vision. Aging in place will reflect the ability to successfully age and remain in one's home of choice **at affordable costs for the society**, whether it is a private home, condominium, apartment, or group home. The AmiLab 5 core vision is that building-integrated technologies can enable this now – and not years from now. Indeed:

[9] By 2020, 30 % of the French citizens (17 million) will be over 60 years old. By 2050, there will be five times more people over 85 years old than in 1990.

- Successful aging means independence. Studies have shown that older persons who live independently have more positive self-esteem than those who are institutionalized, which in turn lower the needs for intensive, costly daily support.
- By improving the quality and the efficiency of care: seniors, informal carers and caregivers (both those who give cares in private homes and those who work in specialized institutions), will benefit from the technology.
- Cost of long-term care is daunting. Home care can reduce significantly such growing costs.
- Care capacity will reach crisis proportions. There might not be enough caregivers, thus requiring new more efficient practices based on technology smart uses.
- Technology capabilities exist now and seniors are willing to adopt these technologies. Today is the first time we can connect multiple generations of families with each other -- and with their care providers.
- Studies show that seniors and caregivers are interested, but not necessarily aware of what can be made available.

Scientific and Technical Objectives

Phase 1

The scientific objectives for AmiLab 5 in Phase 1 include the development of theories, models, tools and methods so as to:

- Integrate any type of products for further experimentation inside the various building components and/or in any layer of the AmiLab stack (hardware: sensors network, middleware / top level-layers for the software);
- Use in parallel the software system to be tested and the (natively integrated) software system of the test facility and compare the results;
- Model frailed people behaviours through a typology of events that may be the cause of difficult or even hazardous situations for those people with reduced perception and anticipation;
- Ensure the functions and efficiency of tested systems with auto-diagnostic procedures;
- Provide with a comprehensive map of fragile people needs, and define the usage value of user-centered technical aids integrating faculties and difficulties inherent to each frailness situation (resource center).

The technical objectives of AmiLab 5 in Phase 1 is to support the above scientific objectives by constructing **an in vitro experimental facility and a control center** according to the work programme presented above. This will include:

- The erection of the building along with the various prefabricated modules allowing to simulate the different living places in a building;
- The installation of physical equipment (hardware) completed with the baseline "bottom layers" of Figure 3.5 that satisfy the requirements of AmiLab 5 Smart Buildings for Phase 2.
- The development and integration of a first version of the "upper layers" of Figure 3.5 that are necessary for the scientific objectives and primary theme of AmiLab 5 Smart Buildings.
- The elaboration and setting-up of a control center.

At the end of Phase 1, the AmiLab 5 Smart buildings will be able to support *in vitro* experiments. In parallel, a control center will be operational for **gathering information** in view of improving innovation processes to meet aging in place demands.

Phase 2

The scientific objectives of concern for AmiLab 5 Smart Buildings in Phase 2 are the design, development, and evaluation of products and services that:

- Ease accessibility to the built environment as well as to the essential functions (food, care, rest, leasure…);

- Enhance the safety and security of the built environment by detecting events and situations potentially leading to difficulties or jeopardizes for elderly and/or frailed people;
- Allow fragile people to stay at home while facilitating daily tasks as well as ensuring an easy link with the family, assisting people and caring people, or spoting unusual behaviours that indicate an increased frailness and new needs.

Examples of *in vitro* building integration studies include:

- Bathroom integration of washing facilities adapted to handicapped people.
- Building integration of smart windows adapting of the external ambient light.
- Performances of an access ramp.
- Validation of elevators that are voice-managed.
- Use value of dedicated floors for bathrooms.
- Acceptability of robots.

In addition to the experiments of product and services, the equipment can also be used for training and dissemination.

Physical Equipment: Installation and Description

Tests will take place in realistic settings realized on the basis of pre-built modules. The most used modules - bedroom, kitchen, bathroom, living room, office etc. - will be available and assembled according to needs in order to create test configurations such as housing, part of a corridor in "medicalized" houses, set of offices, etc. The systems to be tested will be integrated into these modules. Hence, the test center is composed of five zones with different uses.

- The warehouse zone allows the storage of the pre-built modules. Its high ceiling allows stockpiling modules and thus space gain.
- The manufacturing zone allows the building of modules when test specifications are not satisfied by existing pre-built modules.
- A zone of pre-constrained experimentations, called pre-constraints platform, allows the installation and assembly of pre-built modules of known dimensions.
- A zone of free experimentations, called free platform, will be used for custom-made modules and without any size constraints.
- A zone of offices and meeting rooms will be located close to the parking lot. In addition, it offers a viewing "studios" with an interview and observation rooms and end-user lounge.

Infrastructure Description. The infrastructure of the test center includes:

- **The floor.** The floor is a concrete plan whose underground is accessible and allows the flow of all necessary networks (sewage, hot and cold water, electricity, etc.) to travel in the building. It is designed to integrate prefabricated modules and specialized modules so as to simulate operational living places in the built environment with various options and finalities (housing, care-based spaces, working offices, etc.);
- **The envelope**. The envelope is a volume with a metal backbone. The façades are in architectonic concrete or metal cladding and should offer, through their design, all comfort, aesthetics, and safety characteristics for users. This envelope is designed to support equipments allowing opening, shutting and locking (doors, windows, garage doors, …), with various size and forms for these equipments;
- **Access.** Accesses are « volunteer/end-users defined:
  - A "volunteer/end-user" access has the shape of an urban course allowing a total immersion of the "user" before he enters in the experimentation module. This access also allows the benefit from a secured access zone for users and prevent them from crossing the handling and experimenting zones.
  - A "manufacturing" access allows the incoming of raw materials and manufacturing tools. This access can also be used as an entrance and exit gate for manufactured modules.

- An “experimentation” access allows authorized personnel to reach the zone of follow-up and steering of the experimentation.

Modules description. A module is the smallest unit allowing the combination of elements and components with a common feature (function, use, structure, etc.). Example: bathroom, room, kitchen, stairs, etc. A module is a volume that is either in pre-built material or with a wooden backbone. It is a real room (with or without furniture, given the experimentation’s parameters), ready to be positionned and pluged to the different networks. In fact, each module is equipped with a service duct that includes all the hydraulic, electrical and ventilation installations. The connection is therefore easy and fast and control takes place outside the module. Modules are handled and moved by Fenwick-type handling machines for heavy weights. Modules need to be conFigured as follows:

- An empty module allowing the settlement and configuration of finishing elements.
- A filled / furnished module allowing for the configuration of installation furnitures and their components.

The test center will have a warehouse full of modules from the following types: bathroom, kitchen, vertical circulation, technical room as well as many generic modules for simple functions (room, office, living room, corridor, etc.). Each type of module will be available in both empty and filled configuration. Modules can be assembled to constitute a set of modules and even a living unit.

Ambient Intelligence System: An ambient intelligence hardware / software system will be added to this modular structure.

- Each module is equipped with a series of sensors (eg. Cameras) and actuators (eg. Electrical equipment) interconnected through various standard networks of communication.
- Each set of modules, considered as a living unit, will be associated to a Box in order to manage the system.
- This box will support the software platform INRIA (PULSAR team, platform SUP) and I3S (Team Rainbow - WComp platform) for activities recognition from sensors and the creation of new automated services for elderly people. Sensors could be developed by several partner (LEAT).

Resource Center. The resource center will be made of:

- Data on referenced user needs.
- Data on available products and services.
- A description of well referenced *in vitro* and *in vivo* experimental protocols to measure the use value.
- Public results of past experimental campaigns whatever the experimental protocol (focus group, *in vitro*, *in vivo*).
- A list of available user groups available for future studies.

It will be built on the basis of a content management software package and accessible on a server via Internet. When validated, information from the resource center will be made accessible from the Cordination Facility computing system.

The components of the physical equipment. Table 3.6 makes explicit the components of the equipment for AmiLab 5. Section 6.1.6 provides details about the individual elements along with their cost.

Equipment Component	Component function	Location	Techno Maturity	Links with Standards
Table A5.1	Building infrastructure	Sophia Antipolis	To be constructed	Construction norms
Table A5.2	Prefabricated Modules	Sophia Antipolis	To be Prefabricated Off the Shelf	Commercial products
Table A5.3	Testing equipments	Sophia Antipolis	Off the Shelf	Commercial products
Table A5.4	Manufacturing and handling equipments	Sophia Antipolis	Off the Shelf	Commercial products
Table A5.5	Testing software	Sophia Antipolis	Off the Shelf	Commercial

				products
Table A5.6	Operating software	Sophia Antipolis	Off the Shelf	Commercial products

Table 3.6. The components of the physical equipment for AmiLab 5 Smart Buildings.

Technical Environment

The facilities will be erected within an area belonging to CSTB at Sophia Antipolis. They will be owned for a period of ten years by CNRS, with a one Euro retrocession agreement to CSTB after ten years of use.

The facilities will be operated by CSTB, with the support of INRIA and University of Nice. In this facility, the floor, ceiling and building envelope are integral parts of the testing facility, since they contribute to construct dedicated home sites to perform experiments. As such, they appear eligible for EquipEx funding.

Local Context

The AmiLab 5 Smart Buildings will be hosted by CSTB within its R&D and testing facilities located in the Sophia Antipolis technology park, near Nice, where three of the main AmiLab 5 partners have already research facilities and teams (CSTB, INRIA, University of Nice). Launched in 1969, Sophia Antipolis is to-day the home of 1,300 companies employing 27,000 people with 70 nationalities: the technology park houses activities in the fields of information technologies, services, life sciences, which are all contributing to better aging in place. Information Technologies currently account for almost 50% of the total number of jobs and over 25% of the total number of companies; service companies for 30% of total jobs and over 50% of companies; Life Sciences and Chemistry for 9% of jobs and 4% of companies. Several institutions for higher learning are also located in this technology park, along with the European headquarters of World Wide Web Consortium (W3C).

This AmiLab 5 facility will expand locally on past or on-going R&D activities to address aging in place issues. These activities were initiated by the three main partners:

- CSTB with its GERHOME facility located within the CSTB site and its associated R&D projects (SIGAAL, Gerhome Labs, …) .
- The INRIA's Sophia Antipolis - Méditerranée research centre (CRISAM) which has launched a national Initiative Action "Personally Assisted Living" within the themes "aging in place" and "autonomy for the elderly" (9 INRIA teams 4 of which being located in Sophia Antipolis)
- The I3S laboratory of the University of Nice Sophia Antipolis and CNRS within cooperative research programs (Pulsar and Rainbow) to federate their software platforms for ambient intelligence.

At national level, this facility will bring building integration capabilities in line with the activities of

- The newly born « Centre National de Reference de la Santé à Domicile et Autonomie » (CNR SDA) located in Nice, and its upcoming CNR SDA, a program « Centre d'Expertise National - Habitat et au Logement », which will become a sustainable R&D association at national level within year 2011.
- CIU Santé, a new association that develops *in vivo* experimentations for new health applications.

4. DISSEMINATION AND EXPLOITATION OF RESULTS

4.1. POTENTIAL SCIENTIFIC AND SOCIO-ECONOMIC IMPACT OF THE AMILABS

The AmiLabs and the Coordination Facility will enable scientific, economic and socio-economic innovation in both the construction and exploitation phases.

<u>Scientific Impact</u>. During the first (construction) phase, the primary Scientific Impact will concern integration and comparative evaluation of enabling technologies for human services based on

Ambient Intelligence. Integration of the AmiLabs will force ICT and SHS researchers from different subdisciplines to work together to build a common integrated system. Engineering teams will be forced to propose and document systems architectures spanning all of the AmiLab layers for each of the socio-economic challenges (Habitats, Healthcare & Homecare, Commerce, Mobility and Buildings). Constraints specific to each sector are expected to lead to use different technologies in the five AmiLabs. This will offer an opportunity for comparative evaluation for both the ease of integration and the effectiveness of different technological solutions. Social science researchers will be invited to actively participate in the specification and integration of AmiLabs providing opportunities for cross-fertilisation of ideas and methods.

During the second (exploitation) phase, the AmiLabs will provide a set of integrated testbeds enabling the partners to participate in national and European projects aimed at developing new ICT technologies. The AmiLabs will allow informatics researchers to formulate more realistic models of the operating conditions for ICT deployed in the real world, and allow doctoral students and researchers to rapidly deploy and evaluate new technologies for controlled experiments in realistic rather than simulated conditions. Social Science researchers will be challenged to define new methods for observation and experimentation for participatory research with Ambient Intelligence.

Economic and Industrial Impact**.** During the first (contruction) phase, Economic and Industrial Impact will result as a consequence of contracts to local ICT industries for construction of component technologies that currently exist only as laboratory research prototypes. Contracting for industrial quality implementations from local enterprises will foster technology transfer as the enterprises gain experience with advanced technologies. It is important then that the exploitation rights for intellectual property for such contacts be clearly specified.

During the second (exploitation) phase, the AmiLabs will provide a resource for industry for evaluating new products and services. Participative research that involves users is expected to reveal new classes of systems and services for which markets have not yet been created, offering opportunity for creation of start-up ventures for new technologies and markets. Students and researchers will be encouraged to invent and test new technologies for systems and services that can then be licensed to local industry, or used to create new enterprises.

Societal impacts**.** The primary Societal Impacts will occur during the exploitation phase, as the AmiLab testbeds are used to evaluate and refine new forms of services that can help public and non-governmental actors to respond to growing social needs.

Achieving the full potential of these impacts will require that the AmiLabs be accompagnied by an effective collection of legal, financial, administrative and dissemination services that promote and assist external exploitation of the AmiLabs by local industry, commerce, and public partners.

4.2. EXPLOITATION STRATEGY

Successful exploitation will require accompanying both phases of the AmiLab deployment with the appropriate financial and legal services.

In each of the five AmiLab sites, the technology transfer and innovation offices of the AmiLab partners have already established common procedures for assuring effective technology exploitation. The individual AmiLabs will work with the local valorization offices of partners to assure that potentially commercial opportunities are exploited by the creation of new products and services network partners.

The Coordination Facility will oversee this process to assure that exploitation is both effective and fair.

Access to the intellectual property (documented technologies, data, knowledge or know-how, etc.) developed during the construction and operation of the AmiLabs will be covered by the consortium agreement spelling out the rights and obligations of partners, affiliates, and clients (see Section 5.1.3).

4.3. ACCESSIBILITY AND FINANCIAL CONDITIONS

AmiQual includes 3 types of participants: Partners, Affiliates, and Clients.

Partners of the AmiQual facility are organizations that provide resources (human, material, software, financial) during the construction (Phase 1) and/or the exploitation (Phase 2) of the AmiQual facility.

Affiliates are organizations that participate in the definition of the AmiQual facility, and are members of its Scientific Board. Affiliates do not provide any resources neither for the construction (Phase 1) nor for the exploitation of the Equipex (Phase 2), but are however scientific stakeholders and have access to scientific results.

Clients are organizations that do not participate in the definition, construction or operation of the AmiQual facility, but wish to use the AmiQual facility to carry out specific research. Clients typically have access to the facility for a fee that shall be determined based on the duration and the number of AmiLabs used. Users are foreseen to be mainly private companies and research consortium requiring high quality equipment.

Partners, affiliates and clients will have access of the use of AmiLabs for participation in both publicly funded and privately funded research. The cost of such research will not be provided by the EquipEx funding. Partners and Affiliates will be asked to offset any costs resulting from configuring or operating the AmiLab for such research, and will be encouraged to include such costs as part of their research budget in corresponding funding request. In the case of partners, such configuration and operation costs should be directly included as costs of the publicly funded research and the resulting credits transferred internally as part of the partners contribution to AmiLab operation.

For clients and affiliates, the costs of configuration and operation can be covered either by including one of the AmiLab operator in the research project consortium with reimbursement to the operator as part of the contract or through purchase of a service from an AmiLab operator. For affiliates, the cost of such a service will be based on the actual costs of the configuration and operation of the AmiLab. For clients, additional charges may be included to offset general costs of maintaining the AmiLab.

The access rights and involvement of the 3 types of participants are summarized in the following table:

	Access to the EquipEx	**Access to capitalized scientific results**	**Participation**
Partners	Free	Free	Member of the Executive Committee
Affiliates	Usage fee applies	Free	Member of the Scientific Board
Clients	Usage fee applies*	Usage fee applies	N.A.

*Usage fee varies whether experimentation results are publicly available or not.

4.4. TRAINING AND EDUCATION

AmiLabs will be integrated into university graduate education programs for Bachelor (Licence), Masters and Doctoral levels. Much of the pedagogical material is already available in several universities. A group of expert has been created during the ETAI summer school in July 2009 to clarify and organize curricula for Ambient Intelligence (http://www.univ-valenciennes.fr/congres/etia09/). This group will be associated with AmiQual with the following objectives: (1) To define curricula for Ambient Intelligence in relation to current and future business needs. (2) To improve our teaching approaches by completing traditional theoretical material with practical work based on real-world use cases. AmiLabs will provide an effective environment for such training. (3) To share best practice and to produce high quality courses by bringing together the best specialists from various universities while using the AmiQual Coordination Facility as a common repository.

AmiLabs 1 and 5 will provide an important resource for participation in the training and innovation within the framework of the EIT ICT labs devoted to smart environments, homecare, and smart energy.

AmiLabs will also be used for training and certification of professionals from the socio-economic sectors (for example in the context of CIF - Congé Individuel de Formation). Some courses will be made accessible remotely through the recommendation of equipment required for the course. This equipment could be affordably purchased at retail distributors. Communities like Arduino already show that this is possible.

5. PROJECT MANAGEMENT

5.1. ORGANISATION ASPECTS OF MANAGEMENT

5.1.1 RELEVANT EXPERIENCE OF THE PROJECT COORDINATOR

James L. Crowley will serve as project coordinator. In order to ensure continuity of service, he will be assisted by Joëlle Coutaz as co-coordinator.

James L. Crowley (Ph.D. 1982, Carnegie-Mellon University) directs the PRIMA Research Project group of the LIG laboratory at the INRIA Grenoble Rhone-Alpes research center in Montbonnot, France. He holds the post of Professor at the Institut National Polytechnique de Grenoble (INPG), where he teaches courses in Computer Vision, Signal Processing, Pattern Recognition and Artificial Intelligence at ENSIMAG (Ecole National Superieure d'Informatique et de Mathematiques Appliquées).

Since coming to France in 1985, Professor Crowley has participated in a total of 17 European Projects covering every Framework program from FP II through FP VII. From 1989 to 1993, Professor Crowley directed the EU Basic Research "Working Group on Vision" assembling 36 partners from throughout the CEC. From 1994 to 1998, Prof. Crowley served as coordinator of the European Computer Vision Network (ECVnet), the EC "Network of Excellence" in Computer Vision. From 1993 to 2001, Professor Crowley coordinated the Marie-Curie networks SMART and SMART II whose subject was the development of techniques for surveillance and monitoring. The SMART and SMART II networks funded a total of 56 doctoral students at 16 EU Universities.

From 2003 through 2006, Professor Crowley has served as director for the UMR GRAVIR laboratory (UMR 5527 CNRS, INPG, UJF, INRIA), and in 2006 he has been one of the 5 "porter des projet" proposing creation of the LIG : Laboratoire Informatique de Grenoble.

In the last 25 years, professeur Crowley has made fundamental contributions to computer vision and mobile robotics. These include early innovations in multi-resolution and multi-scale computer vision, position estimation, perception and navigation for mobile robots, architecture for autonomous systems, multi-sensor fusion, robust tracking for observing human activity, appearance-based techniques for object recognition and navigation, and observation and modeling of human activity for context aware environments and ambient informatics. Professor Crowley has edited two books, five special issues of journals, and co-authored over 200 articles on computer vision, mobile robotics and Ambient Intelligence. His papers have received over 6500 Citations (Google Scholar June 2010) and an h index of 42.

Joëlle Coutaz is Professor at Université Joseph Fourier (Grenoble 1) where she teaches courses in Human Computer Interaction (HCI). In 2010-2011, Prof. Coutaz will be part time CNRS Director de Recherche to dedicate time to launch Ambient Intelligence in France. Following a period as a visiting scientist at Carnegie-Mellon University in 1982-1984, she has actively promoted the creation of a scientific community devoted to HCI within France. In 1990, she founded the HCI research group (Ingénierie de l'Interaction Homme-Machine) at laboratory LIG (Laboratory of Informatics of Grenoble), and has directed this group until Sept. 2009. She received the honorary degree of Doctor of Science from the University of Glasgow (equivalent to the French *Honoris*

Causa), and she has been elected to the SIGCHI Academy for "leadership in the profession in Computer Human Interaction".

J. Coutaz has participated in 10 European Projects including ESPRIT BRA/LTR project AMODEUS (1989-1995) which was the first project in Europe to truly promote an interdisciplinary approach to HCI. Her group was one of only two French teams to participate in the FET Disappearing Computer, the first European initiative to create Ambient Intelligence, with its participation in the GloSS-Global Smart Space project (2000-2004). Prof. Coutaz serves as expert for ANR (Agence Nationale de Recherche) as well as for the European Commission. In 2008, she chaired a group of experts to elaborate a national research and development "Plan for Ambient Intelligence". She is currently a member of the "Groupe de Concertation Thématique" MathsSTIC of the French Ministry of Research in which she is "rapporteur" for the working group "Ambient Intelligence" to provide recommendations for the next phase of SNRI (Stratégie Nationale de la Recherche et de l'Innovation).

In the last 25 years, J. Coutaz has made pioneering contributions to HCI including software architecture modeling for interactive systems (the PAC model), design and implementation of multimodal user interfaces, the concept of user interface plasticity, and more recently the problem of end-user development within the general framework of Ambient Intelligence. She is the co-author of 2 books, and co-authored about 150 articles in HCI. Her papers have received over 4000 Citations (Google Scholar May 2009).

Some recent publications:

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2. J.L. Crowley, P. Reignier, J. Coutaz. "Context Aware Services", Chapter 12. In "True Vision", The emergence of Ambient Intelligence, E. Aarts & J.L. Encarnaçao Eds., Springer Verlag Publ., 2006, pp. 231-244
3. J. A. Ruiz Hernandez, A. Lux, J. L. Crowley, "Face Detection by Cascade of Gaussian Derivatives Classifiers Calculated with a Half-Octave Pyramid", IEEE Conference on Automatic Face and Gesture Recognition", FG08, Amsterdam, Sep 2008.
4. R. Barraquand and J. L. Crowley, "Learning Polite Behavior with Situation Models", 3rd International Conference on Human-Robot Interaction, HRI 2008, Amsterdam 12-15 March 2008.
5. J. L. Crowley, O. Brdiczka, and P. Reignier, "Learning Situation Models for Understanding Activity" In The 5th International Conference on Development and Learning 2006 (ICDL06), Bloomington, Il., USA, June 2006.
6. J. L. Crowley, "Context Driven Observation of Human Activity", European Symposium on Ambient Intelligence, Amsterdam, 3-5 November 2003.
7. J. L. Crowley, J. Coutaz, G. Rey and P. Reignier, "Perceptual Components for Context Aware Computing", UBICOMP 2002, International Conference on Ubiquitous Computing, Göteborg, Sweden, September 2002.
8. K. Schwerdt, D. Hall, J. L. Crowley, "Visual Recognition of Emotional States", The Third International Conference on Multimodal Interfaces, ICMI-2000, Beijing China, 14-16 October 2000.
9. O. Chomat, J. Martin, and J. L. Crowley, "A Probabilistic Sensor for the Perception and Recognition of Activities", ECCV 2000, 6th European Conference on Computer Vision, Springer Verlag, Dublin, June 2000.
10. J. Coutaz, G. Calvary. "HCI and Software Engineering: Designing for User Interface Plasticity". In The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications, Sears, A. & Jacko, J. Eds, Taylor & Francis Publ., 1107-1129, 2008. Réédition en 2009.
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5.1.2 COORDINATION ORGANIZATION

The large-scale, ambitious objectives of AmiQual require a strong but flexible management structure similar to that of a Très Grand Instrument de Recherche (TGIR). The purpose of such a management structure is to coordinate and integrate project activities, to optimize and promote the use of the experimental facilities, and to ensure the capitalization of research efforts as well as openness and cross-fertilization between ICT and SHS research-driven activities, while making reporting and accountability clear and easy.

- *Management structure*

As shown in Figure 5.1, the management structure of AmiQual is comprised of an Executive Committee whose members are the partners involved in the implementation of the project, and of two peripheral boards, the Governing Board and the Scientific Board, whose members oversee and advise the project.

Figure 5.1. The top-level decomposition of the management structure. Arrows denote information flow between the boards and the Executive Committee. Typically, the Executive Committee proposes strategic orientations and reports to the Governing Board (*arrow 1*) which, in turn, provides feedback and approval to the Executive Committee (*arrow 2*). In addition, the Executive Committee solicits advice from the Scientific Board.

The **Scientific Board** (SB) is comprised of affiliates and experts from outside the project to provide key scientific, technical, and experimental advice. These experts will include prominent scientists who are well-known in the field of Ambient Intelligence as well as experts in the development and use of experimental platforms relevant to AmiQual (e.g., Institute of Quality of Life at CMU, InHaus2, Glasgow University, Philips Research Lab, ENoLL, PME).

The **Governing Board** (GC) analyzes the strategic orientations provided by the Executive Committee, makes recommendations, and provides additional funding in terms of personnel and infrastructure to ensure the perennity of AmiQual. The members of the Governing Board include the directors (or their representatives) of the AmiQual partners (e.g., the director of the Institutes INS2I, INSIS and INSHS of CNRS, director of INRIA, presidents of the university partners, director of Institut Telecom, director of CSTB, etc.), representatives from Alliance Allistene. The Governing Board is chaired by CNRS, which is the coordinating partner of AmiQual.

The **Executive Committee** (EC) is at the core of the management structure of AmiQual. It is composed of the partners and is in charge of the following activities:

- Definition and implementation of strategic orientations, including but not limited to:
    - Decisions for opening (closing) experimental facilities and/or geographical sites.
    - Integration of new partners and affiliates.
    - Politics for international collaboration.
    - Budget and resources allocation to the AmiLabs and to the Coordination Facility.
    - Financial (business) strategy and rules, notably evolution of the access rights to the AmiQual facility.
- Coordination of the project activities, including but not limited to:
    - Identification of the solutions that can be capitalized in the Coordination Facility. Solutions include software, hardware, benchmark data, experimental results, methods, training courses, etc.
    - Promotion of the AmiQual facility by investigating new markets and by identifying and approaching new users such as academics, industries, associations, local territorial collectivities and providers of social services (e.g., Metro, conseil régional, etc.) at the national and international levels.
    - Provision for the appropriate communication means and rules within AmiQual as well as for the diffusion of AmiQual (e.g., a professional web site).
    - Monitoring the use of the AmiLabs and Coordination Facility: Who are the users? What experiments? What is missing in terms of equipment and personnel? What can be

borrowed and moved? What works well and what does not work well? What are the options for progress and evolution?

- Reporting to ANR and to the Governing Board, including but limited to:
  - Financial reporting with regard to budget allocated.
  - Providing progress indicators for Phase 1 and Phase 2 of the project.

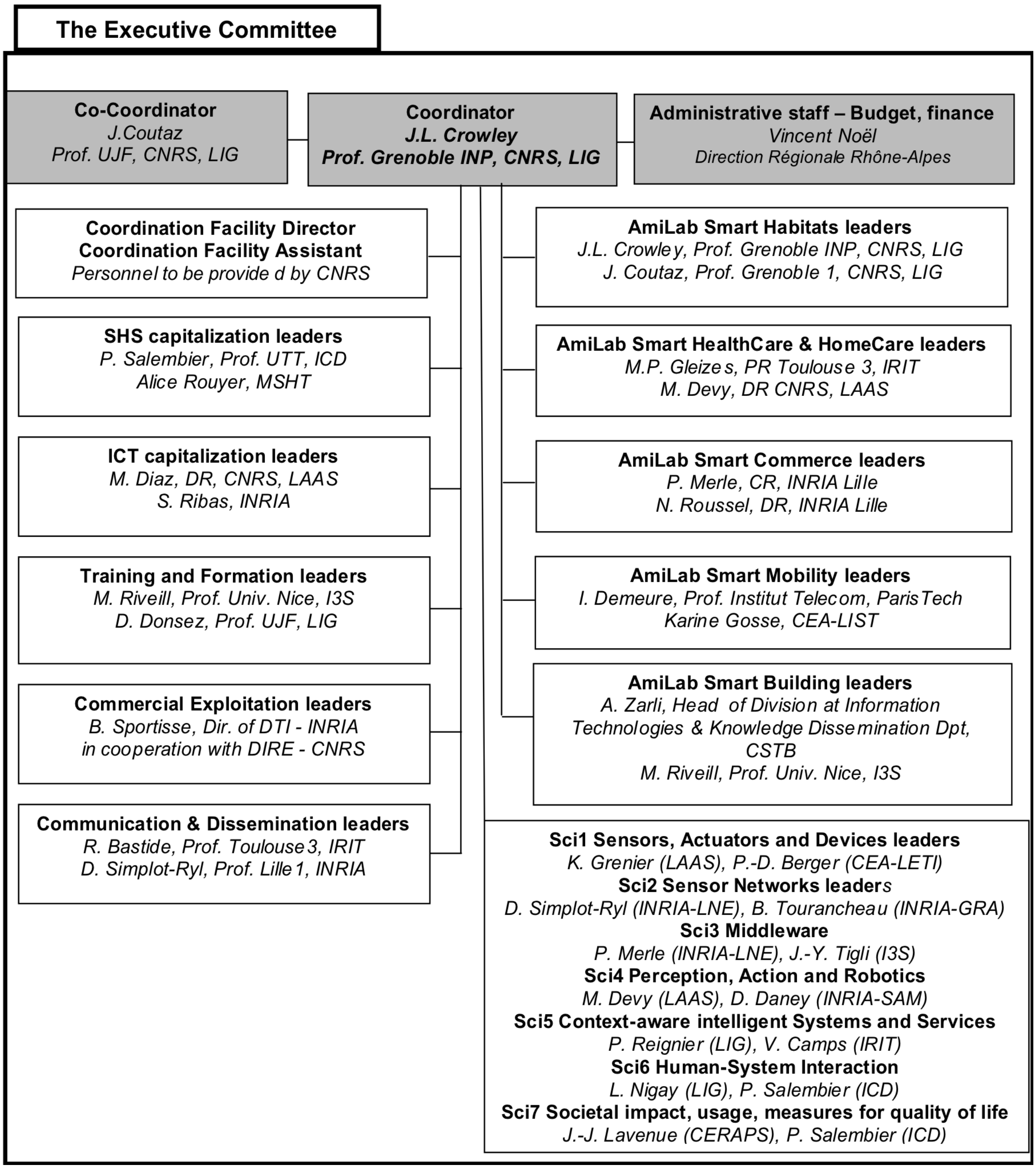

Figure 5.2. The organization chart of the Executive Committee.

Figure 5.2 shows the organization chart of the Executive Committee. **In order to insure responsivenees and availability, each responsibility is animated by a pair of co-leaders (i.e. one binôme)**. The EC includes the Coordination Facility director, the AmiLab leaders, the common cross-activities leaders, the scientific leaders, and the administrative staff responsible for budget and finance. The EC is chaired by the coordinator with the assistance of the co-coordinator.

- *Organization among partners: Roles and Functions*

Coordinator. The coordinator is the interface to the ANR and to the CNRS. He is responsible for coordinating the timely development of AmiQual, in line with the objectives. He is assisted in his task by a co-coordinator in order to ensure full time availability and responsiveness.

AmiLab Operators. The operation of each AmiLab will be assured by a partner who acts as an AmiLab operator. An AmiLab Operator is a legally existing University or Research Organisation (EPST, EPIC) that provides administrative and other services for the operation for an AmiLab. The operator is mandated by the AmiLab partners to provide local operation of the facility for the partners, including maintenance, coordination of installation of components and services, scheduling of experiments, as well as legal and contractual arrangements for experiments by affiliates and clients.

AmiLab leaders and AmiLab teams. Each AmiLab is directed by a pair of AmiLab leaders. These co-leadders are responsible for the coordination and implementation of their own AmiLab in accordance with the decisions of the Executive Committee. For this, the AmiLab leaders will form an AmiLab team composed of technical, administrative and scientific staff provided by the partners:

- Local experts that cover the scientific disciplines and societal domains addressed by the AmiLab.
- Full time engineers (at least one per AmiLab) and a chief engineer for coordinating the technical construction of the AmiLab.
- An administrative person (for managing travel, local budget and finance).
- Personnel for day-to-day maintenance (at least one per AmiLab).

Each AmiLab leaders will nominate individuals from their AmiLab team to participate as members of the working groups of the Coordination Facility.

Coordination Facility Director. This person and an administrative assistant will be in charge of the overall management of the Coordination Facility. For this, he/she will be helped by the coordinator and the cross-activities leaders for SHS capitalization, ICT capitalization, Training & Education, Commercial Exploitation, and Communication & Dissemination.

Cross-activity leaders and Cross-activity working groups. Each AmiQual cross-activity is directed by a pair of cross-activity leaders. These co-leaders are responsible for coordinating, animating, and, when appropriate, for fostering scientific cross-fertilization, for their own cross-activity. For this, each cross-activity pair will be helped by a cross-activity working group (WG). In order to ensure good scientific and geographical representativeness, a cross-activity WG includes one representative from each AmiLab (Cf. Figure 5.3) and, for SHS and ICT capitalization activities, the seven scientific leaders of the project.

Scientific leaders. There is one pair of scientific co-leaders per scientific subdiscipline involved in the project (Cf. Figure 5.2). Their role is to encourage knowledge sharing within a subdiscipline and to favor cross-fertilization in cross-activity working groups.

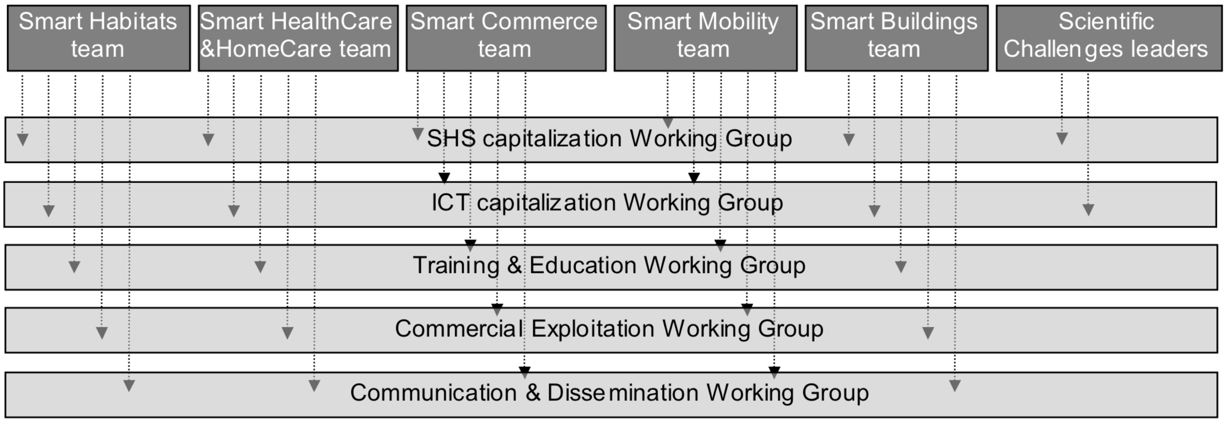

Figure 5.3. Composition of the Working Groups for cross-activities.

5.1.3 Consortium Agreement

If AmiQual is funded under the Equipex ANR program, participants will conclude a *Consortium Agreement* resuming the policies and procedures of the present document and fixing financial arrangements about budget transfers from the coordinator to partners according to the deployment plan of subpart of the equipment. This *Consortium Agreement* will be set up according to the ANNEXE FINANCIERE (Document A) of the AmiQual proposal.

The consortium agreement will be established at the beginning of the project and will be based on following principles:

1) Ownership of background and sideground intellectual property of participants (partners, affiliates, or clients) is unaffected by partipation in AmiQual.

2) Intellectual property developed exclusively by a partner or affiliate for construction or operation of an AmiLab remains the property of the partner or affiliate. Such intellectual property can be used free of charge for experiments in any of the AmiLabs. Any other use is subject to the contractual terms imposed by owning partner or affiliate.

3) Intellectual property developed jointly by more than one partner or affiliate will be shared pro-rata according to the documented investment in creating the technology. Costs reimbursement by the AmiQual EquipEx are not counted as investments by partners. As with individual intellectual property, shared intellectual property will be used free of charge by any of the AmiLabs. Any other use is subject to the contractual terms imposed by the owning partners.

4) Partners, affiliates and clients will be encouraged to publish results of research on technologies, usages and social impacts in the scientific literature, in accordance with proper academic guidelines on shared authorship and shared academic credit.

The AmiLabs will encourage Open Source publication of software and data, as well as cost free sharing for non-commercial uses of technologies and data developed with public resources. The appropriate resources and procedures will be provided to assist and encourage partners to document and publish intellectual property in the case of open source publication and cost-free use. Commercial exploitation will be covered by the appropriate licenses and fees.

Opportunities are expected to exist where socio-economic impact is made more effective by commercial exploitation. In this case, the participants will be encouraged to document and protect intellectual property with appropriate patents, copyrights and documentation procedures (Dépôt APP). Participants will be provided with services for technology incubation and maturation via the valorization services of the participating organisms (CNRS, INRIA, CEA, CSTB) and Universities.

During the second (operation) phase, the AmiLabs will provide an important resource for experiments in development of new systems and services by partners, affiliates and clients. The guiding principles for exploitation of the AmiLabs will depend on contractual status of the participant and whether the results will be freely distributed or privately held.

EquipEx funding during the second phase is restricted to maintenance and operation of the facilities and will not cover costs of experiments by participants. Each of the AmiLabs will be encouraged to work with local public and private concerns to create a fund to cover experiments by non-profit organization and small and medium enterprises (SMEs). While the conditions of access to this fund will be determined in conjunction with contributors, it will be encouraged that non-profit organization responding to societal needs such as services for aging or handicapped be provided with the resources required to exploit the AmiLabs for experiments. For SMEs, such a fund can be justified on the ground of local economic development and used to partially offset costs of evaluation of new systems and services prior to release as products.

5.2. COLLABORATION ORGANIZATION

5.2.1 PARTNERS RELEVANCE AND COMPLEMENTARITY

AmiQual brings together expertise from ICT and SHS along with socio-economic actors.

ICT: The AmiQual consortium includes 12 of the leading French ICT research laboratories (LAAS, LETI, LIST, INRIA Grenoble Rhône-Alpes, Lille Nord-Europe, Paris-Rocquencourt, Sophia Antipolis-Meediterranée research centers, LTCI, SAMOVAR, LIG, I3S, IRIT) from 7 institutions (CNRS, CEA, INRIA, Institut Telecom, Univ. Grenoble I - Joseph Fourier, Univ. Nice-Sophia Antipolis, Univ. Toulouse III- Paul Sabatier), all of them participating in the Allistene alliance. These laboratories provide the scientific and engineering expertise necessary for the construction and exploitation of the AmiQual EquipEx: from sensors and actuators, sensor networks, middleware and service-oriented architectures, context-aware computing, perception-action and robotic systems, HCI, intelligent systems, distributed computing and data-bases, to SHS expertise (e.g., sociology, cognitive psychology and user-centered design at CEA, LIG, IRIT) and ethics at INRIA Grenoble Rhône-Alpes.

SHS: The AmiQual consortium also includes 7 SHS research laboratories (PREG-CRG, CERAPS, ICD, and 6 laboratories under the umbrella of MSHST) from 5 Institutions (Ecole Polytechnique, Univ. Lille II, Univ. Technologie de Troyes, Univ. Toulouse I et II) that cover expertise in economy and business (PREG-CRG), law (CERAPS), cognitive psychology, human factors, and methods for users studies (ICD, MSHT). In addition, the SFR Innovacs chaired by UPMF (Grenoble II), is an AmiQual affiliate bringing additional expertise in human sciences.

The socio-economic sectors targeted by AmiQual:

- Healthcare covered by CHU Toulouse, centre e-santé, ICR (cancer center), and MEDES (médecine physiologique), which propose their clinical infrastructures for AmiQual *in vivo* experiments,
- Buildings with CSTB to promote innovation in the fields of building construction and renovation,
- Energy with the two GINP research labs G2Elab and GSCOP in cooperation with the INEDI decarbonized Energy consortium,
- Important players in socio-economic sectors such as Orange Labs, EDF, and Schneider are affiliated to the project. Fondaterra, a foundation for environmental sustainability, is also an AmiQual affiliate.

In addition to public research institutions, AmiQual includes:

- Two ICT PME's: Altran (telecom and media) and PoleStar SA (navigation systems),
- One private non-profit hospital: ICR
- One GIE: MEDES – Institut Médecine Physiologie Spatiale,
- One association loi 1908 MEDETIC (Médecine Et Développement des TIC).

In short, AmiQual, as a whole, includes the necessary expertise and brings in a good mix of academic and profesionnal partners. In addition, each AmiLab team brings together the range of disciplines for transdisciplinary research for human services based on Ambient Intelligence.

AmiQual has been designed to be an open and extensible facility. As specified in Section 5.1.2, new partners and affiliates can be associated with the EquipEx, new AmiLabs can be constructed around the Coordination Facility. In particular, key ICT and SHS laboratories (such as LRI, LIMSI, LABRI) and industrials involved in Ambient Intelligence, will be welcome. Other relevant target domains such as transportation (INRETS, SNCF, RATP) and e-cities (in cooperation with the Metro's) are invited to share and extend our results. Openess to international collaboration is explicit in the work programme (cf. the working groups of the Coordination Facility related to Communication and Dissemination as well as Training and Education).

5.2.2 Academic Partners and Public Establishments

- *CHU-Toulouse Centre Hospitalier Universitaire Toulouse*

Description. The Toulouse University Hospital (CHUT) offers five care centres at Purpan, Rangueil/Larrey, La Grave/Casselardit, Hôpital Femme-Mère-Enfants, and La Fontaine Salée. This comprehensive healthcare complex is recognized for its medical excellence in all general and specialized fields, as well as for outstanding medico-technical resources. Its 4 principal missions are: Care, Education, Research and Prevention. The CHUT combines expertise in all general and specialized medical and surgical disciplines. Nearly 11,000 people – including 2,000 physicians and 9,000 hospital employees – care for 160,000 hospitalized patients and 600,000 outpatients each year. The annual budget is approximately 620 million Euros. In addition to hospital outpatient consultation, the CHUT has also developed ambulatory surgery services, care networks, telemedicine and home hospitalization, all of which offers significant progress in patient care. The CHUT has internationally renowned investigators and a level of scientific rigor brought by the action of its platforms for research assistance. Therefore the CHUT is seen as a key partner for clinical trials, for the development of more ambitious translational research programs from basic science to biomedical research and for Innovation. The Institutional research activity of the CHUT is driven by the implementation of collaborations between hospital investigators and research teams from INSERM, CNRS, INRA, EFS, ICR, the ENVT, IRIT, LAAS, the Federative Research Institutes (IFR), as well as collaborations with teams from other French and international hospital centers. CHU Toulouse, since over 50 year and the development of telemedicine with Radio St Lys then the CCMM worldwide telemedicine support for the merchant navy, has been part of the development of new technologies for medical applications. Since over 20 year it is recognized as a major stakeholder of Telemedicine in Europe and has been part of many an international Telemedicine project, we are the location of the European Institute of Telemedicine chaired by Pr Louis Lareng. We were not absent of the spaceflights with noteworthy works both in human physiology by our physiology department and in cellular biology. Since the late 1990's, we were part of the emergence of gerontechnology and we founded a gerontechnology laboratory in 2001 that was formally recognized as a part of Inserm U558 at its last evaluation in 2010. Ambient Assisted Living, both in terms of assistance and smart diagnosis aids, and its implication on prevention of the shift from frailty to handicap and disease; is an important part of Pr Vellas' Gerontopôle (that fostered his election as Chairman of the International Gerontology Association).

The place of AmiQual within CHUT strategy. The funding asked in AmiQual will help strengthen our "medically embedded" technological fundamental and applied research. It will facilitate the scalable deployment and the validation "in vivo" of technologies that will improve care and autonomy. AmiQual will increase our capacity to produce patents, papers, teaching content, quality of care, prevention tools. As an addition to the dissemination we will be able to do as a major recognized international center on ageing (from cognitive impairment to oncology, through cardiogeriatrics) we will use the "centre Esanté" (eHealth development center) to foster market development by manufacturers and service providers thence improving access of the general public to the state of the art technologies in AAL and eHealth.

- *Centre e-santé*

Description. The e-Health Centre was created in March 2010 by the Toulouse University Hospital (CHU de Toulouse), the Grand Toulouse Urban Community, The Cancer-Bio-Santé competitive cluster, the Aerospace Valley competitive cluster and the PRES University of Toulouse with the aim of giving a new impulsion and promoting the development of the e-health sector, especially for the chronic diseases, cancers and prevention of dependence.

The e-Health Centre provides businesses with the optimal conditions for the development of e-health innovations, from the time the idea takes place to its launch on the market. It assists and supports companies and medical practitioners through all the critical stages of project development: 1) Sourcing and nursing of projects to establish an efficient networking with the e-health ecosystem, to better communicate with the medical field and to develop the medical and technological project that best suit their needs. 2) Provide a shared platform for testing, experimenting the e-health solutions in laboratory and in real-life conditions. 3) Evaluate the key dimensions of a well-structured project and assist and support e-health solutions to build a consistent economic model.

The place of AmiQual within centre e-Santé strategy. The Centre e-Santé will nurse medical and technological projects to improve patient's' health and quality of life. It will use the equipment acquired to carry out clinical trials and study the benefits of the "e-health solutions" for patients. It will also manage the *in vitro* and *in vivo* evaluations to measure the medical service rendered, the societal and ethical acceptability of projects and build a preliminary medico-economic approach.

- *CNRS – Centre National de la Recherche Scientifique*

LAAS – Laboratoire d'Analyse et d'Architecture des Systèmes (CNRS INSIS et INS2I)

Description. The Laboratory of Analysis and Architecture of Systems (LAAS) is a CNRS research unit associated with four of the six founding members of the PRES University of Toulouse. LAAS research activities fall within the domain of Information Sciences and Technologies and address complex systems (artificial and sometimes natural) generally heterogeneous, and at different scales, to devise theories, methodologies and tools for modelling, designing and controlling them.

The systems considered in our research are of different kinds: integrated systems, embedded systems with real time and safety requirements, distributed systems, mobile systems, autonomous and robotics systems, micro and nanosystems, biological systems. They fall in various application domains such as aeronautics and space, telecommunications, transports, production, services, security and defence, energy management, healthcare, environment and sustainable development. The scientific topics are distributed in four main research areas or domains: Micro and Nanosystems (MINAS), Systems Modelling, Optimization and Control (MOCOSY), Critical Computer Systems (SINC) and Robotics and Artificial Intelligence (RIA). The basic scientific organizational unit at LAAS is the "Research group" that falls in one of the four domains mentioned above. There are collaborations between different groups across different domains. Groups from the four domains will be involved in AmiQual.

Research, innovation and transfer are tied. The lab has a history of strong relationships with industry and works in a large number of collaborative projects with international, national and regional industries of all size. LAAS was one of the 20 first "Carnot Institutes" labelled in 2006.

The place of AmiQual within LAAS strategy. The LAAS scientific axis for the 2010-2013 period, are related to topics considered in Amiqual. At first, the axis ADREAM for *Architectures Dynamiques Reconfigurables de systèmes Embarqués Autonomes Mobiles* (funded by the CPER program) , concerns the study of cyber-physical systems, for ambient intelligence, ubiquitous robotics, energy management, dependability of distributed systems, privacy. A new instrumented building will be available for ADREAM at the end of 2011; this building will be one of the research facilities available for Amiqual: it will be used for in vitro experiments about recognition of human activities, network, middleware, robot navigation in instrumented environments… Two other LAAS scientific axis intersect the Amiqual objectives: human-machine interaction (and mainly Human/Robot interaction for LAAS) and the development of communicating biological sensors (in vivo detection and tracking of cancerous cells). Finally considering AmiLab 2 about smart e-Health and smart Homecare, LAAS has been involved in projets devoted to HomeCare for ten years, i.e. the design, integration and evaluations of sensors network installed for assisting and monitoring elderly people at home or in care center. LAAS will use the AmiLab2 facilities made available by CHU, CUC and CEES in new projects devoted to life-sized evaluation of new technological solutions for homecare. The LAAS laboratory will be involved in the local installation of the equipment: it will participate to the management and the maintenance of the installation in the CHU, the CUC and private houses.

- *CSTB - Centre Scientifique et Technique du Bâtiment (Nice)*

Description. CSTB is a public research establishment in the construction sector. Following a multidisciplinary approach, it contributes to innovation and problem solving for the industry. CSTB's core business covers four major fields: research, technical consultancy, quality assessment and knowledge dissemination. The IIS division, part of the Information Technologies and Knowledge Dissemination Department (TIDS) is devoted to applied research in the field of innovative ambient technology solutions for new services related to comfort, energy saving, safety and assisted living. It has long involvement in national and European R&D (e.g. COMETE, HOMES, ROADCON). It has built a first trial facility for ambient assisted living solutions (the "GERHOME" laboratory), which has been recognized by the French Competitiveness Cluster SCS ("Secured Communication Solutions").

The place of AmiQual within CSTB strategy. In this context, AmiLab 5 Smart Building is an organic equipment to be developped considering CSTB strategy to encourage and promote innovation in the fields of building construction and renovation, so as to provide tangible and proved solutions that are answers to key societal challenges related to environment and well-being at home, where CSTB is acting in support of the whole value-chain, in terms of:

- R&D activities in various national and European projects;
- Support activities to (French) public bodies and agencies, with its recognised expertise in the definition of new regulations (asbestos, building (asset) operationnal status repository, accessibility diagnosis, etc.);
- Accompanying innovation in the industry with packages of diverse testing, evaluation and certification protocols and services (ATEX, Pass'Innovation, etc.);
- Helping the users/consumers to get trust in solutions thanks to certification of products and services.

Within the « better living at home » thematic, such an equipment allowing test-bed and live integration and experimentation is acknowledged as an essential asset to appraise and measure the usage value of new products and services targetting the whole population, including required adaptation to fragilise people (disabled people, aged people, etc.).

- *CEA – Commissariat à l'Energie Atomique et aux Energies Alternatives*

CEA LETI - Laboratoire d'Electronique et des Technologies de l'Information (Grenoble)

Description. CEA-LETI, the Laboratory for Electronics & Information Technology is operated by Direction de la Recherche Technologique at CEA, the French Atomic Energy Commission. It mainly aims at helping companies to increase their competitiveness through technological innovation and transfer of its technical know-how to industry. Major player in the MINATEC Micro-Nano technologies innovation center, CEA-LETI benefits from 8000 m2 state-of-the-art clean rooms, with equipment worth some 160 million euros. It is currently employing some 1600 people among whom 1100 CEA employees and coworkers of various status including 100 people from industrial partners, working in the CEA-LETI premises within the framework of bilateral collaborations. Overall, research contracts with industry are worth 75% of CEA-LETI annual income. It has a very important patents portfolio, and filed last year more than 200 patents and 700 publications. The laboratory is structured into six departments, with a specific department operating 24-7 the technological facilities of the silicon technology platform, and five program-oriented programs covering the field of microelectronics, microsystems, optronics, sytem design and telco, and technologies for bio and health.

The place of AmiQual within CEA-LETI strategy. CEA LETI, mainly the System Department, is working on the integration of sensor with different context. This expertise is also based on the knowledge of the different sensor, how it interacts with material, how it is linked with the environment and how the right information is provided at teh system level. Experts in this laboratory will be able to provide know-how for the functional characteization of sensors and actuators and collect reliable data about the behavior of front end subsystems in controlled operation conditions (bias, non-linearity, drift, accuracy, etc.).

The System Department is also driving a range of activities dedicated to user-centered technological conception and development. These activities based on both Social & Human Sciences and Engineer Sciences skills, methods and tools participate in offering technological innovation at the crossroads of market, technology and society requirements. The objectives are to create both technological and user values to enable the development of relevant and appropriable technologies. Comprising a multidisciplinary team with diverse backgrounds, the System Department already operates a small-scale workshop with an array of computer controlled tools and is willing to develop for the AmiQual Coordination Facility a real fablab with better equipment in order to cover several different length scales and various materials. These approaches are willing to participate to the valorisation of technologies by getting quick proof of concept, empowering users (from SMEs to corporations) to create smart devices, adopting a functional approach and spreading a culture of complete electronic and mechanical systems for innovative objects.

CEA LIST - Laboratoire d'Intégration des Systèmes et des Technologies (Fontenay aux Roses, Saclay)

Description. LIST, which is based near Paris at Saclay and Fontenay-aux-Roses, is a key software systems and technology research center working in three areas with vital societal and economic implications:

- Embedded systems architecture and design of systems, methods and facilities for software and system dependability, and intelligent vision systems);
- Interactive systems (knowledge engineering, robotics, virtual reality and sensorial interfaces);
- Signal detection and processing (ionizing radiation metrology and instrumentation, optical fiber sensors and non-destructive testing).

With the strong project-centered culture of its 450 researchers, engineers and technicians, the CEA LIST is able to perform research work in partnership with the major industrial players in the nuclear, automotive, aeronautical, defense and medical fields and thus investigate and develop innovative solutions corresponding to their requirements. The CEA LIST, which is actively engaged in research work extending from conceptual design of systems to pre-industrial prototypes, contributes to the transfer of technology and encourages innovation, particularly by assisting the emergence of new businesses. LIST technology has enabled the creation of a number of startups, including Haption (haptic interfaces), ActiCM (3D measurement systems), M2M (non-destructive testing), DiotaSoft (virtual reality and mobility). CEA LIST teams have worked as partners with numerous university laboratories, engineering schools and other research establishments on collaborative research projects.

The place of AmiQual within CEA LIST strategy. The objectives of AmiQual are fully aligned with the activities of two CEA LIST departments (Ambient Intelligence and Interactive Systems, and Sensors, Signal and Information) that will combine their forces to fully design and test innovative and ambitious systems and services on the Smart Campus, with the aim to cooperate with other prestigious academic partners, on the Saclay campus, but also to benefit from a full equipment to develop techonologies, validate usages and services acceptability in view of later transfer to industrials. The aim is to study services that would be seamlessly available Indoor and on-the-go to the Outdoor and e-Campus.

The CEA LIST will thus operate the "Smart Appartment" of AmiLab 4 smart Mobilità - eCampus, that will be located in the NanoInnov building of the Saclay campus.

- ## *Ecole Polytechnique*

Description. École Polytechnique is a world-class educational and research establishment. For over 200 years, École Polytechnique has been a leader among the French engineering grandes écoles, thanks to the quality of its students, lecturers and researchers and to its single, firm objective of providing a very high level, multi-disciplinary, scientific and human education. École Polytechnique is a member of the ParisTech Research and Higher Education Cluster (PRES) and is a member of the Plateau de Saclay Scientific Cooperation Foundation (FCS). It has partnerships with many companies in the field of aeronautics, electronics, pharmacy, chemistry, energy, the car industry and optics. Industrial partnerships are established as part of long-term contracts covering a broad range of investigation - education and research chairs - or of short or medium-term contracts, or on the level of joint research teams.

École Polytechnique's Research Centre (22 laboratories for physics, chemistry, mechanics, biology, information technology, mathematics,…) create an environment that encourages innovation. Economic and Management supports a specific research unit of Ecole Polytechnique and CNRS (PREG - UMR 7176). The management component (PREG-CRG) is renowned, for over thirty years, as one of the major management research center in Europe in the field of ICT and innovation. It is involved in international partnerships in research projects and educational programmes (PhD, Masters…).

The place of AmiQual within Ecole Polytechnique strategy. The AmiQual equipment will contribute to the strategic involvement of Ecole polytechnique in Saclay Campus, creating, on a pluridisciplinary basis, a unique location to develop, design, experiment and set up ICT-based innovations. It will support the development of - new and existing – cooperations with local public and private partners (namely, TelecomParistech, CEA, System@tic, Altran, INRIA).

- ## *GINP - Grenoble INP*

Description. Institut National Polytechnique de Grenoble (INPG) is the first French engineering university, both for training and research (30 affiliated laboratories). 1100 engineers are graduated, 350 students receive a Master of Science degree and 150 students their PHD every year. ICT and Energy are two of its most important research topics. Three laboratories from the INPG (Institut National Polytechnique de Grenoble) will participate to the project: LIG, G2ELAB and GSCOP.

The place of AmiQual within GINP strategy.

The AmiQual facility will provide Grenoble INP with an open, experimental facility that enables integrated scientific research on innovative human-centered systems and services in the areas of energy efficient habitats, services for the family, and services for education and research. The experimental facility on Smart Habitats builds on a collaboration with Schneider Electric (Grenoble) in the area of integrated management of comfort and energy. Experiments reconciling energy efficiency and confort within AmiLab 1 will allow the local academic community from informatics to fully participate in the emergence of Grenoble as a world leader in research and innovation in smart energy-efficient buildings as well as systems and services for teaching and research.

The Montbonnot facility will be used by students of the International Masters program MoSIG: Master of Science in Informatics at Grenoble, as well as by local doctoral students in the areas of Informatics, Applied Mathematics, and energy systems. This facility will also provide an important resource for collaboration with Orange Labs Meylan in the area of systems and services communications, health and entertainement. The facility has been endorsed by GRILOG, the local association of software small and medium enterprises, and will be open to usage and evaluation experiments with new systems and services developed by the local software development community.

LIG – Laboratoire d'Informatique de Grenoble (UMR 5217 CNRS INS2I, PRES Grenoble, INRIA)

Description. The Laboratory of Informatics of Grenoble (LIG) is a research unit whose funding partners are CNRS, INRIA, Grenoble INP, UJF and UPMF. The place of AmiLab 1 within LIG is described below in the section on University Joseph Fourier.

G2Elab - Laboratoire de recherche en Génie Electrique (UMR 5269 CNRS, Grenoble INP)

Description. With 114 researchers, engineers, technicians and administratives, more than 100 PHDs students and post-graduate, and roughly 50 Master students, G2Elab is a major national and international actor in electrical engineering. The research fields have for goal to answer to the main societal problematic of tomorrow linked to electricity:

- Energy and environment,
- Increasing and dissemination of scientific knowledge,
- Miniaturising and integration,
- Intelligent systems,
- Economic performances.

The place of AmiQual within G2Elab strategy. G2ELAB is particularly involved in the problem of design and management of electrical energy system for smart-buildings. Since buildings represent more than 67% of the electricity consumption, the G2ELAB, in cooperation with the G-SCOP laboratory, has identified that buildings are of great importance in the global electric network. The challenge is then to design the more efficiently as possible the electric systems of buildings, and then to manage them as cleverly as possible (linked with the problematic of smart buildings). The challenge is to go towards buildings able to produce their own energy, and to use this energy as efficiently as possible by taking into account the inhabitant's usages. This topic is of greatest importance in the emerging problematic of electric management. The idea is to go towards smart buildings integrated in smart electrical grids.

In order to develop this thematic the G2ELAB has widely contributed to develop the PREDIS platform that will be integrated in the AmiQual project. The researchers of G2ELAB involved in this research topic are hosted in this platform. This platform is a dedicated research utility in order to characterize electric energy consumption in buildings, to model, to develop and to test new electric systems, and to develop new strategies and software for managing them by integrating the users (the inhabitants).

The AmiQual project will be an opportunity to exchange with other utilities and researchers around the thematic of smart buildings in topics like sensors and software.

G-SCOP - Laboratoire des Sciences pour la Conception, l'Optimisation et la Production de Grenoble (UMR 5272 CNRS, Grenoble INP)

Description. The G-SCOP lab (Grenoble - Science de la Conception, de l'Optimisation et de la Production) tackles the challenges in production systems, goods and services arising from the distribution of devices as much as from the distribution of people. This new context indeed introduces new problems dealing with cooperation, co-design, safety and security management, operator support systems but also with the sharing of knowledge and the integration of uncertainty modelling into algorithms. The G-SCOP lab proposes a multi-disciplinary approach of problems. It gathers researchers from Mechanical Engineering, Operational Research, Control of Discrete Event Systems, Computer Science and Safety and Security Engineering. G-SCOP lab is associated to the French CNRS and it gathers 140 persons including 50 researchers.

The place of AmiQual within G-SCOP strategy. G-SCOP has signed a cooperation agreement with G2ELAB in order to develop new research in the field of Energy and Power Management in smart buildings. These two labs are already involved into projects dealing management of power appliances in housing, management of energy fluxes in power distribution. These projects are supported by French National Agency of Research (ANR), by companies such as Schneider Electric, and by institutions such Centre Scientifique et Technique du bâtiment. In order to develop this thematic, G-SCOP has widely contributed, in cooperation with G2ELAB, to the PREDIS platform that will be integrated in the AmiQual projet. This platform is more especially a research utility in which software for smart energy supervision developed by G-SCOP is tested.

- *INRIA – Institut National de Recherche en Informatique et Automatique*

Description. INRIA, the French National Research Institute for Informatics and Automatics, is a public research institute under the joint direction of the French Ministers of Research and of Industry. INRIA has eight research centers, with over 5000 researchers, including scientists from INRIA's partner organizations, the CNRS (the French National Centre for Scientific Research), Major French Universities. Approximately 1000 doctoral students work on INRIA research projects. INRIA is well known for its many fundamental contributions to informatics and automatics. INRIA plays an important role in technology transfer by fostering training through research, diffusion of scientific and technical information, and fostering the creation of start-up companies.

INRIA develops many partnerships with industry, facilitating technology transfer and exploitation. INRIA has participated in the foundation of over sixty companies, financed in part by the INRIA Transfer subsidiary that provides start-up funds. INRIA is active in standardization committees including IETF and ISO and was the European host of the W3C from 1995 to 2002. INRIA is involved in ERCIM which brings together 17 European research institutes and is a partner in ap proximately 40 FP6 IST actions. INRIA also collaborates with numerous scientific and academic institutions abroad (joint laboratories such as LIAMA, associated research teams, training and internship programs). INRIA has an annual budget of 160 million euros, 20% of which comes from its own research contracts and development products.

The place of AmiQual within INRIA strategy. In order to focus its research actions and relying on its strengths, the INRIA has defined seven areas of priority in its strategic plan 2007-2012[10]. The first four areas are focused on developing original concepts as well as innovative methods and effective modeling tools, on programming, communication and interaction. The three other areas relate to how ICT is integrated into the fields of computational engineering (designing embedded software and systems for physical objects that are subject to extremely stringent requirements with regard to dynamics and security), digital sciences (particularly material, life and environmental sciences), and digital medicine (production of models and algorithms for the medical and medical biology fields). The objectives of the AmiQual facility fit with these priorities. In particular, aspects of Ambient Intelligence which are addressed by the facility correspond to the "Communicating" and "Interaction" priorities where main research challenges of Ambient Intelligence can be found: "Information, Computation and Communication Everywhere", "The Institute will continue studying new distributed control algorithms for self-organizing networks, in order to allow users to always be connected in the best possible manner." Application domains that are targeted by AmiQual are also in the core of the INRIA's priorities for societal issues[11]: "sustainable development" (smart buildings), "Health" and "Democratic changes" (healthcare), "education" (intelligent campus), etc.

Centre de Recherche INRIA Grenoble Rhône-Alpes

Description. The Centre de Recherche INRIA Grenoble Rhône-Alpes (CR INRIA GRA) is located in the Inovallée Science Park in Montbonnot (near grenoble), and comprises 28 research groups with nearly 600 scientific research staff drawn from the Universities in Grenoble and Lyon, as well as CNRS and INRIA research staff. The 28 research groups perform world-class scientific research and technology innovation in the areas of Embedded Systems, Grid Computing, Distributed Computing, Networks, Bio-Informatics, Graphics and Animation, Computer Vision, Robotics, and Smart Environments. The center is active within the local technology innovation community, and has extensive research cooperation with the Minalogic Innovation Pole, as well as local industrial groups (ST Microelectronics, Orange Labs, Schneider Electric) and small and medium enterprises

[10] http://www.inria.fr/inria/strategie/index.en.html
[11] Ibidem, see pages 28-30.

(GRILOG). In collaboration with Grenoble Univeristies, the CR INRIA GRA is actively involved in masters and doctoral education, notably with teach and research in the International program "Master of Science in Informatics at Grenoble" as well as the doctoral program devoted to Informatics and Applied Mathematics.

The place of AmiQual within CR INRIA GRA strategy. AmiLab 1: Smart Systems and Services will provide INRIA Grenoble with an important research platform for joint innovation with local research community. The AmiLab facility will be an important tool for collaborative and integrative research with Schneider Electric (In the area of energy efficient buildings) and Orange Labs (in the area of multimedia systems and services). The facility will provide a testbed for development and evaluation of technologies in collaboration with local small and medium enterprises, as part of INRIA's I-Labs program. The AmiLab1 facility will be a key part of INRIA's participation in the new European Institute of Technology ICT Labs, providing a facility for research, training and innovation in the EIT ICT labs devoted to smart environments, homecare, and smart energy.

Centre de Recherche INRIA Lille-Nord Europe

Description. INRIA Lille – Nord Europe (ILNE, http://www.inria.fr/lille) has opened in 2008 after an incubation period lasting several years, the result of a government and local authority-backed initiative. Together with the growing influence of existing laboratories, and in close conjunction with nearby universities and schools, this INRIA center will play a determining role in boosting competitiveness in the Nord - Pas-de-Calais region in terms of research and innovation. From the outset, 13 project-teams have worked at the centre. 250 people work in the 4.000 sqm. building, around half of whom are on the Institute's payroll.

The place of AmiQual within CR INRIA SAM strategy. In accordance with the institute's strategic plan for 2008-2012, the center has set itself three priority research objectives to which most of its 13 teams contribute: *software infrastructures for ambient intelligence*, *modeling and interaction with living systems*, and *modeling and simulation*. Dealing with issues such as healthcare, environment, transportation, trade, industry and services, the INRIA Lille – Nord Europe research center is part of the permanent information and communication revolution that is laying the foundations of our future society. ILNE is a founding partner of the *Ambient Intelligence Campus*, an initiative that brings together most of the regional software and hardware players relevant to the field and comprises more than 1000 researchers. ILNE is involved in the Nord – Pas de Calais region's PICOM (mass retail industries) competitiveness cluster. Ambient intelligence is a key strategic focus of the PICOM cluster, which led to several projects on the *internet of things* and *intelligent sales areas*. The PICOM also initiated the *Lille Métropole Ubiquitaire* project on mobile services and ubiquitous commerce, with the ambition to turn the Lille metropolitan area into a life-size laboratory on the commerce of the future.

Centre de Recherche INRIA Paris-Rocquencourt

Description. INRIA Paris - Rocquencourt is one of the eight research centers of the French National Institute for Research in Computer Science and Control (INRIA), a research organization specialized in Information and Communication Sciences and Technologies. A Public institution supervised jointly by the Ministry of Research and the Ministry of Economy, Finance and Industry, INRIA Paris-Rocquencourt employs about 600 people including 400 scientists, and has a yearly budget of approximately 35 million Euros. The Paris - Rocquencourt research center is particularly aligned with the Institute's basic strategy which is to combine scientific excellence with technology transfer. Thus, our priority objectives of research - *communication systems and networks* - *reliable software and security* - *modeling living structures and environment* - are conducted with the goal of reconciling upstream research at the highest international level, applications and development by means of constant interaction with the socio-economic world. We conduct our scientific activities by developing close partnerships with cutting-edge international teams, the world of industry and services, especially as part of competitiveness clusters, and many higher education and research establishments in the Île-de-France area.

The place of AmiQual within INRIA Paris-Rocquencourt strategy. In line with INRIA's scientific policy, one of the three priority objectives of research at INRIA Paris-Rocquencourt is

"Communication systems and networks", which aligns well with the vision of AmiLab 4 – Smart Mobility: E-Campus. Specifically, the researchers of the ARLES project-team at INRIA Paris-Rocquencourt will contribute to AmiQual by partnership in AmiLab 4, bringing expertise in the area of software architecture and middleware for pervasive computing/ambient intelligence systems, as well as high-level application development in sensor networks. Relevant research results for AmiQual include the IBICOOP middleware, which provides discovery and communication among peers in a multi-radio, multi-network scenario, as well as ongoing work on the Yarta middleware for enabling interactions in a mobile social network. Members of ARLES have contributed to a number of European and industrial research projects investigating new system and middleware architectures for emerging networking technologies, including flagship European projects OZONE and AMIGO on system infrastructures for ambient intelligence, FP6 PLASTIC project on services engineering for pervasive networks, and FP7 FET CONNECT project on next generation middleware architectures.

Centre de Recherche INRIA Sophia Antipolis – Méditerranée

Description. INRIA's Sophia Antipolis - Méditerranée research centre was set up in 1983 at the heart of one of the most important scientific parks in Europe. Today it has premises in Sophia Antipolis, Marseille and Montpellier, and now in Italy, bringing together almost 500 staff - including nearly 400 scientists - divided in about 40 research teams, over half of which have established partnerships with public science and technology institutions (EPSTs), universities and grandes écoles (CNRS, CIRAD, ENS, INRA, universities of Nice Sophia Antipolis, Montpellier 1, Montpellier 2, Provence, University of Bologna, etc.).

CR INRIA SAM conducts scientific activities by developing close partnerships with cuttingedge international teams, the world of industry and services, especially as part of competitiveness clusters, and many higher education and research establishments in the Mediterranean area. This contributes to INRIA's strategic objective of combining scientific excellence with technology transfer. The priority objectives of research are Ubiquitous computing and communications, Computational medicine and biology, Modeling, simulating and interacting with the real world. Research in these areas is conducted with the goal of contributing to research at the highest international level, while providing innovative applications and development through interaction with the socio-economic sectors.

The place of AmiQual within INRIA Sophia Antipolis-Médditerranée strategy. One of the three research objectives at CR INRIA SAM is "Modeling, simulating and interacting with the real world". To exemplify our actions on this priority, two milestones of the institute's strategic plan for 2008-2012: Independence for the Elderly and Disabled and Assistance and Service Robotics in a Human Environment. In CR INRIA SAM, five groups propose to work together to develop technologies and services to improve the autonomy and quality of life for elderly and fragile persons. Most of the associated project groups already address issues related to enhancing autonomy and quality of life within their work programs. However, one of their goals is to consolidate their efforts around collaborative experimentation. The AmiLab 5 "Smart Buildings - Aging in place" is perfectly designed to meet the needs of the teams to prototype, certify and transfer their services. This facility will also provide an innovative tool for developing a new partnership with Nice Hospital on the use of ambience intelligence technologies to assess the frailty level of Alzheimer patients.

- *Institut Telecom*

Description. Institut Telecom is made up of 5 major Graduate Schools of France in the field of Information Technology. Two of these schools are involved in the AmiQual proposal:

- Telecom Paris Tech (aka Ecole Nationale Supérieure des Telecommunications, ENST).
- Telecom Sud Paris (aka Institut National des Telecommunications).

The French research landscape has recently evolved in a significant manner and Institut Telecom has emerged as one of the major French public research organizations in information society technologies. With this role of increasing importance Institut Telecom has identified three scientific challenges:

- Challenge 1: significantly increase the performance of communication systems.
- Challenge 2: improve the efficiency and the scope of content creation, processing and retrieval systems.
- Challenge 3: develop new services for the information society and comprehend their uses.

Institut Telecom is currently actively involved in a large number of cooperative projects. Research conducted in the institutes contributes to most of the major European programs and initiatives in the ICT field, including IST, Eureka (ITEA, CELTIC,…), and COST.

Institut Telecom has also developed partnerships with industrial organizations for enabling a rapid transfer of knowledge in the product development cycle. This cooperation is exemplified by the participation in EU-sponsored projects where industry has the prominent role with a strong academic backing from the Institut Telecom researchers. This cooperation takes place with more than 300 organizations in more than 30 countries.

Telecom ParisTech - CNRS LTCI – UMR 5141

Telecom ParisTech is one of France's leading graduate engineering schools and considered *the* school in the field of Communication and Information Technologies. Its disciplines include all the sciences and techniques that fall within the term "Information and Communications": Computer Science Networks, Communications, Electronics, Signal and Image Processing, as well as the study of economic and social aspects associated with modern technology. The school was founded more than a hundred years ago and is classed among the *Grandes Ecoles d'Ingénieurs*. Because of its high scientific standard and the extremely competitive admission procedures, Telecom ParisTech can be compared to the highest level engineering schools and universities that one would find abroad.

As an institution of higher education, the school is publicly funded, with close links with a number of partner institutions: it is part of a federation of schools in Telecommunications, called Institut Telecom and a member of ParisTech, a multi-campus networks of 12 graduate engineering schools, all located in the Paris area.

Telecom ParisTech today has a faculty of about 150 full-time staff (full professors, associate and assistant professors), over 200 part-time lecturers and a student body of about 1000 students (including 750 in the three year diploma program, 100 in one of the master's level programs, and 250 Ph.D. students).

The UMR 5141 aka LTCI (Laboratory for Communication and Processing of Information) is a joint research lab between the CNRS (Centre National de la Recherche Scientifique) and Telecom ParisTech. It currently covers all the research activities within Telecom ParisTech and its structure mirrors that of Telecom ParisTech.

Telecom SudParis – CNRS SAMOVAR - UMR 5157

Telecom SudParis graduate school of engineering is committed to the development of information technology. It offers post-graduate masters programs in English and French. Research at Telecom SudParis is conducted in direct relation with the SAMOVAR (UMR 5157) CNRS research unit that focusses on distributed services, architectures, modeling, validation, network administration.

The place of AmiQual within Paris Tech strategy. AmiLab 4 will contribute to the strategic involvement of Institut Telecom in Saclay Campus, creating a unique opportunity to develop, design, experiment and set up ICT-based innovations involving plusridisciplinary expertise. This is completely alined with the 3rd of the three above mentioned challenges identified as key to the Institut Telecom strategy: "Develop new services for the information society and comprehend their uses". This Equipex will support the development of - new and existing – cooperations with local public and private partners (in particular: Ecole Polytechnique, CEA, System@tic, Altran, INRIA).

- *UJF – Université Joseph Fourier (Grenoble I)*

Description. University Joseph Fourier (UJF) is one of the 5 top universities in France. UJF's ambitious research takes place within 70 research laboratories and is developed in partnership with national research bodies and major international facilities. UJF's research is organized as four scientific and technological clusters: Earth and Universe sciences, Environment and Society, Life and Health Sciences, Chemistry and Bioengineering, Mathematics, Information and Communication Sciences and Technology, Materials Science and Engineering. UJF provides students with its high-quality education, enabling them to gain strong professional skills. 17000 students are registered at UJF to study a wide range of disciplines covering sciences, technology, medicine and society. UJF offers a variety of bachelor and master programmes (52 bachelor's degrees, 84 research-oriented or vocational master's degrees) and has 8 doctoral schools.

The place of AmiQual within UJF strategy. The AmiQual equipment and its scientific project are in accord with the UJF's scientific strategy in the areas of Ambient Intelligence and Smart Habitats. Research in these areas stem from long standing collaborations with major industrial partners such as Orange labs, Schneider Electric and others.

LIG – Laboratoire d'Informatique de Grenoble (UMR 5217 CNRS INS2I, PRES Grenoble, INRIA)

Description. The Laboratory of Informatics of Grenoble (LIG) is a research unit whose funding partners are CNRS, INRIA, Grenoble INP, UJF and UPMF. LIG has been created on January 1, 2007. It gathers over 550 researchers, lecturers-researchers, students and postdocs, technical and administrative staff members. Research activities are structured around 23 autonomous research groups. LIG's scientific project is an invitation to imagine the future of Computer Science: refine the domain's concepts, put forward models and algorithms determining the domain's evolution, and create mock-ups helping to anticipate the usages. In this respect one of LIG's big projects for the period of the four-year strategic plan consists in working on a integrated platform around the thematic of ambient computing. AERES ranked LIG A+, in the top level French laboratories.

The place of AmiQual within LIG strategy. In its founding document in 2005 [Plateau et al 05], the Laboratoire Informatique de Grenoble (LIG) has selected Ambient Informatics as its unifying scientific project. Within this project, LIG has identified core challenges as proposing the theories and models, languages and software components for systems that are multi-scale, heterogeneous, reliable, secure, and interacting with users in an appropriate manner. Smart Buildings have been identified as one of the unifying projects, and a LIG working group was formed to identify challenges and formulate a vision for how ambient informatics could provide systems and services for smart buildings. Many of the ideas proposed in AmiQual can be found documented in the LIG Smart Building working group report [Crowley et al 08] based on contributions from 14 of the 24 LIG research Groups.

The AmiLab 1 Smart Habitats, as well as the Coordination Facility will be located within buildings operated by LIG. During construction in Phase 1, the Smart Habitats AmiLab will rely extensively on LIG research groups, and as well as the MarveLIG research platform for component technologies. LIG researchers will be actively solicited for contributions of expertise in sensors, actuators, robotics, network technologies, middleware, context aware computing, intelligent systems and human-computer interaction. During Phase 2, The Smart Habitats AmiLab platform will serve as a testbed facility for multidisciplinary research by researchers within LIG.

- *Université Lille II, Droit et Santé*

CERAPS – Centre d'étude et de Recherches Administratives, Politiques et Sociales (UMR 8026 CNRS, Lille II)

Description. Mainly positioned at the University of Lille Nord-de-France, CERAPS is the largest research unit specialized in Law and Political Science. Political Science, Public Law and Sociology are its main fields. With a double label granted by CNRS, the lab is recognized by a large scale of academic partners, from the *American Political Science Association (APSA)* to *European Consortium for Political Research (ECPR)*, by the *International Institute of Administrative Sciences (IIAS)* and is celebrated by awards and distinctions. CERAPS' projects include both quantitative and qualitative methodologies to understand changes within the present political order at strategic levels : construction of suprapolitical areas, citizens and their connections with politics, governance and legitimacy in democratic countries, public institutions and political bodies, incrementation of legal norms. Devoted to teaching and training, 34 academics, 5 research-fellows, 6 managing and clerical staffs and 83 graduated and post-graduated students are active participants, in both Master Degrees, of annual colloquiums and conferences.

The place of AmiQual within CERAPS strategy. CERAPS's legal expertise will cover the development of support tools for legal analysis surrounding the elaboration of systems and services for Ambient Intelligence. It lays on an understanding of analysis processus, data processing, and its exploitation, at each step of the process, from design, development to deployment, even the commercilaisation of a finished product. The wealth of legal questions raised by AmiQual will give a direct feedback effect on the science of law. The transversal nature of the problems raised will force us to think the legal aspects outside its classical categories.

- *UNS - Université Nice-Sophia Antipolis*

I3S - Laboratoire d'Informatique, Signaux et Systèmes de Sophia-Antipolis (UMR 6070 CNRS, Université Nice-Sophia Antipolis)

Description. The I3S laboratory ("Laboratoire d'Informatique, Signaux et Systèmes de Sophia-Antipolis") is home to more than 115 academics including Professors and Associate Professors from the University of Nice-Sophia Antipolis along with full time researchers from CNRS and INRIA. The laboratory is hosted across three neighbouring sites: Algorithmes/Euclide B, Polytech'Sophia/Templiers and INRIA Sophia-Antipolis Méditerranée. The research teams are structured into four departments, COMRED, GLC, MDSC and SIS. They cover, almost continuously, all the spectrum of computer science, from the most theoretical to rather applied aspects, and electrical engineering, including signal and image processing, automatic control and robotics. The research activity in COMRED ("COMmunications, Réseaux, systèmes Embarqués et Distribués") is centred on communication networks and embedded and distributed systems. MDSC ("Modèles Discrets pour les Systèmes Complexes") is centred on formal discrete models for complex systems. SIS ("Signal, Images, Systèmes") is centred on signal-processing, image-processing and control. GLC ("Génie du Logiciel et de la Connaissance") is centred on software and knowledge engineering. Techniques are studied and developed to master software complexity, dynamicity and adaptability. Their implementation is considered on widely distributed architectures (grid computing, ambient computing), together with the semantic description of processes and data as well as the design and use of knowledge databases.

The laboratory invests on average 2 M€ per year (not including salaries) in research activities from which more than 90% is funded through competitive grants and industrial collaborations. In 2009, for instance, 29 projects have been supported by the ANR (National Agency for Research) and 7 by the European Union. The scientific achievements have been highly successful over the last four years as demonstrated, for example, by more than 300 papers published in international peer-reviewed journals. These factors underline the international importance and impact of the research carried out at the I3S laboratory.

The place of AmiQual within I3S strategy. The main purpose of the scenarios of I3S in the AmiLab 5 is to test the advanced middleware for ubiquitous computing for home control Indeed new high added-value services are now accessible through better management of the interroperability between devices and smart objects and the dynamic evolution of these facilities.I3S has already built an experimental environment called the Ubiquarium that is comprised of various devices and services, that can be discovered and composed at runtime. Those devices can either be virtual devices (3D scene objects in which the user is immersed), or physical devices worn by users or available in their immediate environment. This represents an ideal framework for the evaluation of new applications for mobile and ambient computing. This platform is particularly well adapted to the study of the software adaptation mechanisms for context-aware mobile and ubiquitous computing applications. AmiQual will provide an exceptional context and tool to go beyond the state of the art in the field of home control and assisted living, in association with other AmiQual partners and research groups of the area of Sophia Antipolis: LEAT (electronics), GREDEG (law and economics), CHU (health) and other UNS partners.

- *UTT - Université de Technologie de Troyes*

ICD - Institut Charles Delaunay (UMR 6279 CNRS, UTT)

Description. The Charles Delaunay Institute (ICD) has been established on 1 january 2006. It gathers 450 lecturers-researchers, phd and postdoc students, engineers and administrative staff members. Research activities are organized around 8 research teams and a transversal scientific axis focused on Risk Engineering which has been recognized as an UMR CNRS on january 2010. Research at the Institute addresses a wide range of disciplinary areas : from physics and signal processing to networks, sustainable development, and cognitive engineering.

The place of AmiQual within ICD strategy. Since 1998 the University of Technology of Troyes has initiated a research activity (led by the TechCICO research team) focused on cooperation mechanisms and on the design and assessment of mobile and cooperative technologies. In this context ICD has developed knowledge, methods, and tools to guide the design of systems to support human performance in cooperative complex settings including pervasive computing situations. We take a highly interdisciplinary approach integrating cognitive ergonomics, psychology, sociology, human-computer interaction and knowledge engineering. Ambient Intelligence introduces pervasive and unobtrusive intelligence appliances in the surrounding environment supporting the activities and interactions of the users in a radical new way. It extends the scope of traditional issues studied in cooperative systems research and offers new opportunities for developing original research trends in the domain of human-computer and human-human cooperation. Recently, the ICD-TechCICO team has initiated scientific and industrial research projects focused on the sociocognitive efficiency and acceptability of ambient intelligence. The team will take benefit from this opportunity to develop this axis of research and to set methods and tools to assess the potential of ambient intelligence situations.distributed, pervasive systems from the point of view of the users in different contexts of use and in coordination with the different AmiLabs.

- *Universités Toulouse I et II*

MSHST - Maison des Sciences de l’Homme et de la Société de Toulouse (MSH9, Toulouse I et II)

Description. The MSHS of Toulouse (Toulouse Institute of Social Sciences and Humanities Federative Research) is a stronghold of interdisciplinary scientific research in Midi-Pyrénées. Created in 1999, it depends on three regulatory authorities (National Centre for Scientific Research, and two universities of Toulouse, and has premises in both universities. It federates 22 research laboratories (with a total exceeding 600 permanent researchers), among which 11 have got the CNRS label. The MSHS of Toulouse and 22 other similar institutes in France constitute a Network recognized since 2006 by the Ministry of Research as a Scientific Interest Group (GIS). Working with approximately 1/3 of Social and Human Sciences university professors and researchers, the network and each of its institutes react to research opportunities at the interdisciplinary level, facilitate the development of collective equipments and shared resources, and help the research laboratories to valorize their results. The specificity of the Toulouse Institute within the French network is its strong support to the development of scientific projects involving collaboration between the Human and Social Sciences and the Engineering and Mathematical Sciences. The MSHST is already a partner of different projects going in this direction.

The 6 MSHST laboratories involved in this EquipEx develop research on the subject of health, aging and disability.

- LISST (UMR CNRS 5193): Housing policy, aging, health and social policies, care.
- CLLE (UMR CNRS 5263): Alteration with age of cognitive functions in a natural environment, testing of innovative assistance and monitoring (ergonomics).

- OCTOGONE (EA 4156): Pain assessment, assessment of quality of life and stress in people dependent on technological devices.
- LLA CREATIS (EA 4152): Therapeutic art practices to improve the environment of care and support for patients.
- LARA (EA 4145): Studies of media use by people with dependency, research interfaces imprisonment.
- LEREPS (EA 790): Theory and modeling of complex systems (including multi-agent simulation), social acceptability, collaborative governance of organizational changes.

The place of AmiQual within MSHST strategy. "Health and aging is an important field of the MSHST policy for the next four years programme. AmiLab 2 Smart HealthCare and HomeCare will become an essential element of this policy, facilitating interactions with the partners in the Toulouse site. It will consolidate some equipments that we have already available at the MSHST (audiometric room, smart home, etc.) related with academic formation (2A2M - Aide et Assistance pour le Monitoring et le Maintien à domicile and gerontology).

- *UPS - Université Toulouse III, Paul Sabatier*

IRIT - Institut de Recherche en Informatique de Toulouse (UMR 5550 CNRS, Université Paul Sabatier -Toulouse III)

Description. The IRIT (Institut de Recherche en Informatique de Toulouse – Toulouse Institute of Computer Science Research) represents one of the major potential of the French research in computer science, with a workforce of more than 600 members including 187 researchers and teachers 187 PhD students, 36 post-doc and researchers under contract and also 47 engineers and administrative employees. AERES ranked IRIT A+, in the top level French laboratory.

The 18 research groups of the laboratory are dispatched in seven scientific themes covering all the computer science domains of today: Information Analysis and Synthesis, Indexing and Information Search, Interaction Autonomy Dialogue and Cooperation, Reasoning and Decision, Algorithms Modelling and High Performance Calculus, Architecture Systems and Networks, and Safety of Software Development. 10 groups are concerned by this equipment demand. From 2008, we defined four strategic fields around the big scientific and socio-economical challenges: Data Mass and Calculus, Critical Embedded Systems, Ambient Socio-technical Systems, Computer Science for Health.

The place of AmiQual within IRIT strategy. Since 2008, IRIT has initiated two scientific axes concerning the Health and the Sociotechnique Ambient Systems based on several existing competencies inside the laboratory. 10 IRIT teams over 18 have some linked research with ambient systems. Some IRIT teams have participated or are currently participating to projects in relation with ambient systems and/or health. IRIT is leader of the AmIE (Ambient Intelligent Entities) project supported by the laboratory and the University Paul Sabatier where healthcare & homecare is one of the application domains. The AmiLab 2 HealthCare and HomeCare will provide an exceptional context and tool to go beyond the state of the art in association with other diciplines. The regional or national projects cannot provide enough funding to create this research tool, that is to say enough equipment to really realise the scalability of our solutions. This equipment will participate in cooperation with our competitivity pole about "Cancer Bio Santé" to the excellence and the visibility of researches done at IRIT.

IRIT will manage the local installation of the equipment that will be in majority in two rooms inside IRIT: smart room and the usage study laboratory: ULYSS. IRIT will actively participate with medical staff to the supervision of the installation in the CIC CHU, CUC and private houses. It will also take into account the maintenance of the equipment concerning HealthCare & HomeCare.

5.2.3 ENTREPRISES

- *ALTRAN*

Description. Altran TELECOMS AND MEDIA (Altran TEM) is for players in the telecoms and media as well as major user accounts. Altran TEM provides an effective board throughout the project life cycle and supports the implementation of global solutions for end-to-end. Altran TEM is the leading European technology consultant in telecommunications. Altran TEM has developed expertise in all activities around networks, both technical (network access GSM CMSMs TETRA, WiMAX, IP architecture, supervision WTO and HP / OV, protocols INAP / CAMEL , safety, etc.) and functional (project management, assistance to the Owner, definition of master plans, etc.). The organization and positioning of Altran TEM have enabled us to expand our operations at the operators but also with equipment manufacturers, or major user accounts. Altran TEM is present on four continents with 2700 consultants, including India and China. The group is positioned as an international partner to its customers, all key players in the market that shape its development. This gives a very good Altran TEM vision of future developments and technologies and enables it to offer a synthesis of high added value.

The telecom market sees the development of new uses, new services and converging more and more industrialized. The network must respond to new technical challenges, such as "very, very high speed" or transparency in relation to services. This development requires new architectures, new solutions for dynamic routing, new service platforms while developing and optimizing recurring activities such as operation and maintenance or monitoring the QoS Quality of Service '.

In all its activities, Altran TEM based on a Department of tenders, innovation and R & D guarantee best practices and an organization by major areas of expertise (divided by area of expertise, covering the entire perimeter of the telecom market) guarantees the capitalization of knowledge. The purpose of this organization is to ensure continuous improvement of skills and knowledge to return the best value to the market.

Altran TEM, through its position as a partner in innovation, is the power of strategic proposals on topics such as research on technological developments in access networks, the FTTX, the Personal Mobile TV or a virtual laboratory testing

The place of AmiQual within ALTRAN strategy. Our strategy Altran Telecoms and Media has driven us to accelerate our offers on the innovation consulting, and counseling in the value-added services on mobile networks 3G and 4G. by providing the platform Neptune results obtained by the combination AMIQUAL associate with a combination of technology, 4G mobile broadband, services and practices of tomorrow. We can cite for example the evolution of geo-location services associated with compulsive shopping, supervision and ensure medical or looking for local services ... The target is both the mass market (B to C) but also the corporate market (B to B).

NEPTUNE network attractive experimental high-speed wireless perennial and open to all actors of products and solutions to evaluate, qualify technologies, uses and technical economic models fit perfectly into the spirit of our strategy. This unique platform will be an added advantage, and competitive differentiator for our credibility sit on the relevance and value of testing and validation services and innovative uses, by focusing the talents of our partnership that we can accelerate innovation in mobile services. Access to the platform NEPTUNE will provide a phase advance through a systematic experimental developments, services and practices, but also on technology and brick network: Optimization radio terminals, mobile services and applications, sensors, behavior and uses.

Have independence in the use of this network, will innovate consistently and sustainably Services seamless mobility time anticipating market demands. Contribution to strengthen innovation and offers services on mobile networks, broadband. Enrichment of unprecedented features and advantages of these innovative networks and open the project AMIQUAL, partners, schools, research center will create value. AmiQual and Neptune will then have a new ability to generate new research and innovation, making our offerings even more attractive to compete internationally and enhance the image and reputation. The radiation will be regional, national and international

- *ICR – Institut Claudius Régaud*

Description. Claudius Regaud Institute (ICR) is the Comprehensive Cancer Center of Midi-Pyrénées country. It is part of a network of 20 French cancer centres managed by the National Federation of Cancer Centres. It is a private institute of public interest. The Insitute was founded in 1923. Since then, doctors, researchers and treatment and administrative professionals specialised in cancer have worked together at the Institute. Today there are 800 people working at the Institute. The Institute faces three key challenges: care, research and teaching. To effectively fight cancer, doctors and researchers from French cancer centres have, for over a century, been relying on a multidisciplinary approach: patients records are discussed and studied during weekly meetings that bring together specialist doctors from different fields. Patients therefore benefit from a customised treatment program which is created by a team of specialists. The Institute brings together all cancer related disciplines required to detect, treat and monitor the disease: surgery, medecine, radiotherapy, brachytherapy, nuclear medicine, imaging, biology and anatomical pathology. Skills and technical means are grouped together on one site to ensure optimum case management. The latest advances related to diagnostics or treatment can therefore be rapidly implemented. Since July 2010, the Claudius Regaud Institute has been certified by the *Haute Autorité de Santé.*

In 2014, ICR will integrate a new hospital called "Clinique Universitaire du Cancer" in which ICR, Centre Hospitalier Universitaire of Toulouse (mainly, haematology activities), the private clinics and private sector clinicians, the French Blood Establishment, the Midi-Pyrenes oncology network Oncomip, University and general hospitals will join forces for treatment and research against cancer. This clinic will facilate collaborations between academic, scientific, medical industrial teams and will ensure for patients a quick access to the latest therapeutic advances.

The place of AmiQual within ICR strategy. As mentionned previously, ICR will join in 2014 a new hospital of 60000 m2 and it is very i;ortant to help the patients and their family in their circulation from their room to the reception desk or to doctor consultaions or for having different radiologic exams. New information technologies such as (je ne connais pas le mot anglais pour GPS) should help them. So we plan to equip a part of the building with this material. An other important problem in medicine is the good identification of a patient in the aim to deliver the good treatment to the good patient> So we plan to give for each patient a RIFD writband including name, first name and date of birth for their identification. A part of th clinics should be equiped with RIFD compounds to garantee the identification of the patients. This new technology will be used mainly in radiotherapy and during surgical interventions when the patient is sleeping and unable to identify himself.

- *MEDES - Institut Médecine Physiologie Spatiale*

Description. MEDES was founded in 1989 by engineers and medical doctors belonging to the French Space Agency (CNES) and University Hospital (CHU) of Toulouse in order to contribute in European autonomy regarding astronautics. This Economic Interest Group located in Toulouse (France) involves the French Space Agency (CNES), Toulouse University Hospital, Angers University Hospital and several French universities (Toulouse, Tours, Bordeaux).

The scientific and medical skills of MEDES and its members allow MEDES to achieve research programmes, medical and technological expertises and evaluations, operational activities. MEDES also carries out activities related to clinical research. Within this scope, MEDES is in charge of operating the Space Clinic, a certified centre for biomedical research experiments and clinical studies on volunteers. MEDES has also a good experience in eHealth projects with a participation in several national and European projects.

The place of AmiQual within MEDES strategy. Within AmiQual, MEDES proposes its Clinical Research Infrastructure (CRI) as an experimental *in vivo* facility for the AmiLab 2 HealthCare and HomeCare. This facility offers all the necessary biomedical equipment to enable *in vivo* clinical evaluations. (MEDES-CRI has obtained the formal approval from Ministry of Health and French Drugs Agency to perform biomedical experiments on healthy volunteers. See

http://www.medes.fr/home_en/clinical_research/experiments/last_experiments.html)

MEDES will medically evaluate the devices before deployment at patient's home or in care centres.

• *MEDETIC – Médecine Et Développement des Technologies de l'Information et de la Communication*

Description. MEDETIC, founded in January 2004, is entitled to promote telemedicine and Information Technology and Communication related to telemedicine and e-health at home. With the goal to conceive affordable solutions responding to elderly needs, MEDeTIC integrates home automation and telemedicine services in accommodations to support community living of elderly or disabled people in complete security. MEDeTIC's non-profit organization is the result of a collaboration between doctors, health specialists and engineers to promote the use of innovative health solutions based on the latest information and communication technologies (ICT).

Medetic' know-how includes : Develop training and use of technology; Build, use and manage projects including technologies; Apply ICT innovations to medical environment regarding diagnosis, therapeutic method, data and knowledge transfer; Promote technological research, know-how transfer; Answer issues linked to ageing in place and community living and propose solutions to the lack of nursing homes available for elderly; Ensure ICT evaluation process: quality, accessibility, cost, adoption and usability.

The place of AmiQual within MEDETIC strategy. MEDeTIC, in its missions of:

- Helps with the design and the restoration of dwellings adapted to the maintenance in residence of the elderly or handicapped at accessible cost, while respecting the will of the occupants in their mode of lodging and their lifestyle,
- Coordination between the needs for medicalized assistance and the services with the person, of comfort or assistance,

MEDeTIC needs for a place of experiments allowing evaluating the practical value and the appropriation of the new devices and services. Thanks to this equipment, MEDETIC will be able to position (in France and abroad) like partner and council of the private promoters or public (social promoters), because the combination of these elements represents a new market, for which the current offer is incomplete even non-existent.

• *POLE STAR SA*

Description. Pole Star is a leading company in the field of indoor location technologies. Pole Star is a SME located in Toulouse, France. Created in 2002 by two former executives of Alcatel Space, Pole Star now counts 14 people – among which 9 in R&D. The annual turnover of the company is by € 1.2 million. Pole Star is investing more than 30% of its turnover in its R&D. Pole Star is a founding member of Aerospace Valley, a Toulouse based competitiveness cluster. Aerospace Valley is the leading employment pool in Europe in the fields of aeronautics, space and embedded systems; the cluster insures a large access to qualified human resources and worldwide class laboratories.

Pole Star core activity is to design and develop positioning technologies for environments where GNSS (GPS, EGNOS, Galileo, etc.) signal propagation experiences difficult propagation, such as urban areas and inside buildings. Pole Star focuses on improving accuracy, availability, and continuity of the positioning service. Pole Star developed the NAO® product line, a positioning solution that combines GPS and Wi-Fi, mainly targeting the mobile phone market. NAO is already deployed on several sites.

Pole Star follows an internal R&D program called POSIRIS that intends to develop a positioning solution for rapid intervention (firemen, special forces, army etc.) on sites that are not equipped with any kind of indoor positioning infrastructure. The core of the system is based on terminals equipped with GPS and Ultra Wide Band (UWB) communication means that cooperate by sharing GPS and UWB ranging measurements.

In the course of its internal R&D activity, Pole Star develops several partnerships with laboratories. Indoor location becomes a key issue for a growing number of mobile applications. Mobility, LBS, Healthcare, security… are some example of uses cases. As technology provider, Pole Star solutions are particularly suited to the needs of people tracking, navigation and step by step and door to door guidance in complex places.

The place of AmiQual within POLE STAR strategy. The AmiQual project is fully in line with Pole Star strategy and road map. By providing to the project Indoor location technology and associated support, Pole Star intends to facilitate and speed up the development of innovative usages for the benefit of the healthcare and homecare domains. In addition to the provision of technology, Pole Star will contribute to experimentation and development of new applications to facilitate patient autonomy, home medical care while improving its management and security.

5.2.4 QUALIFICATION, ROLE AND INVOLVEMENT OF INDIVIDUAL PARTNERS

- *Academic Partners and Public Establishments*

Tables are listed in alphabetical order according to the name of the partners' parent institution.

Partner	Surname	First name	Position	Domain	Center	Contribution
CHUT	Nourhashemi	Fati	Professor	Gerontology	Centre Hospitalier Universitaire de Toulouse	Domain expert (Clinical, health Evaluation)
CHUT	Rascol	Olivier	Professor	Clinical Investigation	CIC	Domain expert (Clinical, health Evaluation)
CHUT	Séchoy-Balussou	Odile	Research and Innovation Administrative Manager	Clinical research and Innovation	Centre Hospitalier Universitaire de Toulouse	Domain expert (Clinical, health Evaluation)

Partner	Surname	First name	Position	Domain	Lab	Contribution
CNRS	Vincent	Noël	Director Financial Services	Administration	DR Rhône-Alpes (DR11)	Financial administration of the project
CNRS	<surname>	<name>	To be provided by CNRS		INS2I	Director of the Coordination Facility
CNRS	<surname>	<name>	To be provided by CNRS		INS2I	Assistant for the Coordination Facility
CNRS	<surname>	<name>	To be provided by CNRS		DIRE CNRS	Coordination Facility: Commercial and Exploitation WG co-leader
CNRS	Alami	Rachid	DR CNRS	Planning for interactive robots, cooperative robots, decisional architectures	LAAS	AmiLab2 (Smart HealthCare & HomeCare) expert for Sci5 (context-aware intelligent systems and services)
CNRS	Berthou	Pascal	Associate professor	Wireless Networks, sensor networks	LAAS/UPS	AmiLab2 expert for Sci2 (sensor networks)
CNRS	Campo	Eric	Professor Toulouse II	Embedded systems	LAAS	AmiLab2 expert for Sci2 (sensors, actuators,..) and Sci7 (spcietal impact, usage, measures for quality of life)
CNRS	Devy	Michel	DR CNRS	Robotics, Perception	LAAS	AmiLab2 co-leader, Sci4 (perception, action and robotics) WG co-leader
CNRS	Diaz	Michel	DR CNRS	Networks	LAAS	Coordination Facility:

						ICT Capitalization co-leader
CNRS	Grenier	Katia	CR CNRS	High frequency Microsystems for biological analysis	LAAS	Sci1 (sensors, actuators and devices) WG co-leader
CNRS	Lerasle	Frédéric	Associate professor	Computer vision, Human-robot interaction, robotic perception	LAAS/UPS	AmiLab2 expert for Sci6 (Human-system interaction)
CNRS	Roy	Matthieu	CR CNRS	Mobile and location-aware computing, middleware, distributed algorithms.	LAAS	AmiLab2 expert for Sci3 (middleware)

Partner	Surname	First name	Position	Domain	Lab/Org.	Contribution
CSTB	Zarli	Alain	Head of Division	ITC	CSTB / IIS	AmiLab5 (Smart Buildings) co-leader
CSTB	Anfosso	Alain	CSTB Expert	ITC and Aging in place	CSTB / IIS	AmiLab5 expert for Sci5 (Context aware intelligent systems and services)
CSTB	Pascual	Eric	CSTB Expert	ITC	CSTB / IIS	AmiLab5 expert for Sci2 (sensor networks) & Sci1 (sensors, actuators and devices)
CSTB	Laaroussi	Ahmed	CSTB Architect	Building conception	CSTB / IIS	Building supervision
CSTB	Bonetto	Régis	CSTB Expert	Project Management	CSTB / IIS	Project Management

Partner	Surname	First name	Position	Domain	Center	Contribution
CEA	Berger	Pierre-Damien	Responsable Ligne Programme	Communicating objects	LETI	Sci1 (Sensors, actuators and devices) WG co-leader, AmiLab2 (Smart Habitats) expert for Sci1.
CEA	Delhome	Tiana	Head of laboratory	SHS – user-centered Innovation	LETI	Fab Lab & ICT Coordination Facility
CEA	Vicard	Dominique	Head of laboratory	Fonctionnalisation des matériaux	LETI	Sci1 (Sensors, actuators and devices), AmiLab2 (Smart Habitats) expert for Sci1.
CEA	Allano	Lorène	CEA expert	Artificial Intelligence, machine learning	LIST	AmiLab4 (Smart Mobility e-Campus) expert for Sci5 (context aware intelligent systems and services)
CEA	Boukallel	Medhi	CEA expert	Sensors, sensory interfaces and micro-actuators	LIST	AmiLab4 expert for Sci1 (Sensors, actuators and devices)
CEA	Gosse	Karine	Head of department	Department for Ambient Intelligence and Interactive Systems	LIST	AmiLab4 operator and co-leader
CEA	Janneteau	Christophe	Lab manager	Sensor networks, IP-based networking	LIST	AmiLab4 expert for Sci2 (sensor

						networks)
CEA	Leroux	Christophe	Project manager	Interactive robotics	LIST	AmiLab4 expert for Sci4 (perception, action, robotics)
CEA	Leservot	Arnauld	Manager for emerging projects	Innovation and creativity	LIST	AmiLab4 Liaison with IRT System-X proposal / innovation lab
CEA	Mégard	Christine	CEA expert	Ergonomics, usage and evaluation of human interfaces	LIST	AmiLab4 expert for Sci5 (context aware intell. systems and services)
CEA	Sayd	Patrick	CEA expert	Image processing (detection, classification)	LIST	AmiLab4 expert for Sci4 (perception, action, robotics)

Partner	Surname	First name	Position	Domain	Lab	Contribution
Ecole polytechnique	Benghozi	Pierre-Jean	DR / Professor	Economic and Management	PREG	AmiLab4 (Smart Mobility eCampus) expert for Sci7 (Societal impact…)
Ecole polytechnique	Lastes	Michel	Engineer	Network administration	PREG	AmiLab4 expert for Sci7 (Societal impact…)
Ecole polytechnique	Teulier	Régine	Researcher	Management	PREG	AmiLab4 expert for Sci7 (Societal impact…)

Partner	Surname	First name	Position	Domain	Lab	Contribution
GINP	Bacha	Seddik	Professor	Electrical engineering	G2Elab	AmiLab1 (Smart Habitats) Domain expert (Optimisation of energy flux in buildings)
GINP	Delinchant	Benoit	Associate Professor	Electrical engineering	G2Elab	AmiLab1 Domain expert (Modelisation & optimisation of energy flux in buildings)
GINP	Wurtz	Frédéric	CR CNRS	Electrical engineering	G2Elab	AmiLab1 Domain expert (Modelisation & optimisation of energy flux in buildings)
GINP	Jacomino	Mireille	Professor	Optimisation	GSCOP	AmiLab1 Domain expert (Optimisation of energy flux in buildings)
GINP	Ploix	Stephane	Associate Professor	Optimisation	GSCOP	AmiLab1 Domain expert (Optimisation of energy flux in buildings)
GINP	Collet	Christine	Professor GINP, GINP Deputy Vice President for Research, head of Hadas group	Active data bases, adaptive service coordination	LIG	AmiLab1 (Smart Habitats) expert for Sci3 (middleware) and Sci5 (context aware Intel. Systems and Services)
GINP	Crowley	James	Professor GINP, Head of INRIA project PRIMA		LIG	Project coordinator, AmiLab1 Co-leader, AmiLab4 expert for Sci4 (perception, action, robotics) and Sci5 (context aware..)

GINP	Denneulin	Yves	Professor GINP, Head of MarveLIG, experimental platform for Ambient Informatics	Grid Computing, File systems for large scale architectures, performance evaluation	LIG	Technical coordination of the construction of AmiLab1

Partner	Surname	First name	Position	Domain	Org.	Contribution
INRIA	Sportisse	Bruno	Director of DTI (Dept Transfer & Innovation)		INRIA national	Coordination Facility: Commercial exploitation co-leader
INRIA	Ubeda	Stéphane	Director of Technology Development	Software Engineering and Networks	INRIA national	Coordination Facility: ICT Capitalization WG
INRIA	Fraîchard	Thierry	CR INRIA	Robotics	Centre Grenoble Rhône-Alpes	AmiLab1 (Smart Habitats) expert for Sci4 (perception, action and robotics)
INRIA	Le Métayer	Daniel	DR INRIA	Privacy protection, Liability issues, electronic contracts	Centre Grenoble Rhône-Alpes	AmiLab1 (Smart Habitats) expert for Sci7 (societal impact, usage...)
INRIA	Tourancheau	Bernard	Professor Univ. Claude Bernard (Lyon 1)	Sensor Networks	Centre Grenoble Rhône-Alpes	Sci2 (Sensor networks) WG co-leader. AmiLab1 (Smart Habitats) expert for Sci2
INRIA	Merle	Philippe	CR INRIA	Middleware Service Oriented Architecture, Component-Based Software Engineering	Centre Lille Nord-Europe	AmiLab3 (Smart Commerce) co-leader, Sci3 (Middleware) WG co-leader
INRIA	Roussel	Nicolas	DR INRIA	HCI	Centre Lille Nord-Europe	AmiLab3 (Smart Commerce) co-leader
INRIA	Simplot-Ryl	David	Professor Lille 1	Sensor Networks	Centre Lille Nord-Europe	Coordination Facility: Communication & Dissemination co-leader, Sci2 (sensor networks) WG co-leader
INRIA	Issarny	Valérie	DR INRIA	Multi-network middleware, sensor networks, ambient intelligence	Centre Paris-Rocquencourt	AmiLab4 (Smart Mobility-eCampus) expert for Sci3 (middleware) and for Sci2 (sensor Networks)
INRIA	Pathak	Animesh	CR INRIA	Ambient intelligence, sensor networks, Mobile social networks	Centre Paris-Rocquencourt	AmiLab4 (Smart Mobility-eCampus) expert for Sci3 (middleware) and for Sci2 (sensor Networks)

INRIA	Daney	David	CR INRIA	Robotics	Centre Sophia-Antipolis Méditerranée	Sci4 (perception, action and robotics) WG co-leader, AmiLab5 expert for Sci4
INRIA	Bremond	Francois	DR INRIA	Computer Vision	Centre Sophia-Antipolis Méditerranée	Sci4 (perception, action and robotics)

Partner	Surname	First name	Position	Domain	Org/Lab	Contribution
Institut Telecom	Busch	Patrick	Technician	Hardware, embedded systems	Telecom ParisTech (CNRS LTCI)	AmiLab4 (Smart Mobility-eCampus) Active support in hardware deployment and operation.
Institut Telecom	Chaudet	Claude	Associate Professor	Networks, sensors	Telecom ParisTech (CNRS LTCI)	AmiLab4 Participation in the wireless network planning task, sensors deployment and the distributed computers setup and configuration.
Institut Telecom	Demeure	Isabelle	Professor	Middleware, service support	Telecom ParisTech (CNRS LTCI)	AmiLab4 co-leader. Will contribute ICT expertise to the project.
Institut Telecom	Diaconescu	Ada	Associate Professor	Middleware, autonomic computing	Telecom ParisTech (CNRS LTCI)	AmiLab4 expert for Sci3 (middleware).
Institut Telecom	Hecker	Artur	Associate Professor	Wireless networks, network security, network management, user access control	Telecom ParisTech (CNRS LTCI)	AmiLab4 expert - Contribution to the platform architecture (to build a sustainable experimentation environment). Definition of platform services and sensor integration in mobile devices.
Institut Telecom	Mouret	Gérard	Engineer	Hardware, Embedded Systems	Telecom ParisTech (CNRS LTCI)	AmiLab4 active support for hardware deployment and operation.
Institut Telecom	Boudy	Jérôme	Associate Professor	Healthcare sensors & signal processing	Telecom SudParis (CNRS SAMOVAR)	AmiLab4 expert for Sci1 (sensors, activators and devices). Will bring his expertise on vital and actimetry sensing devices for tracking person's daily status and activities. Will contribute and install part of the set of sensors and actuators planned in Phase 1.
Institut Telecom	Dorizzi	Bernadette	Professor	Smart appartment, video tracking of persons in mobility, gait and posture	Telecom SudParis (CNRS SAMOVAR)	Co-leadership of operation for the Smart Apartment. Active participation in training around Amiqual.

				detection		
Institut Telecom	Taconet	Chantal	Associate Professor	Middleware	Telecom SudParis (CNRS SAMOVAR)	AmiLab4 expert for Sci5 (context aware Intell. Systems and Services). Will contribute to the design of Distributed Context Management Middleware for context-awareness ambient campus scenarios.

Partner	Surname	First name	Position	Domain	Lab	Contribution
UJF	Coutaz	Joëlle	Professor UJF/DR CNRS	Human Computer Interaction, plastic user interfaces	LIG	Project co-coordinator, AmiLab1 co-leader, AmiLab1 expert for Sci6 (Human-System Interaction)
UJF	Donsez	Didier	Professor UJF	Middleware, Ubiquitous computing, sensors and RFID tags	LIG	Coordination Facility: Training and Education WG co-leader, AmiLab1 expert for Sci1 (sensors…) and Sci3 (mifddleware)
UJF	Estublier	Jacky	DR CNRS, Head of ADELE group	Software Engineering environments, configuration management systems, service-based applications	LIG	AmiLab1 expert for Sci3 (middleware)
UJF	Jambon	Francis	Associate Professor UJF	HCI, usability, user studies and methods	LIG	AmiLab1 expert for Sci7 (societal impact, usage)
UJF	Labbé	Cyril	Associate Professor UJF	DB, Sensor data management	LIG	AmiLab1 expert for Sci2 (sensor networks)
UJF	Lalanda	Philippe	Professor UJF	Middleware, services and software architectures	LIG	AmiLab1 expert for Sci3 (middleware)
UJF	Mandran	Nadine	Ing. CNRS	Sociology, statistics Experimental methods,	LIG	AmiLab1 expert for Sci7 (societal impact, usage)
UJF	Negre	Amaury	Ing. CNRS	Robotics	LIG	AmiLab1 hardware operation
UJF	Nigay	Laurence	Professor UJF, Head of IIHM group	HCI, multimodal interaction, interaction techniques for mobile devices	LIG	Sci6 (Human-System interaction) WG co-leader
UJF	Ortega	Mickael	Ing. CNRS	HCI	LIG	AmiLab1 software operation
UJF	Reignier	Patrick	Associate Professor UJF	AI, context-aware computing	LIG	Sci5 (Context-aware intelligent systems & services) WG co-leader, AmiLab1 expert for Sci5
UJF	Rousset	Marie-Christine	Professor UJF	AI, Logic based mediation	LIG	AmiLab1 expert for Sci5 (context-aware intell. systems and services)
UJF	Vacher	Michel	IR CNRS	Analysis of Sonic and multimodal sources	LIG	AmiLab1 expert for Sci1 (sensors, …)

Partner	Surname	First name	Position	Domain	Lab	Contribution
Univ.	Bezzazi	El	Associate	Law	CERAPS	Sci7 (societal impact, usage, measures

Lille II		Hassan	Professor Lille II			for Quality of Life) - Interactions between Law & Informatics, content for Coordination Facility SHS repository
Univ. Lille II	Lavenue	Jean-Jacques	Professor Lille II	Law	CERAPS	Sci7 (societal impact, usage, measures for Quality of Life) WG co-leader, Interactions between Law & Informatics, content for Coordination Facility SHS repository
Univ. Lille II	Beauvais	Grégory	Post-doc	Law	CERAPS	Legal maintenance for Coordination Facility SHS repository

Partner	Surname	First name	Position	Domain	Lab	Contribution
Univ. Nice Sophia Antipolis (UNS)	Riveill	Michel	Professor UNS	Service Oriented-Architecture	I3S	AmiLab5 (Smart Buildings) co-leader, Coordination Facility: Training and Education WG co-leader
Univ. Nice Sophia Antipolis	Tigli	Jean-Yves	Associate Professor UNS	Service Oriented-Architecture	I3S	Sci3 (Middleware) WG co-leader

Partner	Surname	First name	Position	Domain	Lab	Contribution
Université de Technologie de Troyes (UTT)	Gauducheau	Nadia	Associate Professor UTT	Emotional dimensions of usability and user experience	ICD	Member of Sci7 WG, member of the SHS capitalization WG, human-centered assesment of systems
Université de Technologie de Troyes (UTT)	Salembier	Pascal	Professor UTT	Cooperative systems, Sociocognitive impact, Usage, Assessment of efficiency, quality of life and User experience.	ICD	Coordination Facility: SHS Capitalization WG co-leader, Sci6 (Human-system interaction) WG co-leader, Sci7 (Societal impact, usage, measures for Quality of Life) WG co-leader
Université de Technologie de Troyes (UTT)	Seffah	Ahmed	Professor UTT	Usability assesment, Human-Computer interaction	ICD	Member of Sci6 and Sci7 WG, member of the SHS capitalization WG, human-centered assesment of systems

Partner	Surname	First name	Position	Domain	Org (Lab)	Contribution
Toulouse I et II	Casula	Marina	Associate Professor Toulouse I	Social usability and acceptability	MSHST (LEREPS)	AmiLab2 Smart HealthCare & HomeCare) expert for Sci7 (Societal impact, usage, measures for Quality of Life)
Toulouse I et II	Jouve	Bertrand	Associate Professor Toulouse II	Social usability and acceptability, modeling	MSHST	AmiLab2 expert for Sci7
Toulouse I et II	Marquié	Jean-Claude	DR CNRS	HCI, social usability and acceptability	MSHST (CLLE)	AmiLab2 expert for Sci7, AmiLab2 expert for Sci6 (Human-system interaction)
Toulouse I et II	Munoz-Sastre	Marie-Thérèse	Professor Toulouse II	Social usability and acceptability	MSHST (OCTOGONE)	AmiLab2 expert for Sci7
Toulouse I et II	Rouyer	Alice	Associate Professor	Social usability and	MSHST (LISST)	Coordination Facility: SHS Capitalization WG

			Toulouse II	acceptability		co-leader, AmiLab2 expert for Sci7
Toulouse I et II	Vautier	Claude	Associate Professor Toulouse I	Social usability and acceptability	MSHST (LEREPS)	AmiLab2 expert for Sci7

Partner	Surname	First name	Position	Domain	Lab	Contribution
Toulouse III (UPS)	Bastide	Rémi	Professor UPS	Human-System Interaction e-health systems	IRIT	Coordination Facility: Communication & Dissemination WG co-leader, AmiLab2 (Smart HealthCare and HomeCare) expert for Sci6 (Human-System Interaction)
Toulouse III (UPS)	Bruel	Jean-Michel	Professor UPS	Middleware, Model Driven Engineering	IRIT	AmiLab2 expert for Sci3 (middleware)
Toulouse III (UPS)	Camps	Valérie	Associate Professor UPS	Multi-Agent Systems, Profiling, Context	IRIT	Sci5 (context-aware intelligent systems and services) WG co-leader
Toulouse III (UPS)	Jouffrais	Christophe	CR CNRS	Human-system interaction	IRIT	AmiLab2 expert for Sci6 (Human-system interaction)
Toulouse III (UPS)	Gleizes	Marie-Pierre	Professor UPS	AI, Multi-Agent Systems, self-organizing systems	IRIT	AmiLab2 (Smart HealthCare and HomeCare) co-leader
Toulouse III (UPS)	Peyrard	Fabice	Associate Professor HDR UPS	Wireless Network	IRIT	AmiLab2 expert for Sci2 (sensor networks)
Toulouse III (UPS)	Pinquier	Julien	Associate Professor UPS	Audio vidéo	IRIT	AmiLab2 expert for Sci4 (perception, action and robotics)
Toulouse III (UPS)	Vigouroux	Nadine	CR CNRS	Human-system interaction	IRIT	AmiLab2 expert for Sci7 (societal impact, usage)

- *Enterprises*

Partner	Surname	First name	Position	Domain	Company	Contribution
ALTRAN	Mehand	Guiddir	Chief Technology Officer	Networks	ALTRAN	Participation in AmiLab 4.

Partner	Surname	First name	Position	Domain	Organization	Contribution
Centre e-santé	Decq	Anne	Executive Manager	Hospital Director	Centre e-Santé	AmiLab2 (Smart HealthCare & HomeCare) *In vitro* and *in vivo* experimentations and evaluations
Centre e-santé	Numez	Yorly	Project manager	Computing engineer	Centre e-Santé	AmiLab2 Smart HealthCare & HomeCare –*In vitro* and *in vivo* experimentations and evaluations

Partner	Surname	First name	Position	Domain	Organization or company	Contribution
ICR	Canal	Pierre	Project manager CIO	Information Technology, Computer engineer	Institut Claudius Regaud	Healthcare: clinical experimentations
ICR	Delord	Jean Pierre	Medical Oncologist	Oncology	Institut Claudius Regaud	Clinical Research
ICR	Courbon	Frédéric	Medical	Nuclear	Institut Claudius Regaud	Imaging

			doctor: nuclear medicine	Medicine		

Partner	Surname	First name	Position	Domain	Organization	Contribution
MEDES	Bareille	Marie-Pierre	Coordinator of clinical trials	Clinical trials	MEDES	AmiLab2 evaluations protocols
MEDES	Denat	Géraldine	Contract Officer	Legal affairs	MEDES	AmiLab2 Legal support for clinical trials and e-Health and Homecare evaluations
MEDES	Baillet	Dominique	Technician	Installations	MEDES	AmiLab2 Installations, maintenance...

Partner	Surname	First name	Position	Domain	Organization	Contribution
MEDETIC	Deroussent	Claude	Founder and president of MEDETIC	Physician, geriatrician	MEDETIC	Amilab 5 expert for Sci 7 (Societal impact, usages)
MEDETIC	Boulanger	Juliette	Research Engineer	Ergonomist, Social Psychology	MEDETIC	AmiLab5 expert for Sci6 (Human system interaction)

Partner	Surname	First name	Position	Domain	Company	Contribution
Pole Star SA	Jean Baptiste	Prost	Directeur technique	Localisation Indoor/outdoor	Pole Star SA	Systems Interfaces and applications
Pole Star SA	Baptiste	Godefroy	Responsible Dpt Innovation	Localisation Indoor/Outdoor	Pole Star SA	Indoor localisation solutions Evolution
Pole Star SA	Stéphane	Michaux	Support client	Localisation Indoor/outdoor	Pole Star SA	Implementation of localisation inside buildings

5.2.5 AFFILIATES

The AmiQual affiliates currently include a mix of industrials and academics, geographically distributed, with complementary domains of expertise:

- Artal Technologies – PME Toulouse – Software development
- Auvea Ingénierie – PME Toulouse – Internet service provider
- DiotaSoft – PME Paris – Technical solutions for mobile application.
- EDF Direction Générale de la Recherche, Clamart – Public enterprise – Comfort and Energy.
- Fondaterra Fondation Européenne pour des Territoires Durables – Fondation Partenariale de l'Université de Versailles Saint-Quentin-en-Yvelines et des groupes industriels EDF, GDF-Suez et Vinci – Environmental sustainability.
- France-Telecom R&D – Meylan - Telecommunication
- H2AD – PME St-Etienne– Homecare, distant homecare teleassistance and telediagnosis.
- Institut des Mathématiques de Toulouse (IMT) – UMR 5219 – Mathematics, statistics.
- INTESENS - PME Toulouse - multi-sensor technologies, energy consumption diagnosis.
- KAYENTIS – PME Toulouse - Publisher and operator of digital pen and smart paper solutions for the healthcare industry
- Magellium - PME Toulouse - Signal and image processing, geomatics, learning technologies, robotics and intelligent systems.

- MHComm SAS - PME Toulouse - Mobile telecommunications expert and an IT solutions integrator
- PICOM-Pôle de Compétitivité Industrie-Commerce – Lille - Commerce
- SADIR - association Toulouse – Homecare, technico-medical assistance at home.
- Schneider Electric - entreprise Grenoble – Comfort and Energy.
- Spikenet Technology Sarl – PME Toulouse - Image processing, image recognition application..
- Université Pierre Mendès France, SFR Innovacs – PRES Grenoble.
- Upetec – PME Toulouse – Multi-agent systems, self-adaptive systems.
- Voxler SAS – PME Paris– Technical solutions for vocal interaction.

The formal letters and motivations of these affiliates for AmiQual are presented in Section 7.6

6. Financial Assessment of the Project

This section provides breakdown and explanations for the costs for the coordination facility and the five AmiLabs. Because of the limitation of 10 Megabytes submissions to the ANR EquipEx web server, it is not possible to upload the price quotations (devis) received for equipement and services listed below. Price Quotations (Devis) have been compiled into single large .pdf file and placed on a web server. This file may be obtained from:

http://www-prima.inrialpes.fr/Prima/Homepages/jlc/amiqual/Devis/

6.1.1 Coordination Facility

The coordination facility will provide support for documenting, sharing and deployoing technologies (ICT Capitalisation), documenting legal, ethical guidelines and experimental results and methods (SHS Capitalisation), Resources for Training and Formation, Services and oversight of commercial exploitation, and communication services. In addition, the coordinator will manage travel costs related to both the deployment and operation of the equipement. Costs for these activities are listed in the following tables

Phase 1 costs for Coordination Facility

Activity	Description	Requested From ANR
ICT Capitalisation Equipement	Table CF1.1	693 000
ICT Capitalisation Personnel	Table CF1.2	116 760
SHS Capitalisation Equipement	Table CF2.1	146 900
SHS Capitalisation Personnel	Table CF2.2	226 008
Training and Formation and Communications equipement	Table CF3.1	4 000
Training and Formation and Communications equipement	Table CF3.2	120 840
Project Meetings and Travel Expenses	Table CF4.1	193 200
	Total	1 500 708

The following summarises the costs for the Coordination Facility during Phase 2.

Activity	Description	Requested From ANR
ICT Capitalisation	Table CF1.3	470 000 (€)

SHS Capitalisation	Table CF2.2	4 000 (€)
Communications, Training and Formation	Table CF3.3	4 000 (€)
Project Meetings and Travel Expenses	Table CF6	162 000 (€)
	Total	640 000 (€)

- *ICT Capitalisation*

Constructing the AmiLabs will require integrative research using rapidly evolving technologies. The ICT capitalisation activity will make this integration more efficient and more effective by providing an on-line technology repository for software, components and systems. A key component of the technology repository will be an open Source Forge, where engineers and researchers from the AmiLabs can share software systems. The source forge will be accompanied by wiki system that allows AmiLab researchers to pool information about systems and services, and to share information about common problems and solution. This wiki will be used to contruct an online technology catalog describing products and services that have proven useful, and providing information about suppliers and costs.

The ICT Capitalisation will also provide services for fabricating prototypes of 3D devices with embedded sensing, actuation and interaction, as well as the means to provide precise calibation and characterisation of sensing devices. The Fab-Lab, will employ a 3D printer to construct 3D prototypes from Computer Aided Designs. Device characterisation and calibration instruments and be used to identify the imperfections of a measurement like biais, drift, noise level, and to enable corrections or compensation.

Table CF1.1 Phase 1 Costs for equipement for ICT Capitalisation requested from ANR EquipEx Program.

Item	**function**	**Location**	**Description**	**Cost (€)**
Web Server Software	Technology Repository Wiki, Catalog and Source Forge	Montbonnot	Devis IG Technology	32 000 (€)
Web Server Computers	Technology Repository Wiki, Catalog and Source Forge	Montbonnot	2 x 5000	10 000 (€)
Climate Control System	Precision temperature and humidity for device measurements	CEA LETI-TAC		51 000 (€)
3 Axes Table for Climate Control System	Precise movements for measurements	CEA LETI-TAC		168 000 (€)
Motion Measurement System	Device characterisation	CEA LETI-FabLab		172 000 (€)
3D Printer	Fabricate Metal and plastic prototypes in 3d	CEA LETI-FabLab	Phenix Systems	215 000 (€)
CAD Design Tool	Prototype Design	CEA LETI	AMC	45 000 (€)
			Total	693 000(€)

Personnel Cost

The following provides details on the CDD engineers charged with constructing the ICT capitalisation activity. To the extent possible, engineers will be shared between different posts. For example, the same person my allocate 6 mm per year for the ICT web server, 3 mm per year for SHS web server and 3 mm per year for the communications web servier.

Table CF 1.2. ICT Repository manpower breakdown for salaries of personnel requested from the ANR for Phase 1.

Function	Desrcription	Salary/mo	months	total (€)
CDD Engineer	Web server Maintenance and Content management	3892	24	93 408 (€)
CDD Engineer	Installation of Equipement at CEA	3892	6	23 352 (€)
			Total	116 760 (€)

Table CF1.3 Phase 2 Costs for ICT Capitalisation requested from ANR EquipEx Program.

Item	**Function**	**Location**	**Cost (€)**
Training	Train engineers and students on use of CAO, new sensors, etc	Montbonnot	10 000 (€)
Replacement of Web Server Computers	Source Forge, wiki, component catalog	Montbonnot	10 000 (€)
Maintenance for Sensor Characterisation Systems	Device characterisation	CEA LETI (Grenoble)	300 000 (€)
Supplies for Fab Lab	Prototype Fabrication	CEA LETI (Grenoble)	150 000 (€)
		Total	470 000 (€)

Table CF1.4 ICT Repository manpower provided by partners during phase 2.

Function	Desrcription	Salary/mo	months	total (€)
Engineer CNRS	Web server installation and Maintenance	3892	15	58 380 (€)
Engineer CEA	Equipment maintenance	8093	10	80 930 (€)
			Total	116 760 (€)

- *SHS Capitalisation*

The Social and Human Sciences activity will provide support for user centered experiments using the AmiLabs. This will include a web server providing access to experimental methods and best practices, data from experiments, Ethical guidelines for experiments, and legal guidelines for experiments, as well as a collection of instruments maintained at UTT and made available to the AmiLabs for Human center experiments.

Constructing the SHS activity requires installation of a web server, computing support for construction of the construction of the legal guidelines data based, and a collection of equipement to be used for experiments with human centered services. This equipement will be available for use by the AmiLabs.

Table CF2.1 Equipment for SHS capitalisation

Details	Component function	Location	Manufacture	Cost (€)
Web Server plus replacement	SHS Data repository, Experimental guidelines, Legal guidelines, ethical guidelines, best practices WIKI	Montbonnot	HP, DELL	8 000 (€)
Computer for Legal Repository Composition	Computer Workstations	Lille	HP, DELL	8 000 (€)
Multi-channels recording/editing digital video systems	Digital video editing	Troyes (ICD)	AMC	8 000 (€)
PC/Linux servers	Computing facilities	Troyes	Dell	15 000 (€)
Mobile eye-trackers	Mobile eye tracker for capturing automatic, low-level natural user behavior	Troyes	Tobii	70 000 (€)
Observer XT software system	Collecting and editing rich behavioral data for the assesment of ambient intelligence appliances	Troyes	Noldus	25 000 (€)
GPS tracking systems	Tracking of mobile behavioral data	Troyes	AMC	2 800 (€)
Glass-cameras	Subjective view recording	Troyes	AMC	0 600 (€)
Video sensors	Behavioral tracking	Troyes	AMC	1 000 (€)
Digital camera	Mobile Behavioral tracking	Troyes		2 800 (€)
Hard-disks	Storage units	Troyes		4 200 (€)
LCD displays		Troyes		1 500 (€)
			Total	146 900 (€)

Salary costs required for the construction of equipement to support SHS capitalisation are shown in CF2.2.

Table CF2.2 SHS Repository manpower breakdown

Function	Desrcription	Salary/mo	months	total (€)
CDD Engineer	Web server Maintenance and Content management	3892	12	46 704(€)
CDD Engineer	Support for preparation of Legal Guidelines	3892	42	163 464(€)
CDD Engineer	Support for SHS Equipement	5280	3	15 840(€)
			Total	226 008(€)

The web server will be replaced during phase 2.

Table CF2.3 SHS Capitalisation web server replacement in Phase 2.

Details	Component function	Location	Manufacture	Cost (€)
Web Server plus replacement	Communications server	Montbonnot	HP, DELL	4 000 (€)

- *Communications and Dissemination.*

In addition to the web servers for ICT capitalisation and SHS capitalisation, the coordination facility wil run a web server specifically for communications with potential clients about the AmiLabs and communications within the AmiLabs. This web server will be set up an maintained by the same engineer responsible for the ICT and SHS web server.

The communications activity will also retain the services of a specialist in communications who will provide content for this web site, as well as prepare information brochures, pamphlets, and press releases about the AmiLabs and their exploits.

Table CF 3.1 Table CF Equipement for Communications and Dissemination in Phase 1

Details	Component function	Location	Manufacture	Cost (€)
Web Server plus replacement	Communications server	Montbonnot	HP, DELL	4 000 (€)

Table CF 3.2 Manpower for Communicaitons and Dissemination in Phase 1

Function	Desrcription	Salary/mo	months	total (€)
CDD Engineer	Web server Maintenance and Content management	3892	12	46 704 (€)
CDD Communications Specialist (half-time)	Maintain contents for communications web server, prepare brochures and press releases.	3089	24	74 136 (€)
			Total	120 840 (€)

The web server will be replaced during phase 2.

Table CF 3.3 Replacement of Communications web server in Phase 2.

Details	Component function	Location	Manufacture	Cost (€)
Web Server plus replacement	Communications server	Montbonnot	HP, DELL	4 000 (€)

- *Training and Formation*

Technology for teaching is developed as part of the Classroom of the future detailed in the budget of AmiLab 1.

The training and formation activity of the coordination facility will be primarily carried out by academic personnel of partners. This activity will be supported by a web repository for training material and courseware, constructed and maintained as part of the communications CF web server, by education workshops organised as part of the travel budget listed below, and as technology training for engineers and end users included in the ICT technology repository. Thus no additional funds are requested for this activity.

- *Project Meetings and Travel Expenses.*

To minimize travel time and cost, full use of audio and video conferencing will be made. In addition, the consortium will organise the following physical meetings:

- One Kick-off meeting and a General Assembly (GA) each year located in Paris at a suitable central location for all partners. This meeting will be attended by members of the Executive Committee. The Scientific Board and/or the Government Board will be invited to join specific sessions.
- Interim technical meetings will be held as required for the construction of the AmiLabs and of the Coordination Facility. Six meetings are planned in Year 1 at various partner sites, followed by one meeting per year in conjunction with the ICT and SHS capitalization working groups.
- The ICT and SHS capitalization working groups will meet yearly, organizing a three-day workshop every year.
- The Training and Education, the Commercial exploitation, and the Communication & Dissemination working groups will meet once a year for a one-day meeting.

Whenever possible, these physical meetings will be organised together at the same time and site to minimize travel costs.

Phase 1 Meetings and travel costs

Function	Number Trips	Average Cost	Total
Verification of AmiLabs, Coordiantion (2 persons x 2 trips x 4 amilabs x 4 years)	64	600	38400
Meetings and Workshops (5 Teams x 4 people x 2 meetings/year x 4 years	160	700	112000
Working Meetings (5 groups x 2 meetings x 4 years)	40	600	24000
Scientific Presentations (2 amilab x 5 amilabs x 4)	40	700	28000
Presentations at Workshops, Salons, etc	20	700	14000
Documentation of IP, Meeting with Industries	8	600	4800
		Total	193200

Phase 2 Meetings and travel costs are as follows.

Verification of AmiLabs, Coordiantion (2 persons x 2 trips x 4 amilabs x 5 years)	80	600	48000
Meetings and Workshops (5 Teams x 4 people x 1 meetings/year x 5 years	100	700	70000
Working Meetings (5 groups x 1 meetings x 5 years)	40	600	24000
Scientific Presentations (2 amilab x 5 amilabs x 4)	25	700	17500
Presentations at Workshops, Salons, etc	20	700	14000
Documentation of IP, Meeting with Industries	10	600	6000
		Total	162000

6.1.2 AmiLab 1. Smart Habitats

Phase 1. Construction of the Equipment.

Construction of AmiLab 1 will require restructuring and installation of equipement in the Ground Floor of the ENSIMAG Montbonnot building, as well as installation of equipement in the TempoLogis Apartments and the PREDIS and LIG-Domus satellite facilities. The following table summarizes these installations and associated costs. Equipement costs are detailed in 14 tables located below. Each table is accompanied by an explanation.

Table A1 - Construction Costs of Amilab 1.

Details	Component function	Location	Origin	Cost (€)
Project Engineer	Management of acquisition, installation and integration of equipement	ENSIMAG Building	CDD	186 000 (€)
Software Engineer	Integration of networks, middleware, components	ENSIMAG Building	CDD	148000 (€)
Software Engineer	Integration of context aware services and interaction devices	ENSIMAG Building	CDD	148000 (€)
Workstations	Computing support	ENSIMAG Building	Marché CNRS	20 000 (€)
Construction	Construction Work on ENSIMAG Building	ENSIMAG Building	Marché CNRS	250 000 (€)
Table A1.1	Rental cost of Living Lab Apartments	TempoLogis Building	Long-Term Lease	248 520 (€)
Table A1.2	Environmental Comfort Measurement and modeling	ENSIMAG Building, Tempologis, PREDIS	Commercial products, Professional Installation	152 000 (€)
Table A1.3	Energy usage Measurement	ENSIMAG Building, Tempologis	Commercial products, Professional Installation	101 000 (€)
Table A1.4	Network Infrastructure	ENSIMAG Building, Tempologis	Commercial products, Professional Installation	28 000 (€)
Table A1.5	Building Automation and actuators for Integrated Comfort Control	ENSIMAG Building	Commercial products, Professional Installation	44 500 (€)
Table A1.6	Human Activity observation sensors (Blue-Eye Video)	ENSIMAG Building, Tempologis	Commercial products, Professional Installation	51 200 (€)
Table A1.7	Human Activity observation sensors	ENSIMAG Building, Tempologis, PREDIS	Constructed from Components	60 004 (€)
Table A1.8	Human Interaction devices and software tools	ENSIMAG Buildings, Tempologis	Commercial products, Professional Installation	123 000 (€)
Table A1.9	Human Interaction devices and software tools (HiLabs)	ENSIMAG Building, Tempologis	To be constructed from Components	166 000 (€)
Table A1.10	Acoustic Sensors, microphones	ENSIMAG Building, Tempologis, Domus	To be constructed from Components	80 000 (€)
Table A1.11	Service Robots	ENSIMAG Building	Commercial Products	212 000 (€)
Table A1.12	Control Room for Experiments	ENSIMAG Building	Commercial products, Professional Installation	50 000 (€)
Table A1.13	Creativity Lab	ENSIMAG Building	Off the shelf	75 000 (€)
Table A1.14	Classroom of the Future	ENSIMAG Building	Commercial products, Professional Installation	275 000 (€)
Table A1.15	Speech Recognition System	ENSIMAG Building, Tempologis Apartment	Commercial product	80 000 (€)
			Total	2 498 224 (€)

Personnel Reguired for Construction of the AmiLab1

AmiLab 1 will constructed by a team Contract (CDD) engineers and permenant (Sur Poste) engineers working under the direction of a chief engineer. Component Design, integration architecture and technical expertise will be provided by research staff from the UMR LIG (Laboratoire INformatique de Grenoble), G2ELab, GSCOP, INRIA Grenoble Rhone-Alpes Research center. A local working group of academic researchers will be formed for each of the layers in the AmiLab technology stack (Sci1 to Sci8). The names of the most prominent senior researchers leading these working groups are provided in section 5.

The following are the roles and effort to be provided by the engineering staff committed to the project so far. Requests for additional engineering support will be made to CNRS, INRIA and the Universities as opportunities and needs arise.

Role	Job Description	Salary	Months	Cost	Provided By
Chief Engineer	Engineering Team Leader	4437	48	212976	LIG CNRS Staff
Project Engineer	Systems Integration	3089	48	148272	ANR AmiQual
Software Engineer	Sensors, actuators and Networks	3089	48	148272	ANR AmiQual
Software Engineer	Middleware and service integration	3089	48	148272	ANR AmiQual
Project Engineer	Robotics systems, actuators, Sensor Systems	3088	24	74112	LIG CNRS Staff
Project Engineer	HCI Systems	3088	24	74112	LIG CNRS Staff
Project Engineer	Creativity Lab	3088	24	74112	LIG CNRS Staff
Project Engineer	SHS Experiments	3088	12	37056	LIG CNRS Staff
Project Engineer	Acoustic Perception	3088	12	37056	LIG CNRS Staff
Project Engineer	Classroom of the future	3089	24	74136	ENSIMAG Staff
Project Engineer	Building Management Systems	3542	12	42504	ENSIMAG Staff
Project Engineer	Data Logging System / experimental support	3089	48	148272	UJF Staff
Project Engineer	Tempologis Systems Maintenance	3089	48	148272	UJF Staff
Project Engineer	Robotics Systems	3539	48	169872	INRIA Staff
Project Engineer	Sensor Networks	4771	12	57252	INRIA Staff
	Total Personnel for Phase 1 AmiLab 1		480	1 594 548	

Table A1.1 Describes the costs associated with renting a floor of unfurnished apartments in the TempoLogis building to be used as living labs by participating Masters and Doctoral students, as well as a separate furnished apartment on a separate floor to be used for as an experimental platform for services with the seniors club. These costs assume that the rental period would start during the second year of the contract (to avoid wastage during the specification phase) and cover only the phase 1 period (years 2 through 4). Rental of the furnished T2 would begin during year 4 of the contract.

Experiments will require embedding sensors and actuators within kitchen appliances and furniture. Thus a budget is set aside specifically to purchase and modify common appliances for use in experiments.

Table A1.1				Rental of TempoLogis Aparments
Type	Number	Rent+Charges/month	Months	**Cost (€)**
Unfurnished T1	2	380	36	27 360 €
Unfurnished T2	2	540	36	38 880 €
Unfurnished T3	2	730	36	52 560 €
Furnished T2	1	810	12	9 720 €
		Furniture + Kitchen Equipement		120 000 €
			Total	248 520 €

An extensive suite of sensors for measuring the complete environmental state would be installed in the ENSIMAG building during the first year of the project. This system would include building a TCP/IP and HTTP interface to the existing SEIMENS building management system, as well as installing sensors for temperature, humity, air flow, carbon dioxide, illumination intensity and ambient noise through-out the building, including within the heating, cooling and ventellition systems. Additional sensors would be installed within an interior courtyard to measure ambient environmental conditions. These sensors would be used during the second year of the project to establish a complete base-line model for energy flow and environmental conditions in the interior environement of the building over the course of a year.

Table A 1.2	Environmental Comfort Measurement and Modeling	
Component function	**Origin**	**Cost (€)**
Capteur Comfort Energie	Regeltechnik, Radioteck Ecosense, Watteco	15 000€
Comptage Energie	Schneider, ITRON, Watteco	10 000€
Environnement meteo	ITRON, Electronica	5 000€
Systeme de Collecte Signal	RadioTech, Schneider, ATIM	10 000€
Modification de l'Interface BMS	Seimens	25 000€
2 serveurs	Processeur Intel Xeon Quad-Core Nehalem 5506 2.13Ghz 4Mo de Cache 2 X Disque dur 146Go SAS Mémoire 8	12 000€
Installation ENSIMAG Building (Electricien)	Appel d'Offre	25 000€
Installation in Heating/Cooling System ENSIMAG Building	Public Bid (Marché)	25 000€
Installation Tempologis	Public Bid (Marché)	25 000€
	Total	152 000€

The environmental comfort measurement system will be complemented a network of devices for measuring the use of electrical power. A smart meter device, such as sold by Watteco, will be mounted on the circuit-breaker rack to monitor the power consommation on each electrical circuit. Such devices will installed in the ground floor of the ENSIMAG building and in the PREDIS satellite during the first year. As the Tempologis apartments become available, similar devices will be installed in each apartment. These devices will be used to monitor human activity from electrical device usage, and to provide real time feedback to building occupants about power consomption. The installtion in the tempologis apartments will also provide input for social networking services based on informal non-disruptive communication of presence.

Table A1.3	Energy Usage Measurement			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Smart Power Meter and associated interface	Watteco	10 000	10	100 000 (€)
CPL Outlet Monitor	Legrand	50	20	1 000 (€)
			Total	101 000 (€)

A variety of networks will be installed for experiments in sensing and control. These include CPL nodes, zigbee radio nodes, and more conventional wired networks.

Table A1.4	Network Infrastructure			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
CPL Network Nodes	ATIM, Watteco	50	200	10 000 (€)
Zigbee Radio Control Boards	ATIM, Watteco	50	200	10 000 (€)
Ethernet hubs		50	20	1 000 (€)
Cable, Supplies				5 000 (€)
Modem Radio	ATIM, Watteco	200	10	2 000 (€)
			Total	28 000 (€)

The Blue-Eye video BlueTrack system provides a detection and tracking log of the trajectories that people take over a large connected area. The system does not record images, but only trajectories. A continuous log of trajectories will be used to model activity within the ground floor of the ENSIMAG Monbonnot building 24 hours a day and 7 days a week. This system will provide an important benchmark for activity monitoring, that will be completed by electrical activity sensing and other forms of motion detectors.

Table A1.6	Human Activity observation sensors (Blue-Eye Video)			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Visual Sensors	BlueEye Video VCS B-Track	640	30	19 200 (€)
Server	BlueEye Video Btrack Server	15000	1	15 000 (€)
Installation and Maintenance Cost				17 000 (€)
			Total	51 200 (€)

While the Blue-Eye video system has the advantage of being commercially available it has a number of disadvantages. In addition to being a closed commercial system, it relys on proprietary software running on a TI signal processing chip. More importantly the system requires an installation process that require the services of a highly trained engineer, as well as frequent maintenance visits.

INRIA researchers have recently demonstrated an alternative technology based on low-cost camera equipped with a panoramic lenses. This alternative uses correlation of co-observed motion to automatically calibrate the installation parameters for a network of sensors. This installtion will provide an important test for experiments with automatic installation, auto-regulation and self-repair for activity sensors.

Table A1.7	Platform for experiments with Autonomic sensors for Human Activity			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Omnidirectional Visual Sensor	Vstone VS C14U-80-ST	1200	20	24 000 (€)
PTZ Cameras	Sony SNC DM110 - Network camera - color - optical zoom: 3.4 x - 600 TVL - audio - 10/100 - PoE	600	20	12 000 (€)
Computer Server	Dell Pentium	2500	5	12 500 (€)
Infrared Motion Detecetors	legrand	150	50	7 500 (€)
Color Camera	DragonFly 2	550	2	1100 (€)
Video dome	Spytronic	2000	2	4000 (€)
Cables, Installation Brackets				2 900 (€)
			Total	60 000 (€)

Human Computer Interaction is an important fundamental challenge for smart Habitats. An extensive suite of tools for experiments with natural interaction will be installed in the ENSIMAG Montbonnot building as well as the LIG-Domus facility. Some of these devices will be installed in the Tempologis apartments as these become available.

Table A1.8	HCI Interaction Devices			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Tablet Computer	Apple Ipad	700	20	14 000 (€)
Tactile tablet	HTC	600	10	6 000 (€)
Personal Computers	Apple G4	2000	20	40 000 (€)
Eye Tracker				15 000 (€)
PicoProjector		500	4	2 000 (€)
Interactive Table	TinkerTouch	20 000		20 000 (€)
Cameras	Sony PTV	250	4	1 000 (€)
Micrphone Array		20000		20 000 (€)
Stereo Cameras	Point Gray			2 000 (€)
Tablet Computer	Apple Ipad	700	20	14 000 (€)
			Total	123 000 (€)

Large interactive displays designed to support multi-touch interaction in public spaces have recently become available. Such technologies offer a potentially important means of communication between a building and its inhabitants. Such systems can also be used to bring the full power of access to the internet directly into public spaces. The challenge is not simply providing robust interactive hardware, but also to provide content management system.

Large interactive panels will be deployed in public areas of the ENSIMAG building to provide access to information about the state of the building management system, as well as access to information about daily activities. Multitouch large-screen interactive systems will be deployed in the different workshops of the ENSIMAG building as well as in each of the TempoLogis apartments to provide access to local comfort management systems, as well as informal communication media and the internet.

Table A1.9	Interactive Surfaces and Content Management system.			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Surface Interactives	UbiCity Hilabs	12500	10	125 000 (€)
Equipement Installation	UbiCity Hilabs			2 000 (€)
Content Management Systems	HiLabs			6 000 (€)
Assistance	HiLabs			7 000 (€)
Installation	HiLabs			6 000 (€)
Service and Maintanance	HiLabs			20 000 (€)
			Total	166 000 (€)

Acoustic perception is an important source of information about human activity. The ENSIMAG building and the Domus facility will be equipped with systems to capture and analyse ambient sounds. Events recognized by these systems will be integrated into the activity models of the building.

Table A1.10	Acoustic Sensors, microphones, signal analysers			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Multichannel Signal processor		15	3	45 000 (€)
Soundcard	RME HDSP 9652	479	4	1916
Amplifier	Behringer ADA8000 Ultragain Pro-8	198	10	1980
Snake 6-Way	SSSnake M6 6-Way Sub Multicore	38	20	760
Snake	SSSnake SK233-1,5 XLR Patch	4	64	256
Workstation		5	3	15 000 (€)
Software Licenses				5 000 (€)
Microphones, cables, etc				5 000 (€)
Typical Noise Sources				5 088 (€)
			Total	80 000 (€)

After many years of research, home service robots are finally reaching the market for a limited number of tasks. However, researchers have long assumed that such robots must operate autonomously, with no help from the environment. This requirement is an important, and often overlooked, barrier to the development of home service robots.

Ambient intelligence provides an means to overcome this barrier. Our view is to see the service robot as a peripheral device embedded within a smart environment. With this view environmental sensing, man-machine interaction, and service behaviours can be provided by devices and sensors in the environment, rather than embedded on the robot. A human centered service can recruite and control a service robot, using information about the state and context of the environment provided by external sensors.

To develop this viewpoint, we will create and equipe a service robots laboratory within the ENSIMAG montbonnot building. This facility will be used by INRIA and LIG researchers, supported by the INRIA AEN PAL (Personal Assistive Robotics) program, as well as masters and doctoral students in the international MoSIG Masters program track: Graphics-Vision-Robotics. Service robots will be interfaced to the environment and used for tests in the ENSIMAG building, the tempologis apartments and the DOMUS facility.

Table A1.11	Service Robots and Home Robot Lab			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Cleaning Robots	iRobot Roomba	600	10	6 000 (€)

Mobile Robots	iRobot Create	200	10	2 000 (€)
Robot Platform	Pioneer 3AT	15000	2	30 000 (€)
Robot Platforms	Pioneer IIIDX	10000	5	50 000 (€)
Robot Platforms	Peoplebot	15000	2	30 000 (€)
Humanoid	Aldabaran Nao	12000	5	60 000 (€)
Computer Workstations	Dell, HP	4000	2	8 000 (€)
Software, licenses	iRobot, Aldabaran	14000	1	14 000 (€)
Electrical Test Equipement		5000		5 000 (€)
Tools		1000		4 000 (€)
Workbenchs, Cabinents, Desk, Chairs				3 000 (€)
			Total	212 000 (€)

An control room will be construted to allow data collection from both In-Vitro and In-Vivo experiments. The control room will be connected to sensors, actuators and robots in various parts of the ENSIMAG Building and TempoLogis Apartments. The facility will allow collection of data from controlled experiments with predefined scenarios, including "Wizard of Oz" experiments where control room personal provide device and service intelligence with alternate behavours. The control room will also allow collection and recording of data from long term activity modeling. Special attention will be paid to the ethical and legal issues related to recording human activity.

Table A1.12	Control Room for Experiments			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Computing Equipment	HP, Dell	4000	5	20 000 (€)
100 Terrabyte Data Storage	Fujitsu, Hitachi Disk Array	10000	2	20 000 (€)
Large LCD Monitors	Sharp, Sony, etc	1000	5	5 000 (€)
Audio Communications	Sure etc	2000	1	2 000 (€)
Desk, Cabinets,	Steel case, etc.	3000	1	3 000 (€)
			Total	50 000 (€)

Researchers and students will be provided with a "Creativity Lab" in which they can rapidly fabricate or repair new devices for sensing and actuation. The Creativity lab will include equipement for testing and repairing electrical and electro-mechanical components, and for fabricating printed circuit boards and simple mechanical components. The Creativity lab will be equipped with a low cost Desk-top 3D printer capable of contructing 3D componts for embedding sensing and actuation. The creativity lab will also include a special sewing maching for use in embedding sensing and actuation with garments and textiles (drapery, decorative tapestry, etc).

Table A1.13	Creativity Lab			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Computing Equipement	HP, Dell,	4000	3	12 000
Electrical Test Equipment	HP			10 000 (€)
3D Printer and Supplies	VFLash 3D Printer or equivalent	15 000	1	15 000 (€)
Sewing Machine	ELNA	5 000	1	5 000 (€)
Milling Machines		10 000	1	10 000 (€)
Metal Working Tools		10 000	1	10 000 (€)
Printed Circuit Board Fabrication Supplies		2 000	1	2 000 (€)
Tools		6 000	1	6 000 (€)
Lab Benchs, Furnature, Desk, Cabinents		5 000		5 000 (€)
			Total	75 000 (€)

An important centerpiece of AmiLab 1 will be a prototype "Classroom of the future". The Classroom of the future facility will be used for demonstration and evaluation of systems and services for education. The classroom will be equipped with multiple interactive large screen displays, panoramic cameras and Pan-Tilt-Zoom cameras for locating and recording of students and teachers, acoustic recording for both the environment and workstations. Student and teacher desks will be equipped with interactive tablet computers. A large 3D monitor will be used for exploration of models and information spaces. The classroom will be connected to both local recording facilities (in the control room) and to classrooms on campus using high-bandwidth network communications.

This facility will serve as a pilot test facility for technologies to be deployed during the reconstruction of the Grenoble campus as part of the Plan Campus. The facility will also be used for experiments in remote teaching in cooperation with AmiLab 4 on the Saclay Campus.

Table A1.14	Classroom of the future			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Interactive Surfaces	UbiCity Hilabs	12500	8	100000 (€)
PTZ Camera	Sony SNC DM110	600	10	6 000 (€)
3D Monitors	Sharp, Hitachi	2000	2	4 000 (€)
Large Flat Panel Monitors	Sharp, Hitachi	1500	8	12 000 (€)
Wireless Acoustic Microphones	32 Channels receiver Plus Microphones	15000	2	30 000 (€)
Tablet Computers	Ipads	700	20	14 000 (€)
Integrated Control System		25000	2	50 000 (€)
Computing Equipement		2000	2	4 000 (€)
High Bandwidth Network Connection Equipement		2500	2	5 000 (€)
100 Terrabyte Data Storage	Fujitsu, Hitachi Disk Array	10000	1	10 000 (€)
Panoramic Cameras	Point Gray LadyBug	10000	4	40 000 (€)
			Total	275 000 (€)

Spoken language interaction in natural environments has made rapid progress in recent years. An important challenge will be deploy, integrate and evaluate such technologies into public and private spaces. Systems for hands-free spoken language interaction will be deployers in a public space (building entrance), office space (robotics workshop) and private space (Tempologis apartment). These systems will be integrated in the integrated infrastructure to allow experiments with competing interactive technologies.

Table A1.15	Spoken Language interaction systems	
Item	**Example Product**	**Total Cost (€)**
Speech Recogntion	Voxler Speech Reco System	80 000 (€)
	Total	80 000 (€)

Phase 2. Operation of the Equipment.

Personnel Reguired for Operation of AmiLab 1

AmiLab1 will be jointly operatede by INRIA Grenoble Rhône Alpes Research Center, Grenoble Univeristy, and the CNRS UMR Laboratories LIG, G2Elab and GSCOP. Technical expertise for experiments will be provided by the academic researcher of INRIA, CNRS and laboratories of Grenoble University. Names of key persons are listed in sectin 5. Operations for AmiLab 1 will require the services of a group of engineers provided by LIG, ENSIMAG, UJF and INRIA. These are listed in the following table.

Role	Job Description	Salary	Months	Cost	Provided By

Chief Engineer	Engineering Team Leader	4437	24	106 488 (€)	LIG CNRS Staff
Project Engineer	Robotics systems, actuators, Sensor Systems	3088	30	92 640 (€)	LIG CNRS Staff
Project Engineer	HCI Systems	3088	30	92 640 (€)	LIG CNRS Staff
Project Engineer	Creativity Lab	3088	30	92 640 (€)	LIG CNRS Staff
Project Engineer	SHS Experiments	3088	15	46 320 (€)	LIG CNRS Staff
Project Engineer	Acoustic Perception	3088	15	46 320 (€)	LIG CNRS Staff
Project Engineer	Classroom of the future	3089	30	92 670 (€)	ENSIMAG Staff
Project Engineer	Building Management Systems	3542	15	53 130 (€)	ENSIMAG Staff
Project Engineer	Data Logging System / experimental support	3089	60	185340 (€)	UJF Staff
Project Engineer	Tempologis Systems Maintenance	3089	60	185 340 (€)	UJF Staff
Project Engineer	Robotics Systems	3539	60	212 340 (€)	INRIA Staff
Project Engineer	Sensor Networks	4771	15	71 565 (€)	INRIA Staff
Total Personnel for Phase 2 AmiLab 1			384	1 277 433 (€)	

Training Costs for Personnel

Training costs for engineering personnel include Training for specialized equipement (3D Printer, Robots, Building Automation system), as well as training in specialized programming languages. Esimated cost is 3000 per year.

Operation of the Equipment for AmiLab 1

The operation costs for AmiLab 1 are summarized by the following table.

Details	Item	Cost (€)
Table A1.16	Operation Costs for AmiLab 1 facility	410 000 (€)
Table A1.17	Rental of Living Labs Apartments	147 600 (€)
Table A1.18	Maintenance of Sensors, Actuators and computing Equipement	200 000 (€)
	Training for Personnel	15 000 (€)
	Total	772 600 (€)

Operation of AmiLab 1 includes rental costs for TempoLogis apartments used as living labs as well as provision of furniture and kitchen equipement used for experiments with embedded sensing and actuatation, laboratory supplies, high-speed internet connections for the TempoLogis and ENSIMAG buildings, and cleaning and building maintenance for the PREDIS and LIG-Domus facilities.

Table A1.16	Operation Costs for AmiLab 1 facility			
Item	**Explanation**	**Cost/year**	**Years**	**Total Cost (€)**
ENSIMAG Building	Utilities, Cleaning, Building Maintenance	25 000	5	125 000 (€)
ENSIMAG Building	Furniture + Kitchen Equipement	10 000	5	50 000 (€)
ENSIMAG Building	Laboratory Supplies	20 000	5	100 000 (€)
Internet Connection	High speed internet for apartments	3 000	5	15 000 (€)
Tempologis Apartments	Clearning, Maintenance, Furniture, Repairs	12 000	5	60 000 (€)
PREDIS	Utilities, Clearning, Building Maintenance	6 000	5	30 000 (€)
LIG-Domus	Utilities, Clearning, Building Maintenance	6 000	5	30 000 (€)
			Total	410 000 (€)

Rental costs for the Tempologis apartments is listed in the following table.

Table A1.17	Rental of Living Labs Apartments			
Type	Number	Rent+Charges/month	Months	Total (€)
Unfurnished T1	2	380	60	22 800 (€)
Unfurnished T2	2	540	60	32 400 (€)
Unfurnished T3	2	730	60	43 800 (€)
Furnished T2	1	810	60	48 600 (€)
			Total	147 600 (€)

Maintenance of the Equipment for AmiLab 1

Maintenance for equipement includes renewal of computers, software, sensors, actuators and interface devices. Because of continued rapid technological progress, computing equipement has a relatively short lifetime. Major releases of versions of software and operating systems are released yearly, generally with backwards compatibility assured only for systems released over the last 2 years. New generations of hardware generally require releases of new software and systems. We anticipate the expected lifetime of most computers, software and interaction devices will be approximately 2.5 years. Thus we expect to replace such devices twice within the operations phase of the equipment.

We also include within this budget the regular replacement of furniture and appliances that have been used for experiments with embedding systems and services in home environments, as well as cleaning and renovation of the Tempologis apartments on a annual basis.

Table A1.18	Maintenance of Computing Equipement, sensors and actuators			
Item	**Explanation**	**Unit Cost**	**Num**	**Total Cost (€)**
ENSIMAG Building	Replacement Computers for labs and workshops (6 computers x 2.5 years per computer)	2 000	15	30 000 (€)
ENSIMAG Building	Software Licenses	1 000	15	15 000 (€)
ENSIMAG Building	Tablet Computers	500	20	10 000 (€)
ENSIMAG Building	Replacement for Sensors, Actuators, communications	1000	5	5 000 (€)
ENSIMAG Building	Maintenance for Service Robots and Sensor	5000	5	25 000 (€)
ENSIMAG Building	Maintenance for Service Robots and Sensor	5000	5	25 000 (€)
Tempologis Apartments	Cleaning, Maintenance, Furniture, Repairs	12 000	5	60 000 (€)
Tempologis Apartments	Replacement for Sensors, Actuators, communications	7 000	5	35 000 (€)
PREDIS	Replacement for Sensors, Actuators, communications	2 000	5	10 000 (€)
LIG-Domus	Replacement for Sensors, Actuators, communications	2 000	5	10 000 (€)
			Total	200 000 (€)

Personnel involved in operating and maintaining the equipement during phase 2 are shown in table A1.19.

6.1.3 AMILAB 2. SMART HEALTHCARE AND HOMECARE

Phase 1. Construction of AmiLab2.

Construction of AmiLab 2 will require restructuring and installation of equipement in several locations in Toulouse:

- Research facilities will be made available for Amiqual by IRIT (usage laboratory, plus two instrumented rooms), LAAS (from 2012, ADREAM building, on-going works), MSHST (intelligent house of Blagnac) and GeronTechnology lab (instrumented rooms in La Grave). These facilities will be used for in vitro experiments for technology evaluation and unitary functional tests.

- The Space Clinic of MEDES will evaluate the impact of technological solutions on humans from semi controlled experiments, adding new equipments in existing rooms;
- Finally equipments will be deployed in several new locations made available by the CHU of Toulouse (Garonne Hospital in Ancely) and by CUC (on-going works on the Cancéropôle); the Centre e-santé will select and instrument patient homes to execute in vivo Homecare scenarios.

The following table summarizes these installations and associated costs. Equipement costs are detailed in 10 tables located below. Each table is accompanied by an explanation.

Table A1 - Construction Costs of Amilab 2.

Details	Component function	Location	Origin	Cost (€)
Table A2.1	Human Activity observation off the shelf	all	Commercial products, Professional Installation	564794
Table A2.2	Human Activity observation-component integration	LAAS	Commercial products to be Integrated	56341
Table A2.3	Human Medical and Biological Parameters	all	Commercial products, Professional Installation	377269
Table A2.4	User Studies off the shelf	MSHST	Commercial products, Professional Installation	203387
Table A2.5	Human System Interaction	IRIT, CHU, CUC, CEES	Commercial products, Professional Installation	347129
Table A2.6	Assisting Robots	LAAS, CHU	Commercial products, Professional Installation	336778
Table A2.7	Computing and Data Collection off the shelf		Commercial products, Professional Installation	450554
Table A2.9	Installation Actuators, Network Infrastructure data	CHU, CEES, CUC	Installation, room	86228

	collection		adaptation…	
Table A2.10	Prototype evaluation	MEDES, LAAS	Commercial products, Professional Installation	191443
Table A2.8	Systems Integration	all	CDD	992052
			Total	3 605 977

Details for every table.

Table A2.1	Human Activity observation off the shelf			
Item	Example product	Quantity	Unit cost	Total cost
Numerical pen NOKIA	Nokia	42	650	27300
Medical sensors system	VIVAGO	1	31965	31965
Medical sensors system	VIVAGO	1	4990	4990
Medical sensors system	VIVAGO	1	3850	3850
Classical Cameras	Lextronic, Point Grey, Axis…	45	1097	49366
3D Cameras	Mesa	3	6285	18855
Embedded cameras	SONY HDR-XR550VE	5	1146	5732
Dome Network camera, Mpeg4	Axis	5	578	2891
video camera HD, Steadyshot, HDR		6	1253	7520
Light sensor		67	39	2948
Light sensor (Luxmètre T545 TESTO)		7	118	826,00
Temperature sensor		35	44	1540
Temperature sensor Fluke 63 et malette		5	225	1125
Noise sensor		37	12	461
Bio-feedback sensor (maquette)		1	914	914
Presence sensor	phidget	135	20	2754
RFID formation		2	715	1430

Simulation table of RFID	Société Rfidées Grenoble	1	30000	30000
RFID Tags+ programmer	Lextronic, CAEN (passive tags, omni antenna)	4	2500	12108
Tags		11	380	4180
Mobile reader Pocket Inventory Durci HF Pocket Tracer Durci HF		14	2141	29974
Tags reader lecteur Prx'N'Roll Emulation		134	164	22012
tags reader MEDIO RXU 500		54	2071	111834
Spatial location to detect patient attiture (lying down, sitting, standing)		75	88	6579
Capture movment		1	23988	23988
Movement	phidget	75	36	2735
Indoor localization 1 (academic setup)	Ubisense	4	13000	52000
Network material		4	2105	8420
Indoor localization 1 (in vivo)		1	8361	55694
network material		5	2105	10525
WiFi and GPS localization	Pole Star	1	8361	8361
GPS RTK for evaluation for outdoor scenarios	NavonTime	4	5150	20600
6-axis accelerometer		5	89	445
I/O board PhidgetSBC		1	203	203
50 RFID Bracket		4	105	418
Wireless Sensor Network Ultra Low Power		3	84	251
Total				564 794

Table A2.1 concerns off-the-shelf equipments that will be mainly fixed in the environment: from elementary communicating sensors (light, temperature, noise, presence sensors, IMU…) to more sophisticated ones (cameras). Concerning cameras, it is intended to test different providers (Point Grey, Axis, Lectronix…) from low cost to higher ones, different modalities (fixed, PTZ, omni…).

For the scenario 5 involving navigation of disabled persons in a urban environment, it is intended to do some investigations on the person localization using several modalities (vision, low-cost GPS, IMU…); several RTK GPS (low cost devices provided by the start-up NAVONTIME) will be used only for the evaluation of the proposed solutions

Pole Star as a provider, will install its localization system (based both on Wifi for indoor and GPS for outdoor) in several building; the announced cost concerns the feasibility evaluation, the potential extension of the Wifi network, and the learning step. Pole Star as a partner will make available free NAO Campus licences for the other partners.

Table 2.2	Human Activity observation: component integration			
Item	Example product	Quantity	Unit cost	Total cost
32 Microphones		1	17957	17957
Acquisition unit		1	38384	38384
Total				56341

Table A2.2 concerns components that will be integrated in a new audio sensor, that will do source detection, localization, extraction and identification. An on-going project (ANR BINAAHR project) concerns only the development of a binaural audio sensor: for Amiqual it is intended to integrate an array of microphones and to deploy this array in a room, first at LAAS, then if good results are obtained, in a care facility.

Table 2.3	Human Medical and Biological Parameters Observation			
Item	Example product	Quantity	Unit cost	Total cost
Watch e-health and EZ430-RF2560 Bluetooth Evaluation To		38	150	5700
Force sensor		2	71	141
Voltage Divider		2	5	11
Interlink Electronics 1.5" Square FSR		2	7	14
Vibration sensor		8	42	334
Electronical Bracket		35	42	1463
Heart rythm		1	90000	90000
electrodes		30	10	294
Holter glycémie sensor		50	1460	73000
2 actimeters with application software	ACTIWATCH	6	1799	10796
Système VIVAGO		1	36700	36700
Bathroom scales		34	115	3923
125 Bathroom scales (Bluetooth) + 113		1	42234	42234

tensiomètres				
Pills boxes		66	47	3109
100 Saturometre		38	300	11400
impedancemetre		38	1337	50804
glucometre		50	79	3950
36 Spyrometer		1	3596	3596
Chest trap		3	245	734
Actimeters		120	326	39130
Total				377357

Table A2.3 concerns communicating sensors worn by patients, devoted to the measurement of biological and physiological parameters; several sensors will be evaluated for identical functions and for different diseases.

Table A2.4	User Studies off the shelf			
Item	Example product	Quantity	Unit cost	Total cost
trépied vanguard MK2 noir	vanguard MK2 noi	5	33	167
Panasonic HDC-HS60 Noir + Kit Accessoires+ assurance 2ans	Panasonic HDC-HS60 Noir	4	710	2839
dictaphone numérique Olympus VN-5500 PC	Olympus VN-5500 PC	18	49	888
Vidéoprojecteur Dell 7609wu	Dell 7609wu	5	2999	14996
Caméra SONY Z7 HDV	SONY Z7 HDV	2	5529	11058
data analysis: SPSS Categories	SPSS Statistic Base	5	674	3370
data analysis: SPSS Categories	SPSS Categories	5	496	2480
data analysis:SPSS Forecasting	SPSS Forecasting	5	596	2980
data analysis: LEXICO 3 (licence forfaitaire 5 postes)	LEXICO 3 (licence forfaitaire 5 postes)	10	120	1200
data analysis: SPAD	SPAD	9	700	6300
data analysis:ALCESTE 2010	ALCESTE 2010	1	3410	3410
data analysis: TROPES Standard V7	TROPES Standard V7	1	1435	1435

Atlas Ti (forfait 5postes)	Atlas Ti (forfait 5postes)	2	3499	6999
ETHNOS 12 poste+ (CAPI 5 llcences)	ETHNOS + (CAPI 5 llcences)	1	6041	6041
VIVAGO		20	581	11622
Equipment for Phototherapy		20	305	6104
Eye TrackingSystem Tobi 60Hz-Ecran 24"	System Tobi 60Hz-Ecran 24"	2	34350	68700
CANTAB test battery (computerised batteries of neuropsychological tests) Full 4 (4 years licence, 22 tests) = € 10 000 (voir première ligne du Tableau du devis) - The gold standard test machine at € 3 125 (one PC) (voir texte sous le tableau) - A Clip-on touchscreen for use with standard laptop screens or desktop monitors (with the exception of widescreens) € 343 (voir texte sous le tableau).	CANTAB	2	13468	26936
image processing Nuke 6.0.	Nuke 6.0.	1	2947	2947
Statistica (licence permanente 3 postes) Data Analysis	Statistica (licence permanente)	8	1350	10800
E-Prime Experiment Design	E-Prime	5	2055	10275
Aktogram Kronos (Window) Octares 2001-2003. Event analysis	Aktogram Kronos (Window) Octares 2001-2003.	4	460	1839
Total				203387

Table A2.4 concerns multimedia equipments (cameras, microphones, image processing software…), that will be used mainly by MSHST in order to study the usability and the acceptability of different technological solutions, from basic sensors worn by patients, to the usability of an assistant robot by an elder or disabled person.

It is intended to make more complete studies already made in the context of other projects, especially for robotics, the ASSIST project devoted to the design of an assistant robot for paraplegic people.

Table A2.5	Human System Interaction			
Item	Example product	Quantity	Unit cost	Total cost

90 Tablet PC		1	136500	136500
Microphone		34	33	1114
Loudspeaker		37	34	1269
for interaction with staff/visitors/patients…	HTC, Nokia, Iphone	103	449	46247
Interactive table		1	9932	9932
Interactive whiteboard		3	1099	3297
SAITEK Manette PS 2700 Cyborg V.3 Gamepad		2	19	38
wiimote		2	65	130
SAITEK Joystick Cyborg X		2	35	70
Device to be used by hospital staff, , in place of paper medical records WIFI +3G	Apple Ipad Wifi (no 3G)	220	668	146973
Phone subscription		36	43	1560
Total				347129

Table A2.5 concerns devices that will be made available to people (patient or hospital staff) in order to interact with the ambient system. Ipads will be tested at a life size, as a way to share information about patients. Tablet PCs will be installed mainly in the CUC hospital as an interface to help people navigation between the hospital departments.

Table A2.6	Assisting Robots			
Item	Example product	Quantity	Unit cost	Total cost
Assistance Robot	PR2 (Willow Garage)	1	301003	301003
Rescue Robots	e.g. Peoplebot	2	17888	35775
Total				336778

Table A2.6 concerns robotics; two kind of robots will be evaluated in the Amiqual context.

At first an assistant robot will be prepared at LAAS in order to be deployed in a care facility for semi controlled experiments and to study how real patients behave with such a complex equipment. Another similar robot (concerning the PR2 demonstrator) will be available at LAAS in order to continue developments during the life-sized evaluations or the user studies (funding for this other PR2 robot is requested in the national robotics platform … two similar robots with two different roles). PR2 has been selected because a new roboticists community is emerging just now around this demonstrator; this choice will be validated for Amiqual after the first year, especially considering a possible interaction with CEA LIST (which is developing the demonstrator for the ASSIST project).

Other smaller and less versatile companion robots will be evaluated, mainly as a way to interact with a human lost in a care facility, or in order to move sensors (vision, audio) to verify that some event occurs. The Kompai robot could be selected for this function, mainly because it is rather cheap.

Table A2.7	Computing and Data Collection off the shelf			
Item	Example product	Quantity	Unit cost	Total cost
Medical data storage (3ans)		1	47100	47100
Medical data storage		1	271243	271243
Hard disk - external drive data storage for user studies	SEAGATE FreeAgent GoFlex USB 2.0 - 500 Go	12	71	853
deskTop user studies about social use	PPC Compaq iPaq 3870	10	334	3336
tablet social use	Ipad	3	584	1753
Single computers (for every room, for every home): 30 Homes, MEDES, 20 rooms, plus 20 for labs	Probably less expensive for Homes, MEDES and CHU, more for labs	75	641	48081
Laptop for social use	HP ProBook 6550b (WD696ET)	3	1710	5129
Laptop for social use	Toshiba Qosmio X500-122 18,4" TFT Full HD Blu-Ray	18	1435	25825
Ordinateurs/station image*,- Carte mère : Asus P6T		4	208	832
Screen for image analysis of .social use	Acer 23.6" LCD ….	6	403	2419
Ultra laptop user studies about social use	NP-X420JA05FR Sansung	5	584	2922
8 servers		1	12760	12760
Data jogger		1	16722	16722
3G Keys + 3G subscriptions (48 months)		192	30	5779
Proc : Intel® Core™ i7 950 (3.06)		4	414	1655
RAM OCZ PC12800 Reaper Edition (1600 MHz		4	147	589
Seagate Momentus XT - S-ATA II - 500 Go		4	107	428

Antec Dark Fleet DF-35		4	88	351
ZALMAN Alimentation ZM600HP modulaire 600 Watts		4	52	207
Logitech diNovo Edge		4	115	458
PNY Quadro FX 1800 PCI-E		4	417	1669
DD Western Digital Velociraptor 150 GO 16 MO°		4	111	443
Total				450554

Table A2.7 concerns equipments required to process, exchange or save data. Many computers will be bought, mainly because many partners are involved in AmiLab2. Dedicated computers are requested for user studies that will be done by MSHST. A large storage unit will be installed in the IRIT facilities, in order to save all data recorded during experiments, making possible off line processing.

Table A2.9	Installation Actuators, Network Infrastructure data collection			
Item	Example product	Quantity	Unit cost	Total cost
Installation PoleStar		1	32550	32550
2 rooms adaptation as authorized site of medical evaluation for home care and ehealth system Ce devis est de 200 000 Euros HT pour 230 m². soit un prix au m² de 870 Euros, d'où pour une piece de 20 m² : 17400 Euros HT		2	17400	34800
Implementation and modification of Clinical Trial Software		1	12542	12542
Installation CHUT CES 150,70 TTC par chambres		96	66	6336
Total				86228

Table A2.9 concerns works required in care facilities in order to install equipments. Two rooms will be installed at CEES for equipment tests befor installation in patient homes; 96 rooms will be equipped at CHU.

Table A2.10	Prototype evaluation			
Item	Example product	Quantity	Unit cost	Total cost
Blood Pressure Monitoring	NEXFIN	1	26000	26000

Treadmill trainer	Technogym	1	3390	3390
Posturographic platform (Fee test01) with software	Neuro Com	1	8905	8905
Motion Capture and Sensor System	Xsens	1	14500	14500
Jump Platform	Novotec Medical	1	13282	13282
ISTAT - Blood Drop measurements portable laboratory	ABBOTT	1	7400	7400
Freezer -80°C	Jouan	1	8054	8054
Polysomnograph with interpretation software	COMET PSG - AMPEEG116	1	17893	17893
EZ430-RF2560 Bluetooth Evaluation Tool		2	120	240
sensors		1	91780	91780
Total				191443

Table A2.10 concerns studies, mainly made in the Space Clinic of MEDES, about the impact of the technology on humans.

LAAS intends to develop an in vivo sensor in order to detect cancerous cells; a high-quality spectra analyzer will be bought in order to characterize the performance of this sensor.

Personnel Reguired for Construction of the AmiLab2

Table A2.8	Systems Integration			
Item	Example product	Quantity	Unit cost	Total cost
7 ans de stagiaire pendant 3 ans		84	2637	221508
Développement MSHST-S -6 hommes mois for repository)	6 hommes/mois	6	4824	28944
4mois sur 4 ans	IE	16	4824	77184
2 engineers during 4 years	IR2,9 échelon +PPE (8%)	96	6921	664416
Total				992052

For the installation of Amilab 2, it is intended to hire two full-time engineers that will integrate the AmiLab2 technological team; other permanent staff from all partners will also participate to this team, especially the equivalent of two full-time engineers provided by LAAS (embedded system, network management, robotics, image processing…) and IRIT (data management, network management…).

MSHST will hire a specialized engineer 3 months during the phase 1, in order to prepare the protocol of the user studies. Moreover an engineer will be hired 4 months every year to participate to the preliminary works on these user studies.

Trainees will be selected every year during the phase 1, for some punctual actions, like unitary functional tests or the installation and the evaluation of a new sensor: every year LAAS IRIT and the GeronTechnology lab will propose 6 trainee topics at the master level; the CHU of Toulouse will propose 3 topics per year.

The other permanent persons involved in AmiLab2 during the first phase are listed in the following table; only IT people are considered here; the names of involved researchers are listed in section 5.

Role	Job Description	Salary	Months	Cost	Provided By
engineer	Co supervision of the AmiLab2 installation	4252	48	204096	IRIT
engineer	Co supervision of the AmiLab2 installation	6395	48	306986	LAAS
Management assistance	Secretary, help in management of the AmiLab2 budget	3694	4	14776	IRIT
Management assistance	Secretary, help in management of the AmiLab2 budget	3345	4	13380	LAAS
engineer	Network management	5000	6	30000	CUC
Project responsible	Coordination for the CUC site, teaching users	4000	6	24000	CUC
engineer	Développement d’applications	3644	2	7288	MSHST
technician	électricien	2764	1	2764	MSHST
engineer	Informatique /électronique Smart Home Blagnac MSHST	3250	12	39000	MSHST
engineer	Développement d'applications informatique	3644	5	18220	MSHST
technician	Eploitation, maintenance informatique	2764	5	13820	MSHST
engineer	Design of medical and technological protocole	6000	4	24000	CEES
technician	Installation in the CHU	4800	12	57600	CHU Toulouse

	locations				
technician	Installation in the Space Clinic of MEDES	3120	6	18720	MEDES
technician	Support for the use of NAO Campus	5036	1	5036	Pole Star
engineer	Development support for other partners	10993	1	10993	Pole Star
Total Personnel for Phase 1 AmiLab 2			165	790679	

Phase 2. Operation of the Equipment.

The operation costs for AmiLab 2 are summarized by the following table.

Details	Component function	Location	Origin	Cost (€)
Table A2.1	Human Activity observation off the shelf	all	Commercial products, equipment replacement	109675
Table A2.3	Human Medical and Biological Parameters	all	Commercial products, equipment replacement	39410
Table A2.5	Human System Interaction	IRIT, CHU, CUC, CEES	Commercial products, equipment replacement	21002
Table A2.7	Computing and Data Collection off the shelf	all	Commercial products, equipment replacement	73800
Table A2.9	Installation Actuators, Network Infrastructure data collection	CHU, CEES, CUC	Maintenance	34040
Table A2.11	Training	CHU, CUC, MSHST	Staff training course	27086
Total				305013

Operation of the Equipment for AmiLab 2

Operation of AmiLab 2 includes mainly renewal of some equipments, mainly sensors used for in vivo experiments, and computers (about the renewal of 1 equipment over 5). We take also into account maintenance for the indoor localization systems.

Table A2.1	Human Activity observation off the shelf			
Item	Example product	Quantity	Unit cost	Total cost
Numerical pen NOKIA		8	650	5200
Classical Cameras	Lextronic, Point Grey, Axis…	15	1097	16455
3D Cameras	Mesa	1	6285	6285
Embedded cameras	SONY HDR-XR550VE	6	1149	6894
Dome Network camera, Mpeg4	Axis	3	578	1734
video camera HD, Steadyshot, HDR		4	1253	5012
Light sensor		12	39	528
Temperature sensor		6	46	294
Noise sensor		8	12	96
Bio-feedback Sensor (prototype)		2	300	600
Presence sensor	phidget	24	20	480
RFID Tags+ programmer	Lextronic, CAEN (passive tags, omni antenna)	2	3027	6054
100 TagsMagnet RFID		5,25	318	1670
Mobile reader Pocket Inventory Durci HF Pocket Tracer Durci HF		12	2141	25692
Tags reader lecteur Prx'N'Roll Emulation		37	137	5069
tags reader MEDIO RXU 500		14	1732	24248
Spatial location to detect patient attiture (lying down, sitting, standing)		7	88	614

Movement	phidget	14	42	588
network material		1	2105	2105
50 RFID Bracket		1	87	87
Total				109675

Table 2.3	Human Medical and Biological Parameters Observation			
Item	Example product	Quantity	Unit cost	Total cost
Watch e-health		10	404	4040
Vibration sensor		1	42	42
Electronical Bracket		5	42	210
electrodes		6	226	1356
Sweating sensor		10	42	420
Holter glycémie sensor		11	1460	16060
2 actimeters with application software	ACTIWATCH	2	1799	3598
Bathroom scales		6	115	690
Pills boxes		14	47,11	660
Saturometre		7	300	2100
impedancemetre		7	1337	9359
glucometre		7	125	875
Total				39410

Table A2.5	Human System Interaction			
Item	Example product	Quantity	Unit cost	Total cost
Microphone		7	33	231
Loudspeaker		7	34	238
for interaction with staff/visitors/patients…	HTC, Nokia, Iphone	13	449	5837
To be used by hospital staff, , in place of paper medical records WIFI	Apple Ipad Wifi (no 3G)	22	668	14696

+3G				
Total				21002

Table A2.7	Computing and Data Collection off the shelf			
Item	Example product	Quantity	Unit cost	Total cost
Medical data storage (5 ans)		1	47100	47100
data storage for user studies	SEAGATE FreeAgent GoFlex USB 2.0 - 500 Go	2	79	158
Hard disk - external drive data storage for user studies	SEAGATE FreeAgent GoFlex USB 2.0 - 500 Go	4	71	284
deskTop user studies about social use	PPC Compaq iPaq 3870	2	334	668
tablet social use	Ipad	1	584	584
Single computers (for every room, for every home): 30 Homes, MEDES, 20 rooms, plus 20 for labs	Probably less expensive for Homes, MEDES and CHU, more for labs	22	641	14102
Laptop for social use	HP ProBook 6550b (WD696ET)	1	1710	1710
Laptop for social use	Toshiba Qosmio X500-122 18,4" TFT Full HD Blu-Ray	6	1435	8610
Ultra laptop user studies about social use	NP-X420JA05FR Sansung	1	584	584
Total				73800

Table A2.9	Installation, Actuators, Network Infrastructure data collection			
Item	Example product	Quantity	Unit cost	Total cost
Maintenance PoleStar		1	10880	10880
2 rooms adaptation as authorized site of medical evaluation for home care and ehealth system		1	17400	17400
Installation CHUT CES 150,70 TTC par chambres		96	60,00	5760
Total				34040

Table A2.11	Training			
Item	Example product	Quantity	Unit cost	Total cost
ETHNOS -CAPI		1	3815	3815
ALCESTE 2010/ Lexico/SPAD DTM/ TROPES		1	4172	4172
logiciels analyse de contenu (Nvivo8ATLAS TI 2010). Formation une journée /8 pers		8	640	5120
NUKE		1	3947	3947
Training of medical personnel and personnel working in homecare 20 Jours		20	418	8360
State of the art		4	418	1672
Total				27086

Table A2.11 concerns training costs required either for hospital staff who must assist patients at home in using new technological solutions, or by MSHST researchers in order to use tools bought for data analysis.

Personnel Reguired for Operation of AmiLab 2

Only permanent staff or CDD funded by other projects, will maintain AmiLab2 during the phase 2 (five years).

Role	Job Description	Salary	Months	Cost	Provided By
engineer	Co supervision of the AmiLab2 installation	4252	30	127560	IRIT
engineer	Co supervision of the AmiLab2 installation	6395	30	191866	LAAS
Management assistance	Secretary, help in management of the AmiLab2 budget	3694	5	18470	IRIT
Management assistance	Secretary, help in management of the AmiLab2 budget	3345	5	16825	LAAS
engineer	Implementation of medical and tehcnological projects	6000	8	48000	CEES
technician	Implementation of medical and tehcnological projects	3500	4	14000	CEES
technician	Installation, maintenance of devices and tech. sup. during campaign	3120	5	15600	MEDES
Total Personnel for Phase 2 AmiLab 2			87	432321	

6.1.4 AMILAB 3. SMART COMMERCE

Phase 1. Construction of the Equipment

Construction of AmiLab 3 will require to refit out of the 300m2 modulable technical set in the West side of the ground level of the INRIA Lille – Nord Europe research center building in the Haute Borne Science Park at Villeneuve d'Ascq. Then this technical set will be equipped with a fast wired and wireless network, a cluster of computation and storage servers, a network of sensors, gesture capture systems (vision-based tracking systems, wearable and handheld sensors, tactile surfaces), output devices (a reconfigurable whole of flat screens, workstations, tablets, smart phones, projectors, speakers). The following table summarizes these installations and associated costs. Equipement costs are detailed in seven tables located below. Each table is accompanied by an explanation.

Table A3.1 - Construction Costs of AmiLab 3.

Details	Component function	Location	Origin	Cost (€)
Expert Engineer	Installation/administration of 10Gb and Wi-Fi network, network of sensors, computation and storage servers	Villeneuve d'Ascq	CDD	216 000.00 (€)
Expert Engineer	Installation/configuration of gesture capture	Villeneuve d'Ascq	CDD	216 000.00 (€)

	systems, vision-based tracking systems, wearable and handheld sensors, tactile surfaces, cameras, whole of flat screens, workstations			
Software Engineer	Development of the software infrastructure and middleware for AmiLab3	Villeneuve d'Ascq	CDD	216 000.00 (€)
Table A3.3	Technical set refitting out	Villeneuve d'Ascq	Commercial products, Professional Installation	115 000.00 (€)
Table A3.4	Fast wired and wireless network	Villeneuve d'Ascq	Commercial products, Professional Installation	249 672.62 (€)
Table A3.5	Computation and storage servers	Villeneuve d'Ascq	Commercial products, Professional Installation	224 524.00 (€)
Table A3.6	Network of sensors	Villeneuve d'Ascq	Commercial products, Professional Installation	64 000.00 (€)
Table A3.7	Gesture capture systems (vision-based tracking systems, wearable and handheld sensors, tactile surfaces)	Villeneuve d'Ascq	Commercial products, Professional Installation	149 228.00 (€)
Table A3.8	Output devices (whole of flat screens, projectors, speakers, tablets, smart phones, workstations)	Villeneuve d'Ascq	Commercial products, Professional Installation	119 914.88 (€)
			Total	1 570 339.50 (€)

Personnel Required for Construction of the AmiLab3

Names of permanent academic staff are listed in Section 5.

Role	Job Description	Salary	Months	Cost	Provided By
Expert Engineer	Installation/administration of 10Gb and Wi-Fi network, network of sensors, computation and storage servers	4 500	48	216 000	ANR AmiQual
Expert Engineer	Installation/configuration of gesture capture systems, vision-based tracking systems, wearable and handheld sensors, tactile surfaces , cameras, whole of flat screens, workstations	4 500	48	216 000	ANR AmiQual
Software Engineer	Development of the software infrastructure and middleware for AmiLab3	4 500	48	216 000	ANR AmiQual
Project Engineer	Overall Integration	4 500	12	54 000	INRIA Staff
Permanent Expert Scientist		6 900	12	82 800	INRIA Staff
Total Personnel for Phase 1 AmiLab 3			168	784 800	648 000 - ANR AmiQual

			136 800 - INRIA

Table A3.3 Describes the costs associated with the refitting out of the AmiLab 3 technical set, and its equipment with various shop shelves.

Table A3.3	Refitting out of the 300m2 technical set
Item	Cost
Refitting out of the technical set	90 000 €
Shop shelves	25 000 €
Total	115 000 €

Table A3.4 Describes the costs associated with the fast 10Gb wired and wireless network.

Table A3.4	Fast wired and wireless network			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Network backbone	Cisco 6509	20 860.00	1	20 860.00 (€)
10Gb card	Cisco WS-X6704-10 GE	14 360.00	2	28 720.00 (€)
1Gb card	Cisco	3 494.25	4	13 977.00 (€)
Network switch	Cisco C3750-48-PSE	2 631.75	4	10 527.00 (€)
Cables	Cisco CAB-STACK-3M	134.20	32	4 294.40 (€)
Cables	Cisco GLC-T	177.10	64	11 334.40 (€)
Wi-Fi station		20 000.00	4	80 000.00 (€)
Network monitoring	HP Z400	2 427.10	1	2 427.10 (€)
Monitoring display console	HP LP2475	415.43	4	1 661.72 (€)
Network administration server	Dell PowerEdge 410	3 871.00	1	3 871.00 (€)
Network maintenance		18 000.00	4	72 000.00 (€)
Total				249 672.62 (€)

Table A3.5 Describes the costs associated with computation and storage servers.

Table A3.5	Computation and storage servers			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
NAS	Stordata FAS3140	114 830.00	1	114 830.00 (€)
NAS maintenance		20 000.00	4	80 000.00 (€)
GPU computation server	Dell PowerEdge R710 NVIDIA/ TESLA S1070-400	10 716.00	2	21 432.00 (€)
Sotware continue integration server	Dell PowerEdge R410	4 391.00	1	4 391.00 (€)
Software preparation server	Dell PowerEdge R410	3 871.00	1	3 871.00 (€)
Total				224 524.00 (€)

Table A3.6 Describes the costs associated with the network of sensors.

Table A3.6	Network of sensors			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Sensor		250.00	128	32 000.00 (€)
Connectique		250.00	128	32 000.00 (€)
Total				64 000.00 (€)

Table A3.7 Describes the costs associated with gesture capture systems.

Table A3.7	Gesture capture systems and the screen whole			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Système de suivi de marqueurs	VICON	108 500.00	1	108 500.00 (€)
Microsoft Surface tactile table	Microsoft Surface	13 260.00	2	26 520.00 (€)
Camera	Time-pf-flight MESA SR4000	6 000.00	2	12 000.00 (€)
Camera	Point Grey Dragonfly2	552.00	4	2 208.00 (€)

Total				149 228.00 (€)

Table A3.8 Describes the costs associated with output devices.

Table A3.8	Output devices			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Multitouch screen	3M M2256PW	1 622.34	32	51 914.88 (€)
Reconfigurable screen whole structure	Appel d'offre	15 000.00	1	15 000.00 (€)
Workstation	Apple iMac 27'	3 000.00	10	30 000.00 (€)
Tablet Computer	Apple iPad	700.00	10	7 000.00 (€)
Smart Phone	Apple iPhone	600.00	5	3 000.00 (€)
Smart Phone	Android	600.00	5	3 000.00 (€)
Projectors, speakers, microphones				10 000.00 (€)
			Total	119 914.88 (€)

Phase 2. Operation of the Equipment.

The operation costs for AmiLab 1 are summarized by the following table.

Details	Item	Cost (€)
Table A1.17	Maintenance of Computing Equipment	870 339.50 (€)
	Training for Personnel	15 000.00 (€)
	Total	885 339.50 (€)

Personnel Required for Operation of AmiLab 3

Names of permanent academic staff are listed in Section 5.

Role	Job Description	Salary	Months	Cost	Provided By
Chief Engineer	Engineering Team Leader		15		INRIA Staff
Project Engineer	Network, sensors, gesture capture systems, whole of flat screens, middleware		180		INRIA Staff
Expert Scientist	Network, sensors, gesture capture systems, whole of flat screens, middleware		15		INRIA Staff

Training Costs for Personnel

Training costs for engineering personnel include Training for specialized equipement (network of sensors, gesture capture systems, whole of flat screens), as well as training in specialized programming languages and middleware. Esimated cost is 3000 per year.

Maintenance of the Equipment for AmiLab 3

Each computer equipment will be replaced one time during the nine years of the AmiQual project.

Table A3.11	Maintenance of Computing Equipment			
Item	**Explanation**	**Unit Cost**	**Num**	**Total Cost (€)**
INRIA Building	Replacement of shop shelves			25 000 00 (€)
INRIA Building	Replacement of network equipment, see details in Table A3.4			177 672.62 (€)
INRIA Building	Network maintenance	18 000	5	90 000.00 (€)
INRIA Building	Replacement of computation and storage servers, see details in Table A3.5			144 524.00 (€)

INRIA Building	NAS maintenance	20 000	5	100 000.00 (€)
INRIA Building	Replacement of sensors and connectiques			64 000.00 (€)
INRIA Building	Replacement of gesture capture systems, see details in Table A3.7			149 228.00 (€)
INRIA Building	Replacement of output devices, see details in Table A3.8			119 914.88 (€)
			Total	870 339.50 (€)

6.1.5 AmiLab 4. Smart Mobility

Phase 1. Construction of the Equipment.

Construction of AmiLab 4 will require installation of equipement in two parts of the Sacaly campus:

1. "Saclay Apartment and garden": a 200 m2 apartment that will be located in the Nano-Innov building (and a small outdoor part in the building's "garden"),
2. "Saclay outdoor campus": an outdoor area covering a large part of the Polytechnique school campus and going all the way to the Nano-Innov building.

The following table summarizes these installations and associated costs. Equipement costs are detailed in 6 tables located below. Each table is accompanied by an explanation.

Table A4 - Construction Costs of Amilab 4.

The component function along with their cost.

Details	Component function	Location	Origin	Cost (K€)
Engineer	Management of acquisition, installation and integration of equipement	Saclay apartment	CDD	408
Engineer	Integration of networks, middleware, components	Saclay outdoor campus	CDD	254
Table A4.1	Campus Embedded PC network	Saclay apartment and campus	Commercial products, Professional Installation	1369
Table A4.2	Campus Embedded PC network - Parts spécific to apartment and its garden	Saclay apartment	Commercial products, Professional Installation	63
Table A4.3	Interacting equipment (terminals)	Saclay apartment and campus	Commercial products	101
Table A4.4	Sensors and actuators for smart apartment and its garden	Saclay apartment	Commercial products, Professional Installation	225
Table A4.5	Sensors and actuators for outdoor campus	Saclay outdoor campus	Commercial products, Professional Installation	160
Table A4.6	Amilab Control Center" (storage and processing of usage data)	Saclay apartment	Commercial products, Professional Installation	76
Table A4.7	PC platform for software and service	Saclay apartment	Commercial products, Professional	76

	operation and data storage		Installation	
			Total	2732

Personnel Reguired for Construction of the AmiLab4

Names of permanent academic staff are listed in section 5.

Role	Job Description	Salary/ Month	Months	Cost	Provided By
Engineer	Engineer for acquisition, installation, and integration of equipment of campus part	6 360	40	254 396	ANR AmiQual
Engineer	Engineer for acquisition, installation, and integration of equipment of apartment part	8497	48	407 856	ANR AmiQual
Project Engineer	Sensor and PC network deployment over campus	5 300	48	254 400	Ecole Polytechnique staff
Project Engineer	In charge of equipment	5 570	4	22 280	CEA LIST staff
Project Engineer	Coordination of campus deployment	7 341	2	14 683	Institut Télécom staff
Engineer	Coordination and administrative support	2 917	15	43 755	Ecole Polytechnique staff
Total Personnel for Phase 1 AmiLab 4			157	997 373	

Table A4.1 establishes a list of equipment costs, study costs and installation costs necessary to : deploy the embedded PC network over the Saclay campus (including solar power supply when necessary), set up a mesk wifi network covering the campus area and establishing link between the campus network and the Neptune 4G platform. Note that Ecole Polytechnique is providing free access to the campus area and Altran is providing free access to the Neptune platform.

Table A4.1 - Campus Embedded PC network			
Item	**Quantity**	**Unit Cost**	**Cost (€)**
Embedded PC outdoor quality, 1 wifi card included, Axiomtek eBOX620 with disque automotive	120	972	116 640
2nd wifi card to turn PC into wifi base station	120	59	7 080
Waterproof PC box	120	25	3 052
LTE (4G) communication card for access to Neptune platform (Estimate from discussion with Neptune partners since not commercialized yet)	30	6000	180 000
Solar power supply on pylones for coverage where no building present	20	5620	112 400
Lithium Battery (complement to power supply)	20	2500	50 000
Deployment of embedded PCs on top of buildings	100	6528	652 800
Deployment of embedded PCs on top of pylones where no building present	20	5884	117 680

Engineering study	120	260	31 200
Execution study	120	817	98 040
	Total		**1 368 892**

Table 4.2 describes the parts of the embedded PC network that will be needed to cover the apartment itself and its garden in order to form a unique indoor / outdoor network.

Table A4.2 - Campus Embedded PC network-Parts spécific to apartment and its garden			
Item	**Quantity**	**Unit Cost**	**Cost (€)**
Routeur:	1	7911	7 911
Firewall	1	2464	2 464
Gateways wifi-CPL	5	80	400
Gateway Ethernet CPL	2	44	88
Outdoor Wifi Access Point	3	764	2 292
Installation, wiring (80h)	80	60	4 800
Cables, small hardware equipment	1	45000	45 000
	Total		**62 955**

Table A4.3 describes a set of terminals that will be used as end user terminals in the experiments conducted on the equipped: it features a variety of terminals including smartphones, internet tablets, light PCs and a robot. Some services will require 3G access and we therefore include a few 3G operator subscriptions.

Table A4.3 - Interacting equipment (terminals)			
Item	**Quantity**	**Unit Cost**	**Cost (€)**
Android terminals	10	418	4 180
Other Smartphones type iPhone, Nokia N900 ….	25		15 632
3G operator phone subscription	20	2100	42 000
Internet Tablets	4	162	648
SunSPOT light PC with embedded sensors (temperature, light, 3-axis acceleration maximum, battery level), communication radio et connexion USB, batterie	30	630	18 900
EEEPCs	5	210	1 050
Kit 802.15.4	10	101	1 010
Robot for outdoor operation	1	18 186	18 186
	Total		**101 606**

A variety of sensors and actuators including cameras for the tracking experiments, intelligent locks, laser trackers to follow movements, projectors and televisions for display will be needed to equip the apartment. They are listed in Table 4.4.

Table A4.4 - Sensors and actuators for smart apartment and its garden			
Item	**Quantity**	**Unit**	**Cost (€)**

		Cost	
Sensors for 4 60 M2 areas (legrand sensors+ sono sensors)	4	5500	22 000
Sound sensors for garden	10	1800	18 000
Indoor Cameras	10	3200	32 000
Outdoor Cameras	10	3700	37 000
Camera recorders	10	1400	14 000
3D samsumg televisions	4	2507	10 028
Indoor Projectors intérieurs	8	3400	27 200
Intelligent lock	10	908,54	9 085
Digicode for intelligent lock	10	184,9	1 849
Outdoor projectors	2	11400	22 800
Laser trackers	4	5700	22 800
Inertial measurement unit	5	1700	8 500
	Total		**225 262**

Similarly, a variety of sensors and actuators will be installed outdoor. They are listed in table A4.5.

Table A4.5 - Sensors and actuators for outdoor campus			
Item	**Quantity**	**Unit Cost**	**Cost (€)**
Outdoor cameras	10	3700	37 000
Camera recorders	10	1400	14 000
Meteo stations installed on pylones	2	3800	7 600
Desk meteo stations	2	150	300
Outdoor Single-Colour LED Display Sign	5	2500	12 500
Outdoor TRI-COLOR LED Display Sign	2	7500	15 000
WiFi Ethernet Device Server – for outdoor LED displays	7	200	1 400
Applications iButton: iButton with ID et 64k RAM + lecteur + clipper	100	13	1 300
25 RFID - TouchTag readers (USB)	25	40	1 000
25 RFID – SD card readers for smartphones, …	25	210	5 250
500 RFID - Tags Touchtag	500	1	500
Optical reader for 2D tags	20	600	12000
GPS receivers	50	50	2500
Sensors and actuators installation	1	50000	50 000
	Total		**160 330**

To store collected data and perform simulations as well as data mining and analysis of data collected during service and system execution we need processing and storage equipment. It is listed in Table 4.6.

Table A4.6 - "Amilab Control Center" (storage and processing of usage data)			
Item	**Quantity**	**Unit Cost**	**Cost (€)**
Cluster for data management and processing	5	9200	46 000
Cluster for data storage	5	10100	30 300
	Total		**76 300**

To execute system and services logic and to store related data we need processing and storage equipment. It is listed in Table 4.7.

Table A4.7 - PC platform for software and service operation and data storage			
Item	**Quantity**	**Unit Cost**	**Cost (€)**
Cluster for data management and processing	5	9200	46 000
Cluster for data storage	5	10100	30 300
	Total		**76 300**

Phase 2. Operation of the Equipment.

At the beginning of phase 2 we will renew the equipment installed during phase 1 and will therefore require the same equipment and same installation costs. Tables A4.2 to A4.7 will therefore be replicated. Table A4.1 will be replaced by table 4.8 to reflect the fact that istudy and installation costs will be limited to renewal in phase 2. We summarize Phase 2 costs in the table below that refers to some of the above presented sub-tables.

Details	**Component function**	**Location**	**Origin**	**Cost (K€)**
Table A4.8	Campus Embedded PC network, renewal	Saclay apartment and campus	Commercial products, Professional Installation	919
Table A4.2 (see above)	Campus Embedded PC network - Parts spécific to apartment and its garden	Saclay apartment	Commercial products, Professional Installation	63
Table A4.3 (see above)	Interacting equipment (terminals)	Saclay apartment and campus	Commercial products	101
Table A4.4 (see above)	Sensors and actuators for smart apartment and its garden	Saclay apartment	Commercial products, Professional Installation	225
Table A4.5 (see above)	Sensors and actuators for outdoor campus	Saclay outdoor campus	Commercial products, Professional Installation	160
Table A4.6 (see above)	Amilab Control Center" (storage and processing of usage data)	Saclay apartment	Commercial products, Professional Installation	76
Table A4.7 (see above)	PC platform for software and service operation and data	Saclay apartment	Commercial products, Professional Installation	76

	storage			
			Total	1620

Table A4.8 establishes a list of equipment costs, study costs and installation costs necessary to: renew and redeploy the embedded PC network over the Saclay campus (including solar power supply when necessary), set up a mesk wifi network covering the campus area and establishing link between the campus network and the Neptune 4G platform.

Table A4.8 - Campus Embedded PC network renewal

Item	**Quantity**	**Unit Cost**	**Cost (€)**
Embedded PC outdoor quality, 1 wifi card included, Axiomtek eBOX620 with disque automotive	120	972	116 640
2nd wifi card to turn PC into wifi base station	120	59	7 080
Waterproof PC box	120	25	3 052
LTE (4G) communication card for access to Neptune platform (Estimate from discussion with Neptune partners since not commercialized yet)	30	6000	180 000
Solar power supply on pylones for coverage where no building present	20	5620	112 400
Lithium Battery (complement to power supply)	20	2500	50 000
Redeployment of embedded PCs on top of buildings	50	6528	326 400
Redeployment of embedded PCs on top of pylones where no building present	10	5884	58 840
Engineering study	60	260	15 600
Execution study	60	817	49 020
	Total		**919 032**

Personnel Required for Operation of AmiLab 4

Names of permanent academic staff are listed in section 5.

Role	Job Description	Salary	Months	Cost	Provided By
Project Engineer	Maintenance and operation of software and equipment	5 805	40	232 212	Institut Télécom
Project Engineer	Maintenance and operation of software and equipment	5 230	40	209 200	Ecole Polytechnique
Project Engineer	Maintenance and operation of software and equipment	5 570	48	267 360	CEA LIST staff
Project Engineer	Maintenance and operation of software and equipment	7 341	2	14 683	Institut Télécom staff
Project Engineer	Maintenance and operation of software and equipment	5 300	48	254 400	Ecole Polytechnique staff
Engineer	Administrative support	2 917	15	43 755	Ecole Polytechnique staff
Total Personnel for Phase 2 AmiLab 4			**190**	**1 021 597**	

6.1.6 AmiLab 5. Smart Buildings

Building the Amilab 5 includes the creation of the experimentation facility at Sophia Antipolis as well as providing it with all necessary equipment to allow experimentations on usage value and building integration of new products and services. The following table summarizes these installations and associated costs. Equipement costs are detailed in 6 tables located below. Each table is accompanied by an explanation.

Table A5 - Construction and Operation Costs of Amilab 5

Equipment Component	Component function	Location	Techno Maturity	Total Costs
Phase 1 – Construction of the equipment				
Personal Phase 1	Resource Center : collect and disseminate information about "Aging in place"	Sophia Antipolis	CDD	167 256
Table A5.1	Building infrastructure	Sophia Antipolis	To be constructed	978 075
Table A5.2	Prefabricated Modules	Sophia Antipolis	To be Prefabricated Off the Shelf	137 200
Table A5.3	Experimentation electronic equipment	Sophia Antipolis	Off the Shelf	473 984
Table A5.4	Manufacturing and handling equipments	Sophia Antipolis	Off the Shelf	241 780
Table A5.5	Testing software	Sophia Antipolis	Off the shelf	4 498
Table A5.6	Engineering software	Sophia Antipolis	Off the Shelf	25 230
Table A5.7	External services (Architect, Thermician, …)	Sophia Antipolis		263 363
Phase 2 – Operation of the equipment				
Table A5.8	Equipment Replacement in Phase 2	Sophia Antipolis	Off the shelf	311 182
Table A5.9	Externals services in Phase 2 (software Maintenance)	Sophia Antipolis	Off the shelf	29 728
			Total	2 632 294

Phase 1. Construction of the Equipment.

The A5.1 Table is about building the facility, designed by the CSTB teams. It is going through sketches phase and the technical and financial evaluation has been validated by an independent consulting office. The items not included in the study have been evaluated according to ratios and standards of the profession.

Table A5.1	Building			
Item	**Product Example**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Building infrastructure (estimated sections)		850 500	1	850 500
Building infrastructure (non estimated sections)		127 575	1	127 575
			Total	978 075

The A5.2 Table concerns the empty and furnished prefabricated modules made to create living spaces. One of the builder (ELOA) was chosen to establish the reference for the technical and environmental quality of those modules.

Table A5.2	Prefabricated modules			
Item	**Product Example**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Prefabricated Empty modules	ELOA Modules	5 670	7	39 550,00

Prefabricated furnished modules	ELOA Modules	13 950	7	97 650,00
			Total	137 200

The A5.3 Table is dedicated to all the experimentation electronic equipment that will allow the real occupation environment production of the modules and the acquisition of measures and events of human activity in the modules.

Table A5.3	Experimentation electronic equipment			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Computer Hardware1	PC and accessories as AXION estimation	37 619	1	37 619
Computer Hardware2	Server and accessories as AXION estimation	14 448	1	14 448
Video and Audio recording equipments	Camera, DVD storer, microphone	4 040	1	4040
Sensors and data acquisition system	Deltadore sensors and acquisition system	25 945	1	25 945
Modification and repair instruments	Electronic workshop	28 420	1	28 420
immersion system	Sky Factory Skyceiling and Sky factoring eScape	63 512	1	63 512
External conditions simulators		150 000	1	150 000
Internal conditions simulators		150 000	1	150 000
			Total	473 984

The A5.4 Table details all the manufacturing and handling equipment of the modules.

Table A5.4	Manufacturing and handling equipments			
Item	**Product Example**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Fenwick-type handling machines for heavy weights		84 640	2	189 280
Machine Shop equipments for modules		52 500	1	52 500
			Total	241 780

The A5.5 Table presents the video and images management softwares.

Table A5.5	Testing Software			
Item	**Product Example**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Digital video software		4 498	1	4 498
			Total	4 498

The A5.6 Table displays the necessary engineering softwares for the experimentations and the resources center.

Table A5.6	Engineer software			
Item	**Product Example**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Operating Software		25 230	1	25 230
			Total	25 230

The A5.7 Table displays the external services needed for Amilab 5 construction and installation.

Table A5.6	External services in Phase 1			
Item	**Product Example**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Architect Services		66 536	1	66 536
BET Services		35827	1	35827
Expertise for experimentations definition		161000	1	161000
			Total	263 363

Phase 2. Operation of the Equipment.

The A5.8 Table displays the equipment replacement en phase 2, based on the same price than in phase 1.

Table A5.3	Experimentation electronic equipment			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Prefabricated Empty modules	ELOA Modules	5 670	7	39 550,00
Prefabricated furnished modules	ELOA Modules	13 950	7	97 650,00
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Modification and repair instruments	Electronic workshop	28 420	1	28 420
immersion system	Sky Factory Skyceiling and Sky factoring eScape	63 512	1	63 512
			Total	311 182

The A5.9 Table displays external services for phase 2 corresponding to software maintenance calculated by 10% by year on 10 years. So this table groups the A5.5 and A5.6 tables items.

Table A5.3	Experimentation electronic equipment			
Item	**Example Product**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Digital video software		4 498	1	4 498
Operating Software		25 230	1	25 230
			Total	29 728

Table A5.1	Building			
Item	**Product Example**	**Unit Cost**	**Quantity**	**Total Cost (€)**
Building infrastructure (estimated sections)		850 500	1	850 500

Building infrastructure (non estimated sections)		127 575	1	127 575
			Total	978 075

The A5.2 Table concerns the empty and furnished prefabricated modules made to create living spaces. One of the builder (ELOA) was chosen to establish the reference for the technical and environmental quality of those modules.

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			Total	25 230

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Operating Software		25 230	1	25 230
			Total	29 728

7. ANNEXES / APPENDICES

7.1. SCENARIOS OF USE OF THE AMIQUAL FACILITY

The purpose of this section is to make concrete the exploitation of the AmiQual facility by providing typical examples of experiments that AmiQual will make possible. Each example is described as a scenario structured according to the following template:

- Scenario's name
- Users of the AmiLab(s) and status: partners, affiliates, and/or clients along with their background expertise
- Amiqual facility: AmiQual facilities used for the experiments along with the expected equipment
- Test subjects: Users observed in the experiment
- Objective of the experiment
- Context of the experiment
- Hypothesis: e.g., specification of technical components that are supposed to be robust enough for the experiment
- Expected and actual outcomes of the experiment

7.1.1 EXAMPLES SCENARIOS FOR COORDINATION FACILITY

- *Looking for a method for identifying users needs for smart homes*

Users of the platform and status: Engineers at Schneider Electric (affiliates) and LIG Researchers experts in middleware and context-aware computing (partners).

AmiQual facility: Coordination Facility.

Test Subjects: To be identified.

Objective: To identify the services that families may expect from a smart home to support their daily activities.

Context: The researchers are developing a middleware that will permit end-users to dynamically build confederation of interoperating artifacts for future smart homes.

Hypotheses: End-users (family members) are willing to shape their home by coupling smart artifacts, building imaginative new functionalities that were not anticipated by ambient system designers and manufacturers.

Expected outcome: A method and an experimental protocol that guides ICT researchers to conduct their field study.

Actual Outcome: The SHS repository of the CF proposes DisQo, a method developed by an HCI research group from LIG (partner) with the help of a sociologist (partner). The method include a combination of several enquiry techniques to reach a satisfying balance between experimental control, privacy issues, and ecological validity. The LIG researchers and Schneider are able to contact the authors of the method for additional help.

- *Borrowing an equipment*

Users of the platform and status: HCI researchers from institut Telecom Paristech (partners).

AmiQual facility: Coordination Facility.

Test Subjects: mobile students, saclay campus.

Objective: To identify the key locations of the Saclay campus.

Context: The HCI researchers are developing a new directory service to be made accessible on large-scale interactive surfaces. The goal is to verify the hypothesis using a mobile GPS tracking system.

Hypotheses: The most popular areas of the Saclay campus are the main entrance of the campus, and the cafeterias.

Expected outcome: Confirmation of the hypothesis.

Actual Outcome: The equipment repository of the CF indicates that a mobile GPS tracking system is currently available. Instructions for use in field studies are provided. These have been compiled by ICD (partner) and CERAPS (partner) so that experimental biais are avoided and legal and ethical issues are sastified.

7.1.2 Examples Scenarios for AmiLab 1 – Smart Habitats

- *Integrated Comfort System*

Users of the platform and status: Engineers at Schneider Electric (partners) and INRIA/LIG Researchers experts in context-aware computing, a cognitive psychologist from UTT (partner), a sociologist from LIG (partner) using a method available from the Coordination Facility.

AmiQual facility: Montbonnot ENSIMAG Building equipped with an extensive suite of sensors and actuators. Sensors include temperature, humidity, CO2, light level and sound level in all rooms, hallways, air conduits, enclosed courtyard and external environment as well as sensors for human presence in all rooms and hallways. Actuators include building heating, air conditional, ventilators, window shades, motorized window openers, and lighting controls. Building control is provided by a centralized Building Management System interface in a locked room, whose state is reflected on large screen panel in the building central hallway.

The system is constructed using robust ad-hoc network technologies that are designed to automate much of the installation, calibration and configuration of sensors and actuators.

Test Subjects: INRIA/LIG researchers working in the building but not the authors of the system under test, students attending classes in the building.

Objective: Experiment with methods for integrative environmental control of a building using self-configuring network of sensors and actuators.

Context: Schneider Electric is developing a new product line based on integrating sensors and actuators in a building to control temperature, humidity, sound level, air quality, and other parameters of comfort. They need to test the product concept *in vivo* with informed users who can provide technical assistance in the case of breakdown or malfunction, as well as suggestions for improvement.

Hypotheses: Network technology is mature; Building occupants are cooperative and technically competent.

Expected outcome: satisfied users and validation of proposed service for product development. Behavioural data for the data base of the Coordination Facility.

Actual Outcome: Schneider observes unintended consequences sensor and actuator auto-configuration system. Building users complain that they can no longer open the windows. Building user request more transparency in system function and more local control of system function and comfort levels by building occupants. Results suggest new experiments in end-user programming with the HCI partners, as well as new challenges in auto-configuration of sensors and actuators.

- *Visual and Non-Visual Sensors for Human Activity*

Users of the platform and status: Researchers at CEA-LETI (partner), 2 research teams from LIG experts in artificial perception (partner), and CERAPS researchers, legal experts (partner).

AmiQual facility: Montbonnot ENSIMAG Building.

Test Subjects: Students and researchers who work in the facility but who are not the developers of the systems to be tested.

Objective: Compare cost, reliability of installation and reliability of resulting data from observation of human activity using:

- A network of visual and acoustic sensors
- A network of infrared presence detectors communicating over CPL
- Information obtained from electrical circuit activity and multi-media equipment (WiFi, telephone, etc.) combined with returns from ambient temperature and carbon-dioxide sensor.

Context: Three competing research teams each claim to have created a distributed sensing activity that can detect and model human activity on a 24/7 basis in a public research laboratory. Each system objective is to determine a log number of people present and nature of their activity in the Smart Habitat.

Hypotheses: Visual and acoustic sensors are sufficiently reliable and low cost that they can be used as a primary means for obtaining information about human activity. Commercially available power panels sensors can be accessed as an open source of information for the experiment.

Expected outcome: Visual and acoustic sensors provide a reliable and powerful, but expensive means of sensing human activity. Much of the required information can be obtained from analyzing patterns of use of electrical and media equipment.

Actual outcome: During deployment researchers discover a simple and elegant means to recognize the activity of people from fusion of visual and acoustic data. Unfortunately, the obtained data is very incomplete, as habitants in the building do not trust the assurances about privacy, and systematically unplug or block the visual and acoustic sensors. Meanwhile, obtaining open access to the commercial systems for electrical circuit use turns out to be a problem because the system is constructed on a proprietary protocol, and the manufacturer refuses to communicate the necessary documents. Sensing with infrared presence sensors turns out to be reliable, but access to commercial communications protocol also turns out to be problem.

- *PAL Domestic Service Robot*

Users of the platform and status: Researchers at INRIA/Sophia experts in robotics and Personal Assisted Living (partner), Aldebaran (Client) developer of the robot Nao, HomeCare developers.

AmiQual facility: Test apartment block in Montbonnot.

Test Subjects: Married graduate students, and friends.

Objective: Determine if a Personal Assistant robot is reliable enough for deployment.

Context: Several manufacturers of robot hardware claim to have platforms that are ready for deployment in home environments.

Hypotheses: Domestic robot technology has matured for home deployment.

Expected outcome: Demonstration of role that robot can play in the family.

Actual outcome: Robot control system turns out to be insensitive to human activity. Robot is frequently turned off and left in closet because its behaviour is distracting and annoying. Robot is reduced to a cute parlor trick to show visitors, but is not of any real use.

7.1.3 Examples Scenarios for AmiLab 2 – Smart HealthCare and HomeCare

- *Ambient assisted-living at home*

Users of the platform and status: CHU Toulouse medical and research staff, MEDES, Centre e-Santé, CUC medical staff, IRIT researchers on human-machine interaction, MSHST sociologists and ergonomists, LAAS researchers on human-machine interaction, perception, network communication, on dependability and security. All of them are partners.

AmiQual facility: The equipped rooms of Amilab 2 Centre e-Santéand/or persons wearing sensors and actuators. Sensors include wearable medical monitoring sensors (heartbeat sensor, ECG sensors, blood pressure sensors, pulse oxymeter sensors, activity sensors or glucose sensor), non-wearable medical sensors (weight scale, blood pressure monitor, spirometer, equilibrium functional exploration devices, motion capture system, exercisers etc…..), and environmental sensors installed in the patient's home (video cameras, presence sensors, videoconferencing devices, temperature, brightness, audio sensor…). A smart interface computer or smart phones that are able to store data and communicate with a central server through Internet is installed in the facility. Because the system is deployed at the patient's own living place, equipments are less intrusive, easy to deploy, easy to use, and possibly autonomously.

Test Subjects: Representative patients: for *in vitro* tests, test subjects are researchers and engineers. For *in vivo* tests, test subjects are patients in real life environmental conditions during their inclusion in medical and technological projects. The applicable regulations are applied (using the CF SHS repository about legal issues).

Objective: To develop innovative ambient intelligence based services that improve healthcare. Medical and technological research projects are being developed to enhance the use and appropriation of e-health systems, including home care processes models, evaluation of patients' acceptability as well as economic benefits.

Context: The Centre e-Santé in Toulouse promotes the development of e-health projects. It brings together a network of multidisciplinary experts in the medical, technical, economic, legal, societal, ethical, psychology and ergonomics fields and proposes evaluation methods to boost innovation in the area of e-health. The CENTICH (Centre Expert National des TIC en situation de Handicap) develops technological projects and proposes both evaluation methods and evaluation sites.

Hypotheses: Basic components, devices and sensors are available. The medical and research teams are ready to study the outcomes of different projects. The patients are willing to participate in different experimentations.

Expected outcome: Basic components and devices arey available, but their adaptability to remote medical treatments and their acceptability by patients have to be improved.

- *Follow-up in care facilities*

Users of the platform and status: CHU Toulouse, MEDES and CUC engineers and medical staff, Laboratory of Gerontology researchers and engineers, IRIT researchers in human-machine interaction, audio and video, context, services composition with multi-agent systems, middleware, software engineering, networks and indoor localization, LAAS researchers in network communication, perception, dependability, privacy, security, indoor localization, and middleware for mobile systems. Sociologists and ergonomists from MSHST. All of them, partners.

AmiQual facility: For *in vitro* tests, an equipment kit is available in IRIT, LAAS, MSHST, CHU Toulouse (Gerontechnology laboratory), and MEDES. For *in vivo* tests at hospital, the equipment will be deployed in several rooms. For example the equipment will be installed for experiments in the room of the CIC (Centre Investigation Clinique), in the spatial clinic of MEDES, or in the gérontopôle.

Test Subjects: For *in vitro* tests, test subjects are researchers and engineers. For *in vivo* tests, test subjects are patients identified by CHU Toulouse.

Objective: The objective is to develop innovative technologies for follow-up care of patients, to propose the continuity of services between hospital care and home care.

Context: The Institut Claudius Régaud, MEDES and CHU are looking for innovative solutions to solve some of their concerns about hospital and home care.

Hypotheses: Basic service components and devices are available. Research teams experts in software technology have developed new self-adaptive and cooperative servicest. Patients have agreed to participate in the experiments within the respect of applicable regulations.

Expected outcome: Useful, usable, and accepted tools and services for follow-up care. The equipment enables monitoring medical parameters as well as patients' activity. This permits to improve the follow-up of patients by automatically adapting the room to the patient's profile and by providing the medical staff with the appropriate information.

- *Assisted living with robots*

Users of the platform and status: LAAS researchers in robotics (navigation, manipulation, decision, human-robot interaction, perception…), dependability, indoor localization and middleware for mobile systems; IRIT researchers in human-machine interaction, MSHST sociologists and ergonomists; Laboratory of Gerontology researchers and engineers for robotized assistance for elder or disabled people, Centre e-santé and/or MEDES for evaluations. All of them, partners.

AmiQual facility: robots are prepared using the robotics LAAS facilities (guiding and dual-arm demonstrators) identical to robots that will be deployed for *in vivo* experiments. Users, either are equipped with dedicated interfaces (smart phones, innovative human-robot interface) used to send requests to the robot, or interact by natural modalities (voice, gesture…). Data acquired by sensors merged in the environment (microphones, cameras…) are fused with data acquired from embedded sensors in order to improve the quality of service. Depending on the maturity of the development and on user studies made by MSHST, *in vivo* experiments are then performed, either in a patient home (under the Centre e-santé control) or in a controlled domotic environment (provided by MSHST or MEDES).

Test Subjects: LAAS researchers play the patient role (*in vitro* experiment). Informed consent actual patients, selected by the Centre e-santé, test the innovative technology for robotized assistance at home (*in vivo* experiment).

Objective: The long-term objective concerns the development of a generic companion robot for humans at home; in the home-care context, two services are developed: (1) Assist an elderly or disabled person, living mainly alone at home, in order to solve some simple problems involving autonomous navigation and manipulation (typically, bring an object to the user, plug an equipment, pick up an object that has been dropped accidentally…). Here LAAS (possibly, with CEA LIST) reuse, improve and develop methods that will be designed and evaluated by the on-going ANR ASSIST project; (2) Deploy a simple domestic robot, possibly remotely controlled capable of moving sensors and/or actuators (cameras, microphones) close to a patient who has fallen.

Context: More and more elderly or disabled persons live alone at home, with only a home care assistant for a couple of hours. If such a person has a problem (e.g., an unreachable object to be grasped), he may have to wait for this assistant for a number of hours. On the other other, if a patient at home has a problem, a remote-controlled robot could help distant medical staff to do a preliminary diagnosis, or could help the patient (bring water or drugs…) before the intervention of the recue service.

Hypotheses: Are available: (1) a wifi network at home so that the robot can be safely controlled by Internet or can send alarms to a remote center; (2) multiple sensors (RFIDs, cameras…) or actuators (automatic door opening…) embedded in the environment, in order to make more robust and sure the robot.

Expected outcome: technological and scientific innovations in robotics for human applications, steps towards the emergence of a robot product that satisfy tthe needs expressed by users and medical staff, steps towards the certification of such products.

- *Quality of life within the hospital*

Users of the platform and status: CUC engineers and medical staff, IRIT researchers on human-machine interaction, context, distributed optimization with multi-agent systems, networks and indoor localisation, IMT researchers on optimization algorithms, MSHST sociologists and ergonomists, LAAS researchers on human-machine interaction, network communication, dependability, privacy, security, indoor localization, and middleware for mobile systems, Pole Star to evaluate new solutions for indoor localization.

AmiQual facility: LAAS and IRIT facilities (for *in vitro* experiments) equipped with RFID tags and RFID readers, and several indoor/outdoor systems. Patients and personal are equipped with smart phones and innovative human-machine interaction tools. In some strategic parts of the building, sensors as well as with display screens and loud speakers will be installed. Some specific rooms will be equipped with RFID readers. Clinique Universitaire du Cancer (for in vivo experiments).

Test Subjects: LAAS and IRIT researchers play the patient role (*in vitro* experiment). Informed consent actual patients (*in vivo* experiment).

Objective: To provide patients unfamiliar with the hospital with a secure service that guides them efficiently to the appropriate medical service. When entering the hospital, users have access to the service by a specific device (Smartphone, RFID tags on a bracket…) in contact with the "Hospital Welcome Console" appropriately located at the entrance of the hospital. From now on, they are registered for accounting, they are informed whether there is any delay about their appointment, and a personal navigation companion guides them to find the medical services they need (medical appointment, scanner, radiography…), a mean to reinforce the identification of the patients for specific care.

Context: The hospital become larger and the care protocols could be complex. The needs of guiding and resources management inside these large structure is required to facilitate the work of medical staff and the welcome of patients.

Hypotheses: The underlying network technology and a wifi access is available.

Expected outcome: Improved efficiency of several hospital services: (a) for patients: less time spent wandering lost in hallways and waiting in line for accounting procedures, increase the security in reinforcing the identity checking (b) for hospital personnel: reduced workload, more time for caring patients.

- *Scenario of an aware campus for disabled persons*

Users of the platform and status: IRIT researchers in human-machine interaction, audio and video, context, learning, distributed optimization with multi-agent systems, networks and outdoor localisation; LAAS researcher in outdoor localization, navigation, environment learning; Pole Star SA for indoor and outdoor localization. All partners of the project.

AmiQual facility: AmiLab 2 IRIT smart room.

Test Subjects: Researchers and students (including disabled ones).

Objective: The objective is to develop a real-time learning service deployed on the campus in Toulouse to identify the relevant potential trajectories for each disabled person based on to his/her collective concrete displacements. The ambient campus is then able to pro-actively provide handicapped people with a route optimized for their handicap.

Experimenting adaptive real time methods for helping persons using self configuring network of indoor and outdoor sensors and actuators. The goal is to improve their quality of life on the campus.

Context: At IRIT, a team is specialized in research for disability. The Toulouse University with "Plan Campus" and other projects is able to provide the location to show this innovative tool. The CENTICH (Centre Expert National des TIC en situation de Handicaps) will develop technological projects and will propose both evaluation methods and evaluation sites. LAAS could bring competences on navigation using joint modalities (embedded vision, sensors in the environment, GPS, INS…), e.g. GPS-INS fusion proposed for navigation of blind people in urban scenes, vehicle navigation…,

Hypotheses: The density of outdoor sensors and effectors is sufficiently important to obtain continuous help between buildings.

Expected outcome: To propose at the Toulouse PRES level, accessible and innovative services for improving the mobility and autonomy of disabled persons (students, employees, visitors). The university campus has buildings separated by large areas. Blind persons or with reduced mobility are equipped with an RFID on their mobile phones. Each phone possesses a virtual guide working proactively for a person in her everyday activities: in this case moving inside and between buildings.

- *Guide Service within the hospital*

Users of the platform and status: CHU Toulouse (partner), Institut Claudius Régaud (partner), MEDES (partner), IMT, IRIT, LAAS, MSHST Researchers.

AmiQual facility: Amilab 2 LAAS and IRIT facilities (for *in vitro* experiments) equipped with RFID tags and RFID readers, and an indoor-GPS system. The corridors are equipped with sensors in order to localize persons, as well as display screens and loud speakers. Clinique Universitaire du Cancer, CHU Toulouse and/or MEDES (for *in vivo* experiments).

Test Subjects: LAAS and IRIT researchers play the patient role (*in vitro* experiment). Informed consent actual patients (*in vivo* experiment).

Objective: To provide patients unfamiliar with the hospital with a secure service that guides them efficiently to the appropriate medical service. When entering the hospital, users have access to the service by bringing their SmartPhone in contact with the "Hospital Welcome Console" appropriately located at the entrance of the hospital. From now on, they are registered for accounting, they are informed whether there is any delay about their appointment, and a personal navigation companion guides them to find the medical services they need (medical appointment, scanner, radiography…).

Context: The hospital guide service is the result of a 4 year integrated research project. It is ready for deployment.

Hypotheses: The underlying network technology used is robust. Patients have their own SmartPhone that is compatible with the hospital system.

Expected outcome: Improved efficiency hospital reception service: (a) for patients: less time spent wandering lost in hallways and waiting in line for accounting procedures. (b) for hospital personnel: reduced workload, more time for caring patients.

7.1.4 Examples Scenarios for AmiLab 3 – Smart Commerce

- *Gesture-based interactions for interactive shopwindows, kiosks and fitting rooms*

Users of the platform and status: Human-Computer Interaction researchers from INRIA Lille – Nord Europe (partners) and LIFL (affiliates), and employees of companies involved in the *Industries du Commerce* competitiveness cluster (affiliates or clients).

AmiQual facility: INRIA Lille's reconfigurable technical platform: the platform provides a variety of gesture capture systems (e.g., vision-based tracking systems, wearable or handheld sensors, tactile surfaces), output devices (e.g., flat screens, projectors, speakers) and support structures that can be flexibly assembled together to create different configurations of interactive shopwindows, kiosks and fitting rooms.

Test Subjects: Ordinary people including students and actual customers of the involved companies.

Objective: The goal is to design, implement and evaluate gesture-based interaction techniques for interactive shopwindows, kiosks and fitting rooms:

- evaluate the benefits and drawbacks of the available gesture capture systems for generic direct and indirect pointing tasks in these contexts;
- design, implement and evaluate more complex gesture-based interactions for associated commerce-oriented services such as catalog browsing, orientation maps, clothes recommendation, etc;
- evaluate the impact of the size, orientation and resolution of the display(s) on the above techniques (both generic and specific);
- evaluate the impact of the possible input+output configurations on the collective use of the system;
- evaluate the impact of the possible input+output configurations on the combined use of the system with personal devices brought by customers (e.g., a smartphone or a tablet).

Evaluations will be conducted from both a quantitative (e.g., speed, accuracy) and qualitative (e.g., social acceptability) perspective.

Context: Interactive shopwindows, kiosks and fitting rooms are gaining popularity with the advent of gesture-based interaction and augmented reality. Yet designing and implementing such a system remains a hard task, and most of the people who can actually do it do not have the time or resources required to explore and compare alternative solutions.

Hypotheses: The so-called ``Natural User Interfaces'' do not scale:

- simple gestures that are effective and efficient on small-scale configurations (e.g., an iPhone) and basic tasks (e.g., shuffling photos) are not suitable for large-scale configurations or complex tasks;
- large-scale configurations and complex tasks require parameterized gestures (gestures that exhibit a meaniful variation) which are more difficult to interpret, especially from multipoint data.

The scale factor also has social implications: unlike the larger ones, small scale configurations ensure a certain level of privacy.

Expected outcome: Results from the in-lab evaluations corroborated by further *in vivo* studies will improve the researchers and practitioners' understanding of the considered interactions. This acquired knowledge will be capitalized into guidelines that will help practitioners' design and implement better interaction devices and techniques for their specific applications.

7.1.5 Examples Scenarios for AmiLab 4 – Smart Mobility

- *Collaborative work*

Users: Software developers, members of industrial partners and research institutions engaged in R&D and innovative projects (partners, and clients).

AmiQual facility: Amilab 4 Campus sensor network + smart house facilities + specific research projects developed in the Innovation Lab (IRT)

Test subjects: Researchers and participant to R&D and innovation projects.

Objective: Growing importance of partnership and co-development in organization life and innovation development call for cooperative work on various aspects: sharing information, remote collaboration, co-development of products and documents… AmiLab 4 provides the possibility to scrutinize cooperation processes and to assess the evolution of uses and cooperative performance adapting existing software and available infrastructures for distant work and collaboration.

Context: The test will benefit from the fixed-mobile continuity existing between Smart house-office relations on the one hand, outdoor network and locations in research institutions. Quality of the observations will take advantage from the existing supervision the research projects handled by the Innovation lab and from competencies develop by research partners (Telecom ParisTech and Polytechnique) with regard to the use and design of tools for computer supported cooperative work.

Hypothesis: Quality of innovation and tangible performance of cooperation process are highly dependent upon the management tools supporting cooperation. New ICT provides opportunities for designing and developing new disruptive set of applications.

Expected outcome: To comprehend emerging cooperative process in innovative projects and to design new applications and services related to distributed work and smart offices.

- *Optimizing smart mobility*

Users: Car suppliers, energy suppliers, developers of mobile embedded services.

AmiQual facility: Amilab 4 Campus sensor network + smart mobility technological platform + Polytechnique management research group on electric cars.

Test subjects: Researchers and members on the campus involved in geographically distributed projects.

Objective: Life on the campus, especially for individuals involved in distributed projects and research teams, calls for various moves and transportation in order to collaborate with different partners. People are, therefore, incented to frequently use a large array of transport means: car, vehicle pooling, public transportation, bikes, foot… It put at stake the optimization of energy expenses and carbon emissions. Campus will provide traceability of moves in connection with actual activity and "correlated emission costs". Experimentation aims at analyzing to which extent giving users real time information on this topic contribute to changing driving and working practices.

Context: The test will benefit from relations with Smart Mobility 2015 and the affiliation of EDF in AmiQual. Moreover, such test will take place in the projects Polytechnique run for a long time on services and product innovations for electric cars.

Hypothesis: Availability of information on sustainability of individual performances and the way they are displayed shape and contribute to the evolution of users practices.

Expected outcome: To define and propose efficient information services to be embedded in transportation means and individual devices (e.g., smartphones); to improve the design of transportation network in the campus, taking into consideration evolution and possible adaptation of users attitude.

7.1.6 Examples Scenarios for AmiLab 5 –Smart Buildings

- *Value-added services for assisted living*

Users of the platform and status: Researchers at I3S (CNRS and University of Nice Sophia Antipolis) (partners).

AmiQual facility: Amilab 5 Smart buildings modular apartment in Sophia Antipolis.

Test Subjects: mainly elderly people.

Objective: Provide, in home context, new services thanks to interoperability between multiple devices and smart objects.

Context: Manufacturers can test their own new devices interacting with others, to create new services for elderly people.

Hypotheses: Recent advances in middleware for ubiquitous computing allow the management of the interoperability between devices and smart objects at home, and then the creation of value-added services for assisted living.

Expected outcome: Demonstrate that value-added services for assisted living improve everyday life of elderly people.

Actual outcome: A set of standard smart objects and devices (X10, X2D ...) are already available to create new services using I3S middleware platform.

- *Indoor transfer and walking assistance*

Users of the platform and status: Robotic Researchers at INRIA/Sophia experts.

AmiQual facility: Amilab 5 Smart buildings modular apartment in Sophia Antipolis.

Test Subjects: the elderly in loss of mobility.

Objective:

- Provide an indoor transfer device with added functionalities such as walking assistance and some limited manipulation possibilities. It achieves mainly an assisted change of posture (for example to go from a lying down position to a standing position).
- The proposed device is a wire-driven parallel robot with a very little intrusion and a limited cost.
- Its geometry is modular and can be adapted to the room configuration to optimize it performance - e.g. workspace.

Context: A transfer is about making a person to go from one position to another : lie down, sit, stand. Obviously this problem is crucial in everyday life (getting off bed, lunchtime, wash).

Hypotheses: The use of a wired parallel robot with a crane layout, the actuators being located on the room's ceiling. When not in use this service will be hidden and will only come out on request for partial or complete assistance.

Expected outcome:

- Design: Determine the robot geometry, which could allow the transfer in the major part of a room with a given shape. One should take into account some uncertainty in the physical realization of the geometry;
- Command: One problem is linked with the use of wires only acting when under tension. In a crane structure the mechanical balance may lead to slack wires and therefore not all degrees of freedom of the system may be controlled simultaneously. The command should insure that in spite of this limit the system remains globally operational;
- Cost: the mechatronic part of the system should have a reduced cost in order to keep it affordable for the largest majority of users;
- Fitting: besides the fitting of the component realized during the phase of dimensional synthesis, one should offer and allow for changes on the robot end effector according to the user and the tasks assigned to the robot;
- Adequate interfaces.

Actual outcome: The feasibility of a crane based on a cable robot has been demonstrated.

- *Assessing the degree of frailty of the elderly*

Users of the platform and status: Researchers at INRIA/Sophia experts (experts), CHU Nice (clients).

AmiQual facility: Amilab 5 Smart buildings modular apartment in Sophia Antipolis**.**

Test Subjects: the elderly detected as frail -- e.g., after a medical operation or medical interview.

Objective: Provide a geriatric aid in home context to evaluate the degree of frailty of the elderly.

Context: The gerontologist must decide whether a frail elderly can return to home or must be placed in specialized institutes.

Hypotheses: The technics to determine the behavioral profile of a person is mature enough. Behavioral modeling of a person in a normal situation can be used to detect deviations from the representative profile and can prevent a potential accident.

Expected outcome: Demonstrate that a robust evaluation of the degree of elderly frailty, determined in a home context, could help improving a medical diagnostic and provide a more satisfactory care.

Actual outcome: Video analysis can perform simple situations when for example a fall occurs in front of the camera. A coarse behavioral profile of a person can be computed with basic activities.

7.2. STATE OF THE ART IN SCIENTIFIC SUBDISCIPLINES

This section provides a complementary description of the state of the art in the subdisciplines required for AmiQual. We have selected the following set of closely related issues currently addressed in very distinct disciplines (or sub-disciplines): Human-Computer Interaction, Intelligent systems and services, Multi-agent systems, Context-aware computing, Machine perception of human activity, Services Oriented Computing and Middleware, Integration of heterogeneous components, systems of systems, and sensor networks.

Human-Computer Interaction

A fundamental challenge concerns for HCI is the *nature of the interaction between ordinary people and human centered services*. This challenge is currently addressed in the areas of Human Computer Interaction [Beaudouin-Lafon 04], ergonomics [Nielsen 90], cognitive psychology, sociology, and design [Carroll 97, Carroll 01, Hollan 00, Hutchins 95, Preece 02]. With Ambient Intelligence, people will live in enriched spaces that will be sensitive to people's needs, spaces that will anticipate human behavior and will be responsive to their presence. In this context, the articulation and interplay between external and internal representations become key. What is the appropriate *balance between full transparency and full opacity about system state*? How to make sense of sensing systems [Bellotti 02]?

Although Ambient Intelligence is often promoted with concepts such as 'automation of device actions' and 'proactive technology', these features have *to be in balance with user's control*: lack of human control can happen due to device automation, for example when context-triggered actions are executed in a non explicit way. The background ideology here is that users, who originally have full control over the technological space, have voluntarily delegated some of their power to the system in order to expand the potential efficiency of the computing services. Actually, experience shows that users must be given the opportunity to (re)take control whenever desirable. This capability has strong requirements, deep in the system layers. In AmiQual, we will have the opportunity to make explicit the control points that the technical architecture must support to keep the human in the loop. Related to system architecture and software mechanism, dynamic adaptation of user interfaces to changes of the context of use is still an unsolved problem [Calvary et al. 03].

Ambient Intelligence promises unprecedented empowerment from the flexible and robust combination of software services with the physical world. This opens the opportunity for end-users to shape their own interactive spaces by coupling smart artifacts, building imaginative new functionalities that were not anticipated by system designers. A number of tools and techniques have been developed to support this view including the Jigsaw editor [Humble 03], CAMP [Truong 04], iCAP [Dey 06], aCAPpella [Dey 04], or Newman's work on end user composition with OSCAR [Newman 08]. Although these tools are novel attempts, we are far from providing end-users with the "right" end-user development environment [Burnett 03]. How can end-users, whose goal is not to learn programming, but to get something new by programming the system, harness the capabilities of their ambient system and take full advantage from it? AmiQual will provide the opportunity to address this question.

Intelligent Systems and Services

To be considered as intelligent, a system must be embodied, situated and autonomous. This view of intelligence has been elaborated by a variety of researchers [Brooks 91], [Breazeal 92]. Embodied means that the system must have some form of physical manifestation. For purposes of intelligence, *embodiment* requires that the system be able to interact with the environment [Pfeifer 95]. In the cognitive systems approach to robotics, systems are embodied in the sensory-motor system with which a robot interacts with its environment. For Ambient Intelligence, embodiment is provided by sensori-motor components that interact with the environment and its occupants.

Situated action was introduced in 1987 by Suchman [Suchman 87] as a way to reformulate the problem of purposeful action. The term situated action emphasizes the interrelationship between an action and its context of performance. Suchman argued that human action is constantly constructed and reconstructed from dynamic interactions with the material and social worlds. The theory of situated cognition emphasizes the importance of the environment as an integral part of the cognitive process. Her theory is widely used in ethnographic analysis, conversational analysis and the design of systems for human-computer interaction.

Situation modeling for context awareness has been addressed from a variety of different viewpoints in a variety of scientific communities. Early researchers in both artificial intelligence and computer vision recognized the importance of context for understanding. The Scripts representation [Schanks 77] sought to provide just such information for understanding stories. Minsky's Frames [Minsky 75] sought to provide the default information for transforming an image of a scene into a linguistic description. Recognizing such context was referred to as the Frame Problem and became known as one of the hard unsolved problems in AI.

Situation models for understanding human language abilities have been proposed by Johnson-Laird [Johnson-Laird 83] as a cognitive theory for human mental-models. While his model, as well as much of the subsequent literature in this area, has been concerned with spatial reasoning or linguistic understanding [Johnson-Laird 06], these concepts can be adopted for the construction of software systems and services for understanding social interaction. Situation models have been used to construct context aware services [Crowley 03]. As in the cognitive modeling literature, situations are defined as relations between entities, where entities may be agents, objects or any abstract concepts observed as a correlated set of properties. Situations may be organised into networks, with transition probabilities, so that possible next situations may be predicted from the current situation. This model has been used to construct a variety of services including services for recording events in a meeting or lecture [Metze et al. 05], privacy protection services and other communications services.

In most existing literature the context description is a static 'situation' vector, describing the state of the real world at a certain moment or during an interval in time at a certain location. To fully describe the state of the real world at a given moment in time is almost impossible. Any description of a situation is therefore incomplete, and a description is hence always an abstraction of the real world. Since we do not know the desired level of abstraction in advance we have to define a set of hierarchical representations. Those representations are commonly organized in an ontological hierarchy. Each level of the hierarchy has its own set of entities and relations for describing the world (ontology) and its own set of planning and operational methods. The entities, relations, and assumptions required by each level are provided by one or more of the lower levels in the hierarchy. The dependencies among levels in the hierarchy help clarify which combinations of representations are coherent, and which states of incomplete knowledge are meaningful.

Autonomous refers to the ability of a system to recognize and protect its own integrity. While autonomous systems have been extensively studied in the field of robotics over the last 30 years, the field has recently made major progress by importing concepts and techniques from autonomic computing [Kephart 03]. Autonomic computing has emerged as an effort inspired by biological systems to render computing systems robust [Horn 01]. Such systems monitor their environment and internal state in order to adapt to changes in resource availability and service requirements.

These concepts and techniques apply not only to autonomous robots, but provide an important enabling technology for all forms of systems and services that interact with people or with the physical environment. In particular, systems and services to be developed within the AmiLabs will require technologies for auto-configuration, auto-regulation, and self-repair.

Context-Aware Computing

Human activity is extremely rich. Real world scenes can contain an overwhelming number of possible agents and objects to detect and observe. The human environments of concern in AmiQual present highly complex environments with multiple overlapping contexts. AmiQual systems and services will be at or beyond the current state of the art in context-aware computing.

Human services require some method for organizing and representing information about human activity. Context modeling is necessary for determining appropriate actions and interactions, for completing missing information and for directing the computational resources of the system to the relevant observations [Coutaz 05].

Context awareness has become very important to mobile computing, where context is defined as "the location and identities of nearby people and objects and changes to those objects" [Schilit 94]. Other authors, such as [Rodden 98], [Cheverest 00] have defined context in terms of the environment or situation. Dey [Dey 01] reviews definitions of context, and provides a definition of context as "any information that can be used to characterize situation". This is the sense in which we use the term context. Situation refers to the current state of the environment. Context specifies the elements that must be observed to model situation.

Many models of space (and time) have hierarchical representations (e.g., European project Amigo). At the lowest level a representation close to the physics is chosen, such as an occupancy grid [Elfes 88] or metric representations of walls and doors. Also appearance-based models have been presented at this level. At the next level, usually topological representations are used, where the nodes are defined by geometrical characteristics [Kuijpers 87] or sensory features. A recent trend is to associate semantics with the topological representation [Zivkovic 06].

Following [Kuijpers 78] proposes the following hierarchy of representations of space.

- Metric: A geometric Cartesian coordinate system, completed by a universal time reference. In this coordinate system low level properties such as occupancy, walls, etc. can be represented, or the sensory (appearance) properties of the space.
- Topological: A network of named places joined by route segments. The places may be defined by geometric or by appearance properties. The temporal equivalents are the sequential periods of the day, such as morning, noon, afternoon, evening, and night. Also typical travel times can be represented at this level.
- Operational: Regions of space and periods of time in which certain behaviours are prohibited or allowed. Examples might include private spaces (bathroom, closet) versus public spaces (salon, dining area), and quiet periods (typically at night).

These can be used to organise location-based situation models for services.

A situation model has two facets: perception and action. Brdiczka [Brdiczka 06] has provided methods for learning entities, roles, situations and state transitions for recognizing situations. The use of modified reinforcement learning for learning the appropriateness of possible actions or behaviors that may be chosen in each situation has been described in [Barraquand08]. Learning approaches are also exploited by Remagnino and Zaidenberg as well at IRIT (with the AmiE project).

Machine Perception of Human Activity

Situating behaviour within the physical and social environment requires an ability to recognize and model human context in order to determine the appropriate behavior. Technologies and theoretical foundations for computer vision, acoustic scene analysis and machine learning have all made substantial progress over the last decade. This progress has been enabled by continued exponential growth in available computing power and memory, combined with sustained research funding from the European Commission's IST program, a series of DARPA and NSF initiatives in the US, and similar research programs in Canada, Japan, and more recently China and India. As a result, commercially viable technologies have lead to rapid market growth for application sectors such as Video Surveillance for security and commercial services [Collins 00], [Rejman 03], speech recognition for telephone based services, and machine learning for data mining [Mitchell 99]. Laboratory experiments have demonstrated the feasibility of many other high volume applications in areas as diverse as use of vision and acoustic sensing for video communications and video conferencing [Schwerdt 00a], perceptual user interfaces [Crowley 00], autonomous vehicles, and new classes of meeting services based on observation of human activity [Brdiczka 05a]. New DSP technologies developed for embedded devices [Wolf 04] now enable many real time computer vision and acoustic sensing algorithms to be embedded directly in hardware to provide low-cost integrated sensing systems. In addition, commercial technologies integrating large numbers of sensors and actuators are becoming commercially available [Harper 03].

AmiQual will exploit these advances to create the enabling technology for new class of applications for machine perception. Computer vision, acoustic perception will be used, in conjunction with a wide range of other sensor technologies, to provide software to detect, locate and track humans, to observe face and hands, to recognize individuals to monitor activity and to detect and recognize non-linguistic vocalisations like laughter, cries and sighs.

Acoustic sensing can be an important source of information about human activity. Acoustic energy recorded by either a small microphone array or individual microphone may be classified into speech or non-speech in order to provide clean signals to the speech localization and topic spotting processes. Probabilistic classification is used to classify signals based on a spectrogram provided by a Fast Fourier Transform. The recognition of acoustic signals is provided by a series of statistical tests applied to the spectrogram. Classifiers are trained on samples of the target acoustic signals [Omologo 97].

To be useful within real world environments, automatic speech recognition (ASR) technologies are made robust to any natural occuring signals (refrigerator, TV) occurring in particular environment. For automotive and telephone applications, noise-robust speech recognition is commonly obtained by multi-condition training using a mixture of clean speech and noises [Pearce 01]. Because an acoustic model obtained by multi-condition training reflects all expected noises in specific conditions, ASR's use of the acoustic model is effective as long as the noise is stationary. This assumption holds well for background noises in a car and or on a telephone. However, multi-condition training may not be as effective for dynamically changing noisy environment. Under such conditions, the system may be optimized by exploiting the microphone array theory [Brandstein 01] and the Multi-band approach [Bourlard 97] in order to enhance ASR performances. Both techniques will be tested and combined to optimize the recognition accuracy of the final system.

Tracking is fundamental to observing human activity [Crowley 03]. A tracking system provides information about users' behaviors that can be used for recognition of users and their activities. Perceptual components for detection and recognition of faces have been developed in recent EU projects. Identification of individuals from a small set of people including the owner, family, friends, and frequent visitors can be based on both face recognition and voice recognition. Face recognition using simple techniques such as principle components analysis [Turk 99] is feasible for small groups, provided that facial features can be precisely located for normalisation [Gourier 04]. Similar methods have been demonstrated for detecting interest, pleasure and displeasure based on face expressions from localised, normalised face images [Schwerdt 00b].

Observation of appearance and activities can be based on appearance information, based on statistical classification using scale normalised receptive fields [Schiele 00], [Hall 00, Hall 04, Hall 05a], spatio-temporal receptive fields [Chomat 00], and situation modelling [Crowley03].

Statistical classification of appearance can be used to classify such information as whether the owner has changed clothes. Articulated models can also be used to recognize actions and activity. Spatio-temporal information can be used to classify activity states (such as agitation or lethargy] as well as to detect information about movement and posture, and to recognize actions such as sitting, standing or falling [Chomat 99]. Such techniques can also be adapted to observing people to aid in communication of presence information.

For estimating the overall posture of the human body, two broad approaches have been adopted in past work [Gavrila 99]. In the first, the shape, articulation and kinematics of the human body are modelled explicitly and related to image features using photometry and projection. In the second, the characteristic arrangements of image features are modelled directly, without recourse to an object-based representation. A predominant theme in recent work has been to learn as much as possible about such models from training data.

For our purposes, the object-based approach has the advantage that postures are recovered directly and there are predictive tracking algorithms with good performance. However, discovering the posture in the first frame of a video sequence and dealing with tracking errors remain largely unsolved problems. In recent work, an elegant and unified solution to both problems has been proposed, using learned bottom-up part detectors such as that described by Viola and Jones [Viola-Jones 04]. This is combined with a 3D body model with relationships between parts that are learned from motion capture data. We will explore an extension of this method to integrate learning of part detectors – essentially a synthesis of the 'constellation' model with an object-based model of the relationship between parts. This will require a novel setup for simultaneous acquisition of posture and appearance data for training.

Machine perception of the emotional state of humans is a notoriously hard problem that is rapidly gaining attention in all areas of machine perception. Driven partly by the appreciation that computer interfaces are socially insensitive [Reeves96], a movement is growing to develop a science of affective computing [Picard 97, Pantic 03, Pantic 07a, Pantic 07b]. The area first gained attention in the mid-90's as many researchers attempted to extend the "Eigen-Faces" approach [Turk 91] to recognition of Ekman's Facial Action Codes [Ekman 77, Ekman 05] in face expressions. Such efforts proved frustrating, in part because the emotions in face expressions give rise to individual specific visual appearances. Nevertheless, Ekman's work on FAC has led many computer vision researchers to formulate the problem as that of assigning facial image sequences to one of seven fundamental classes [Essa 97]. Work on perceiving emotions from audio has met similar frustrations [Aubergé 03], in part for many of the same reasons.

Models of activity also can be represented with hierarchical representations. There are several papers describing a hierarchical hidden Markov model for activity recognition [Duong 05] [Oliver 02]. An important, but difficult, step in creating a hierarchical HMM is deciding what the intermediate level should represent. The goal of the intermediate level is to abstract away irrelevant details in the lower level, making it easier to perform classification from the intermediate level to the higher level. Of course this abstraction from lower to intermediate level should be easier to perform than the abstraction from lower to higher level directly. Promising is an approach [Oliver 02] where a two-level cascade of HMMs is used. The middle layer consists of an HMM for audio and a HMM for video. The highest layer uses the output from the middle layer as input and distinguishes the following activities: phone conversation, face-to-face conversation, presentation, other activity, nobody around and distant conversation. Also [Duong 05] uses a two layered system for the analysis of video captured from multiple camera's in a home setting. Also in an article by [Bobick 97], written with video analysis in mind, various levels of motion understanding are described. The lowest and most atomic level is referred to as movement. This is a type of motion whose execution is consistent one instance after the next and can be easily characterised by a definite space-time trajectory in some configuration space. The next level is called action. An action involves a spatio-temporal collection of movements. Although the semantic description of an action might be straightforward, visual recognition using purely visual appearance is a challenging research problem because of the variability of how the movements may be made. The recognition of action needs to be understood in a context of task and activity.

Services Oriented Computing

Service-oriented computing (SOC) has emerged as an approach to tackling the complexity of developing, operating and maintaining Internet-scale applications of high quality. SOC shifts the focus from monolithic systems to flexible integration of services using novel approaches to dynamic discovery, orchestration, assembly and management, policy and governance, quality of service, and information assurance. SOC is also a key enabler of the emerging trends towards grid and cloud computing, which play an integral role in enabling novel applications in E-Sciences, E-Government and ultra large-scale software-intensive systems, to name just a few examples. This shift toward flexible service integration also requires a deep understanding and, often, rethinking of end-to-end systems engineering processes, including the corresponding business and economic drivers for definition of, or changes to, enterprise architectures.

To be able to access different services, their description and how to compose them, they are usually deployed in a service-oriented architecture (SOA) [Bell 08]. OASIS defines SOA as "a paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains. It provides a uniform means to offer, discover, interact with and use capabilities to produce desired effects consistent with measurable preconditions and expectations." Significant works in these domains are for instance the SHAPE (http://www.shape-project.eu/), which "supports the development and realization of enterprise systems based on a Semantically-enabled Heterogeneous service Architecture (SHA), and SOA4All which is a Large-Scale Integrating Project funded by the European Seventh Framework Programme, under the Service and Software Architectures, Infrastructures and Engineering research are http://www.soa4all.eu/.

Working on the limitations of how services are currently used, the US Naval Research Laboratory explains [Kim et al 09] that "complex mission plans may need to incorporate information from various sources and domains to achieve a task. This information is available through a variety of web services in the Service-Oriented Architecture (SOA), but the ability to automatically compose them into a single coherent task is not readily available. Traditional composition approaches require human-intensive involvement, making them time-consuming and error prone. Therefore, the ability to automatically or semi-automatically orchestrate web services in a short timeframe is highly desirable."

Middleware systems

Middleware is the abstraction layer between applications and operating systems/networks offering two main facilities: 1) interactions between distributed applications, and 2) containers for hosting application components. For the first point, several interaction paradigms exist, mainly, RPC, message passing, data sharing, eventing, and all their variants. For a same given paradigm, a large variety of transport protocols can be envisaged like CORBA, Java RMI, SOAP, REST, JSON-RPC, Google RPC, etc. for RPC-centric interactions. For the second point, containers manage the life cycle of application components including installation, instantiation, configuration, starting, execution, stopping, reconfiguration, updating, and uninstallation. The main difference between the various container technologies is that each provides a specific programming model (e.g., API) to develop and manage application components. Orthogonally to these two key concerns, middleware must also manage extra non-functional properties like security (e.g., access control, encryption of interactions, and privacy), fault-tolerance (e.g., transactions and replication), resilience (i.e. persistence of dependability when facing changes), logging facility, embed ability, real-time support, context-awareness, etc.

Main generic challenges to address for next generations of middleware are:

<u>Integration</u>. Currently, no middleware fits all application requirements in terms of interactions, containers, and non-functional properties. Often, designers/developers need to integrate inside their applications several middleware technologies together to address their application requirements. We need to design, and prototype the “middleware of middlewares” layer as a new abstraction layer between applications and the diversity of middleware to integrate. OASIS’s Service Component Architecture (SCA) specifications provide first elements of a preliminary answer in to this problem.

<u>Discoverability</u>. The users in the user-centric systems supported by AmiQual cannot be assumed to have prior knowledge about all the facilities provided by the ambient intelligent system, making it

essential to provision a (set of) discovery protocol(s). Since the envisioned systems may contain nodes running different system software stacks (including different discovery protocols) and may belong to multiple networks (e.g., Bluetooth, WiFi, 3G, Ethernet, Zigbee/IEEE 802.15.4), we need to analyze existing multi-network discovery protocols, and augment them to address the larger amount of heterogeneity exhibited by the systems in AmiQual.

Modularity and extensibility. Middleware systems are complex pieces of software providing orthogonal but complementary features. Then, as any other complex software, middleware must also be built with modularity and extensibility in mind. Applying modern software engineering techniques like Model-Driven Engineering (MDE), Service Oriented Computing (SOC), Component-Based Software Engineering (CBSE), Aspect Oriented (AO*) must allow the modularization of middleware features and provides better foundations for middleware extensibility. AmiQual should investigate middleware extensions for embedding software into sensors and actuators, new interaction paradigms and protocols dedicated to context-aware application services.

Adaptability, configurability, and reconfigurability. Middleware must be adaptable to fit various application requirements, system constraints and the distributed nature of ambient systems. Middleware adaptability takes two forms: configurability at middleware deployment time and reconfigurability to take runtime context changes into account. Reflective component models (e.g., OpenCOM, Fractal, FraSCAti [Seinturier et al 09]) are one of the research directions to continue to investigate for addressing adaptability, configurability, and reconfigurability of distributed middleware and applications. The completely distributed nature of ambient systems and their context-awareness imply to design and implement fault-tolerant and adaptable a resilient middleware with fault-tolerance and adaptation features (using by instance self-managed middleware).

Integration of heterogeneous components

To be useful and economically viable, human services must accommodate and employ whatever devices can be found in the local infrastructure. In order for ambient systems and services to truly improve the quality of life for ordinary citizens, networked devices must work together in automatic and seamless manner to provide user services. In reality, it is currently impossible to achieve such seamless interoperability, and the problem is made ever worse as new types of devices and services emerge. While a small number of technophile early adopters manage to cobble together federations of incompatible devices, the average person has neither the patience nor the availability for overcoming the barriers that separate small islands of interoperability.

Integration of truly useful ambient systems and services raises serious architectural problems that currently cannot be addressed by the individual sub-disciplines of informatics. How can new devices and services be designed to interact with one-another, as well as with future categories of devices that have not yet been imagined? Is it possible to propose a standard universal set of protocols that span the existing diversity of devices, and adapt to the emergences of new categories of devices? How can human services evolve to accommodate a changing federation of devices and device types? How can user interface of these evolving services dynamically adapt to the context of use [Calvary et al. 03]? Such questions require an integrated systems context to be properly posed. Possible answers can only be properly validated by experiments with real users in real-world environments.

Current approaches to interoperability adopt an "ontological" approach [Edwards 09]: A standard is created for how the device's functions are to be exposed to the network and used by peers. Knowledge of this standard, in the form of protocols, data formats, and semantics, are then built in to peer devices. New types of devices require creation of new standards, that must be retrofit into earlier devices. For example, UPnP encodes interfaces for families of devices as "profiles". Examples of existing profiles include printers, scanners, video projectors, etc. Similarly, Bluetooth defines profiles for cameras, keyboards, mice, smart phones, headsets, etc. For cost and reliability such protocols are stored in read-only memory. As a result, interoperability with new classes of devices is impossible. Even when retrofit is possible, the complexity and inconvenience tend to exceed what the average user is capable or willing to provide.

Such arrangements gain interoperability at the expense of evolution. New families of devices are required to interoperate with earlier devices, imposing standards and protocols that may be highly constrained or poorly adapted to current needs. The requirements of backwards compatibility severely hinder functionality of new devices and services. This is visible in personal computers when new systems and software maintain compatibility with only the most recent versions of previous systems. Users are forced to abandon otherwise useful software and hardware older than 5 years for reasons of incompatibility with peer systems. Such forced incompatibility may be acceptable for personal computers where the average life cycle is 2 or 3 years. It is completely unacceptable for habitats designed to last 25 to 50 years between major renovations.

System of systems

A system of systems is an assembly of "components" collaborating over time in order to reach a specific goal. Examples of SoS can usually be found in aeronautical, space, army, railway or telecommunication industries. The main difficulty for a SoS is to choose the right systems, their right interactions to satisfy at the best the mission requirements for which a SoS has to be assembled. Consequently, the integration of an existing system into a SoS [Maier, 1998] concerns several questions: the required representation about a system inside a SoS (architecture frameworks such as NAF[12] TOGAF[13]), the interoperability of these systems [Eklöf, 2006], the composition of a subset of systems in order to achieve a given new mission in real-time [Liu, 2008]. The composition of these individual heterogeneous systems implies non-linear interactions typically leading to important emergent properties [Bar-Yam, 2004].

SoS are built from existing systems and have a dynamic composition, that is systems have their own objectives and selectively cooperate to SoS objectives. The dynamic composition of SoS implies that architectural constraints of existing systems must be taken into account for defining SoS-level requirements. This engineering question seems to be close with the similar problem in ambient systems.

Service-Oriented Architecture (SOA) [Papaglozou, 2007] addresses some of SoS specificities. Indeed, SoS are made of communicating and evolving units but missions are also built out of available services, the capabilities of which have to be described. This service description must also be specified in ambient systems. Moreover ambient systems must address a new question: determining the current context in order to decide if a given service could be relevantly applied. This is a non-trivial problem due to the inherent mobility of some devices and volatility of services.

The main remaining difference with ambient systems is the inability in the latter to define explicitly a common global objective to reach. Moreover, several dynamic and perhaps conflicting goals may coexist requiring some mechanism for satisfying several evolving constraints dynamically.

Multi-Agent Systems

Multi-agent systems are systems composed of several autonomous and distributed agents that interact in a common environment in order to solve a common task. "An agent is a computer system that is situated in some environment and that is capable of autonomous actions in this environment in order to meet its delegated objectives" [Wooldridge, 1995]. Multi-agent systems are used for networked applications (such as web services, mobile computing, service computing). They complement service oriented computing by offering the intelligence and reasoning capabilities that are needed [Chao, 2010], [Blake 2007] to take into account more complex, heterogeneous environment. The classical multi-agent systems are composed of provider agent, requester agents and broker agents. In the first systems, the broker is centralized and provides information about the services (FIPA architecture). Currently the approaches are decentralized where there are several brokers [Moukas, 1996], [Camps 1998], or where a provider or a requester agents can play the broker role [Sycara, 2004]. In general, most applications are web-based. The next challenges that Griffiths et al propose as future direction for agent-based service-oriented computing, is to assess and reduce the risk of failures, and define the responsibilities of the agents

[12] http://www.nhqc3s.nato.int/ARCHITECTURE
[13] http://www.opengroup.org/togaf/

involved (accountability). These systems can also exhibit self-* properties in order to be robust and efficient.

Sensor Networks and Communications Systems

Integration within the AmiLabs will impose a number of constraints on technologies for Sensor Networks and Communications Systems:

- The networking infrastructure should be non-intrusive energy and form-factor.
- The communication performance should follow the needs of the devices which are more in terms of lifetime, connectivity and robustness than the usual throughput and latency.
- The network should be easily accessible from the existing Internet connected interfaces.
- All devices, sensors, actuators, should be able to interact, cooperate and interoperate with the networking infrastructure.
- The network should use any convenient media available.

The first and second points define a set of physical and electronic constraints as well as networking aims that are summarized in what is called Low Rate Personal Area Networks (LR-PAN). The third and fourth points lead to the IETF works about Ipv6 for LR-PAN starting with the 6LoWPAN RFC adaptation layer. The fourth point may take advantage of the automation experiences with application predefined profiles. The last point covers wireless and wired physical media, especially the power grid support (PLC) that is widely available in buildings and the control point of all the power grid connected devices.

The existing works about the wireless PANs, embedded systems, control, sensing and actuating are numerous. Our target in AmiQual is the definition, design and prototyping of an operational LR-PAN multi-media infrastructure supporting Ipv6 with a 10 years lifetime corresponding the building automation demand. This infrastructure will be based on physical layer standards already usable for the *in vivo* testbeds.

Within AmiQual, researchers from the area of sensor networks will address challenges related to

- Realization of an operational networking infrastructure for the in vivo testbeds.
- Lifetime optimization by the placement of the power grid connected networking nodes.
- The design of IPv6 adaptation protocols for LR-PAN.
- Multi-media routing between LR-PAN.
- Lifetime optimization by the routing metrics of LR-PAN.
- Scalable support of the diversity of data communication schema on the LR-PAN infrastructure.
- Protocols allowing the maintenance and evolution of the networking infrastructure.

Wireless sensor networks (WSN) have received considerable attention in recent years due to their potential applications in numerous areas such as environment monitoring, military and emergency fields, healthcare and ubiquitous computing. Ubiquitous sensor networks, which correspond to the field of the AmiQual platform, are seen as an enabling technology for Ambient Intelligence [Fleury et al 07] because they are able to bring contextual information about the system, the environment or the users. The typical example is the usage of WSN in "smart buildings" where they allow optimizing heating systems, detecting users and intruders, etc. Data fusion performed in the system, which can use sophisticated algorithms coming from artificial intelligence like machine learning, leads to an infinite number of possibilities. The scientific challenges in the domain of WSN are numerous; the literature [Fleury et al 09] distinguishes several main areas: low-energy communication protocols (from physical layer to transport layer), self-organization, data-fusion, software development, and efficient operating systems for limited devices.

Position with regard to SensLab [SensLab] and F-Lab [F-Lab] platforms and the FIT (Future Internet of Things) platform: While these platforms mainly concentrate on communication protocols, the AmiQual platform will provide the possibility to experiment WSN usage in Ambient Intelligence context. Our main goals involve interoperability with other components of the system, combination of services from different sensor networks or other computing systems, quality of service, security aspects, software development and their integration in standard middleware.

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7.5. Estimates for the Equipment

The ANR Web site limits EquipEx proposals to 2 files (fiche-a and fiche-b) with a combined total of 10MegaBytes. Due to the very large number of components required to construct the AmiQual facility, we could not reasonably join the assembled price quotes to this document. Price quotations ahve been assembled as a single file that can be downloaded from:

http://www-prima.inrialpes.fr/Prima/Homepages/jlc/amiqual/devis

7.6. PARTNER COMMITMENT LETTERS

Because of the storage limitation of 10Mb on the ANR web site for the EquipEx proposal, we are unable to join these letters. Letters from Partners may be recovered from

http://www-prima.inrialpes.fr/Prima/Homepages/jlc/amiqual/letters

7.7. AFFILIATE COMMITMENT LETTERS

The AmiQual affiliates currently include a mix of industrials and academics, geographically distributed, with complementary domains of expertise:

- Artal Technologies – PME Toulouse – Software development
- Auvea Ingénierie – PME Toulouse – Internet service provider
- DiotaSoft – PME Paris – Technical solutions for mobile application.
- EDF Direction Générale de la Recherche, Clamart – Public enterprise – Comfort and Energy.
- Fondaterra Fondation Européenne pour des Territoires Durables – Fondation Partenariale de l'Université de Versailles Saint-Quentin-en-Yvelines et des groupes industriels EDF, GDF-Suez et Vinci – Environmental sustainability.
- France-Telecom R&D – Meylan - Telecommunication
- H2AD – PME St-Etienne– Homecare, distant homecare teleassistance and telediagnosis.
- Institut des Mathématiques de Toulouse (IMT) – UMR 5219 – Mathematics, statistics.
- INTESENS - PME Toulouse - multi-sensor technologies, energy consumption diagnosis.
- KAYENTIS – PME Toulouse - Publisher and operator of digital pen and smart paper solutions for the healthcare industry
- Magellium - PME Toulouse - Signal and image processing, geomatics, learning technologies, robotics and intelligent systems.
- MHComm SAS - PME Toulouse - Mobile telecommunications expert and an IT solutions integrator
- PICOM-Pôle de Compétitivité Industrie-Commerce – Lille - Commerce
- SADIR - association Toulouse – Homecare, technico-medical assistance at home.
- Schneider Electric - entreprise Grenoble – Comfort and Energy.
- Spikenet Technology Sarl – PME Toulouse - Image processing, image recognition application..
- Université Pierre Mendès France, SFR Innovacs – PRES Grenoble.
- Upetec – PME Toulouse – Multi-agent systems, self-adaptive systems.
- Voxler SAS – PME Paris– Technical solutions for vocal interaction.

Labège le 14 Septembre 2010

Artal Technologies
Rue Pierre Gilles de Gennes
BP 38138
31681 LABÈGE cedex

Objet : Affiliation au projet Equipex « AMIQUAL » AMbient Intelligence for QUAlity of Life

Madame, Monsieur,

Après avoir pris connaissance du projet AMIQUAL, je vous confirme que ARTAL Technologie porte un fort intérêt à la mise en place d'une plateforme d'intelligence ambiante et souhaiterait rejoindre le projet en tant qu'**Affilié**.

A ce titre, Artal pourrait intervenir comme utilisateur représentatif de la plateforme et participer aux réunions du comité scientifique concernant la définition de l'Amilab Healthcare & Homecare.

En contrepartie, Artal aura libre accès aux résultats scientifiques capitalisés par la plateforme.

Je reste à votre disposition pour tout complément d'informations et vous prie d'agréer, Madame, Monsieur, l'expression de ma considération distinguée.

Benoit VIAUD,
Responsable département Modélisation & Simulation

artal technologies

Rue Pierre-Gilles de Gennes
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31681 LABEGE CEDEX
Téléphone : 05 61 00 39 30
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Société par Actions Simplifiée (SAS)
Au capital de 219.600 €
RCS Toulouse B 419 472 493
SIRET 00032 - APE 722C
TVA intra-communautaire 19 419 472 493 00032

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Monsieur Alexandre SEMENADISSE
Gérant de la société Auvea Ingénierie
100 route de Francazal
31120 Portet-sur Garonne

Objet : Affiliation au projet Equipex « AMIQUAL » *AMbient Intelligence for QUAlity of Life*

Madame, Monsieur,

Après avoir pris connaissance du projet AMIQUAL, je vous confirme qu'Auvea Ingénierie est très intéressée par les objectifs ambitieux et la mise en place de cette plateforme d'intelligence ambiante et souhaite le rejoindre en tant qu'Affilié.

En tant qu'Affilié, Auvea Ingénierie interviendra comme utilisateur représentatif de la plateforme. Il participera aux réunions du comité scientifique concernant l'expression des requis, au regard notamment des expérimentations liées aux maladies chroniques.

En contrepartie, Auvea Ingénierie aura libre accès aux résultats scientifiques capitalisés par la plateforme.

Fait le 9 septembre 2010, à Portet-sur-Garonne

Alexandre SEMENADISSE

SARL AUVEA INGENIERIE
100 ROUTE DE FRANCAZAL
31120 PORTET
0562 [illegible] 0561749136
450 10[illegible] 000 000 [illegible] RCS TOULOUSE

Monsieur Lionnel JOUSSEMET
Co-fondateur et président
DIOTASOFT S.A.S
17, rue Liénard
92160 Antony

DIOTA SOFT

Objet : Affiliation au projet Equipex « AMIQUAL » ***AMbient Intelligence for QUAlity of Life***

Madame, Monsieur,

Après avoir pris connaissance du projet AMIQUAL, je vous confirme que la société DIOTASOFT est très intéressé par les objectifs ambitieux et la mise en place de cette plateforme d'intelligence ambiante et souhaite le rejoindre en tant qu'Affilié.

En tant qu'Affilié, DIOTASOFT interviendrait comme utilisateur et expert des technologies nomades grand public, tant au niveau du développement d'applicatifs mobiles que de l'élaboration de briques technologiques telles que celles relatives à la réalité augmentée mobile. Il participerait aux réunions du comité scientifique concernant l'expression des requis, au regard notamment des expérimentations liées aux problématiques technologiques et fonctionnelles inhérentes à la mobilité.

En contrepartie, DIOTASOFT aura libre accès aux résultats scientifiques capitalisés par la plateforme.

Fait le 6 septembre à Antony,

Lionnel Joussemet

DIOTASOFT S.A.S.
Société par actions simplifiée au capital de 15 000 €
17, rue Liénard
92160 ANTONY – FRANCE
Tel. : +33 1 46 66 46 03 Fax : +33 9 58 48 85 03
RCS NANTERRE 511 778 532

copie

EDF

INRIA Rhône-Alpes
A l'attention de James CROWLEY
Professeur Grenoble INP
655 Avenue de l'Europe

38330 MONTBONNOT-ST-MARTIN

Nos références : E70/10/042/CM/DW
Interlocuteur : C.MULLER – 01.47.65.37.38
Objet : : Projet AMIQUAL

Clamart, le 3 septembre 2010

Monsieur,

EDF R&D département ICAME est intéressé par les objectifs et les résultats du projet de plate-forme AMIQUAL et souhaite se joindre au projet en tant qu'affilié.

En tant qu'affilié AMIQUAL, EDF R&D département ICAME interviendra comme utilisateur représentatif de la plate-forme. Il participera aux réunions et ateliers concernant l'expression des requis et pourra être amené à évaluer les résultats du projet, au regard notamment des expérimentations liées au bâtiment. Notre intérêt porte plus particulièrement sur le confort durable dans l'habitat (énergie et confort) et sur les services numériques pour la famille. En contre-partie, EDF R&D département ICAME aura librement accès aux résultats du projet.

Dans le cadre de notre participation en tant qu'affilié, nous envisageons une participation initiale modeste nous permettant de nous rendre compte de la portée de la plate-forme AMIQUAL relativement à nos objectifs et relativement à l'engagement en temps que cela suppose.

Dans un premier temps, et plus concrètement, nous engageons des discussions avec le CEA dans le cadre du projet Innovation Lab et de l'initiative SystemX à Saclay.
David Menga, Philippe Suignard et Yvon Haradji pourront alors rendre compte du travail effectué et des perspectives envisageables en lien à nos projets, pour décision de poursuivre plus avant notre implication.

Nous vous prions d'agréer, Monsieur, l'expression de nos sentiments distingués.

Le Chef du Département
Innovation Commerciale, Analyse des Marchés
et de leur Environnement,

Corinne MULLER.

Page 1/1

Direction Recherche & Développement
Département I.C.A.M.E.

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Téléphone +33 1 47 65 54 20
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EDF - SA au capital de 8 129 000 000 euros - 552 081 317 R.C.S. Paris

france telecom

Meylan, le 7 septembre 2010

Noël CHATEAU
Responsable du laboratoire MATIS
France Télécom R&D
28 Chemin du vieux chêne
BP 98, 38243 Meylan cedex, France
Fax : +33 4 76 90 43 32
Tél : +33 4 76 76 40 60

Joëlle COUTAZ
Professeur Université Joseph Fourier
Laboratoire d'Informatique de Grenoble
385 rue de la Bibliothèque
BP 53, 38041 Grenoble cedex 9, France
Fax : +33 4 76 63 56 86,
Tél : +33 4 76 51 48 54

Madame le Professeur,

Suite à votre sollicitation et après avoir pris connaissance du projet AMIQUAL, je vous confirme que France Télécom R&D est très intéressé par les objectifs et les résultats de ce projet de plate-forme et souhaite le rejoindre en tant qu'affilié.

En tant qu'affilié AMIQUAL, France Télécom R&D interviendra comme utilisateur représentatif de la plate-forme. Il participera aux réunions et ateliers concernant l'expression des requis et sera amené à évaluer les résultats du projet, au regard notamment des expérimentations liées au bâtiment. En contrepartie, France Télécom R&D aura librement accès aux résultats du projet.

Je vous prie d'agréer, Madame le Professeur, l'expression de ma considération distinguée.

Noël CHATEAU

France Télécom SA

H2AD

Docteur Jean-Michel Souclier
Directeur Général
H2AD
7 Metrotech
42650 St Jean Bonnefonds

Professeur Marie-Pierre Gleizes
Université Paul Sabatier, IRIT
118 route de Narbonne
31062 TOULOUSE CEDEX 09

Objet : Affiliation au projet Equipex « AMIQUAL » *AMbient Intelligence for QUAlity of Life*

Professeur,

Après avoir pris connaissance du projet AMIQUAL, je vous confirme que H2AD est très intéressée par les objectifs ambitieux et la mise en place de cette plateforme d'intelligence ambiante et souhaite la rejoindre en tant qu'Affilié.

En tant qu'Affilié, H2AD interviendra comme utilisateur représentatif de la plateforme. Il participera dans la mesure du possible aux réunions du comité scientifique concernant l'expression des requis, au regard notamment des expérimentations liées aux solutions de télémédecine.

En contrepartie, H2AD aura libre accès aux résultats scientifiques capitalisés par la plateforme.

Fait le 10 septembre 2010, à St Jean Bonnefonds

Jean-Michel Souclier, p.o. Cédric Wartel

Monsieur Xavier LAFONTAN
Président
INTESENS
10 av Europe
31520 RAMONVILLE

Objet : Affiliation au projet Equipex « AMIQUAL » AMbient Intelligence for QUAlity of Life

Madame, Monsieur,

Après avoir pris connaissance du projet AMIQUAL, je vous confirme qu'INTESENS est très intéressée par les objectifs ambitieux et la mise en place de cette plateforme d'intelligence ambiante et souhaite le rejoindre en tant qu'Affilié.

En tant qu'Affilié, INTESENS interviendra comme utilisateur représentatif de la plateforme. Il participera aux réunions du comité scientifique concernant l'expression des requis, au regard notamment des expérimentations effectuées.

En contrepartie, INTESENS aura libre accès aux résultats scientifiques capitalisés par la plateforme.

Fait le 10 septembre 2010, à Montpellier

Xavier Lafontan

kayentis

Objet : Affiliation au projet Equipex « AMIQUAL » *AMbient Intelligence for QUAlity of Life*

Madame, Monsieur,

Après avoir pris connaissance du projet AMIQUAL, je vous confirme que la société Kayentis est très intéressée par les objectifs ambitieux et la mise en place de cette plateforme d'intelligence ambiante et souhaite le rejoindre en tant qu'Affilié.

En tant qu'Affilié, Kayentis interviendra comme utilisateur représentatif de la plateforme.
Il participera aux réunions du comité scientifique concernant l'expression des requis, au regard notamment des expérimentations.

En contrepartie, Kayentis aura libre accès aux résultats scientifiques capitalisés par la plateforme.

Fait à gif sur Yvette le 10 septembre 2010

Philippe BERNA
Président

Kayentis
[illegible] route de la Noue
91190 Gif-sur-Yvette
FRANCE

Tel +33 (1) 69 1 825 40
Fax [illegible] 611 679 09
www.kayentis.com

SAS au capital de 142 658 [illegible] RCS 451 564 809 Evry [illegible] APE 7415
[illegible]

magellium

Affaire suivie par : Bruno KRIEF
Téléphone : 05 62 24 70 21
Fax : 05 62 24 70 01
e-mail : bruno.krief@magellium.fr

LAAS-CNRS
7, avenue du Colonel Roche
31077 Toulouse Cedex 4

A l'attention de M. Michel DEVY

Toulouse, le 8 septembre 2010

Nos réf. : MAG-10-CSP-144-v1.0

Objet : Lettre de soutien au projet AMIQAL (Equipement d'Excellence/Grand Emprunt)

Monsieur,

Nous avons pris connaissance du projet AMIQAL (Systèmes AMbIants pour la QUALité de vie) en réponse à l'appel à projets « Equipements d'excellence » du Grand Emprunt. Ce projet de plateforme nationale se focalise sur des thématiques telles que l'habitat intelligent (Grenoble et Nice), la mobilité (Paris), le commerce (Lille) et la e-santé (Toulouse). Ce dernier item nous intéresse tout particulièrement et concerne le développement et la validation de solutions technologiques pour l'aide à domicile, l'assistance à l'hôpital à travers la robotique et la géo-navigation notamment.

Magellium est une société Toulousaine de plus de 130 personnes intervenant dans les domaines de l'espace, la défense, l'environnement et la santé selon quatre grandes thématiques technologiques : le traitement du signal et de l'image, la géomatique, la géo-navigation, les technologies innovantes de la communication (NTIC) et la robotique/systèmes intelligents. Nos clients et partenaires sont les grands donneurs européens de la défense et de l'industrie spatiale (DGA, CNES, ESA, THALES, EADS,...) ainsi que le tissu scientifique/académique national (LAAS, IUP, ONERA, Telecom Paris,...).

Magellium est actuellement impliquée dans un certain nombre de développements dans le domaine médical : (i) plateforme de eLearning en biologie médicale (eHematImage), (ii) plateforme d'imagerie multimodale en onco-dermatologie (Camm4D), (iii) solution WEB pour le HAD en cancerologie (SEHO), (iv) solution de télé-échographie robotisée (projet ARTIS pour l'ESA). D'autres projets collaboratifs viennent compléter de manière transverse les activités R&D de Magellium en relation avec les ambitions d'AMIQUAL, ils concernent la robotique mobile autonome, la navigation indoor (projets Agexpo, Filonas,...).

Magellium est très intéressée par les objectifs du projet de plateforme AMIQUAL, et souhaite donc se joindre au projet en tant qu'affilié. Nous avons pris note que les conditions d'accès à la plateforme en tant qu'affilié seront évaluées ultérieurement.

Nous vous prions d'agréer, Monsieur, l'expression de nos salutations distinguées.

Jean-Pierre Madier
Président

24 rue Hermès - BP 12113
31521 Ramonville St Agne cedex
Tel: +33 (0)5 62 24 70 00
Fax: +33 (0)5 62 24 70 01

www.magellium.fr

Mr Olivier Galy
Directeur Général
MHComm SAS
Site Freescale
134 avenue du Général Eisenhower
31100 Toulouse

Objet : Affiliation au projet Equipex « AMIQUAL » *AMbient Intelligence for QUAlity of Life*

Madame, Monsieur,

Après avoir pris connaissance du projet AMIQUAL, je vous confirme que MHComm est très intéressée par les objectifs ambitieux et la mise en place de cette plateforme d'intelligence ambiante et souhaite le rejoindre en tant qu'Affilié.

En tant qu'Affilié, MHComm interviendra comme utilisateur représentatif de la plateforme. Il participera aux réunions du comité scientifique concernant l'expression des requis, au regard notamment des expérimentations liées à la plateforme de communication (terminal, tablette) et son intégration aux domiciles avec les capteurs biomédicaux, les logiciels métiers et éducatifs.

En contrepartie, MHComm aura libre accès aux résultats scientifiques capitalisés par la plateforme.

Fait le 09 Septembre 2010 à Toulouse

Olivier Galy

MHComm SAS
Site Freescale
134 avenue du Général Eisenhower
31100 TOULOUSE
Siret n° 5?2 889 179

Pôle de compétitivité
Industries du Commerce

Centre de Recherche
INRIA Lille Nord Europe
Université Lille 1
LIFL - UMR 8022 CNRS - Bat M3
59655 VILLENEUVE D'ASCQ CEDEX

Le 13 septembre 2010

A l'attention du Professeur David Simplot-Ryl

Monsieur,

Nous avons pris connaissance du projet d'Equipement d'Excellence AMIQUAL sur l'Intelligence Ambiante que vous nous avez soumis pour avis et qui a retenu tout notre intérêt. Ce projet vise la création d'une plate-forme de recherche autour de l'intelligence ambiante autour de plusieurs chantiers dont le Commerce du Futur à Lille.

Je vous écris pour vous faire part de notre intérêt pour ce projet. Nous considérons que l'approche expérimentale est fondamentale pour l'innovation dans ce domaine.
La plate-forme AMIQUAL permettra aux partenaires académiques et industriels de disposer d'un socle technique et scientifique d'expérimentation et de validation de nouveaux usages et services. Ce projet est en parfaite adéquation avec les thématiques et objectifs du pôle et complémentaires avec des projets comme ICOM (Infrastructure du Commerce du futur).

Le Pôle souhaite que ses membres puissent être associés au projet de manière concrète, le moment venu, selon les modalités à convenir.

Nous vous prions d'agréer, Monsieur, l'expression de nos salutations distinguées.

Patrick Brunier
Délégué Général

MÉTROPOLE LILLOISE :
ENTREPRISES ET CITÉS

RÉGION PARISIENNE :
CONSEIL DU COMMERCE DE FRANCE

Sadir Assistance

Mr Jean Louis FRAYSSE
Président du Directoire
SA SADIR ASSISTANCE
Zac de Grande Borde Voie l'Occitane
BP 87 555
31675 LABEGE CEDEX

Objet : Affiliation au projet Equipex « AMIQUAL » *AMbient Intelligence for QUAlity of Life*

Madame, Monsieur,

Après avoir pris connaissance du projet AMIQUAL, je vous confirme que SADIR ASSISTANCE est très intéressée par les objectifs ambitieux et la mise en place de cette plateforme d'intelligence ambiante et souhaite le rejoindre en tant qu'Affilié.

En tant qu'Affilié, SADIR ASSISTANCE interviendra comme utilisateur représentatif de la plateforme. Il participera aux réunions du comité scientifique concernant l'expression des requis, au regard notamment des expérimentations médicales ou technologiques.

En contrepartie, SADIR ASSISTANCE aura libre accès aux résultats scientifiques capitalisés par la plateforme.

Fait le 10/09/2010, à LABEGE

Jean Louis FRAYSSE
Président du Directoire

S.A. à Directoire et Conseil de Surveillance au capital de 5 000 000 €
ZAC de Grande Borde Voie L'Occitane BP 87555 - 31675 LABEGE CEDEX
SIREN 444 678 122 - RCS Toulouse
Tél. : 05.62.884.334 Fax : 05.62.884.335
Mail : contact@sadir-assistance.com

Schneider Electric

Monsieur James L. Crowley
CNRS INS2
LIG - UMR 5217

Objet : Affiliation au projet Equipex « AMIQUAL » AMbient intelligence for QUAlity of Life

Madame, Monsieur,

Notre société Schneider Electric, comptant 100000 personnes, dont le siège social est localisé à Rueil Malmaison et réalisant un chiffre d'affaire de 16,000 M€ est spécialisée dans la gestion de l'énergie.

Ses principaux axes de recherche et développement sont notamment l'efficacité énergétique des bâtiments, des centres de données, des logements tertiaires et résidentiels, les réseaux intelligents, les solutions d'infrastructures pour le véhicule électrique, ..

Après avoir pris connaissance du projet AMIQUAL, je vous confirme que Schneider Electric est très intéressé par les objectifs ambitieux et la mise en place de cette plateforme d'intelligence ambiante et souhaite le rejoindre en tant qu'Affilié.
En tant qu'Affilié, Schneider Electric interviendra comme utilisateur représentatif de la plateforme. Il participera aux réunions du comité scientifique concernant l'expression des requis, au regard notamment des expérimentations liées à Amilab1

En contrepartie, Schneider Electric aura libre accès aux résultats scientifiques capitalisés par la plateforme.

Fait le 14 Septembre, à Grenoble
Je vous prie d'agréer, Monsieur, l'expression de mes salutations distinguées

Sylvain Paineau
Responsable Partenariats R&D et Valorisation
Direction Stratégie et Innovation

Schneider Electric Industries SAS
Postal address / Adresse postale
[illegible]
[illegible]
[illegible]
Tel. [illegible]

http://www.schneider-electric.com

[illegible]

Mr. Hung, DO-DUY

Titre : Gérant

Société : SPIKENET TECHNOLOGY Sarl.

Adresse :

26 rue Hermès

31520 Ramonville Saint Agne

Objet : Affiliation au projet Equipex « AMIQUAL » *AMbient Intelligence for QUAlity of Life*

Madame, Monsieur,

Après avoir pris connaissance du projet AMIQUAL, je vous confirme que SPIKENET TECHNOLOGY est très intéressée par les objectifs ambitieux et la mise en place de cette plateforme d'intelligence ambiante et souhaite le rejoindre en tant qu'Affilié.

En tant qu'Affilié, SPIKENET TECHNOLOGY interviendra comme utilisateur représentatif de la plateforme. Il participera aux réunions du comité scientifique concernant l'expression des requis, au regard notamment des expérimentations liées à l'assistance des personnes par des solutions liées à la vision artificielle et plus particulièrement la reconnaissance de formes en temps réel.

En contrepartie, SPIKENET TECHNOLOGY aura libre accès aux résultats scientifiques capitalisés par la plateforme.

Fait le 13 Septembre 2010, à Ramonville Saint Agne

Hung, DO-DUY

upmf Grenoble
Université Pierre Mendès-France
Sciences sociales & humaines

Objet : Affiliation au projet Equipex « AMIQUAL » *AMbient intelligence for QUAlity of Life*

Madame, Monsieur,

L'Université Pierre Mendès France est fortement intéressée par les objectifs ambitieux de la mise en place de cette plateforme d'intelligence ambiante proposée par le projet Equipex "AMIQUAL" et souhaite la rejoindre en tant qu'Affiliée. En particulier la Structure Fédérative de Recherche Innovacs, portée et pilotée par l'UPMF, trouvera dans la plateforme AMIQUAL des terrains d'expérimentations particulièrement riches et tout à fait en cohérence avec ses axes de recherche.

En rapport avec le Plan Campus, la SFR Innovacs a vocation à fédérer les actions liées à l'axe « Innovation », un des quatre enjeux sociétaux de Grenoble Université de l'Innovation (PRES « Université de Grenoble », INRIA, CEA, CNRS, CEMAGREFF, CHU, GEM). A tous les membres fondateurs du PRES (UJF, UPMF, Stendhal, GINP et IEP), partenaires de la SFR Innovacs, s'ajoutent également le CEA, GEM, le CNRS, le pôle de compétitivité Minalogic, Minatec Ideas'Laboratory, le CCSTI, la MSH et le Cluster 4 « Gestion et Organisation des Systèmes de Production et d'Innovation ». D'ores et déjà, la SFR regroupe 16 laboratoires dans différents domaines des Sciences Humaines et Sociales, des Sciences pour l'Ingénieur et des Sciences Exactes. Dans le projet scientifique de la SFR, le terme *Innovation* est pris dans son acception la plus large, au-delà de l'innovation technologique ou de produit à proprement parlé, à savoir les innovations au niveau des systèmes de production, des rapports marchands, des mécanismes de gouvernance, mais également des modalités de production des connaissances scientifiques, des territoires ou encore des politiques et modèles d'action publique.
Ainsi, la Structure Fédérative de Recherche a pour enjeu de développer de nouvelles synergies entre les acteurs du site grenoblois soucieux d'intégrer dans leurs travaux les enjeux économiques et sociétaux de l'innovation.

En tant qu'Affiliée, la SFR Innovacs interviendra dans des projets liés à l'innovation dans le domaine de l'informatique ambiante. Cette dimension est notamment en complète synergie avec l'un de ces axes de recherche : « Innovations et Usages : des interactions au cœur des innovations ». Basée sur des expériences interdisciplinaires menées sur le site (Minatec IDEAs Laboratory®, ERT Umanish, ...), l'analyse de l'innovation vise en effet à imaginer les usages liés aux technologies émergentes en recourant notamment aux approches « user experiences » et de créativité.
La SFR au travers de projets interdisciplinaires sera donc actrice et utilisatrice de la plateforme, en étroite collaboration avec les acteurs partenaires du projet AMIQUAL.

Fait le 8 septembre 2010 à Grenoble

Alain Spalanzani

Président de l'UPMF

Pierre Glize

Gérant Upetec

Ramonville, le 1 septembre 2010

<u>Objet</u> : Objet : Affiliation au projet Equipex « AMIQUAL »
AMbient Intelligence for QUAlity of Life

Le domaine des systèmes ambiants intéresse particulièrement la société Upetec, spécialisée dans technologie des systèmes auto-adaptatifs. A ce titre nous souhaitons suivre les avancées du projet AMIQUAL en nous y joignant en tant qu'affilié.

Ainsi, Monsieur Sylvain Rougemaille participera pour la société UPETEC notamment aux réunions, ateliers et présentations des résultats de AMIQUAL. En contrepartie, Upetec aura libre accès aux résultats scientifiques capitalisés par la plateforme.

Pierre Glize

SARL UPETEC
10 avenue de l'Europe - 31520 Ramonville Saint-Agne
Tél: (+33) (0)5 34 32 03 60 E-Mail: upetec@upetec.fr

Mr Olivier Lescurieux
Directeur Général
Voxler SAS
8 passage Brulon
75012 Paris
T : 0182235832

Objet : Affiliation au projet Equipex « AMIQUAL » *AMbient Intelligence for QUAlity of Life*

Madame, Monsieur,

Après avoir pris connaissance du projet AMIQUAL, je vous confirme que Voxler est très intéressée par les objectifs ambitieux et la mise en place de cette plateforme d'intelligence ambiante et souhaite la rejoindre en tant qu'Affilié.

En tant qu'Affilié, Voxler interviendra comme utilisateur représentatif de la plateforme. Voxler participera aux réunions du comité scientifique concernant l'expression des requis, au regard notamment des expérimentations liées à l'interaction vocale.
En contrepartie, Voxler aura libre accès aux résultats scientifiques capitalisés par la plateforme.

Fait le 2 *septembre 2010*, à Paris

Olivier Lescurieux

VOXLER
Voxler SAS
8 passage Brulon – 75012 Paris
www.voxler.fr
Tél : 33 1 47 04 00 41
494 440 243 RCS Paris