BSN – Jelgava

BALTIC SEA
Network

Intensive Program – IP

Ambient Intelligence

AmI

Ambient Intelligence

New Paradigm:

Ambient Intelligence (AmI) is the vision that technology will become invisible, embedded in our natural surroundings, present whenever we need it, enabled by simple and effortless interactions, attuned to all our senses, adaptive to users and context and autonomously acting. High quality information and content must be available to any user, anywhere, at any time, and on any device.

Ref.:
Menno Lindwer, Diana Marculescu, Twan Basten , Rainer Zimmermann, Radu Marculescu , Stefan Jung , Eugenio Cantatore:
Ambient Intelligence Visions and Achievements: Linking Abstract Ideas to Real-World Concepts.

Philips Research, Eindhoven, The Netherlands, Carnegie Mellon University, Pittsburg, PA, USA, Eindhoven University of Technology, Eindhoven, The Netherlands, European Commission, Brussels, Belgium, Infineon Technologies, Corporate Research, Emerging Technologies, Munich, Germany

AMI

The Ambient Intelligence vision is abstract and as such not useful for funding decisions, research project definition, and business plan development. This is in particular the case for the electronic design community. The European Commission intends for the EU to achieve world leadership in Information Societies technologies within ten years.
*To that end, it has incorporated the Ambient Intelligence vision in its **Sixth Framework**. Microelectronics and nanoand optical devices are seen as key technologies. Interesting chip-level challenges are found in, amongst others, explicit modeling of mobility and self-management, and novel computing substrates, based on electronic textiles or organic electronics.*

Ambient Intelligence Visions and Achievements: Linking Abstract Ideas to Real-World Concepts

What is Ambient Intelligence?

"Ambient Intelligence is a distributed network of intelligent devices that provides us with information, communication and entertainment."
"Ambient Intelligence is a network of hidden intelligent interfaces that recognize our presence and mould our environment to our immediate needs."
"Ambient Intelligence refers to an exciting new paradigm in information technology, in which people are empowered through a digital environment that is aware of their presence and context and is sensitive, adaptive and responsive to their needs, habits, gestures and emotions."

Ambient Intelligence: The Vision of Information Society, BWZ der Universität Wien, Sommersemester 2002

Ambient Intelligence is based on three key technologies:

- Ubiquitous Computing,
- Ubiquitous Communication and
- Intelligent User Interfaces.

Ambient Intelligence: The Vision of Information Society, BWZ der Universität Wien, Sommersemester 2002

AMI

Ubiquitous Computing

means the integration of microprocessors into everyday objects like furniture, clothes or toys.

Ubiquitous Communication

should enable these objects to communicate with each other and with the user.

Intelligent User Interface

enables the inhabitants of the AmI to **control** and interact with the environment in a natural (voice, gestures) and personalized way (preferences, context).

Ambient Intelligence: The Vision of Information Society, BWZ der Universität Wien, Sommersemester 2002

EU research efforts in Ambient Intelligence

Erkki Liikanen, Member of the European Commission for Enterprise and Information Society

"The world of Ambient Intelligence will, gradually but surely, emerge from research in the Information Society Technologies (IST) programme of the European Community.
It puts people at the centre of the development of future IST, i.e.'design technologies for people and not make people adapt to technologies'. It aims at making technology invisible, embedded in our natural surrounding and present whenever we need it (e.g. electricity) and at making interaction with the technology simple, effortless and using all our senses."

AmI@Life

European
Science and
Technology
Observatory

Science and Technology Roadmapping: Ambient Intelligence in Everyday Life (AmI@Life)

Michael Friedewald (Fraunhofer Institute Systems and Innovation Research ISI)
Olivier Da Costa (Institute for Prospective Technology Studies IPTS)

The Vision of AmI

The concept of Ambient Intelligence, being developed in the ISTAG reports (ISTAG 2001, 2002), provides a vision of the Information Society future where the emphasis is on userfriendliness, efficient and distributed services support, user-empowerment, and support for human interactions.

People are surrounded by intelligent intuitive interfaces that are embedded in all kinds of objects and an environment that is capable of recognising and responding to the presence of different individuals in a seamless, unobtrusive and often invisible way.

Michael Friedewald (Fraunhofer Institute Systems and Innovation Research ISI)
Olivier Da Costa (Institute for Prospective Technology Studies IPTS)

AmI@Life

The vision of AmI assumes a shift in computing from desktop computers to a multiplicity of computing devices in our everyday lives whereby computing moves to the background and intelligent, ambient interfaces to the foreground.

This vision of AmI places the user at the centre of future development. Therefore the technology should be designed for the people rather than making people adapt to the technology. It is less clear however, how this can be realised.

We propose to implement a holistic approach that takes into account that socio-technological systems always have three dimensions:
a technological, a social and a policy dimension.

Michael Friedewald (Fraunhofer Institute Systems and Innovation Research ISI)
Olivier Da Costa (Institute for Prospective Technology Studies IPTS)

AmI@Life

IST today	AmI
PC based	“Our surrounding” is the interface
“Writing and reading	Use all senses, intuitive
“Text” based information search	Context-based knowledge handling
Low bandwidth, separate network	Infinite bandwidth, convergence
Mobile telephony (voice)	Mobile/Wireless full multimedia
Micro scale	Nano-scale
Silicon based	new materials
e-Services just emerging	Wide adoption (e-Health, Learning,..)
< 10% of world population on-line	World-wide adoption

Michael Friedewald (Fraunhofer Institute Systems and Innovation Research ISI)
Olivier Da Costa (Institute for Prospective Technology Studies IPTS)

The Vision of AmI - Ambient Intelligence

- The technological dimension
- The social dimension
- The policy dimension
- Trusted and Universal Access to Ami@Life

Michael Friedewald (Fraunhofer Institute Systems and Innovation Research ISI)
Olivier Da Costa (Institute for Prospective Technology Studies IPTS)

The social dimension

Social, economic and geo-political trends are influencing, to a major or minor extent, everyday life. Some of these are an ageing society, a mosaic society, a multi-cultural society, the European Enlargement, life-long-learning, consumerism, (anti-) globalisation, etc.

Many of them are triggered by IST developments and should thus be taken into account.

Michael Friedewald (Fraunhofer Institute Systems and Innovation Research ISI)
Olivier Da Costa (Institute for Prospective Technology Studies IPTS)

The policy dimension

According to the Lisbon European Council of 2000 and the e-Europe Action Plan (prolonged to 2005), the Commission is committed to ensure European leadership in generic and applied knowledge society technologies, to improve European competitiveness and to enable all European citizens to benefit from the knowledge society. The Lisbon process clearly stated that the European knowledge based society should also be a socially inclusive one.

This places topics of the digital divide and of access to ISTs on the policy agenda. Public policy is needed to address these issues. New technologies should not become a source of exclusion for society. Therefore security, trust and confidence were recognised as key bottlenecks for the deployment of AmI.

Michael Friedewald (Fraunhofer Institute Systems and Innovation Research ISI)
Olivier Da Costa (Institute for Prospective Technology Studies IPTS)

Application areas for Ambient Intelligence in Everyday Life

- Housing
  - Home Automation
  - Communication
  - Rest, Relaxation, and Entertainment
  - Work and Learning
  - Acceptance Factors
- Mobility and Transport
  - Management of Multi-Modal Traffic Systems
  - Navigation
  - Safety
  - Mobile Information and Entertainment

Michael Friedewald (Fraunhofer Institute Systems and Innovation Research ISI)
Olivier Da Costa (Institute for Prospective Technology Studies IPTS)

Application areas for Ambient Intelligence

- **Shopping and Commerce**
  - E-business and E-commerce
  - Evolution of Retailing
- **Education and Learning**
  - Formal Learning
  - Non-Formal Learning
- **Culture, Leisure and Entertainment**
  - Cultural Heritage
  - Cultural Participation
  - Media
  - Entertainment
  - Sport & Fitness
  - Avatars

Michael Friedewald (Fraunhofer Institute Systems and Innovation Research ISI)
Olivier Da Costa (Institute for Prospective Technology Studies IPTS)

Application areas for Ambient Intelligence

- **Health**
  - **Prevention**
  - **Cure**
  - **Care**
  - **Support**

Michael Friedewald (Fraunhofer Institute Systems and Innovation Research ISI)
Olivier Da Costa (Institute for Prospective Technology Studies IPTS)

Enabling Technologies for Ambient Intelligence Applications

- Networking and Communication
- Microsystems and Electronics
  - Embedded Systems
  - Microprocessors
  - Memories
  - New electronic materials

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Enabling Technologies

- **Software**
  - **Large-scale distributed systems**
  - **GRID Computing**
  - **Workflow management**
  - **Embedded systems**
  - **Lightweight Operating Systems**
  - **New and open standards**
  - **Advanced software engineering (robust development tools and platforms)**
  - **Plug and play**
  - **Self organising and repairing software**
  - **Personalization**

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Olivier Da Costa (Institute for Prospective Technology Studies IPTS)

Enabling Technologies

- **Knowledge Management**
  - Semantic web
  - Ontology
  - Standards
  - Advanced data warehousing, Knowledge Data Discovery
- **Artificial Intelligence**
  - Cognitive vision
  - Speech recognition
  - Learning & adaptive systems
  - Context-sensitive & affective computing
  - Artificial Intelligent Agent
  - Perspective of Artificial Intelligence

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Enabling Technologies

- User Interfaces
- Displays
- Power Sources
- Trust & Security
  - Privacy, anonymity protection
  - Identity Management Systems
  - Digital rights management
  - Secure transactions & Payments
  - Dependability

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Example: Philips HomeLab

Example Philips:

HOMELAB – advanced feasibility research lab

New system concepts

HomeLab has been designed to allow studies of novel system concepts, which today may still require a lot of equipment to realize, but which can be expected to become compact enough to disappear in the background in the near future. It allows studies of distributed home networking systems which require connecting different rooms and floors as found in a real-home environment.

By prototyping such systems in HomeLab, researchers can discover and solve the issues that emerge in such actual use environments.

AmI - Philips

Situational awareness

Ambient Intelligence systems are envisioned to be supportive, because they are aware of the users, and can adapt to their habits and wishes. Therefore, such systems need to include methods to discover the identity and location of users, devices and objects. Research projects are ongoing to develop optimal technologies, e.g. by investigating the behaviour of radio waves and ultrasound waves in an actual home environment, where furniture and moving people cause a much more complex reflection and transmission behaviour than in an outdoor environment.

AmI - Philips

Natural interaction

Speech is often considered one of the most natural modalities for interaction between users and ambient systems. Thus far, however, improvement of recognition rates in natural language dialogues, and even in the more limited command and control interactions, is hampered by echos and background noise in real environments, forcing users to wear microphones close to their mouths. Novel technologies are being developed to solve these problems, and HomeLab allows such solutions to be tested in a realhome environment. Similar problems are encountered when introducing other modalities, like gesture recognition. Gesture recognition is typically realized using video image processing. Again, whereas nice examples can be demonstrated in special rooms with well controlled light conditions, gesture recognition in a real-home environment, where doors open and close, people walk around, reflections occur from shiny surfaces and light conditions change continuously, requires the development of more fundamental solutions.

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Mobile assistants

Mastering speech and gesture recognition allows studies into exciting further user interaction concepts, such as mobile, robotic personal assistants. These studies are also conducted in HomeLab. HomeLab provides the actual conditions that such mobile assistants have to be able to cope with, like staircases, multiple rooms and families with children.

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Connectivity

The Ambient Intelligence systems aim at providing users with the freedom to choose what kind of information or entertainment they want when and where, e.g. on portable screens they can take with them as they move through the house. This means that such systems typically rely on ad-hoc wireless networking of devices. Depending on the type of device (mobile phone, PDA, portable PC, webtablet) and content (photos, films, messages), an appropriate wireless connection is applied, e.g. WLAN (802.11b or 802.11a) for large bandwidth, and Bluetooth or Zigbee for ultra-low power. Optimal systems will likely consist of a combination of such technologies, most of which operate in the same frequency band. HomeLab offers a realistic environment to test effects like mutual interference and the influence of walls and ceilings, and to study, for example, security mechanisms and bridging of networks in home.

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Ubiquitous sound and vision

The key output modalities needed are sound (music, speech) and vision (images). Whereas today the latter is typically concentrated in one TV screen in the living room, future homes will have display solutions in any space where that is appropriate (kitchen, bedroom, etc.). They will range from small displays for messages to full-wall-sized displays for movies. Entirely new technologies will be required to realize such visions in actual home situations, e.g. where people do not have the room required for existing back-projection solutions, or the money for current large-flat-display technologies. Again, HomeLab offers Philips the opportunity to already create the experiences today that such future technologies will bring tomorrow.

AmI - Philips

Separating functions from boxes

Once the information is fully digital, and ubiquitous connectivity has been realized, it becomes possible to separate the functions actually desired by users (images, sounds) from the boxes that are needed to produce them, thus providing users with a much greater freedom. Users can, for example, choose to place the TV tuners or PCs out of the field of view, and eventually to let them disappear in the background. Many issues emerge when trying to realize such solutions in real-life circumstances, and HomeLab is a rather unique environment for learning how to solve them: in its 'user spaces' it provides all the actual elements found in a real house (e.g. walls blocking the infrared remote control), whereas through its 'research spaces' ambient solutions that require further miniaturization before they can be made ambient, can already be realized today.

AmI - Philips

Feasibility research

In the months up to the opening, HomeLab has already proven to be a valuable tool to study and demonstrate the feasibility of the novel system concepts developed in several Research projects, and to collect the feedback of visitors and users. Many more projects will populate HomeLab in the coming years.

Related Subjects:

- Ubiquitous Computing
- Pervasive Computing
- Nomadic Computing

English

Language Issues:

English
ubiquitous
Ubiquitous Computing
Similar meaning:
Pervasive
Nomadic Computing
Nomads

Ubicomp

The idea of ubiquitous computing as invisible computation was first articulated by Mark Weiser in 1988 at the Computer Science Lab at Xerox PARC.

Mark Weiser
July 23, 1952 - April 27, 1999

Xerox PARC:
"*Palo Alto Research Center*"
(now "*Palo Alto Research Center Incorporated*")
http://www.parc.xerox.com/

parc® Palo Alto Research Center

Ref.:
`http://www.ubiq.com/hypertext/weiser/weiser.html`

Some Computer Science Issues in Ubiquitous Computing

Mark Weiser
March 23, 1993

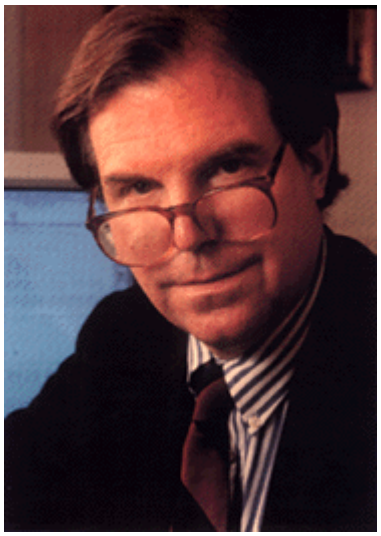
"Ubiquitous computing is the method of enhancing computer use by making many computers available throughout the physical environment, but making them effectively invisible to the user."

Scientific American Ubicomp Paper

Mark Weiser:
The Computer for the 21st Century,
Sci. Amer., 265 (3), 94-104, September 1991

"The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it."

Pervasive Computing



Nicholas Negraponte - MIT Media Labs
"Things that think want to link".

This is the doctrine on which pervasive computing is based!

Final Words

Mark Weiser:
The Computer for the 21st Century

"Most important, ubiquitous computers will help overcome the problem of information overload.

There is more information available at our fingertips during a walk in the woods than in any computer system, yet people find a walk among trees relaxing and computers frustrating. Machines that fit the human environment, instead of forcing humans to enter theirs, will make using a computer as refreshing as taking a walk in the woods."

AmI

Proposal:

SOCRATES PROGRAMME
Application for ERASMUS
Intensive Programme (IP)
Academic year 2006-07-08

Thank You