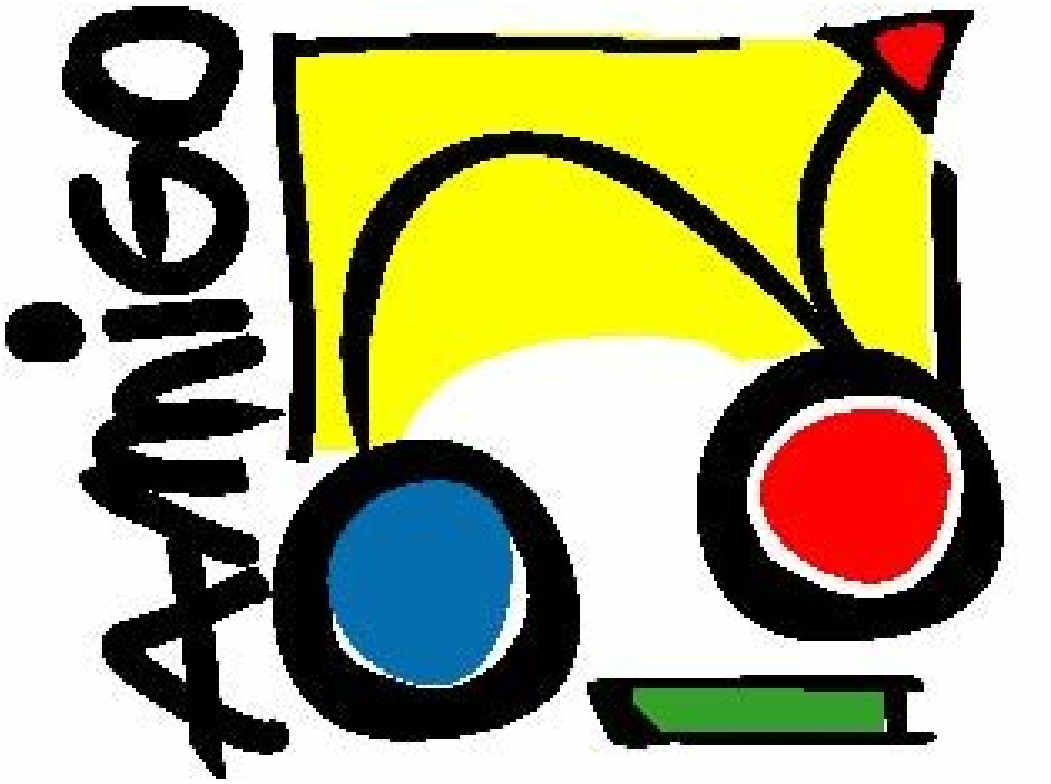

IST Amigo Project

Deliverable D1.2

Report on User Requirements State of the Art

Volume II

Public

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Author(s)	:	Carsten Magerkurth, Norbert Streitz, Fraunhofer IPSI (Eds.), Maddy Janse (Philips), Nathalie Portolan (France Telecom), Mirko barone, Sergio di Marco (Italdesign-Guigiaro), Arantxa Larrannaga, Imanol Lucas (Fagor), Javier Arribas, Sara Carro-Martinez (Telefonica I+D)

Abstract

In this section, an overview about what has been done before in the field of scenarios for Ambient Intelligence is given. Thereby, we effectively set a frame for the work in Amigo. Since the state of the art is also an input for the requirements that are relevant for the Amigo project, conclusions are drawn that help refining our own scenarios and provide an input for later work packages. For each presented scenario, key aspects and critical issues are identified based on an appropriate structuring template. Topics that are found among multiple scenarios are obviously interesting for the work in Amigo and should be regarded appropriately. Therefore, these topics are identified and discussed after the discussion of the single scenarios with recommendations for the work in Amigo drawn from them.

The following topics are identified and discussed: a.) Automatic Composition of Available Devices, b.) Implicit, Multimodal & Non-Standard Interaction, c.) Integrating Custom Devices with Standard Devices, d.) Social Awareness/ Sharing of Experiences and e.) Intelligent Room Infrastructures.

Keyword list

Scenarios, State of the Art, Related Work, Requirements, User Services, Application Domains, Common Issues

Table of Contents

1. Introduction

Ambient Intelligence is one of the hottest buzzwords in multiple research disciplines at the moment. The vision of calmly and unobtrusively supporting human-to-human or human-to-information interaction without having to deal with typical computing interfaces is intriguing: For the first time, the computer as we know it, disappears into the environment and weaves itself into the fabric of our lives, still being proactive, sensing how it could serve us.

The potential benefits of Ambient Intelligence are clear, however, its comfort comes at a price. For an ambient system to effectively support us in our home environments, we must take great care to build trusted platforms that perform exactly as they are expected to do, that protect our intimate data, and still allow easy access to it. But still, people might be hesitant to accept services that an intelligent ambient home environment offers, if issues of control or privacy are involved.

Therefore, in order for Amigo to succeed at defining, developing, and delivering useful services for the networked home environment it is most crucial, to regard and involve the potential users of our technologies straight from the beginning of the project. To gather multiple sources of user input, substantial effort has gone into reviewing the state of the art of scenarios in the field of Ambient Intelligence as well as the methodology and results of focus groups undertaken with typical end users of our technology. Both these results will work towards a refinement of the initial AMIGO scenarios for the proposed application domains, namely home care and safety, home entertainment, and the extended home environment.

The purpose of the section on the state of the art of related scenarios is twofold. First, we demonstrate what has been done before and thereby relate to what Ambient Intelligence in home environments is commonly regarded as, effectively setting a frame for the work in Amigo. Second, and more importantly, we regard the state of the art as input for the requirements that are relevant for the Amigo project. Due to the nature of the scenario technique, we draw our conclusions based on topics, designs, and implementations that are commonly found among independent scenarios. In contrast to other tools such as the focus groups described in a later section, the scenario technique depicts scenes from a user perspective and shows them as working examples of how something could be, usually not contrasting with alternative visions and not geared towards a concluding synthesis among rivalling potential realizations. This also applies to underlying technologies that make the scene work. Usually, we see one single realization that is obviously suitable for the scene described. However, we do not learn how things could have been done differently, perhaps equally well. To overcome this property of the scenario technique and optimize the use of this technique, we have chosen to identify key aspects and topics that we find among multiple scenarios. The rationale behind this is that if multiple independent scenario sources come up with similar solutions, then the Amigo-relevant scenarios and services should regard these common findings. Consequently, the section on the related work of scenarios first discusses each individual scenario that was carefully chosen for a balanced relevance to the respective application domains. Then, common issues are identified and finally recommendations for the work in Amigo are drawn from them.

The next section about the focus groups reports from our efforts to improve our own scenarios by presenting multiple realizations of them to carefully chosen subjects who are close to our targeted end users. Gathering the direct feedback from the focus groups, we have a strong source of input for the final section on the refinement of our scenarios, while the review of the state of the art in scenarios forms a more indirect, yet still important source of information for the Amigo scenarios refinement.

The third section finally brings together the results from the focus groups and related scenarios to refine our own Amigo scenarios, optimizing the end users' relevance.

2. State of the Art: Related Work on Scenarios and Services

The scenarios presented and discussed in this document are organized linearly by the domain each scenario is related to. Each scenario also addresses one or several services that are taken from WP4. Because each scenario addresses several services in a more or less integrated fashion, it is cumbersome to organize the state-of-the-art on scenarios from a "service-only" perspective. Presenting and discussing them from a "service-only" perspective would result in a number of repetitions mentioning the same scenario again and again. We have thus adopted the following organization:

In order to facilitate the search for services and associated scenarios as well as for scenarios and associated services, the state of the art is organized in the following fashion. The section is started with a "Scenario x Services" Matrix which serves as an outline and advance organizer and is then followed by descriptions of relevant scenarios including all the services relevant for this scenario.

We consider the following ***six services (S1, …., S6)*** taken from WP 4:

- S1: Context collection, aggregation, and prediction
- S2: User modelling and profiling
- S3: Awareness and notification
- S4: Content provision, selection and retrieval
- S5: User interface
- S6: Security and privacy

The scenarios are organized according to the ***three domains (D1, D2, D3)*** taken from the three application work packages WP 5, 6, and 7:

- D1: Home Care and Safety
- D2: Home Information & Entertainment
- D3: Extended Home Environment

Each scenario will be discussed in relation to the (multiple) services that it addresses.

The following scenarios have been discussed with the partner abbreviation in brackets relating to the responsible organization.

- *D1: Home Care and Safety*
    - *1A: Voice command based home (FAG)*
    - *1B: Software component based household appliances domotic controller (FAG)*
    - *1C: A Multimedia Telemedicine Home Platform (TID)*
- *D2: Home Information & Entertainment*
    - *2A: Interactive Background Portal (FT)*
    - *2B: EasyLiving: Technologies for Intelligent Environments (TID)*
    - *2C: Gemini: Accumulating Context for Play Applications (IPSI)*

- *2D: Context Aware Information Retrieval in the Home (IPSI)*
- *2E: Context Aware Multimedia Browsing (Philips)*

- *D3: Extended Home Environment*
  - *3A: Design Meeting (ITAL)*
  - *3B: Tele Worker (ITAL)*
  - *3C: Ozone (Philips)*
  - *3D: Astra (Philips)*
  - *3E: Connecting Remote Teams (IPSI)*
  - *3F: Mirror Space (FT)*

Below (A2) is also a template that describes how each scenario is presented and discussed.

A.1 "Scenario x Services" Matrix

	SERVICES S1, …, S6					
SCENARIOS in the 3 application domains D1, D2, D3	**S1: Context Aggregation and Prediction**	**S2: User Modeling and Profiling**	**S3: Awareness and Notification**	**S4: Content Provision, Selection, and Retrieval**	**S5: User Interface**	**S6: Security and Privacy**
D1: Home Care & Safety						
1A		X	X		X	X
1B		X	X	X	X	X
1C					X	
D2: Home Information & Entertainment						
2A				X	X	
2B		X				X
2C	X				X	
2D	X				X	
2E	X	X	X		X	
D3: Extended Home Environment						

	SERVICES S1, …, S6					
SCENARIOS in the 3 application domains D1, D2, D3	**S1: Context Aggregation and Prediction**	**S2: User Modeling and Profiling**	**S3: Awareness and Notification**	**S4: Content Provision, Selection, and Retrieval**	**S5: User Interface**	**S6: Security and Privacy**
3A		X	X	X	X	X
3B		X	X		X	X
3C			X	X	X	
3D		X	X		X	X
3E			X		X	X
3F					X	

As can be read from the matrix, there is a sufficient coverage of each application domain with increasing coverage in D2 and D3:

D1: Home care and safety: 3 scenarios

D2: Home information and entertainment: 5 scenarios

D3: Extended home environment: 6 scenarios

Regarding the six services from WP4 there we can derive the following distribution from the matrix:

S1: Context collection, aggregation, and prediction: 3 scenarios

S2: User modelling and profiling: 7 scenarios

S3: Awareness and notification: 8 scenarios

S4: Content provision, selection and retrieval: 4 scenarios

S5: User interface: 13 scenarios

S6: Security and privacy: 7 scenarios

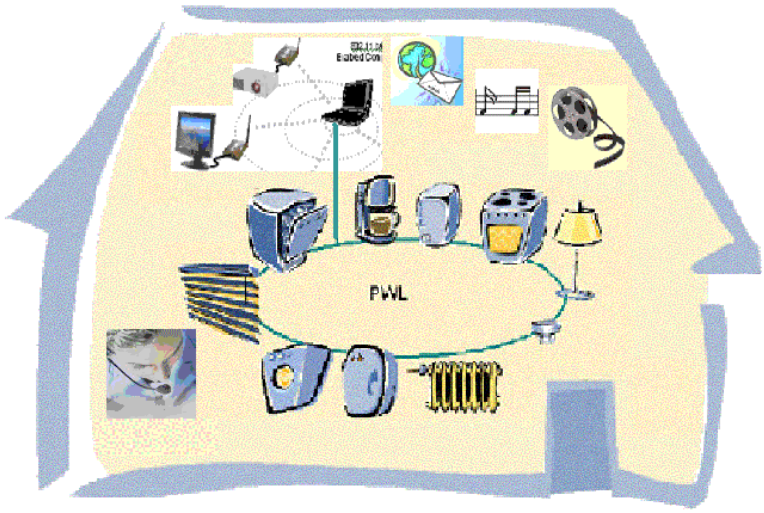
A.2 Template for Scenario Description and Associated Services

Scenario Title	"Scenario Title"
Reference	Literature and web references including authors, place and time of publication information about the context of the scenario/project should be given here, e.g., a larger project or a research initiative.
Scenario Summary	This "executive" summary should not exceed 4-5 sentences.
Primary Application Domain	One of three possible domains • *D1: Home Care and Safety* • *D2: Home Information & Entertainment* • *D3: Extended Home Environment* should be listed here. The scenario does not necessarily cover only one domain, but its content should be directly applicable to the domain.
Relevant User Services	A bulleted list of one or more of the following services addressed in the scenario should be listed here: • *S1: Context collection, aggregation, and prediction* • *S2: User modelling and profiling* • *S3: Awareness and notification* • *S4: Content provision, selection and retrieval* • *S5: User interface* • *S6: Security and privacy*

	The last section of this template (“Discussion”) goes back to the services listed here and evaluates the scenario in terms of the services addressed.
Scenario Description from User Perspective	The scenario should be described from the user’s perspective in this section. The user’s perspective does not refer to explaining what is technically done in terms of devices and services, but how the protagonists of the scenario experience their situation and their activities. If you can provide corresponding illustrations of the user experience, please insert them here as well. The scenario description should be between 1-2 pages including images and diagrams.
Key issues	While the previous part focuses on the user’s perspective, this section should explain the underlying services and point out which key issues are addressed, i.e., what are the main contributions and ideas. Illustrating diagrams or pictures are highly welcome. The length of this part should be between 1-2 pages including images and diagrams.
Details of Implementation: Devices/ Artefacts	This section briefly outlines the devices and artifacts present in the scenario in a bulleted list with additional short paragraphs whenever explanations are appropriate. Devices and artifacts may also include relevant hardware including network connections.
Details of Implementation: Software/ Services	Complementary to the previous section, the relevant software services should be listed here.
Discussion along relevant Services	This final and most important section goes back to the bulleted list of the services addressed in the scenario and discusses the contributions, critical issues, relevance, and requirements of each service in a dedicated paragraph. You can include user feedback/evaluation if appropriate. This section should be up to 2 pages in length depending on how many relevant services are applicable to the scenario.

A.3 Scenarios related to Home Care & Safety (D1)

Scenario Title	1A: “Voice command based home”
Reference	[1] Smart Home: Speech based user interfaces for smart home applications. Maik Hampicke. Seminar Speech and Hearing Technology. 2000 Cottbus Germany. [2] A User-Interface Robot for Ambient Intelligent Environments. A.J.N. van Bremen, K. Crucq, B.J.A. KrÄose. ASER ’03. [3] A network architecture for building applications that use speech recognition and/or synthesis. Dominique Vaufreydaz, José Rouillard, Mohammad Akbar.
Scenario Summary	A home with a centralized control system able to control household appliances (including functionalities and configurations), entertainment applications (music, video, photos, e-mail...) and security systems (gas, water, anti-intrusion…). The main interface is based on speech with other visual interfaces based in displays and projectors.
Primary Application Domain	*D1: Home Care and Safety*
Relevant User Services	• *S2: User modeling and profiling* • *S3: Awareness and notification* • *S5: User interface* • *S6: Security and privacy*
Scenario Description from User Perspective	A home system able to control household appliances (including functionalities and configurations), entertainment applications (music, video, photos, e-mail...) and security systems (gas, water, anti-intrusion…). The main interface is based on speech with other visual interfaces based in displays and projectors. All the entertainment information is stored digitally at home.

	 1. Mum wants to switch on/off any of the household appliances. She speaks to the home system indicating the appliance and the action to be executed (selected program, or description) [1] [3]. 2. Mum wants to know what goods are available in the fridge and what ingredients are needed for cooking chicken at evening. The system recognizes the goods in the fridge, creates a shopping list adding the elements needed to cook the chicken and downloads it to a PDA [2]. 3. Mum wants to listen music. She asks the home system for the songs available at home regarding to a specific singer and the home system answers with the available ones. Mum selects her favorite song [3]. 4. Mum wants to read her e-mail. The home system reads the new mails [1]. 5. Mum wants to rest watching a film. She sits on the sofa and asks for the film that she wants to see. 6. A water sensor has detected water in the bathroom, the home system automatically closes the valve and mum is informed. 7. Mum wants to know what Tom (a child) is doing in his bedroom. Mum asks the home system to show on the living room TV the images of Tom's room [1]. 8. A thief wants to enter in the home while Mum is working. As she has activated the anti-intrusion system before leaving home, the system detects the thief and the alarm is activated. Mum is informed of the happening.
Key issues	A natural user interface of the home by means of voice interaction. Ubiquity and mobility: The user can manage his home from any place thanks to the voice. The user doesn't need to learn any device commands. There is no needed to use multiple remote controllers.

	New intelligent services for the user can be achieved combining device features (for example: oven and fridge). Transparency: The user is not aware of the technology around him. The main challenge for this application is: • Noises, everything that can disturb to the user commands. They can be: o General noises: washing machine, vacuum, computer,… o Conversations: conversations between people, T.V. and radio speakers,…
Details of Implementation: Devices/ Artefacts	• PC: with control, speech recognition, synthesis and verifier applications. Home system able to recognize what the user says, and acts in consequence by incorporating a speech recognition system and a TTS to establish the dialog between the user an the home applications. Also the PC needs an application to read the RFID tags included with the goods, which are in the fridge. • Microphone & Loudspeakers Nowadays each user needs a wearable microphone. • PDA PDA with integrated WiFi adapter. • Last generation household appliances • Internet connection Connection that enables the user to interact with the world. • Wireless network (cameras, displays, PDA) The connection between video cameras, displays and PDA is wireless. • Power Line network The Power Line network makes possible the communication between the home system and household appliances, so that they can be commanded “remotely”. • HW RS232-Power Line adapter This adapter converts the RS232 commands for the node PC to Power Line network. • Cameras The cameras around the home (in and out) enable the video surveillance. • Sensors and activators With those sensors home system controls all the possible incidents at home: water, gas …

Details of Implementation: Software/ Services	Centralized intelligent system with: • Appliances controller • Automatic Speech Recognition • Text To Speech • Verifier
Discussion along relevant Services	• *S2: User modeling and profiling* *With the "verifier" the home system is able to offer or deny some services to each user, for example: Tom (5 year old child) is not allowed to turn on the oven, but is allowed to listen his favorite songs.* • *S3: Awareness and notification* *If the home system detects alarms is able to close the correspondent valve and notify the action.* • *S5: User interface* *The user can interact by means of natural speech or can show the results (state of the appliances network state, shopping list, photos, videos,…) in the indicated display.* • *S6: Security and privacy* *Each houses Power Line network and other wireless networks are isolated for the rest of the houses of the building by filters, so the actions in a house have no effect in the neighborhood.*

Scenario Title	1B: "Software component based household appliances domotic controller"
Reference	[1] "Interoperating with Heterogeneous Mobile Services". ERCIM News No. 54, July 2003 [2] "Interoperating with services in a mobile environment". Postgraduate papers. Lancaster University 2003. [3] Reflective framework for ubiquitous mobile computing" Lancaster University 2002

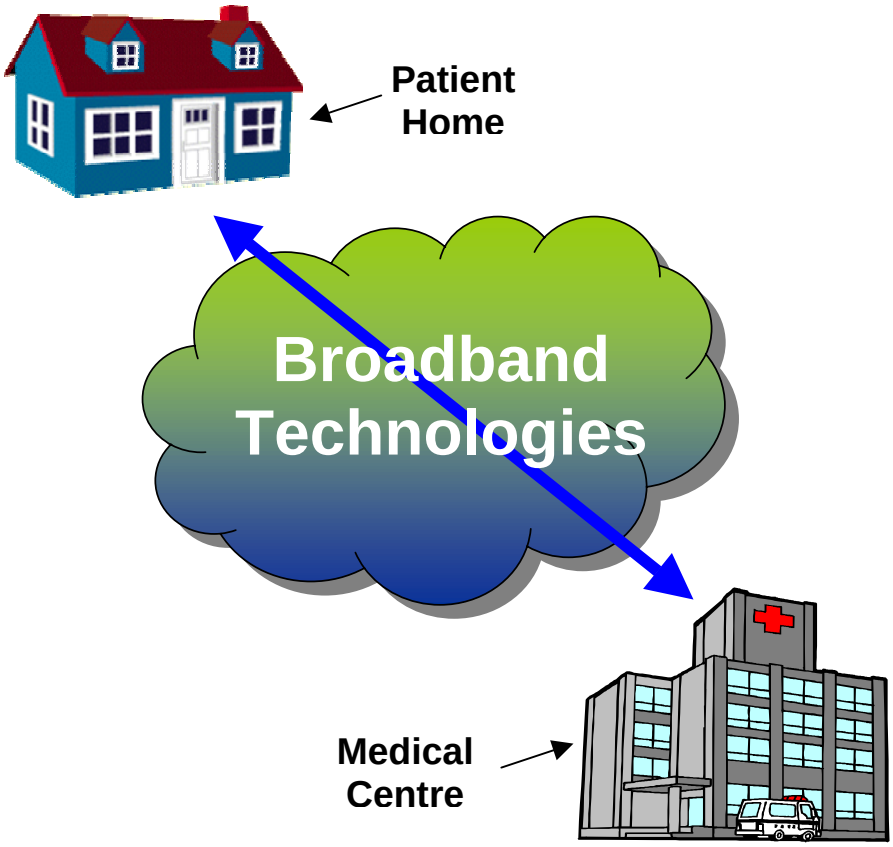
Scenario Summary	A software component based domotic controller, which is composed by a basic framework where new components can be downloaded to upgrade the system. The user can add new functionalities and applications just buying the new components of the new household appliances he has bought and upgrade the domotic controller as he gets new appliances. Also the system provider can upgrade the component installed at client's home if it is necessary.
Primary Application Domain	*D1: Home Care and Safety*
Relevant User Services	*A.1 S1: Context collection, aggregation and prediction* *A.2 S3: Awareness and notification* *A.3 S5: User interface* A.4 *S6: Security and privacy*

Scenario Description from User Perspective	Component based centralized household appliances control system. The user can only get (buy) the software component and upgrade the domotic controller for supporting new functionalities or new home appliances. Also the system provider can upgrade an already installed component in client's home, if it is necessary because some fault is detected. Mary and Joe have just bought a new house with a domotic controller that manages all the household appliances connected through power line. Thanks to this, Mary and Joe will get some advantages in the following situations: 1. The oven they had has broken down so they decide to buy a new oven. When they plug the new oven in the power line network, the domotic controller realizes of this and it will download (buy) the new oven's component (upgrading the domotic controller itself). From now on Mary and Joe can control the new oven without any effort and knowledge. 2. The manufacturer has upgraded its washing machine component. As the manufacturer knows all the clients who have the old version of the washing machine component, the manufacturer's server upgrades all domotic controllers via Internet avoiding the need of visiting each installed house. 3. The dishwasher is not working properly and it itself detects the failures. The domotic controller contacts manufacturer's maintenance server and the dishwasher is remotely diagnosed. After the diagnosis downloading a new component can repair the dishwasher. 4. Mary and Joe can program all networked appliances calling from work to home, for example: turn the washing machine on, programming the oven… 5. Mary is watching TV and the washing machine is on. She wants to relax and watch her favorite film. In the PDA, that is a remote user interface of the domotic controller, she selects the washing machine and switches it off. 6. A thief wants to enter in home while Mary and Joe are working. As they have activated the anti intrusion system before leaving home, the system detects the thief and an alarm is activated and Mary is informed of the incident by means of a call to her mobile phone.

Key issues	Dynamic upgrade of the home systems without any interaction. The user can achieve new functionalities using the same devices and hardware. It's known that in the new devices 80% of the offered services are software and only a 20% are hardware (for example: a DVD player and the different codecs). Automatic software upgrade in following situations: • New devices add to the network (plug & play). • Fault detection and automatic recovery by replacing bad components. • Addition of new functionalities and services by downloading new versions of components. • Incorporating new user interfaces. For example when Mary buys a PDA and downloading the correspondent application to use it as a remote controller. Upgrading with new components the devices have to keep stable and consistent. Robustness and reliability.
Details of Implementation: Devices/ Artefacts	Embedded device: the domotic controller Central node with basic software framework to receive new manufacturer's components. Telephone The telephone enables remote activations and alarm notifications. PDA Internet connection All domotic systems (each house with the system) need an Internet connection to be able to communicate with manufacturer central server, so they can download new components (plug & play). The manufacturers can upgrade the home systems automatically. Last generation household appliances (Power Line) Power Line network The Power Line network makes possible the communication between the domotic controller and household appliances, so that they can be commanded "remotely". Wireless network Sensors and activators With those sensors the system controls all the possible happenings at home: water, gas… HW RS232-PowerLine adapter This adapter converts the RS232 commands for the central node PC to Power Line network.

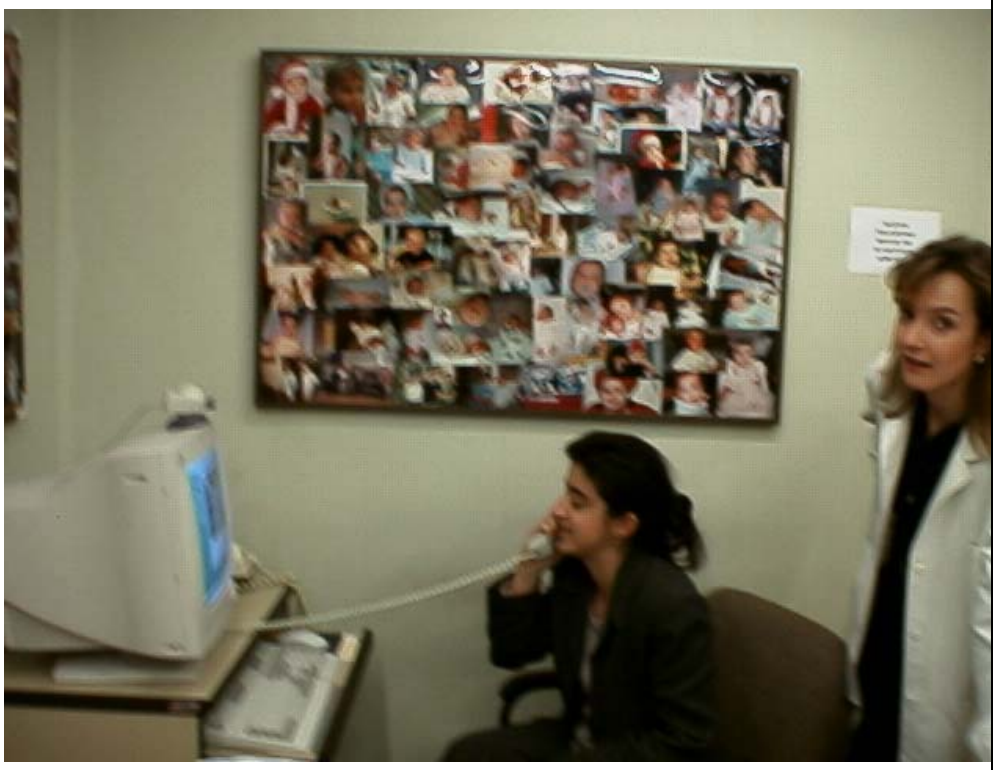
Details of Implementation: Software/ Services	•Domotic Controller: Embedded device built around an Intel XScale. •Operating system: Windows CE •Software: – Basic framework – Download framework – Resource management framework – Fault management framework
Discussion along relevant Services	S3: Awareness and notification If the system detects alarms is able to notify the incident to the user. If the user is at home by small messages on the PDA and if it is out of home by a phone call or SMSs. Also all changes made by manufacturer central server are notified to the clients. S5: User interface The user can interact with the system by: Telephone call to the domotic controller and indicating the action Interface of the embedded device PDA remote controller S6: Security and privacy Each house power line network and wireless network are isolated from the rest of the houses of the building by filters, so the actions in a house have no effect in other systems of the building. Manufacturer central server is full of users' personal data. This information must be protected with correspondent law.

Scenario Title	1C: “A Multimedia Telemedicine Home Platform”
Reference	Cullen, K., Duff, P. (Work Research Centre Ltd.) and the rest of TEN-CARE partners, “*TEN-CARE Workpackage One - Deliverable 1.1 - Requirements Database v.1*”, 30 April 1999 Cullen, K., Duff, P. (Work Research Centre Ltd.) and the rest of TEN-CARE partners, “*TEN-CARE Workpackage One - Deliverable 1.2 - Requirements Database v.2*”, September 1999 Fergusson, R. S. (South and East Belfast Trust), Cullen, K., Duff, P. (Work Research Centre Ltd.) and the rest of TEN-CARE partners, “*TEN-CARE Workpackage Five - Deliverable 5.1 - Report on initial application set trials*”, 23 March 2000 Fergusson, R. S. (South and East Belfast Trust), Mocholi, A. (Grupo de Bioingeniería, Electrónica y Telemedicina de la Universidad Politécnica de Valencia) and the rest of TEN-CARE partners, “*TEN-CARE Workpackage Six - Deliverable 6.1 - Extended application set demonstrators*”, February 2000 Guillén, S. (Aplitec S.L.) and the rest of TEN-CARE partners, “*TEN-CARE Workpackage Seven - Deliverable 7.1 - Report on extended application set trials*”, 17 April 2000 TEN-CARE consortium, “*TEN-CARE Workpackage Eight - Deliverable 8.4 - Dissemination Report 4*”, July 2000 Website of project: http://www.empirica.biz/ten-care/index.html
Scenario Summary	A Multimedia Telemedicine Home Platform has been developed within TEN-CARE project making use of previous acquired knowledge in the provision of telemedicine services. This Platform is made up of hardware and software elements that allow to maintain a tele-consultation or/and a tele-visit between patients and medical staff through different broadband networks.
Primary Application Domain	• *D1: Home Care and Safety* • *D3: Extended Home Environment*
Relevant User Services	• *S5: User interface* • *S6: Security and privacy*
Scenario Description from User Perspective	This scenario implicates two distributed sites, the patient home and the medical centre, connected via broadband technologies.



OVERVIEW:

Maria is an elder person who needs to have frequent contact with her doctor. Using its telemedicine set box, Maria can have these contacts periodically, previously scheduled or at any moment, when Maria feels the need of such professional attention.

	The contact between the doctor/nurse and Maria is facilitated though a telematic media so that to provide a Virtual Person to Person interaction, permitting the exchange of images, sound and data (virtual presence). Maria can be alone at home or assisted by relatives or care givers. She should in no case need special training in computer use, communication or other different than the standard home appliances.  The doctor who provides the medical attention may work in a hospital/health care centre or may provide his/her professional service from home or a private consultation

	
Key issues	Key elements are the medical sessions database, the videoconference and the biomedical data acquisition and transmission modules. Different measurements can be done: ECG (electrocardiogram), chest sound, blood pressure, temperature. Patient uses a TV set as visual interface and a prototyped set top box. This set top box will use Windows, running as a multimedia PC but without keyboard. 

The following table shows the main features of the project:

Name	Functionality	Achieved
Health professional or patient's image and sound	The patient/health professional must be able to see the image of the health professional /patient on the screen. Conversation without delays, cuts, ... as a phone conversation	Yes
Scheduled appointment	-Through a web page indicate consult reasons and choosing the time that fits better -During a tele-visit session, doctor and patient can arrange when the following session will take place.	Yes
ECG acquisition	The system allows the doctor to acquire the ECG of the patient while performing the tele-visit /tele-consultation	Yes
Temperature acquisition	The system shall allow the doctor to acquire the temperature of the patient while performing the telemedicine session	No
Estethoscopic sound acquisition	The system shall allow the doctor to acquire estethoscopic sound of the patient while performing the tele-visit/ tele-consultation	Yes
Blood pressure and pulse acquisition	The system shall allow the doctor to acquire patient's blood pressure and pulse while performing the tele-visit/ tele-consultation	Partial
Health professional's agenda	the doctor/nurse can consult the agenda at any time in order to check scheduled clinical appointments (tele-visit sessions or demanded tele-consultations)	Yes
Connection establishment	Connection establishment between patient and medical staff should not fail, independently on whom has started the session	Yes
Help	User will have available at any time help off-line. It can also change with the moment of the session or the application	Yes
User interface	Patient will read and distinguish any object being far away from TV. Health professionals will have a high usability graphical interface	Yes
User interaction	Patient will interact with the system using a remote mouse/ remote control (no keyboard will be present). Health professionals will interact with the system using a mouse and keyboard	Yes
Database	Medical staff can access to the database and consult any issue while performing the telemedicine service	Yes

This table shows data about the system performance:

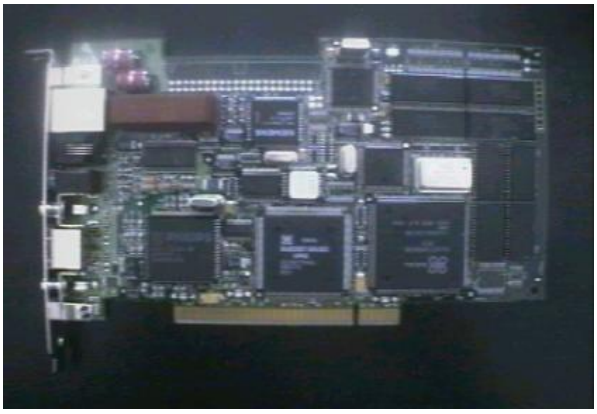
Indicator	Range	Comments
Time of connection	Lower than 10 secs.	Connection is quickly achieved but no feedback is easily obtainable when initial delays
Number of attempts to get a safe connection	Lower than 3	Sometimes users are not ready and a phone call is needed to ensure operability
System failure rate	Lower than 2 per session	In very few occasions system hung up and required reboot
Time to refresh screen	Lower that 1 second	Zoom or data access could limit this indicator and work satisfactory

Details of Implementation:

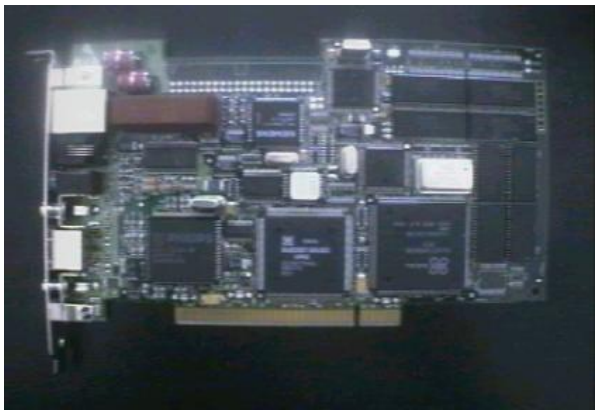
Devices/ Artefacts

Patient devices are the following ones:

- TV set (20'' minimum recommended)
- PC multimedia: 233 MHz, Hard disk 6.4 GB, 64 MB RAM, graphic card with PAL output, no keyboard, and remote control (minimum recommended). It also includes:
  - VCON videoconferencing board:



- BIO card for acquiring biomedical signals (designed and built by Grupo de Bioingeniería, Electrónica y Telemedicina de la Universidad Politécnica de Valencia)
- VDSL modem

	Doctor devices are the following ones: • PC multimedia: 233 MHz, Hard disk 6.4 GB, 64 MB RAM, 17'' screen, keyboard, and mouse (minimum recommended) • VCON videoconferencing board:  • VDSL modem
Details of Implementation: Software/ Services	Doctor and patient applications runs over Internet browsers (whether the proper specific components have been installed). Programming languages to develop the application were Microsoft Visual Basic and HTM 4.0/Javascript. The following Active X have been developed to achieve a fully understandable program, easy to modify and to migrate to other platforms: *Audiovisual contact: Two ActiveX manage the videoconference requirements to set up high quality audiovisual contact between patients and medical staff. A TV like component shows medical staff image as seen in a TV by patients. On the other hand, the PC like ActiveX presents patients image as seen by medical staff at the heath care centre.* - ECG: Active X that is in charge of acquiring the ECG (patient terminal) and showing it (medical staff terminal) - Chestsound: Active X that is in charge of acquiring the chest sound (patient terminal) and reproducing it (medical staff terminal) - Comunica: Active X that allows the transmission/reception of the acquired data and the control of the measurement devices.
Discussion along relevant Services	• S5: User Interface User interface for patients has been designed as simple as possible in order to facilitate the utilization to people which has no special computers or technologies training. The possibility of interchange images and multimedia data between doctor and patients improve the situation to those elder people who has mobility problems. In addition the BIO card for acquiring biomedical signals is accurate enough for sending confident data to doctors.

- Feedback from users in relation to positive and negative aspects of the application produced the following comments described below. They are an outline of the feedback extracted from users both by collection of data through questionnaires and also observation of users reaction performed by the technical. Reactions have been categorised into a number of types (include user interface, system performance, usability, usefulness of the system, and appropriateness of the service) and divided also according user types:

Type	Positive or Negative	User Type	Comments
User Interface	Positive	Patient	I do not feel lost in front of the TV because I do not have to do hardly anything
User Interface	Positive	Patient	Icons and buttons are easy to understand
User Interface	Negative	Patient	Sometimes, written text is difficult to understand
System Performance	Negative	Patient	Sometimes, hospital PC is off and I have to phone them previously
System Performance	Positive	Doctor	System runs OK and hangs are very strange
System Performance	Positive	Patient	I hear the doctor better than in a phone conversation
System Performance	Positive	Doctor	I can see if legs swell when the liquid bags and the therapy is not properly adjusted
Usability Factors	Negative	Patient	Wireless mouse is not very easy to use
Usability Factors	Positive	Professional	Not intensive training is needed to use the system
Usefulness of the System	Positive	Doctor	From my office, I can follow-up a higher number of patients at home
Usefulness of the System	Positive	Patient	I do not need to go to the hospital to consult my doctor unless I need to charge the infusion pump
Appropriateness of Service	Positive	Doctor	Unnecessary emergency admissions could be divided by two thanks to this audio-visual contact
Appropriateness of Service	Positive	Doctor	Thanks to the application and nurse's support, I can attend several patients at my clinic despite of being at the hospital
Appropriateness of Service	Positive	Patient	I can point where it hurts me and doctor really knows now where, not as before

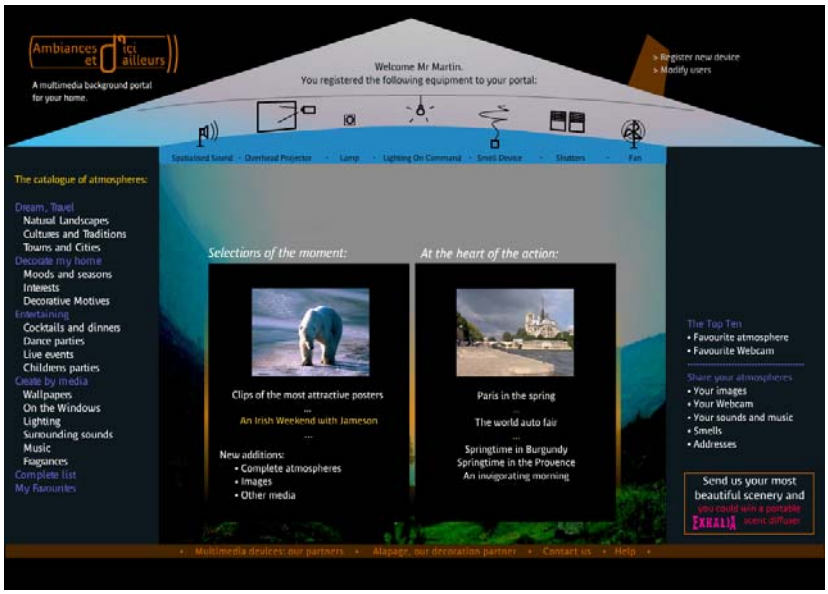
	• S6: Security and Privacy Several issues have been identified in the legal or regulatory field that may affect TEN CARE developments. Data protection: databases containing medical records and private information should be in conformance to the LORTAD – Spanish Law that takes care of data privacy and protection. Medical information is high level security and there is no problem to fulfil this request. Electronic signature: Several systems can be adopted to achieve it and a lot of effort is being done to standardise it by big companies and organisations. That would facilitate identification, remote prescriptions, authentication tasks and others. European level laws will make also easier the use of trans national services. Medical responsibility: When more than one doctor participates in a diagnostic, responsibilities should be very well defined in order to avoid further problems. In this case, the use of a telematic way should not modify the current laws and not difference has to be done for cooperative diagnosis using or not TEN CARE services. Something similar happens with the medical associations, as doctors have to be associated in the region they are providing their services, which could result in some kind of impediment for Telecare beyond this geographical limits.

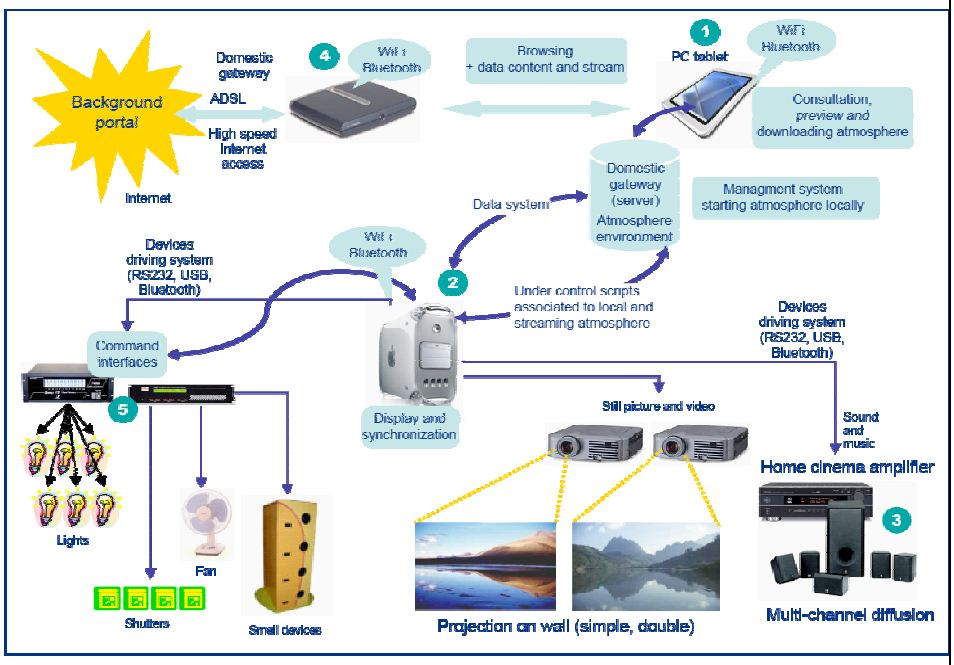
A.4 Scenarios related to Home Information & Entertainment (D2)

Scenario Title	2A: “interactive background portal”
Reference	“Sensitive and audiovisual house “project, http://www.rd.francetelecom.fr/index.htm.en.php Related work done by others Jensen T, Rognskov H, Thrane K: The flexible room- technology to communicate and personalize; proceeding of "the good, bad and irrelevant", page 3 to 7 cost 269 conference, Helsinki, September 2003, publisher media Lab/University of Art and Design Helsinki
Scenario Summary	This scenario provides a description of how some household objects could support this new kind of services content. These services allow people to change or get a special atmosphere in the house by using the equipment already present (lights, sound devices, screens, electric shutter, video projector…)
Primary Application Domain	• *D2: Home Information & Entertainment* .

Relevant User Services	• *S4: Content provision, selection and retrieval* • *S5: User interface*
Scenario Description from User Perspective	The user can access this “interactive background” service by 2 ways, illustrated in two different scenarios Scenario 1 Anne is at home and she wants to read in a special atmosphere. So she goes to the “interactive background” internet portal l and navigates through the different proposed atmospheres. She chooses to relax in an Indian atmosphere near the Ganges. As soon as she has made her choice, the lighting in her home changes, pictures of the Ganges appear on several screens, specific scents are diffused and a mixture of sounds coming from the shores of the Ganges mixed with some music can be heard.  Scenario 2 Benjamin is very fond of zen and Japanese culture. He has just bought himself a special candle in a Japanese store. This candle provides a complete change of atmosphere when it is lightened up. When he gets home, he lights up the candle. The atmosphere of the room changes: music, lights, picture end scents, all linked to a zenetic experience.

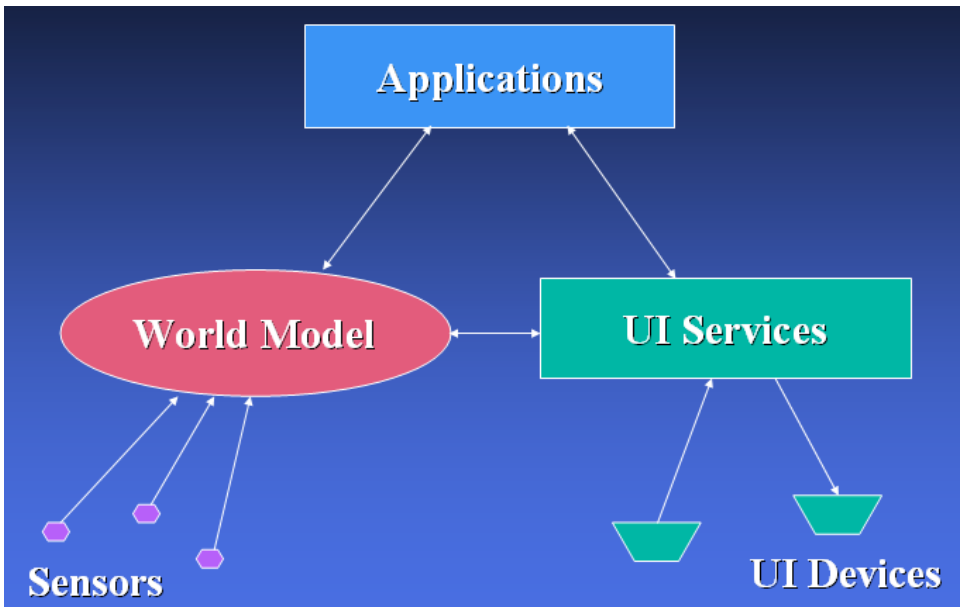
	
Key issues	The basic idea behind this is that through a home gateway it is possible to take control of different kinds of devices that are present in a user's home, such as: lights, TV screen or video-projector. This allows a content service provider to display multimedia information from the network to those devices in order to create global atmospheres (for example). • The system is composed of 2 elements: First, a home gateway always connected to a broad band. The user registers the devices he owns: visual (TV screens, computer screens, phone screens, video projectors….); audio (all means of displaying sound) and every other remote controlled device (lights, electric shutters, scent diffusers….) Once registered, each of those devices can be selected and activated by the gateway Second, an online portal that offers hundreds of atmospheres to download. The atmospheres are sorted out according to the different moments of life (dinner with friend, relax…). Each atmosphere is made of: pictures (already recorded or coming from web cam), sound track, light effects, scents ▪ The user controls every element of the service: He only notifies the portal of the devices he wants to be controlled. For example: if he only wants to register a TV screen, he can. In that case, when he chooses an atmosphere in the portal, only pictures designed for a TV screen will be displayed. On the other hand, if he wants to add light, scents diffusers or whatever else, the atmosphere will be more global.

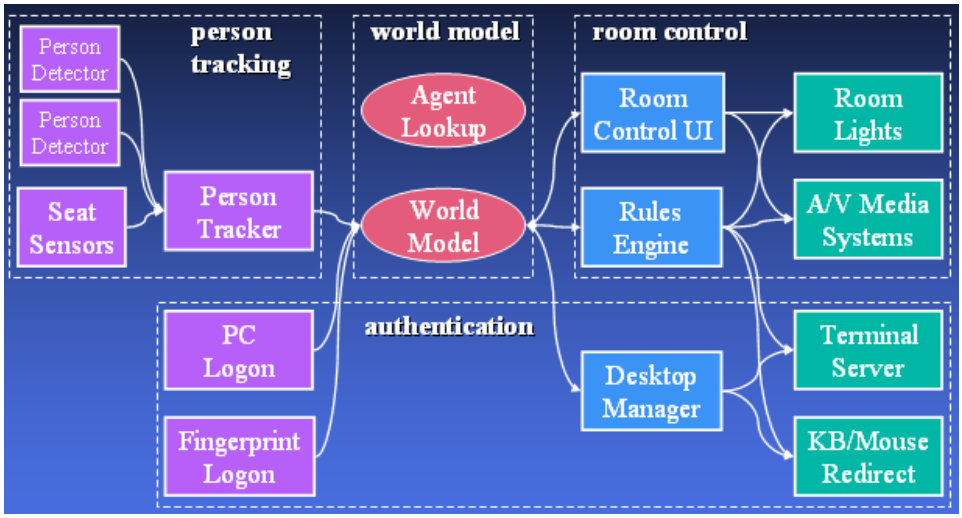
	The picture below shows a page from the portal. At the top of the screen, the user can see all the devices he has registered. The other part is dedicated to the proposition of atmospheres  ▪ This system does not need any additional devices. The service uses the devices that the user already has. For example, if the user owns a home cinema setup, then the service will use it to display the contents. ▪ The user does not have to set anything up**.** He just registers his devices and the services deals with everything ▪ The idea of this service has been designed on the basis of users group's results. It answers to the need of "changing the background as we change our mood"
Implementation Details Devices/ Artifacts	▪ Domestic gateway ▪ Any devices allowing display of information or any remote controlled device that can be used to create an atmosphere ▪ Smart object: The "background" service can work with a smart object, for example a candle. These objects need to include a sensor (warmth or movement or any other one). The activation of the background is then made when the sensor reaches a certain value. ▪ Broad band connection

Implementation Details Software/ Services	
Discussion of relevant Services	• *S4: Content provision, selection and retrieval* This service is aimed at providing new kinds of content to the user directed towards the creation of global atmosphere. It is a new way of gathering multimedia devices and other any remote controlled device through a gateway in order to provide a unique service to a user. It is also a way to provide online services content just by using all kind of physical devices already in the home. This kind of content can be used in 3 different ways: - individually: when people take time for themselves and adjust their environment for them. - When the whole family is gathered when people are in search of a common atmosphere - For a party when people want to create a specific atmosphere, for example a Mexican dinner • *S5: User interface* The user interface is designed for 2 kinds of users: - For experienced people who do not mind using a web portal, in a classical way trough a personal computer - For people who do not want to use a web browser through a decorative smart object. This interaction mode allows the launch of several events by using a familiar gesture.

Scenario Title	2B: “EasyLiving: Technologies for Intelligent Environments”
Reference	1. Addlesee, M.D. et al, “ORL Active Floor”, IEEE Personal Communications, Vol.4, No.5, October 1997, pp. 35-41. 2. P. Bahl and V. N. Padmanabhan, “RADAR: An In-Building RF based User Location and Tracking System”, Proceedings of IEEE INFOCOM 2000, Tel-Aviv, Israel, March 2000. 3. Michael Coen, “Design Principals for Intelligent Environments”, Intelligent Environments, Papers from the 1998 AAAI Spring Symposium, March 23-25, 1998, Technical Report SS-98-02, AAAI Press. 4. John Krumm, et al “Multi-Camera Multi-Person Tracking for EasyLiving”, Third IEEE International Workshop on Visual Surveillance, July 1, 2000, Dublin, Ireland. 5. Michael Mozer, “The Neural Network House: An Environment that Adapts to its Inhabitants”, Intelligent Environments, Papers from the 1998 AAAI Spring Symposium, March 23-25, 1998, Technical Report SS-98-02, AAAI Press. 6. R. Smith, P. Cheeseman, “On the Representation and Estimation of Spatial Uncertainty”, International Journal of Robotics Research, Vol. 5, No. 4, Winter 1986, pp. 56-67. 7. Steven Shafer, et al, “The New EasyLiving Project at Microsoft Research”, Proceedings of the 1998 DARPA / NIST Smart Spaces Workshop, July 1998, pp.127-130. 8. Triclops Stereo Cameras, Pt. Grey Research, http://www.ptgrey.com/. 9. Universal Plug and Play, http://www.upnp.org/resources.htm. 10. Roy Want., Andy Hopper, “Active Badges and Personal Interactive Computing Objects”, IEEE Transactions on Consumer Electronics. Vol 38. No.1, Feb. 1992, pp.10-20. Website of publications: http://www.research.microsoft.com/easyliving/publications.aspx#Journal
Scenario Summary	The EasyLiving project is concerned with development of an architecture and technologies for intelligent environments which allow the dynamic aggregation of diverse I/O devices into a single coherent user experience. Components of such a system include middleware, world modelling, perception, and service description.
Primary Application Domain	• *D2: Home Information & Entertainment*

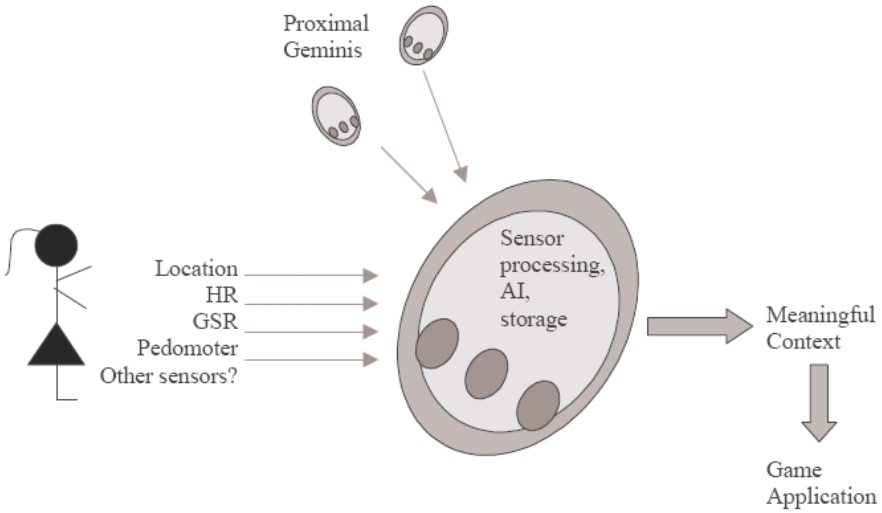
Relevant User Services	• *S2: User modelling and profiling* • *S6: Security and privacy*
Scenario Description from User Perspective	Tom is at home. He enters the living room sits down at a PC in the corner. He surfs through a selection of MP3's, and adds them to a playlist. He gets up and sits down on the couch. His session follows him to the large wall screen across from the couch. This screen is selected because it is available and in Tom's field of view. Tom picks up a remote control sitting on the coffee table and uses the trackball on it to request the room controls. They appear in a window on the wall screen, showing a small map of the room with the controllable lights. He uses this interface to dim the lights. Tom opens up his playlist and presses play. The music comes out of the room's large speaker system. Sally enters the living room from the sliding doors to the outside and walks over to the PC. She has to manually log in, since she hasn't previously identified herself. She brings up a Word document that is an invitation to a shindig she and Tom are 2 hosting. Wanting Tom's input, she asks him if she can use the large room display. He uses the remote to release control of the wall screen, and she uses the room's controls on her PC to move her session to that display.  *Tom & Sally discuss a document in their Living Room*

Key issues	The EasyLiving project at Microsoft Research is concerned with the development of an architecture and technologies for intelligent environments. An intelligent environment is a space that contains myriad devices that work together to provide users access to information and services. These devices may be stationary, as with acoustic speakers or ceiling lights, or they may be mobile, as with laptop computers or mobile telephones. While the traditional notion of a PC is a part of this vision, a broader goal is to allow typical PC-focused activities to move off of a fixed desktop and into the environment as a whole. An intelligent environment is likely to contain many different types of devices. First, there are traditional input devices such as mice or keyboards and traditional output devices such as speakers or displays. To support richer interactions with the user, the system must have a deeper understanding of the physical space from both a sensory (input) and control (output) perspective. For example, it might be desirable for the system to provide light for the user as he moves around at night; to enable this, the system uses some form of perception to track the user, and must be able to control all of the different light sources. Input devices can include things such as active badge systems, cameras, wall switches, or even sensitive floor tiles. Output devices can include home entertainment systems, wall-mounted displays, speakers, lighting, etc. Besides I/O devices, there will likely be devices dedicated to providing computational capacity to the system. EasyLiving's goal is the development of an architecture that aggregates diverse devices into a coherent user experience. This requires research effort on a variety of fronts, including middleware, geometric world modelling, perception and service description. 

Details of Implementation: Devices/ Artefacts	• Two colour Triclops stereo cameras, each connected to its own PC. • Fingerprint reader. • Desktop PC. • Visual Panel. • Wireless keyboard and mouse. • Network Connection. • RF, IR or ultrasonic transceivers.
Details of Implementation: Software/ Services	• An overview diagram of the system: 
Discussion along relevant Services	• S2: User modelling and profiling When a user is authenticated to the system, custom preferences are loaded that direct automatic behaviours. In the example scenario, one of Tom's preferences was a standing MP3 playlist. Similarly, users can have behaviours that direct various media types, for example, a CD, MP3, DVD or Videotape, that plays based on their location context. Defining automatic behaviours and preferences for an intelligent environment in a consistent user-friendly manner remains an open challenge.

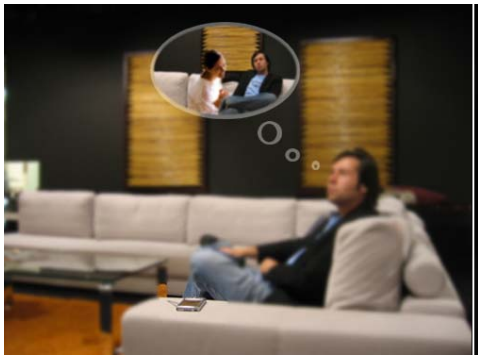
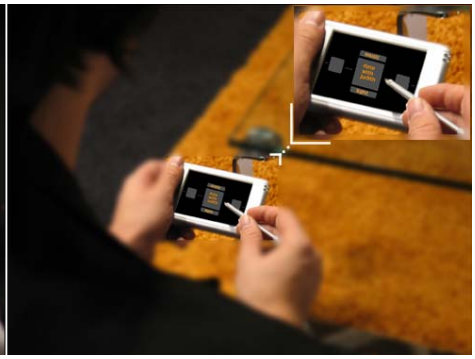
	• S6: Security and privacy One novel sensor that provides input to the system is a fingerprint reader manufactured by Digital Persona. This device is connected via USB to a machine with a database of fingerprints. When the user places a finger on the device, it automatically activates and sends messages that assert the identity of the person. This information can be used in combination with other components to assign a network identity to data that is currently being sensed. Knowing the measurement between the fingerprint sensor and the camera and the geometric extent in which a person can use the reader, allows the system to map the network identity to the reports from the vision system. This mapping can also be accomplished when the user logs in using a keyboard with a known location.

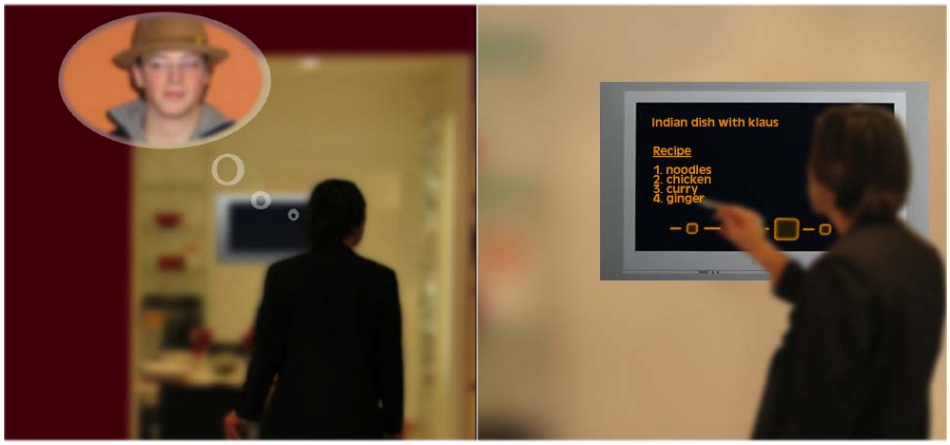
Scenario Title	2C: “Gemini: Accumulating Context for Play Applications”
Reference	R.L. Mandryk and K.S. Stanley. (2004). Gemini: Accumulating context for play applications, In Ubicomp 2004 Workshop on Playing With Sensors, September 2004, Nottingham, England. EDGE LAB at Dalhousie University's Faculty of Computer Science. http://www.edgelab.ca/edgelab.php?content=home
Scenario Summary	The scenario deals with a pervasive gaming application that brings former computer games into the physical world of a leisure environment. The scenario deals with sensing and capturing aspects of an individual’s context and injecting this “personality” into a gaming environment so that the environment can meaningfully respond to a player’s context rather than players responding to preconceived gaming challenges. Although efforts are made to create natural interfaces, the focus lies on sensing and utilizing cumulative context.
Primary Application Domain	• *D2: Home Information & Entertainment*
Relevant User Services	• *S1: Context collection, aggregation, and prediction* • *S5: User interface*

Scenario Description from User Perspective	Colleen always carries her Suki character (physical playing piece) with her. Suki has characteristics that Colleen admires; she's a great warrior, can catch a fish with her bare hands, and can climb a tree without any low branches. Colleen can't do these things but has enabled Suki to through her own activities (e.g. swimming, hiking, kayaking). In the online community where Suki lives and plays, Suki will become more successful if she learns how to fly. Suki has become aware of this and let Colleen know that she wants to learn to fly and it is up to Colleen to figure out how to do it. While Colleen is waiting by the bus stop to get home from university one day, Suki perks up because one of her friends is near by and she wants to say hello. Colleen doesn't recognize anyone she knows already so she looks around. She notices a holding a character and also looking around. Colleen holds Suki up and smiles at the girl who comes over and begins to talk. Turns out that the girl, Emily, recently helped her character Jackson learn to fly. No wonder Suki was so excited! On the bus the girls talk and trade ideas about the game.
Key issues	 The main issue of the Gemini scenario is about a collecting and processing context on a small device and then using this context to influence a gaming application nearby in the home or outside environment. Sensors perform an inherent mapping between the real world and data through physical processes. Sensor data, through accumulation algorithms is mapped into the Gemini's data set. This data set is interpreted by the local AI on the Gemini altering the intermediate game state of the piece, and finally, the game state of the piece is mapped into the shared virtual gaming environment. Each of these mappings reduce the total dimensionality of the system, reducing the infinite dimensionality of the real world into a manageable gaming data set.

Details of Implementation: Devices/ Artefacts	• Gemini A small, mobile object that travels with a player and communicates gathered information into a game environment. • Smart Environment The environment hosts the actual gaming application to which the Gemini forwards its reckoning of the physical and social context the player is in. • Home Entertainment Devices (Game consoles etc) Typical Home Entertainment Devices are used as interfaces to the game.
Details of Implementation: Software/ Services	• Context Collection Gemini gathers and accumulates context about the players' actions from a network of sensors (e.g. location, proximity, biometric sensors, number of steps taken, light, RFID). • Context Aggregation Context Aggergation services are used to reduce a time sequence of data points to a single value within the Gemini. Different possible accumulation algorithms include: maximum, minimum, threshold counts, averages, summation, departure from norm and statistical methods. For sensor data where noise and uncertainty undesirable, statistical or summation techniques can be used to diminish the impact of noise on the Gemini's state.
Discussion along relevant Services	• *S1: Context collection, aggregation, and prediction* This scenario addresses multiple ways that contextual input can be used to enhance the experience of playing digital games. In this scenario, Gemini is used to capture and store contextual data about the real, physical world. This could be when players are out with friends, waiting for the bus, pursuing hobbies, or being at home. Gemini also interfaces with a computer or game console (much in the way a memory card does) to allow the character to inhabit the virtual world, both when the player is controlling the character, and when the player is simply going about their daily routine. • *S5: User interface* The Gemini device entirely focuses on implicit interaction that does not require special attention to a (graphical) user interface. This way, the problem of intrusion that many pervasive games have. The propose Gemini, is a passive sensing device that does not interrupt the player. The player chooses when to play with Gemini. When they are not playing, Gemini will play itself by collecting sensor data about the player and their activities, synthesizing this data into information meaningful to the end applications(s). Thus, the act of playing computer games could become more social, drawing users from new demographics not currently represented.

Scenario Title	2D: “Context Aware Information Retrieval in the Home”
Reference	Brotherton, J.A., “Enriching Everyday Experiences through the Automated Capture and Access of Live Experiences: eClass: Building, Observing and Understanding the Impact of Capture and Access in an Educational Domain”, Georgia Tech, College of Computing, Ph.D. Thesis, December 2001. Brown, P., Burleson, W., Lamming, M., Rahlff, O.-W., Romano, G., Scholtz, J., Snowdon, D., “Context-awareness: some compelling applications”, http://www.dcs.ex.ac.uk/~pjbrown/papers/acm.html, 2000. Brown, P.J., Jones, G.J.F., “Context-aware Retrieval: Exploring a New Environment for Information Retrieval and Information Filtering”, Personal and Ubiquitous Computing 5(4), 2001, pp. 253-263. Garlan, D., Siewiorek, D., Smailagic, A., Steenkiste, P., “Project Aura: Toward Distraction-Free Pervasive Computing”, IEEE Pervasive Computing, 1(2):22-31, April-June 2002. Harvel, L.D., Liu, L., Abowd, G.D., Lim, Y.-X., Scheibe, C., Chatham, C., ”Context Cube: Flexible and Effective Manipulation of Sensed Context Data”, Proceedings of The Second International Conference on Pervasive Computing, 2004, pp. 51-68. Henricksen, K., Indulska, J., Rakotonirainy, A., “Modeling Context Information in Pervasive Computing Systems”, Proc. of the First International Conference on Pervasive Computing, Pervasive'02, Zurich, August 2002, F. Mattern, M. Naghsineh (eds). Lecture Notes in Computer Science, Springer Verlag, LNCS 2414, pp. 167-180. Hess, C.K., Campbell, R.H., “A Context-Aware Data Management System for Ubiquitous Computing Applications”, Proceedings of International Conference of Distributed Computing Systems (ICDCS 2003), Providence, Rhode Island, May 19-22, 2003, pp. 294-301. Kidd, C.D., Orr, R.J., Abowd, G.D., Atkeson, C.G., Essa, I.A., MacIntyre, B., Mynatt, E., Starner, T.E., Newstetter, W., "The Aware Home: A Living Laboratory for Ubiquitous Computing Research", Streitz, N.A., Siegel, J. Hartkopf, V. Konomi, S. (Eds.), “Cooperative Buildings - Integrating Information, Organizations, and Architecture”, Proc. of the Second International Workshop on Cooperative Buildings (CoBuild'99), LNCS 1670, Heidelberg, Springer, 1999, pp. 191-198. Lamming, M., Flynn, M., “Forget-me-not” Intimate Computing in Support of Human Memory”, Proceedings of FRIEND21. Meguro Gajoen, Japan, 1994. Prante, T., Stenzel, R., Petrovic, K., Bayon, V., “Exploiting Context Histories: A Cross-Tool and Cross-Device Approach to Reduce Compartmentalization when Going Back”, Proceedings of Informatik 2004, Ulm, September 20-24, 2004, pp. 314-318.

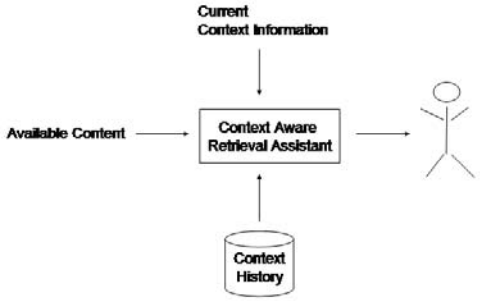
	Rhodes, B.J., Minar, N., Weaver, J., “Wearable Computing Meets Ubiquitous Computing: Reaping the best of both worlds”, Proceedings of The Third International Symposium on Wearable Computers (ISWC '99), San Francisco, CA, October 18-19 1999, pp. 141-149.
Scenario Summary	The scenario is based on research done in several projects (Aware Home & eClass/Classroom 2000, Aura, Gaia, Forget-me-not, ContextDrive, Remembrance Agent). All of them employ context-aware search components: Retrieval of information is done with the help of context information attached to the information now searched for in the context of earlier use. This context information can either be used in more or less explicit query interfaces parameterizing the search or implicity by taking the current situation (= context) as a default way of narrowing down the query.
Primary Application Domain	• *D2: Home Information & Entertainment*
Relevant User Services	• *S1: Context collection, aggregation, and prediction* • *S5: User interface*
Scenario Description from User Perspective	  It is Saturday morning and Marc relaxes in the couch in his living room and is dreaming about the dinner with his girl friend Judith last weekend. To support his dreaming, he wants to listen to the same music played at that time. He grabs his PDA from the couch table, enters her name, and navigates to the representation of their dinner, wherefrom he can initiate playing the music, which had been put together from calculating similarities to examples they provided together.



Later, when thinking about what he should prepare for lunch, he remembers the excellent Indian dish that he prepared about half a year ago with Klaus who visited from Germany. Being in the dining room, whereto the music followed him, he brings up the timeline view of his automatic context diary and quickly finds the main dish recipe he had looked up in the internet, the emails they had exchanged about what to have as a starter and desert, and the files representing their annotated versions of the recipes. The latter stem from the pen-interactive kitchen cupboard display, where they refined and elaborated the recipes with their experience from preparing the food. Marc checks the material put together by the context aware retrieval assistant and discovers that he has all the ingredients at home. Before having a walk, he enjoys the pictures that Klaus and he had exchanged.

Coming home, Marc enters the kitchen to start cooking, where the annotated recipe pops up on the kitchen cupboard display immediately.

	 In the early evening, his neighbour Chris peeks in to ask him for the book he borrowed to Marc. As they both are passionate divers and Marc's last business trip led him to Madagascar, Marc's context aware retrieval assistant, via the hallway display, proposes to look at the pictures and thus a chatty evening has just started …
Key issues	As interactions tell stories, a promising approach to enhance the user experience in ambient intelligence environments is to exploit recorded histories of the users' interactions in context (context histories for short). These histories can be used to support ambient intelligence applications with an enhanced understanding of the users' activities as they expand and develop over time. In addition, current contextual data is often imperfect and noisy and can be smoothed from the use of histories. In more traditional computer use, interaction histories have been in use for quite some time. Interaction logs of evaluation tasks serve a detailed analysis. Histories of visited web sites are used to support navigation. Online shops offer recommender functionality based on interaction logs. Finally, interaction histories are sometimes used to infer user tasks. These and other applications can be enriched by integrating context sensing from even more sensors into the physical and digital world. Users will employ an increasing number of computational artefacts both consecutively and simultaneous while performing everyday activities. Exploiting context histories may, for example, result in less distractions, more adapted and coherent behaviour of multiple computers and devices, and better support in home information management and search. The user will end up with a more supportive and comforting environment.
Details of Implementation: Devices/ Artefacts	• Wall displays in living room and dining room • PDA • Sound system • Pen-interactive display in kitchen • User identification technology

Details of Implementation: Software/ Services	• A rough overview diagram of the system: 

Discussion along relevant Services	• *S1: Context collection, aggregation, and prediction* For the content to be indexed with context data from the user experience, context needs to be collected from physical as well as from digital world sensors. In smart home environments, there will be input from a variety of such sensors distributed throughout the home and even outside. Some of them will be hosted on devices with little storage and computing power. Issues are: Collection of all the data needed, synchronization of the data between devices, and putting the user in control to feel comfortable with the level of data being stored. The collected sensor/context data is then used to build up an „automatic diary" as Rhodes put it. For this to be efficiently queried and to be presented to users in a meaningful way, the raw sensor/context data needs to be aggregated into a use-case driven context model to make up the basis for extracting user activities like relaxing in the couch, cooking, listening to music, reading a book, or brushing teeth. • *S5: User interface* Exploitation of the context histories can, for example, result in proactively providing visualisations to the user in support of, e.g., her each day morning routines. She will implicitly trigger that by her presence/aura in context. At the same time, however, the collection, storage, management, and exploitation of context histories is a delicate issue, as privacy, informational self-determination, and data security are touched. One appropriate user interface metaphor for presenting the automatic diary is a timeline, which can be employed to browse through the information. In addition, context cues from users' experience can be implicitly and explicitly provided to search for the relevant and related information. This can be, for example, the users' locations, other people that have been part of the experience/activity, the users' vague memory of when experiences related to the information searched for took place, and in which of their own activities did they employ the information searched for so far.

Scenario Title	2E: “Context aware multimedia browsing”
Reference	ITEA-Ambiance project Qian, Y., Udink, R., Feijs, L.M.G., A photo management system for future home environments. In Proceedings of the International ITEA woprkshop on Virtual Home Environments. Paderborn, Germany. Shaker Verlag (2002) 93-101. Qian, Y., Udink, R., Feijs, L.M.G., Stepwise Concept Navigation. In de Moor, A., Ganter, B. (eds.): Using Conceptual Structures: Contributions to International Conference on Conceptual Structures 2003. Dresden, Germany. Shaker-Verlag (2003) 255-268. Qian, Y., Formal development of a distributed logging mechanism supporting disconnected updates. In Dong, J.S., Woodcock, J. (Eds.) Proceedings of the International Conference on Formal Engineering Methods 2003 (ICFEM 2003). Singapore, LNCS 2885, Springer—Verlag (2003) 338-358. Dijk, E. O., Berkel, C. H. van, Aarts, R. M. and Loenen, E. J. van. Ultrasonic 3D Position Estimation using a Single Base Station. In Proc. First European Symposium on Ambient Intelligence (EUSAI), p. 133-148, Veldhoven, The Netherlands, 2003, Springer-Verlag. Dijk, E. O., Berkel, C. H. van, Aarts, R. M. and Loenen, E. J. van. A 3D Positioning method using a Single Compact Base Station. In IEEE Int. Conf. On Pervasive Computing and Communications, p. 11-110, Orlando, Fl. USA, 2004
Scenario Summary	A mobile digital photo-album device can detect screens nearby in the home. Physical objects can be used as part of a user interface.
Primary Application Domain	*D2: Home Information & Entertainment*
Relevant User Services	• *S1: Context collection, aggregation, and prediction* • *S2: User modelling and profiling* • *S3: Awareness and notification* • *S5: User interface*

Scenario Description from User Perspective	Marc and his daughter come home from a nice afternoon of shopping. They have bought a second Sepia: a portable touch screen (webpad, pda), which allows them to acces any of their multimedia resources, including their personal photos. When left alone, it can e.g. display their favourite photos in the living room. When they enter their house, and switch on the Sepia, it is able to discover the existing home server and make an instant connection to it. A familiar photo selection interface is shown on the new Sepia enabling the new owners to easily browse through their photo collection on both Sepia's. The system learns what their favourites are. These are automatically displayed, depending on who is nearby. The Sepia's are also smart: they know in which room they are, and even in which position and orientation. This allows them to adapt the user interface to the local needs. There are various displays in the house, of which two in the living room. Content can e.g. be directed to an appropriate display by changing Sepia's orientation, or by pointing their finger to it. They can quickly access favourite albums by simply placing a physical object, which reminds them of that album, close to the Sepia. They can alternatively have a conversation with the system, to have it find certain photos back for them. Than their favourite "butler" appears on one of the screens, so they have someone to talk to. Marc decides to do some browsing of the news before sorting out dinner. He goes to get a Sepia from the family shelf, and activates the latest messages for him. The screen starts to show some pictures from Claire, his wife, in Paris for all the family. It also pops up a special written message just for him. Claire says she will be back from Paris in time for dinner tomorrow. She suggests they might do something special, since the kids will be out then. Marc sits down in his favorite comfy chair. Together with his favorite news channel he starts some music, and turns the screen to portrait orientation, as this is better for displaying news text. Later he gets a video call from his wife on the large screen. She's standing at the Arc de Triumph and wants to show it to him. "We should come here for a romantic weekend sometime," she says. This gives Marc a great idea for a romantic French dinner for when she gets home. The kids love the Sepia's, and often take them to their rooms. The home system can tell them at any time where the Sepia's are, but Claire doesn't like to go fetch it. She recently bought a special chair, which has one built in, so she always knows where it is. It acts a universal remote control, which can be configured to handle new devices. At least 2 buttons are provided for personalisation, and it can even switch on the radio or TV automatically.

Key issues	Users cannot only modify photos, they can also modify albums by adding, removing or reordering photos. In data synchronization, both photos and albums need to be handled. Disconnected updates and data synchronization are at key and user dependent conflict resolution. The ease-of-use and enjoyment-of-use of electronic devices can be improved using context awareness. A mobile digital-photo-album device could detect screens located nearby in the room. The album then could offer the option to the user to display photos on these screens. The user interface to in-home electronics can be more than the traditional buttons, remote controls, or keyboard and mouse. Physical objects can also be part of a user interface. A user may initiate a certain function by touching or moving a physical object. Location systems can help to determine the location and movement of this object.
Details of Implementation: Devices/ Artefacts	Home network. Wired- and wireless net, distributed HW/SW platform. Zigbee links Context aware portable screens (webpads, PDA's, remotes) with smart interfaces, Tracking and positioning system (RF and US), (local) world model, agents Location based services at home Mobile robotic personal assistant Speech and gesture recognition, conversational interfaces User profiles, user recognition, user interfaces Tangible object interfaces Virtual presenter
Details of Implementation: Software/ Services	See ref.

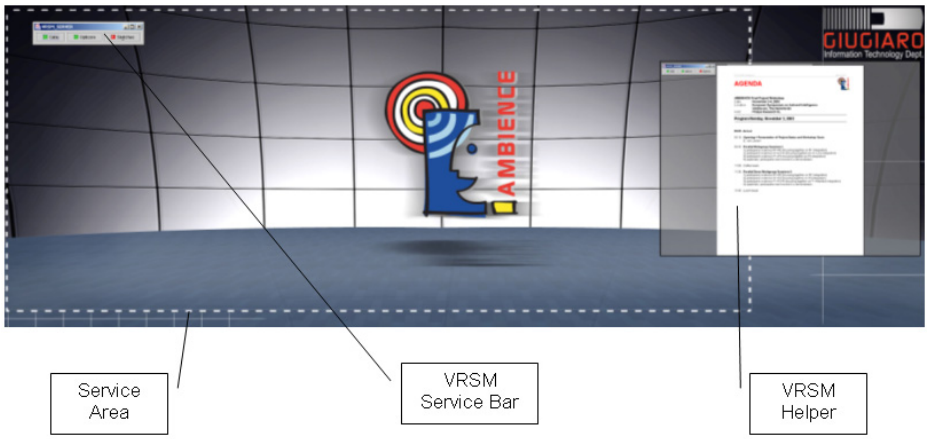
Discussion along relevant Services	This discussion will only highlight one intelligent user service and two special technical aspects that were explored, implemented and evaluated. S1 Context collection, aggregation and prediction Ultrasonic systems for indoor domestic applications were used based on the assumption that low cost and minimal infrastructure are important. For this an ultrasonic location system for 3D position estimation, using a single base station was introduced. Mobile devices were located in 3D space by measuring the acoustic reflections in a room. Another method used was to measure both distance and direction of a mobile device with respect to a base station and calculate its 3D position. The following problems were specifically addressed: unfavourable geometric configuration of the array, line-of-sight path inclusion, multipaths interference, and movement during measurements. The heterogeneity of home environments was addressed by introducing data identities for modelling digital multimedia data objects that are often replicated across interconnected devices. Semantic rules were introduced to reduce user-centric involvement in data synchronization.

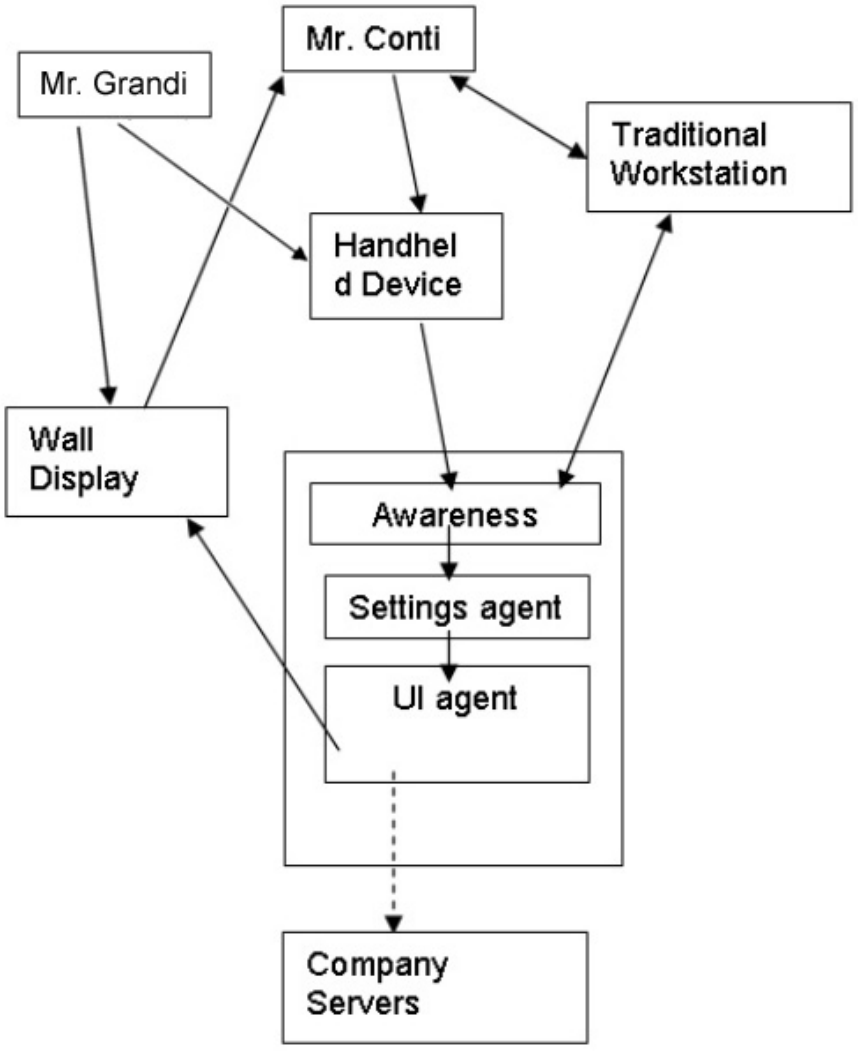
A.5 Scenarios related to Extended Home Environment (D3)

Scenario Title	3A: “Design Meeting”
Reference	Website of the project: http://www.extra.research.philips.com/euprojects/ambience/ Related arguments: - Savino, G., Jozzo, L., Di Marca, S., (2003) Ambience Smart Design Studio. Speech at European Symposium on Ambient Intelligence (EUSAI). Eindhoven, The Netherlands, November 3-4, 2003 http://www.eusai.net/EUSAI2003/programme.html - E. Arts, R. Collier, E. van Loenen, B. de Ruyter, 2003, “Ambient Intelligence First European Symposium“, EUSAI 2003 Proceedings. Eindhoven, The Netherlands, November 3-4, 2003
Scenario Summary	This scenario describes a setup created in order to support people involved in a context aware ambient meeting. Ambient technologies allow users to share documentation and data according to their preferences and profiles. The scenario is related to a typical design session performed in the virtual reality centre of Italdesign – Giugiaro.
Primary Application Domain	D3: Extended Home Environment
Relevant User Services	• S2: User modelling and profiling • S3: Awareness and notification • S4: Content provision, selection and retrieval • S5: User interface • S6: Security and privacy

Scenario Description from User Perspective	 Human actors • Group of people • Project Manager Assumptions • Ambience platform installed • Wireless LAN with devices recognition • Device/people tracking system Mr. Bianchi is a Project Manager working in Italdesign – Giugiaro, he is a part of the staff authorized to have an access to the Virtual Reality Centre and he is actually involved in a meeting with customers and colleagues. When Mr. Bianchi wants to enter the VRC he opens the door with his identification tag and, as soon as he is inside the room, he is identified by the system that provides data security. After the identification/authentication, the system logs the Project Manager and the aware system displays on its screen a list of items that could be useful during the meeting (like e.g. costs analysis, prototype pictures, prototype drawings, etc), giving him a choice of the different activities based on his personal profile. Mr. Bianchi has got a portable pc with a presentation which is not present in the company server; the presentation is downloaded through wireless network to the central system, then displayed and archived. When the participants involved join the meeting, Mr. Bianchi starts to show them the Agenda of the day. He starts the PowerPoint application and the meeting agenda pops up on the big screen by simply using the Physical Tangible Object and by placing a tagged object to the scan area. Mr Bianchi shows some sketches of the prototype to all the participants. He starts the Sketches application simply putting the corresponding HiTag on the Application antenna and then he shows different sketches simply putting the corresponding HiTag on the data antenna. The different sketches are visualized on the screen in order to evaluate or compare them.

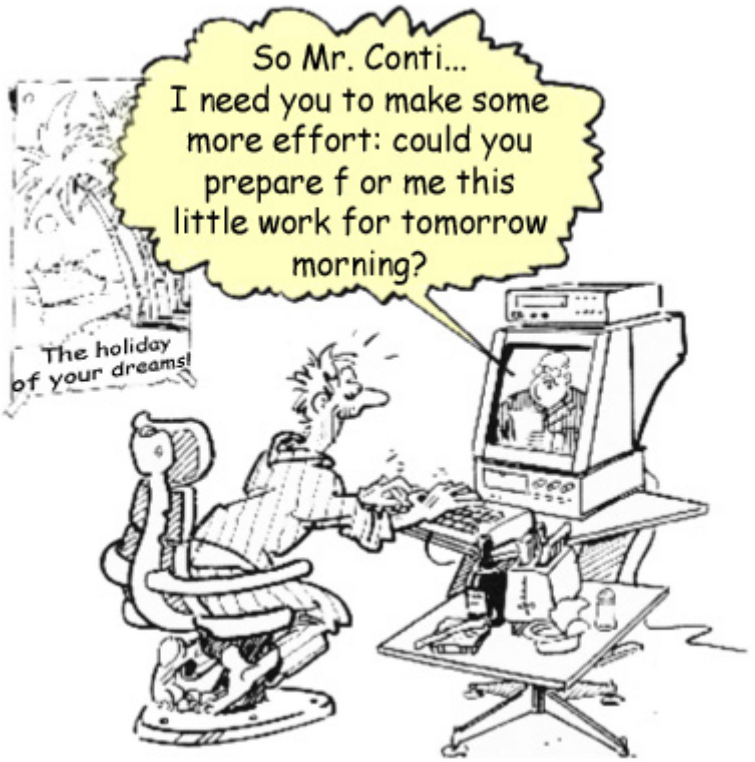
	Mr Bianchi shows the virtual model of the current prototype in order to better evaluate it. He starts the Viewer application simply putting the corresponding HiTag on the Application antenna and then using the voice and/or the PDA device, he can navigate in the virtual reality model moving, zooming and starting animations. Mr Rossi, another meeting attendant, finds also in his own desktop computer the new data and the sketches that will be evaluated during the meeting. Mr Bianchi activates the teleconferencing system, by using the voice commands, in order to call Mr. Green who is currently working at his desk. Mr. Green answers the call and then goes to join the meeting in the VRC. He opens the door with his tag, the system does not require a further certification since Mr. Rossi was invited by a certified user who is inside the Centre. Mr. Bianchi switches the system in the presentation mode by a voice command, which gives the users the possibility to work together on the same project. Mr. Green wants to show the refined work to Mr. Brown, who works in the engineering dept in the customer's company. The customer has got a VRC and the two centres are networked with a dedicated broadband connection. When the system is asked to contact Mr. Brown, it finds out that he is in the customer's VRC and then it starts the videoconference connection, asking if they want to share the presentation. The customer's VRC is a simple virtual centre, without awareness ambience technologies. They share the virtual model and they have a brief DMU (Digital Mock-Up) session. When the working session is finished, Mr. Green uses the company's Product Data Management software to store the modified model and its different versions and then identifies the working session with a physical object, which contains the mpeg video of the DMU session in order to easily retrieve the data once he gets back to his office. Mr Bianchi wants to compare the mathematical model to the real physical model in 1:1 scale that is being built in the workshop: so he asks some information to the workshop responsible through his PDA. The workshop responsible takes a photo of the model using his workshop mobile phone and sends it via UMTS to Mr Bianchi, who downloads it to the company server for its evaluation on the powerwall.

Key issues	**VRSM** The VRSM (virtual room service manager) is able to run different services according to a specific context. VRSM collect all the inputs coming from different device (Tag recognizer) or specific application (speech module) and it is able to manage COTS application by generating native input events on X-window system.  **Physical Tangible Object** The Tangible Object interaction modality is designed to allow the VRC users to start applications and select designs by simply placing a physical object on a table. In the demonstrator this is implemented using 2D cards with a name of the application or a photo of the respective car model. The latter could just as easily be implemented using for example a small 3D model of the car. Tangible object recognition offers the advantage of instant access to certain functions, eliminating the need to search through menus of different applications. Also, it is very flexible, and not restricted to e.g. the number of buttons that fit on a remote control. The main advantage expected however, is enabling users to interact with the system using one of their most basic and intuitive skills: handling physical objects. The Tangible Object is also for people identification. In fact, users that need to enter the VRC should be identified by the system in order to create limitations to the application and environment access. **PDA** The interaction through wireless PDA (or through portable laptop, connected to company's network) helps to create easy and intuitive commands due to graphical interface, based on a common use device. PDA can be used as an easy tool that interacts with the system by an ad-hoc and re-configurable graphic interface.

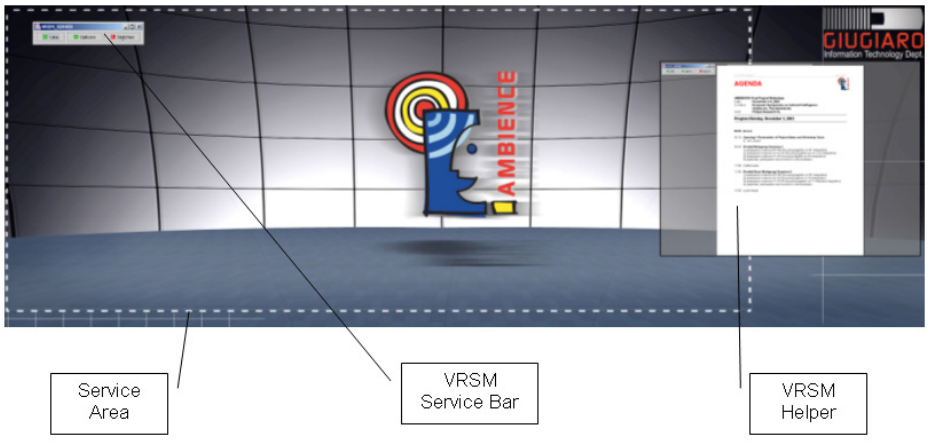
	Using the PDA together with the VRSM tool, it's possible to have an easy and immediate interface with the Ambience system: for example it is possible to interact with a presentation in the Virtual Reality Centre using the features of a wireless PDA. The commands thought for the PDA are basically the same previously defined for the vocal control: general commands, able to activate the main functions of the Virtual Meeting Room and in particular the various applications.
Details of Implementation: Devices/ Artefacts	• Speech recognition • Power wall VRC server (VRSM) • Wireless LAN • Video communication facilities • Network connection • Recognition system • Physical Tangible Object • Handheld device • Wall Display
Details of Implementation: Software/ Services	

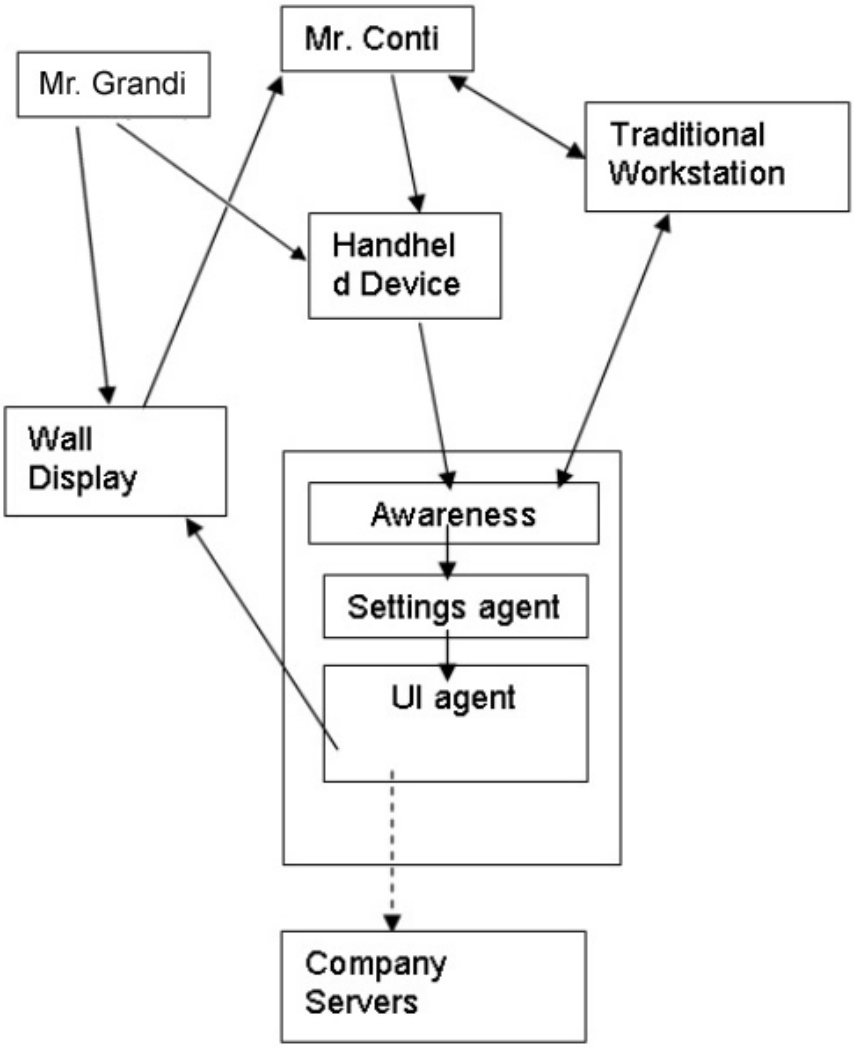
Discussion along relevant Services	S2: User modeling and profiling The information related to the single user and his role inside the company is used to define the scene: only people that are involved in a particular project are allowed to access to the project data and to the project meeting room. Furthermore, the information about the attendants is used to provide the system with all the working instruments needed to perform the tasks inside the project. S3: Awareness and notification The awareness and notification system is used to provide information for the person responsible for the meeting, regarding the presence of people inside the room, and their relevance for the project meeting. It means that the system knows well all the profiles of the people working in the company and the activities that they perform at the moment. In this way the system can help the meeting responsible to involve all the people present to fulfill the meeting goals. S5: User interface The system allows the person responsible for the meeting and the participants to interact with the disposable tools in various. For example, the user can easily interact with the system by voice (through speech recognition) and communicate with other users that are not attending the meeting through teleconference. The user interface gets all the information about the preferences of the user (provided by the user modeling and profiling system) that is interacting in that moment with the system, and provides him with all the needed tools. S6: Security and privacy The security and privacy system guarantees that people not involved in the project (company employers or other project customer) or in the specific topic of the meeting cannot have an access to the virtual reality centre and get the related data and information. Ambience categories addressed Platform and architecture - yes Position awareness – not necessarily Learning and intelligence –yes User interaction – yes User benefits • Easy access to personal data • Easy access to personal settings • User friendly interaction with system

Scenario Title	3B: “Tele Worker”
Reference	Website of project: http://www.extra.research.philips.com/euprojects/ambience/ Related arguments: - Savino, G., Jozzo, L., Di Marca, S., (2003) Ambience Smart Design Studio. Speech at European Symposium on Ambient Intelligence (EUSAI). Eindhoven, The Netherlands, November 3-4, 2003 http://www.eusai.net/EUSAI2003/programme.html - E. Arts, R. Collier, E. van Loenen, B. de Ruyter, 2003, “Ambient Intelligence First European Symposium“, EUSAI 2003 Proceedings. Eindhoven, The Netherlands, November 3-4, 2003
Scenario Summary	This scenario describes a setup to support the co-operation of people that are distant and are to work in a team. Displays and notification systems are used as tools that permit to connect different teams and to share information and data. The scenario is related to a possible communication between two separate teams involving people into the virtual reality centre of Italdesign – Giugiaro and people at their home.
Primary Application Domain	D3: Extended Home Environment
Relevant User Services	• S2: User modelling and profiling • S3: Awareness and notification • S5: User interface • S6: Security and privacy

Scenario Description from User Perspective	 Human actors • Mr. Conti • Mr. Grandi Assumptions • PC with home system • Ambience platform installed • Teleconference system Mr. Conti is an automotive cad engineer working at home with a network connection to his company servers. He works with his PC, linked to his home context aware system and to his company. He logs on and the home system prompts Mr. Conti with a list of possible services to help him in his job presented on his home wall display. He can select items by a wireless handheld device (PDA). He uses the PC to draw, while the home system provides the videoconference capabilities and the browser to access the company's databases. User identification techniques help Mr. Conti in his work, allowing him to share the same data, settings and desktop at home and whenever he visits the company headquarters.

	He has to deliver the final version of a car part, but before uploading it on the company database he wants to discuss it with his boss. So he starts the teleconferencing application. Mr Grandi receives the incoming request for videoconference on his PDA. He decides to accept it and performs the session on the company Virtual Reality Centre which is equipped with the latest context awareness technologies. He opens the VRC door with his identification tag and, as soon as he is inside the VRC, his identity is certified by the system providing security data. After the identification/authentication the system logs him and the aware system displays on its screen a list of items that could be useful during the teleconferencing session. Mr Grandi, using voice commands, starts the teleconference. Mr. Conti shows the current status of his work and Mr Grandi watches it on the VRC powerwall. Mr Grandi likes the results but asks for a little modification in order to match the latest customer request. Mr. Grandi says that this new customer specification is described in a technical document that is stored in the company database that could be directly downloaded by Mr. Conti using his secure access. During this session, the notification system informs Mr. Grandi that another company employee tries to access the VRC. Mr Grandi does not permit his access because the system shows him that currently this person is involved in another project.

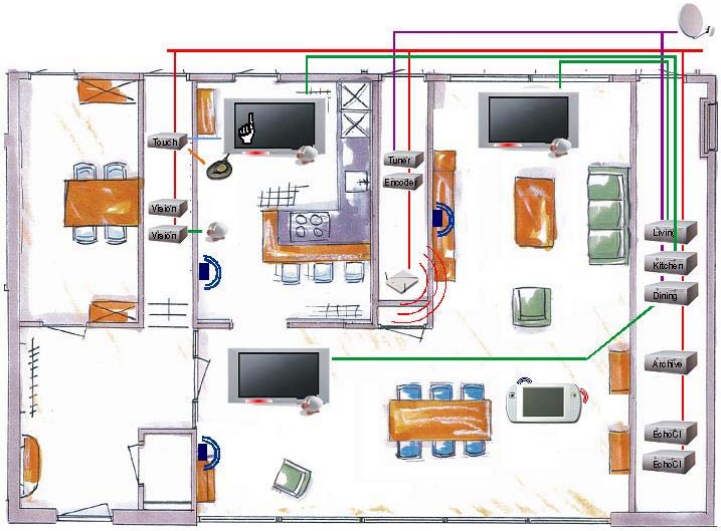
Key issues	**VRSM** The VRSM (virtual room service manager) is able to run different services according to a specific context. VRSM collect all the inputs coming from different device (Tag recognizer) or specific application (speech module) and it is able to manage COTS application by generating native input events on X-window system.  **PDA** The interaction through wireless PDA (or through portable laptop, connected to company's network) helps to create easy and intuitive commands due to graphical interface, based on a common use device. PDA can be used as an easy tool that interacts with the system by an ad-hoc and re-configurable graphic interface. Using the PDA together with the VRSM tool, it's possible to have an easy and immediate interface with the Ambience system: for example it is possible to interact with a presentation in the Virtual Reality Centre using the features of a wireless PDA. The commands thought for the PDA are basically the same previously defined for the vocal control: general commands, able to activate the main functions of the Virtual Meeting Room and in particular the various applications. **Teleconference system** The teleconference system permits to share data and images between the two separate teams working on the same project. **Physical Tangible Object** The Tangible Object is used for people identification. In fact, users that need to enter the VRC should be identified by the system in order to create limitations to the application and environment access.
Details of Implementation: Devices/	• Home LAN network • Speech recognition • Power wall VRC server (VRSM)

Artefacts	• Home server • Wireless LAN • Workstation • Wall Display • Handheld device • Recognition system • Physical Tangible Object
Details of Implementation: Software/ Services	
Discussion along relevant Services	**S2: User modeling and profiling** The information related to the single user and his role inside the company is used to define the scene: only people that are involved in a particular project are allowed to access to the project data and to the project meeting room. Furthermore, the information about the attendants is used to provide the system with all the working instruments needed to perform the tasks inside the project.

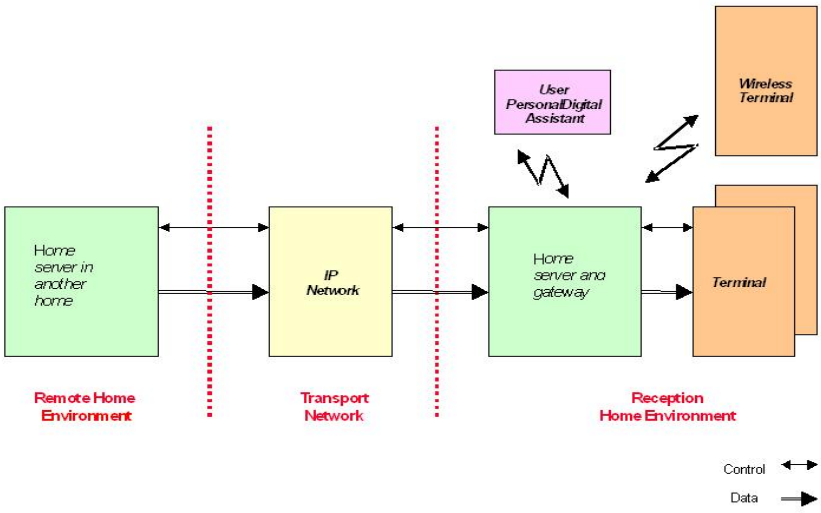
	S3: Awareness and notification The awareness and notification system is used to provide information for the person responsible for the meeting, regarding the presence of people inside the room, and their relevance for the project meeting. It means that the system knows well all the profiles of the people working in the company and the activities that they perform at the moment. In this way the system can help the meeting responsible to involve all the people present to fulfil the meeting goals. **S5: User interface** The system allows the person responsible for the meeting and the participants to interact with the disposable tools in various. For example, the user can easily interact with the system by voice (through speech recognition) and communicate with other users that are not attending the meeting through teleconference. The user interface gets all the information about the preferences of the user (provided by the user modeling and profiling system) that is interacting in that moment with the system, and provides him with all the needed tools. **S6: Security and privacy** The security and privacy system guarantees that people not involved in the project (company employers or other project customer) or in the specific topic of the meeting cannot have an access to the virtual reality centre and get the related data and information. Ambience categories addressed • Platform and architecture - yes • Position awareness – not necessarily • Learning and intelligence –yes • User interaction – yes User benefits • Easy access to personal data • Easy access to personal settings • User friendly interaction with system

Scenario Title	3C: “OZONE” (O_3 – Offering an open and optimal roadmap towards consumer oriented ambiant intelligence) New technologies and services for emerging nomadic societies
Reference	http://www.extra.research.philips.com/euprojects/ozone IST-2000-30026 *Q. Zhao, B. Mesman, and T. Basten*, “**Static Resource Models for Code-Size Efficient Embedded Processors**”, ACM Transactions on Embedded Computing Systems, 2(2): 1-32, May 2003. ACM Press. *J. Bormans, J. Gelissen, Adrew Perkins*, **“MPEG-21: THE TWENTY-FIRST CENTURY MULTIMEDIA FRAMEWORK”** IEEE Signal Processing Magazine, March 2003, Special Issue on Universal Multimedia Access. *C Otero-Perez, L. Steffens, P. van der Stok, R.J. Brill S. van Loo, A. Alonso, J. Ruiz, M. Valls*, **QoS-based Resource Management for Ambient Intelligence**, in Ambient Intelligence: Impact on embedded System Design, Kluwer, pp 159-182, 2003. *J. Liu and V. Issarny*, “**Service allocation in selfish mobile ad hoc networks using Vickrey auction**”. To appear in W. Lindner, M. Mesiti, C. Türker, Y. Tzikzikas, A. Vakali (editors): Current Trends in Database Technology - EDBT 2004 Workshops: PhD, DataX, PIM, P2PDB, ClustWeb, Heraklion, Greece, March 14-18, 2004, Revised Papers. Lecture Notes in Computer Science 3268, Springer-Verlag, Berlin, 2004. *Bormans, J.; Pham Ngoc, N.; Deconinck, G. and Lafruit, G.*, “**Terminal QoS: advanced resource management for cost-effective multimedia applications**,” Chapter in: Ambient Intelligence: Impact on Embedded System Design, Kluwer; 2003. *Chirila-Rus Adrian, Lafruit Gauthier, Masschelein Bart*, “**Scalability and error protection. Means for error-resilient, adaptable image transmission in heterogeneous environments**“, Chapter in: Ambient Intelligence: Impact on Embedded System Design, Kluwer; 2003.

Scenario Summary	Three scenarios envision situations of future everyday life in which intelligent systems and devices are made sensitive to the context of use, support social groups in sharing and communication, and control and transfer of activities in and between rooms via a linking concept.
Primary Application Domain	***D2: Home Information & Entertainment***
Relevant User Services	• *S3: Awareness and notification* • *S4: Content provision, selection and retrieval* • *S5: User interface*
Scenario Description from User Perspective	Users were provided with an electronic TV program guide (EPG) application on a context-aware remote control with a touch screen. Users are reminded of selected TV programs and informed about incoming suggestions sent by friends. These reminders and suggestions were presented in an adaptive way according to the context of use. The scenario to explain the linking concept focuses on situations in which several members of a family want to watch the same video content on different receiving devices in different locations and at the same time. As such, comparable user experiences can be created for people in different locations. The *linking* concept enables users to dynamically incorporate a portable device into the stationary infrastructure of a room. As a result, the portable device can be used to control activities in the room and to transfer activities between the portable and the 'room'. Furthermore, using these transfer capabilities, the portable can act as a flexible content carrier that can be used to move an activity from one room in the home to another.
Key issues	The focus of the first scenario is on the use of a PDA as remote control for accessing personalized news, video on demand, and TV from every where. The second scenario addressed four different user aspects: 1) Location and activity awareness of people, 2) Linking concept, i.e., comparisons of wired and wireless transmission with regard to video quality perception and overall concept appreciation, 3) The effect of terminal resource management and real-time streaming variables on perceived video quality, and 4) The effect of handling multiple applications/streams within one terminal, in a closed network and displaying with various configurations of PIP windows. The third scenario concerned an away environment in which users can use the system for various different tasks, concerning available services and their several characteristics, such as, obtaining information through invisible computing sources for nomadic personal use.

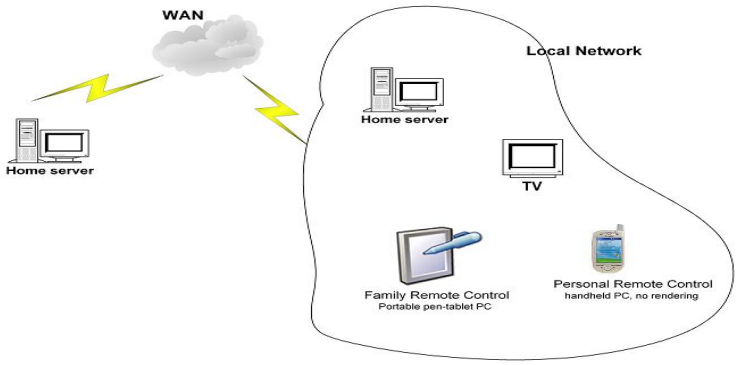
	The home networking system shares CE devices and PCs between users. The network has to deliver real-time audio and video to its users while network and device resources are shared. This implies that overload conditions may occur and that choices need to be made on the allocation of resources to the video streams and indirectly to the users of these streams. In the wireless part of the network fluctuations in bandwidth may occur due to overload and interference of other devices in the home. In the Ozone home networking system a SNR scalable video encoding scheme was used to overcome wireless network bandwidth fluctuations and to simplify networked terminal control. These scenarios were implemented in demonstrators and evaluated with users. See Deliverable 9a and Deliverable D15d of the OZONE project for a full description of the scenarios and the evaluations see: • D9a Ozone application scenarios • D15d User experience report of the three demonstrators and the external application of the Ozone framework.
Details of Implementation: Devices/ Artefacts	The linking concept was implemented by connecting two or more receivers and to synchronize the same video content on the two devices. Initially, one of the devices is receiving content from a source. A second device can start receiving the same content after an indication command. Proximity detection is used to initiate the receiving of video content by the second device. A portable pen-based screen was adapted as the primary means of interaction. Such a portable device can be used to interact with content, as an advanced remote control, and as a flexible content carrier. The demonstrator was set in a real home environment, i.e., a living room, kitchen, bedroom etc. see figure. 

Details of Implementation: Software/ Services	The demonstrator is based on an embedded platform architecture, which also includes mobile terminals. The latter shows explicitly the technologies that were developed within the context of the Ozone project. The home server is based on a PC platform, which is the most realistic platform for this functionality at this point in time. The in-home network is partly wired Ethernet and partly based on 802.11b. The architecture is shown in Figure 2.



Demonstrator architecture

The demonstrator is based on the infrastructure as shown below.



Infrastructure of demonstrator

	The main technical issues covered in the demonstrator (see OZONE Deliverable 9a [8]) are: 1. Location awareness of people 2. Activity awareness of people 3. Handling of multiple applications/ streams within one terminal & in closed network 4. Terminal resource management 5. Wired and wireless transmission 6. Scalable video and multimedia contents Real-time streaming
Discussion along relevant Services	S3: Awareness and notification A major concept from the behavioral point of view for the Ozone system is being aware of location and activities of people. The perceived benefits of such context aware features were investigated in an exploratory study. For this study, an electronic TV program guide (EPG) application was implemented on an advanced remote control (PRC) with a touch screen. Reminders and suggestions about selected programs were presented in an adaptive way according to the context of use. The perceived attractiveness of the PRC and the relevance of its context aware behavior were evaluated in comparison to another usage domain, i.e., the mobile phone domain. Missing reminders installed by the users themselves was perceived as a more serious problem then missing a telephone call for which they can later decide whether to call back or not. These results indicate a complex relation between perceived user control, context, and notification which needs further research. *Linking concept* Location and activity awareness was implemented by connecting two or more receivers and to synchronize the same video content on the two devices. Proximity detection was used to initiate the receiving of video content by the second device. This linking concept facilitates viewing the same video content by several members of the same family at the same time on more than one receiving device and in more than one location The evaluation of this OZONE demonstrator was conducted in the HomeLab of Philips Research in an informal fashion.

	The goal of this study was to demonstrate the linking concept in a realistic home setting and to investigate the judgment of end-users with regard to perceived value, perception of image quality on the wireless receiver and to elicit input concerning viability, attractiveness and usefulness of wireless transmission of video. The image quality on the wireless receiver was judged as adequate by 63% of the participants and at the same time identified as one of the most important factors for acceptance of the system. The linking concept was perceived as quite natural. That is very promising. Our implementation in the Ozone project, however, was received more skeptical. This shows very clearly that we need more user involvement in the early phases of system development. That is, the usage scenarios as well as the usage in natural environments should be scrutinized. In addition, the evaluation was based on video only. For completeness, audio has to be taken into account as well. S4: Content provision, selection and retrieval Provision of content and the perceived video quality was addressed by studying the effect of terminal resource management and real-time streaming variables. With regard to terminal resource management we wanted to find the optimal configurations for scalable video coding based on subjective judgments. A multitude of possible configurations is possible. The selected configurations were composed of a different number of enhancement layers, different types of coding and different levels of bitrate. The different types of coding refer to different combinations of base layer (BL) and enhancement layers (EL). We found that the size of the BL is more important than the size of the ELs and that adding enhancement layers doesn't improve the perceived quality of a small BL. In other words, adding enhancement layers cannot improve the quality of a small base layer. The size of the base layer (BL) is more important than the sizes of the enhancement layers (ELs). The effective deployment of the effect of shot changes is another source for decreasing the resource demands for the decoding algorithm. This possibility was explored by investigating the effect of length (different number of frames) and depth of a drop (number of enhancement layers) in video quality on the perceived video quality. The results showed that the depth of a quality drop plays a more important role than the duration of the quality drop. Thus, the a-priori shot-change information can be used for preventing resource overload by a momentary reduction of video processing power.

	Allocation of resources is also a major problem for handling multiple video streams within one terminal. To address this problem we investigated whether people wouldn't perceive the difference in quality between a low quality video displayed in a PIP window and a high quality video displayed in full screen on the same terminal at the same time. The results showed that viewers didn't see the difference in the quality levels of video that were displayed in the PiP window. These are promising results that might be considered in the resource management mechanism. *In sum* The different user evaluation that were conducted with the concepts presented in the initial OZONE scenarios showed promising and high levels of appreciation and attractiveness with regard to the basic concepts like location and activity awareness of people and different possibilities to optimize the perceived video quality by using different configurations for wired and wireless transmission (linking). S5: User interface services The user interfaces were integrated in the demonstrators and subsumed in the concepts.

Scenario Title	3D: “Astra – Design and assessment of an asynchronous awareness system” IST-2001-39270 A mobile-home awareness system enabling distributed family members to stay in touch
Reference	http://www.presence-research.org/Astra/index.html *W.A. IJsselsteijn, P. Markopoulos, J. van Baren, and N. Romero* **Shifting Perspectives in Communication Media: Social Presence and Connectedness as Complementary Notions** Submitted to International Communication Association Conference, to be held May, 27-31, New Orleans, USA. *IJsselsteijn, W.A., van Baren, J., & van Lanen, F.* **Staying in touch: Social presence and connectedness through synchronous and asynchronous communication media** In: C. Stephanidis and J. Jacko (eds.), Human-Computer Interaction: Theory and Practice (Part III), volume 2 of the Proceedings of HCI International 2003, pp. 924-928. Lawrenece Erlbaum and Associates *IJsselsteijn, W.A., van Baren, J., Romero, N. & Markopoulos, P.* **The unbearable lightness of Being There: Contrasting approaches to presence engineering** In: T. Ebrahimi and T. Sikora (eds.), Proceedings of SPIE Vol. 5150, Visual Communications and Image Processing 2003, pp. 61-68 *Romero, N., van Baren, J., Markopoulos, P., de Ruyter, B., & IJsselsteijn, W.* **Addressing interpersonal communication needs through ubiquitous connectivity: Home and away** EUSAI - European Symposium on Ambient Intelligence, Eindhoven, The Netherlands, 3-4 November 2003 *Romero, N., van Baren, J., Markopoulos, P., de Ruyter, B., & IJsselsteijn, W.* **Addressing interpersonal communication needs through ubiquitous connectivity: Home and away** Internal Conference at Philips Research, Eindhoven, The Netherlands, 1-2 December 2003 *van Baren, J., IJsselsteijn, W.A., Romero, N., Markopoulos, P., de Ruyter, B.* **Affective Benefits in Communication: The development and field-testing of a new questionnaire measure** PRESENCE 2003, 6th Annual International Workshop on Presence, Aalborg, Denmark, 6-8 October 2003

	van Baren, J., Romero, N. **ASTRA: Design of an awareness service and assessment of its affective benefits** MTD Thesis, ISBN 90-444-0291-9, September 2003, User System Interaction, Technical University of Eindhoven, The Netherlands
Scenario Summary	ASTRA is an Awareness System that communicates distributed family members. Awareness Systems are Computer Mediated Communication tools that offer lightweight, always-on exchange of information to keep people aware of others' activities without incurring in explicit communication effort to achieve it. ASTRA supports informal serendipitous and lightweight communication.
Primary Application Domain	*D3: Extended Home Environment*
Relevant User Services	• *S2: User modelling and profiling* • *S3: Awareness and notification* • *S5: User interface* • S6: Security and privacy

Scenario Description from User Perspective	Users can share daily experiences using a mobile phone that supports picture taking, freehand drawing and handwriting. The home device acts as an always-on display and prompts for communication through other media, by providing awareness of daily experiences of connected individuals. The system gives an opportunity to people to stay in touch by sharing daily life moments. Users take pictures and personal notes, as if they were digital postcards, capturing a specific moment during the day. These messages are collected in a To-Tell list that is displayed in the home device as a mean to keep them aware of each other's activities and to trigger further communication. In the background, Telenor's Mobile Presence Server manages messages, pictures and real time reachability information. Field-testing during the ASTRA FET assessment project shows that such a system provides significant affective benefits and strengthens ties between family members. An important deliverable of the ASTRA project has been the Affective Benefits and Costs of Communication Questionnaire, which is now adopted by other researchers as a means to assess how communication systems meet the needs of users for social communication. This study shows empirical evidence that awareness systems like ASTRA arises affective benefits where users experience a lasting feeling of connection. Profiles Family Sanders Selma and Simon live in the countryside quite far from where their daughter, Laura, lives. Their favourite hobby is to travel, but they find it hard to keep in touch about what they are doing. Also, when they are back it is difficult to keep track of Laura's activities. Laura lives with her husband, Vincent, and their two children, Anniek and Chantal. They all like to visit her parents as much as they can but because of the distance and their travelling habits it is not so easy to do. But after every return of a nice trip they manage to visit them so to go and see pictures and listen all nice stories they have to tell them.    Family De Jong Sam does no longer live with his parents, Renske and Arthur. He moved a year ago to a close city to start his university study. He keeps a very close relation with them and tries to visit them almost every weekend, but because he has a very busy schedule is difficult to keep in touch during the week. Renske and Arthur both have a part-time job. They like to spend most of their free time working in the house and garden. They love when Sam comes to visit them and they proudly show him all the new changes.

Scenarios

Sharing experiences

> "Selma and Simon are visiting one of their favourite cities, Barcelona. Last time that they went there was with their two grandchildren three years ago. They are now walking around a big park and they recall how much fun Anniek and Chantal had at the playground. Simon takes a picture of Selma playing on a swing as he took one of Anniek three years ago. They send them to heir grandchildren with a note "Who remembers this?" When they get back they will show them the original picture of Anniek too".

Shared and personal area

> "Selma and Simon arrive home after a short holiday. Their homebound device has received several messages while they were away. The device starts up automatically in the shared mode, where they can see the messages that were sent to them both. After that, they can see the messages that were sent to them individually in their personal mode. It's a nice feeling that their relatives thought of them while they were on holiday".

Reaction on information

> "Laura's parents are on holiday. She has received various nice pictures from them, showing where they are and what they are doing. When she gets up on Sunday morning, she sees on the home device that they are available for communication. They must be back! She quickly calls them to hear all about their holiday".

> "Sam wants to check if his mother has replied to some of the latest pictures he has sent. He sees the latest information they have been sent to each other. He makes a full screen of a picture he sent her that shows his final grades. He found a reply with a drawing of a nice piece of pie. He calls her immediately to see when he can visit them".

Background mode

> "Sam has not recently used his home device. It is in the background mode, displaying a slideshow of Sam's favourite pictures. The system shows that new information has arrived. When he decides to look at the new information, he touches the screen. He is happy to see that the tulips are starting to bloom in his parents' garden and he plans to visit them next weekend".

To tell list

> "Renske and Arthur's ASTRA system continuously displays what has been shared between them and their son lately. Renske is looking at it and sees a couple of new pictures about a tennis match Sam had last evening. She is really wondering how it went. Renske sees that Sam is already at home, so she calls him immediately. Sam is happy to tell her all about the match".

A summary of the core-group scenarios in terms of user tasks is presented. This set of functionalities was selected for implementation in a functional prototype to enable a meaningful assessment.

<table>
<tr><td></td><td>
<table>
<tr><th>Homebound device</th><th>Mobile device</th></tr>
<tr><td>See/check pictures and text that has been sent to his/her household

See/check pictures and text that has been sent to his/her personal area

See/check pictures and text that has been exchanged between him/her and a member of the other household → to tell list.

React on a picture drawing a small note. This reaction is sent to the sender to his home device.

Only the sender of that picture can see the reaction after s/he activates the correspondent to tell list.

Check reachability information of the other (is s/he online, is s/he at home, is s/he mobile?)

Set her/his own reachability.

Put the display in a background mode (slideshow)</td><td>Capture daily events by taking pictures

Compose a message with picture or handwritten note and text.

Send the message to member(s) of the other household.</td></tr>
</table>
</td></tr>
<tr><td>Key issues</td><td>Asynchronous communication: both senders and receivers should be able to communicate in their own time, on their own terms.

Easy access: sending and receiving messages should not require many actions.

Personal effort: although sending messages should be easy, personal effort should be preserved to make them meaningful and valuable for the receiver.

Support sharing of personal experiences: users should be able to record and send daily life experiences anytime, anywhere.

Home experience: to support feelings of connectedness, users should be able to receive messages in their home environment.

Support a lasting sense of connectedness: provide always-on system; provide a memory/history of messages to keep permanently.

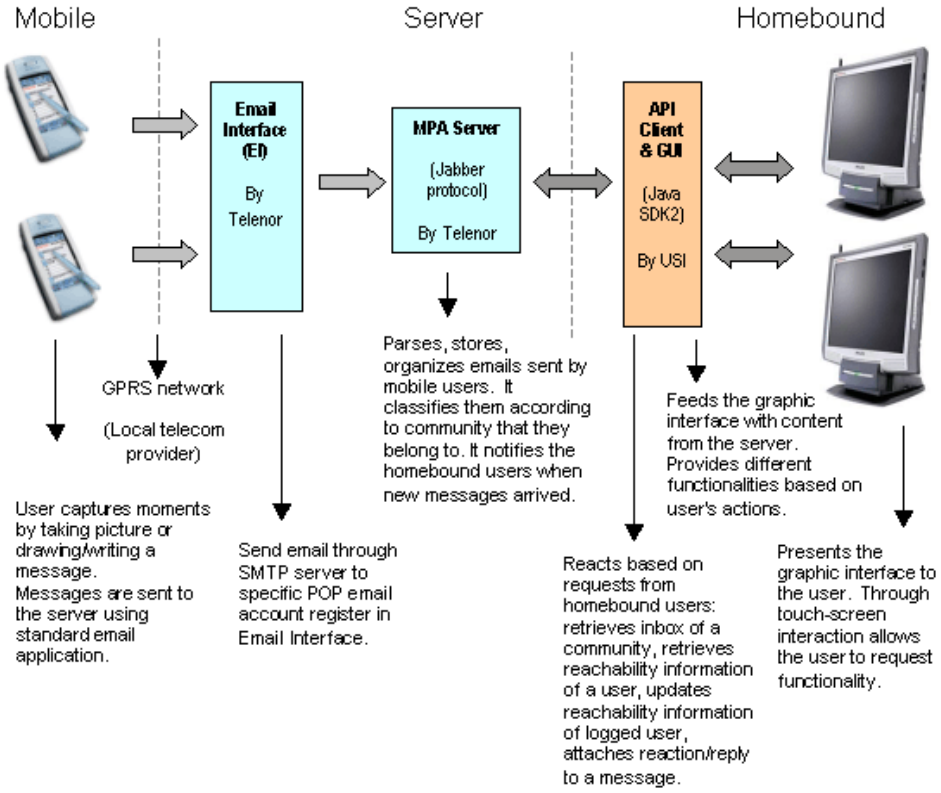
Provide concrete, visual information

The user should be in control: provide always on, peripheral system so the user can choose when to attend to incoming messages, thus preventing disruption and information overload.

The system should not create new obligations

Trigger synchronous communication: the system should offer information about reachability of users.</td></tr>
</table>

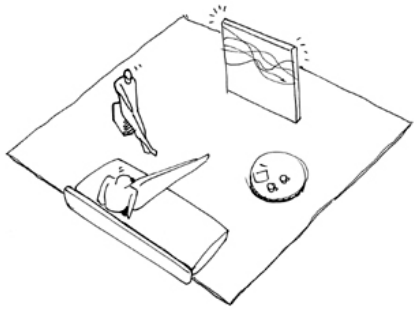
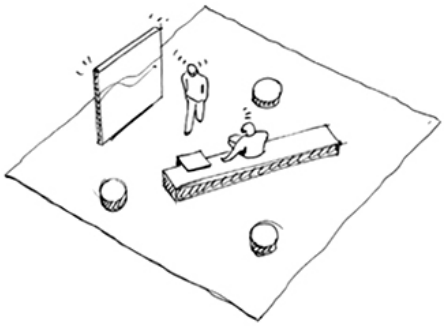
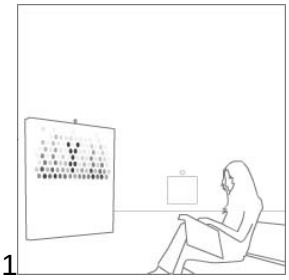
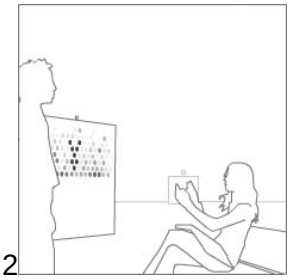
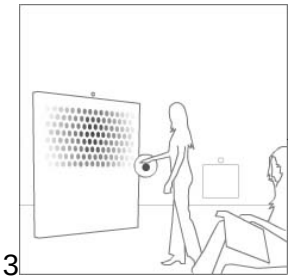
Details of Implementation: Devices/ Artefacts	Visualization and interaction: • Postcard metaphor • Spiral visualization  In this screenshot the first user of the host household (yellow colour) is logged in and a To Tell List with the first user of the guest household (purple colour) is activated. Also, reachability information is displayed (pop up menus with three icons) as well as the icon for a new message (upper left corner under the slideshow icon).
Details of Implementation: Software/ Services	Java API Client: • Show messages in shared and personal areas. It provides a simple way to access personal areas where no explicit log in action should be required. The main implication is that privacy protection of family members will rely on social control. • Provide three modes of visualization: spiral, full screen and slideshow mode. That works as an easy and smooth transition between detailed and overviewed information but implies some restriction with regards to scalability and personalization (only four members per family group, only two families, and colour-map is predefined). • Provide feedback in the full screen mode if the message has text or a reply attached. Display that text or reply when the user asks for that. • Provide a way to react on a message by drawing a small text/drawing. The sender of the message in his homebound device can only see the reply of that message. This functionality provides a simple solution to support two-way communication. • Provide a way to check the reachability information of a user. • Provide a way to change the reachability information of the logged on user.

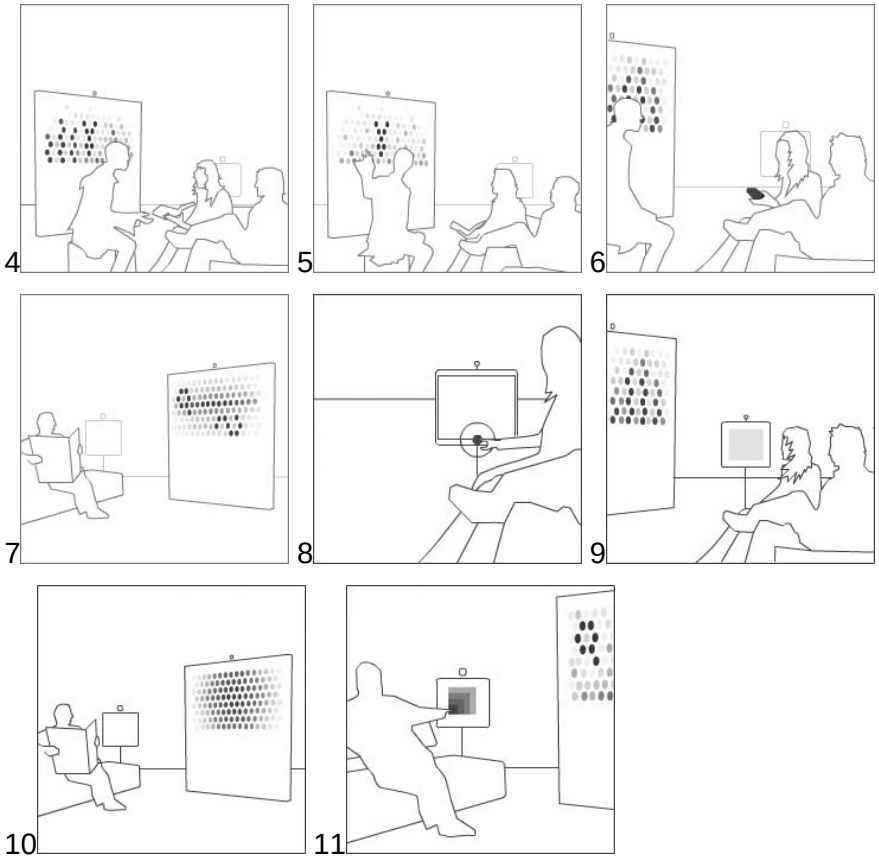
	Architecture: 
Discussion along relevant Services	The following discussion is based on the evaluation results from the ASTRA project. S2: User modeling and profiling The household appears to be a meaningful unit for communication. Inter-household communication is not well supported by current means, which are rather focused on communication between individuals. Participants report that they often have one central person in the household, who is involved in most of the communication and spreads the news to other members. Although this works fine from an information point of view, people feel less connected to the household members they do not regularly communicate with. Participants appreciated the fact that the ASTRA system allowed them to send messages to the whole household at once. Communication patterns are strongly affected by influences other than communication needs. For example, the households in Amsterdam and Bilthoven have a strong wish to communicate and meet each other more often, but do not manage it because of time-consuming jobs and busy family life. It seems these needs can be addressed quite well by lightweight, asynchronous systems designed for shared experience.

	S3: Awareness and notification The ASTRA system addresses a need, which is currently not sufficiently satisfied by other media: sharing experiences. Because of its accessible, asynchronous nature the ASTRA system supports the capturing and sharing of everyday events. This functionality seems to be most valuable for people who are too busy to use current ways of communication, but still want to keep a close contact with their family members. The regularly incoming messages fostered a lasting sense of awareness about members of the other household and helped them to feel more involved in each other's lives. Apart from addressing this need, the messages have the effect of making people curious and thus stimulate communication by other, synchronous means. These contacts may also be enhanced, because the ASTRA messages provide starting points for conversation and a better understanding of each other's context. Designing for shared experience appears to be a promising direction. Users want to share events of their daily life, right at the moment when they happen. The visual modality (a picture), accompanied by an explanation in the form of a text or voice message, seems to be very suitable for this type of communication. Although communication is asynchronous, light-weight and the content can be quite superficial, messages result in a lasting sense of connectedness, feeling more involved in each other's life and stimulate the use of other communication means by triggering curiosity and providing starting point for conversation. Because the sharing of everyday experiences, even quite superficial ones, is much valued by the receiver, it is important to address impulse behaviour by supporting mobility and easy capturing and sending. S5 User interface Although the results from the assessment were very encouraging, there is room for much improvement of the system. First of all, the homebound and the mobile device should be more integrated. This could be done by designing a GUI for the mobile device that is consistent with the interface of the homebound device. Also, the functionalities of the homebound device can be more integrated in the mobile device. For example, the mobile device should also support availability information and get an automatic notification if a message is received on the homebound device. Furthermore, the system should be scaled to allow communication with more than one other household. If this happened, the personal spaces will become more important (to support privacy and prevent information overload) and therefore should be more accessible. It should be possible to easily create shared spaces, such as "my parents" or "my nieces". To support two-way communication, conversation threads should be visualised. Also, if more people would use the system for a longer time, message management such as save and delete becomes an issue. To support user's needs to add a personal interpretation to pictures, the system should be extended to support audio messages. Also, video images could be an option.

	It seems worthwhile to support mobility and to consider integrating the homebound device with already available displays in the home, such as the television. People felt a strong need to react on each other's messages and to start conversations. Although the ASTRA-system allowed the sending of replies, this was not sufficient. Two-way interaction should be well supported by offering an accessible reply option and visualising conversation threads, so that users can see which messages are related to each other. S 6 Security and privacy There is a trade-off between effort and privacy/control. Most people do not regard automatic capturing favourable, because they lose control and feel their privacy is threatened. On the other hand, providing input manually takes a lot of time and effort. If information is not updated regularly, receivers will lose interest or perceive it as unreliable. In the ASTRA system, all input had to be done manually. For the messages (sharing experiences), this worked very well. Users did not find it too much effort, and the receivers valued the messages because they knew that senders had consciously selected the experiences they wanted to share. The availability information, however, was not used, because participants thought it was too much effort. It would have been better to capture this information automatically. This illustrates that it is important to find a good balance between control, privacy and effort. Future research should determine what is valuable presence and availability information for users and how this can best be captured.

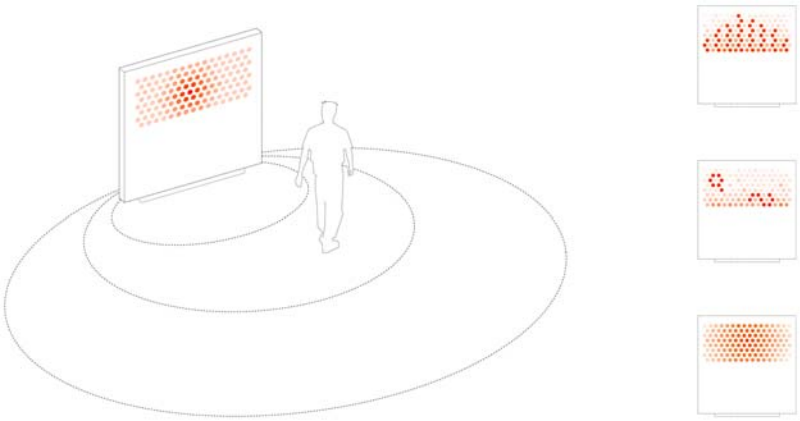
Scenario Title	3E: Connecting Remote Teams – Cross-Media Integration to Support Remote Informal Encounters
Reference	Prante, T., Stenzel, R., Röcker, C., van Alphen, D., Streitz, N.A., Magerkurth, C., Plewe, D.A. (2004) Connecting Remote Teams: Cross-Media Integration to Support Remote Informal Encounters. Video Track and Adjunct Proceedings of the Sixth International Conference on Ubiquitous Computing (UBICOMP'04), Nottingham, England, September 7-10, 2004. Prante, T., van Alphen, D., Röcker, C., Streitz, N. A., Stenzel, R., Magerkurth, C., Plewe, D. A. (2004) Hello.Wall® - Contributing to a Social Architectural Space. Interactive Design Award Finalist at the ACM Conference Designing Interactive Systems (DIS'04), Cambridge, MA, USA, August 1-4, 2004. Röcker, C., Prante, T., Streitz, N. van Alphen, D. (2004) Using Ambient Displays and Smart Artefacts to Support Community Interaction in Distributed Teams. Proceedings of OZCHI'04. Wollongong, Australia, November 22-24, 2004.

	Website of publications: http://iis.ipsi.fraunhofer.de/ipsi/ambiente/Liste.asp Website of project: http://www.ambient-agoras.org The scenario is part of “Ambient Agoras”, one of the projects of the EU-funded proactive initiative “The Disappearing Computer” http://www.disappearing-computer.net
Scenario Summary	The scenario describes a mixed-media setup to support spontaneous, informal encounters in two remote lounge spaces of a distributed team. Ambient displays are used as awareness tools to know more about the remote team’s state and at the same time as a tool to smoothen transitions to place-based video communication among the remote teams’ members.
Primary Application Domain	• D3: Extended Home Environment
Relevant User Services	• S3. Awareness and Notification • S5: User Interface • S6: Security and Privacy
Scenario Description from User Perspective	Two sites of a distributed team are connected via a mixed-media setup to support spontaneous, informal encounters in two remote lounge spaces. OVERVIEW:   Fraunhofer IPSI, Darmstadt EDF-LDC, Paris SCENARIO:    1 2 3

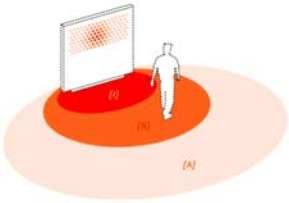
	 4 5 6 7 8 9 10 11 (1) Bettina relaxes in the lounge space of her company. The Hello.Wall shows the presence and mood of her colleagues in the lounge area of a remote office… (2) …Bettina explains the Hello.Wall to a visitor: Each sign represents two team members, one from the local and one from the remote team. The ambient patterns in the background reflect the general presence and mood of the whole team… (3) …Bettina enters her mood at the push button interface next the Hello.Wall… (4) …Sabine and Carsten join Bettina at the local lounge…they discuss… (5) …and realize the sign of the remote colleague Nicolas at the Hello.Wall, what means that he entered the remote lounge area… (6) …Bettina employs a View.Port and checks his availability using a View.Port-based video stream… (7) …Nicolas reads the newspaper and recognizes the remote team members' interest on the Hello.Wall… (8) …Bettina requests a video communication by pressing a request button next to the video conference trolley… (9) …Bettina and Carsten wait for Nicolas to join… (10) …Nicolas reads the newspaper and recognizes the request for a video communication on the Hello.Wall… (11) …Nicolas joins the discussion with his remote team members.
Key Issues	• We present the Hello.Wall (upper left) along with ViewPorts (upper right), physical button interfaces (not shown below), video trolleys (lower left), and Personal Aura artifacts (lower right) to support spontaneous, informal encounters in two remote lounge spaces. These lounge spaces are at two sites of a distributed team.

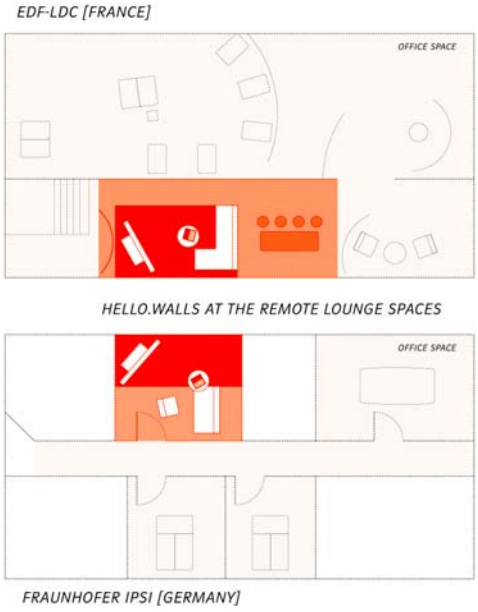
- The Hello.Walls are used as awareness tools to know more about the remote team's state and at the same time as a tool to smoothen transitions to place-based video communication among the remote teams' members. This is achieved by providing cues for encounter-opportunities in remote lounge spaces.
- This draws upon the observation that people in lounge spaces while, e.g., having their coffee break are tentatively available to others for a chat. As in preparing the ground for informal (intended, opportunistic, or spontaneous) face-to face communication, we support people on both sides in approaching each other by successive signals of agreement before actually engaging in a (then video-based) conversation.

- To structure the interactions of people with Hello.Wall-enriched environments we introduced three zones of interaction:
  - ambient zone (farest away from the wall/ light colored)
  - notification zone (middle far away/ middle colored)
  - interaction zone (closest to wall / dark colored)
- The distance of an individual from the wall-setting defines the interactions offered and the kind of information shown

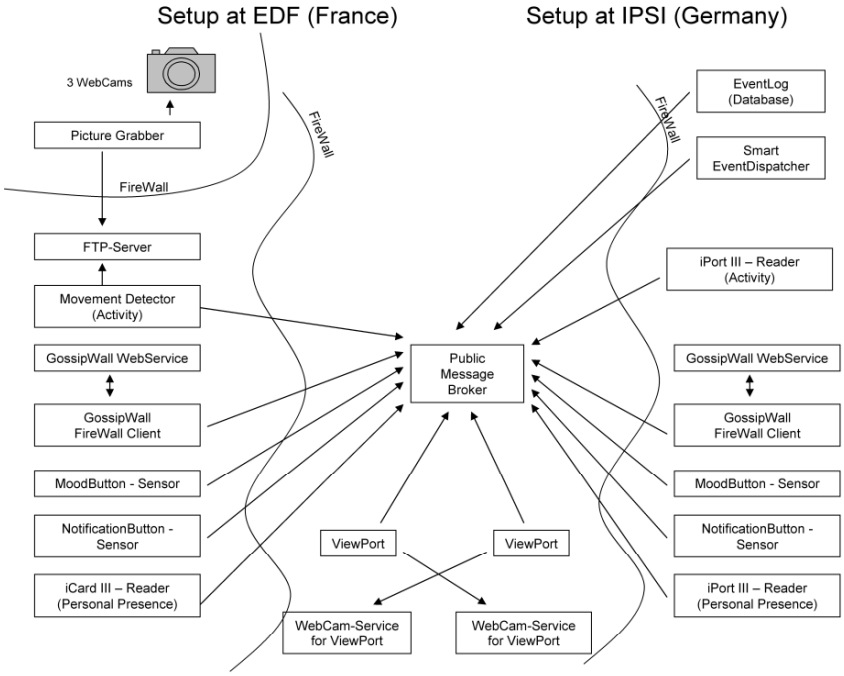


- The three zones of interaction were mapped to the floor plans of the two remote teams' office spaces.





- People in the *ambient zone* as well as people providing their moods contribute to the ambient patterns displayed at the remote site.
- People in the *notification zone* notify their personal presence in the lounge space to the other side and thereby provide encounter cues.
- People in the *interaction zone* directly get involved with the system's communication facilities showing the remote site's team members their interest in engaging in a direct communication. They can do so by either directly requesting for video communication (VC) via pressing a physical VC request button or by employing the View Port which can show a video-only stream from the remote lounge space.
- Both results in attention-catching patterns to be shown on the remote lounge space's Hello.Wall.

	• The purpose of employing a ViewPort-based and thereby rather private video stream is to see if somebody in the remote lounge space is available for video communication or engaged in another activity.
Details of Implementation: Devices/ Artefacts	• Hello.Wall artefact (ambient display with integrated RFID antennas and transponders that emits information via light patterns) • View.Port artefact (PDA-like device with integrated WiFi adapter and RFID reader) • physical button interface • video communication facility • network connection
Details of Implementation: Software/ Services	• An overview diagram of the system: 
Discussion along relevant Services	• S3: Awareness and Notification The Hello.Wall is used as a medium and mediator for conveying social awareness and atmospheric aspects within organizations or at specific places in order to support informal communication. It is a piece of unobtrusive, calm technology exploiting humans' ability to perceive information via codes that do not require the same level of explicit coding as with words. It can stay in the background, only perceived at the periphery of attention, while one is being concerned with another activity, e.g., a face-to-face conversation.

	The symmetric Hello.Wall set-up is meant to hide disturbing and disrupting information compared to an always open video-link. As an example, consider seeing somebody on the other side via a continuous video-link. People often feel forced to react in some way (habits, internalized social protocols, etc.). In addition, the level of detail a video stream provides is not always appropriate. Instead, the Hello.Walls continuously present an intuitively perceivable picture about the remote team's state in an ambient way to communicate atmospheric aspects and social awareness. • S5: User Interface In order to structure the interactions of people with Hello.Wall-centered settings and for providing a coherent and engaging user experience, three zones of interaction were introduced. The distance of an individual from the Hello.Wall implicitly defines the interactions offered and the kind of information shown. • S6: Security and Privacy With respect to interacting with information technology in public spaces in office buildings, it is necessary to address the challenge of transmitting organization-oriented information publicly and information addressed to individuals privately. This was realized by combining public and private displays for conveying and interacting with information. To complement the Hello.Wall a mechanism was proposed where the Hello.Wall can "borrow" the display of other artefacts, so-called ViewPorts, in order to communicate more detailed and personal information. Moreover, the Hello.Wall unobtrusively serves an informative role only to the initiated members of an organization or a place. Others might see it as an atmospheric decorative element and enjoy its aesthetic quality. Therefore, we consider our work to be at the crossroads of privacy-enhancing technology and informative art. With the development of the Personal Aura (PA) artefact we have focused on the design of an easy and intuitive user interface for recurring changes of personal profiles. The purpose of the PA artefact is to put the user in control of their appearance in a smart environment. The Personal Aura enables individuals to decide whether they are "visible" for a tracking system and in which "social role" they want to appear. At the same time, the PA artefact aims at enhancing the user's awareness for tracking and identification events by giving optical and acoustic feedback. • The "Connecting Remote Teams" scenario was tested in a living-lab evaluation for several weeks and proved to foster remote informal encounters and thereby contributed to smooth and fluent project work.

Scenario Title	3F: “Mirror space”
Reference	MirrorSpace: using proximity as an interface to video-mediated communication, N. Roussel, H. Evans, H. Hansen in Delivrable 1.3& 2.3, interliving project Design exhibition: Jeune Creation, Grande Halle de la Vilette, Paris February 2003 Mains d'oeuvre, St Ouen, April 2003 Interactive Design Exhibition, November 2003/january 2004, Centre Beaubourg, Paris
Scenario Summary	Mirror space is a video mediated communication tool that considers distance as a criterion. The aim of MirrorSpace is to support a continuum of space, to allow a variety of interpersonal relationships to be expressed. MirrorSpace relies on the mirror metaphor. MirrorSpace was originally conceived as a prototype for the Interliving project of the European Disappearing Computer initiative
Primary Application Domain	One of three possible domains • *D3: Extended Home Environment*
Relevant User Services	A bulleted list of one or more of the following services addressed in the scenario should be listed here: • *S5: User interface*
Scenario Description from User Perspective	Marc and Daniel are both equipped with one Mirror Space each, at their home. Their Mirror Spaces are linked by video. When Marc passes in front of his Mirror space, if someone is at Daniel's place he can see him. Marc, just sees a fuzzy form, he can tell that someone is here but doesn't want to speak. Then he sees the form becoming more and more clear and then recognizes Maurice (see set of picture below). 

	When Daniel and Marc want to speak to each other, they each go to the mirror and face each other to talk. (as shown in the photo below). 
Key issues	▪ Mirror space relies on the mirror metaphor, which is already perceived as a surface for mediating communication with its own rules and protocols. Live video streams from all the places that it is connected to are superimposed on a single display on each site, so that people see their own reflection combined with the reflections of the people on the other side. ▪ Supporting several levels of communication from peripheral awareness to intimate eye to eye communication. When a person is far from the mirror, a blur filter is applied on the images displayed to visually express a distance computed from the local and remote sensor values. Blurring distant object and people allows you to see their movement or passing with a minimum involvement. If people want to enter into deeper conversation, they just have to move towards the mirror and their image will become clearer. The intimate form of communication is supported by the superimposed images and by allowing people to look into each other's eyes, so the camera is placed right in the middle of the mirror. This set up allows participants to come very close to the camera while still being able to see the people on the other side and interact with them. ▪ Supporting intuitive interaction by using a space's physical property: objects and people close to the mirror are seen better than those who are far away. It allows people to get in the focus slowly as they move closer to the unit .
Implementation Details: Devices/ Artefacts	Two Mirror Spaces units are needed. Each unit consists of a flat screen (Samsung TFT 19), a camera (Philips ToUcam Pro), a proximity sensor (Devantech SFR04) on a computer (Power Mac cube) that runs dedicated software. The screen and its attached sensors are placed into a wooden box, protected by a transparent glass partially covered with a real mirror film. The image sensor and the camera lens have been placed in the centre of the screen. The sensor is connected back to the logic board of the camera using hair thin isolated wires running over the screen surface.

	The proximity sensor (able to measure a distance from 3cm until 3 m) has been placed at the bottom of the screen. It is connected to a Parallax Basic Stamp chip, which is connected to the computer via a serial interface. For this prototype, there was no broadband connection, but a 100Mbits/sec Ethernet network.
Implementation Details: Software/ Services	Mirror Space software is written in C++. It uses the videoSpace library to capture SIF images from the camera in real time and OPEN GL to display a graphical composition created from the images and the proximity sensor value. Those are sent on the network with a best-effort strategy (images are transmitted as JPEG data compresses to fit in a single datagram). The compositing process applies a blur filter on the image of each unit and superimposes them using alpha blending. The resulting composition is flipped horizontally before display to produce the expected mirror effect. The blur effect is implemented with a two-passed incremental box filter. The size of the filter (i.e. the number of neighbours taken into account for one pixel) determines the blur level. The sensor values of all connected units are used to compute the size *s* of the filter to apply to each image. Three computation modes have been investigated so far. The first one (1) only takes into account the distance *d*, measured by the unit that captured the image. The two others (2 and 3) also take into account the distance d_{loc} measured by the unit that displays the image: $s = f(d)$ (1) $s = f(d_{loc}+d)$ (2) $s = f(\lvert d_{loc}-d \rvert)$ (3) The software allows choosing a different mode for each unit. However, a strict WYSIWIS condition has to be imposed
Discussion of relevant Services	S5 User interface Taking into account proxemics (coined by T. Hall) in the design of the user interface for ambient intelligence is a challenge. Physical proximity to other people is a form of non-verbal communication. We use space and distance to define and negotiate the interface between private and public matter. By altering our physical distance from other people in a space we communicate subtle message such as our willingness to engage into dialogue with them, the desire for more intimacy or lack of interest. MirrorSpace offers an example of what could be done. It contributes to the reflection about video and intimacy. It can also be seen as an alternative to a more classical user interface, used to protect user intimacy: Venetian blind.

A.6 Conclusions

This state of the art section has covered 14 different scenarios on more than 70 pages that come from a myriad of research projects, activities, and institutions from Europe and outside Europe.

To draw conclusions from these scenarios presented in this chapter, we have taken a threefold approach:

First, the critical issues and their relation to the relevant services are extracted and discussed for each of the scenarios. As detailed in the previous 'Template for Scenario Description and Associated Services' there are dedicated sections at the end of each of the scenario descriptions.

Second, the common issues and topics that are brought up in multiple scenarios are extracted and presented in the next section. The rationale behind this aggregation is that if multiple independent scenarios regarding the application domains come up with the same issues, then these issues will most likely be relevant.

Third, for each of these common issues identified, conclusions and recommendations towards possible realizations are given with regard to the requirements and constraints found in the scenarios and with regard to how these will fit into the scope of the Amigo project. Recommendations are split up in those related to the user's perspective and technical points of view.

1.6.1 Common Issues/ Topics

1.6.1.1 Automatic Composition of Available Devices

The automatic composition of available devices relates to the process of creating user interfaces that take into account the specific suitabilities of devices in the environment for a given task. Without any or with only little explicit commands from a user, these devices are utilized to provide an interface in a way that the best suited device and modality combinations are found.

Automatic Composition of Available Devices is discussed in the following scenarios:

2A: Interactive Background Portal (any device available can be integrated for output)

2B: EasyLiving (any device available can be used for input and output)

2E: Context aware multimedia browsing (Sepia detects large displays and integrates them for output)

3C: Ozone (Portable device controls stationary services)

3E: Connecting Remote Teams (Sentient, ambient wall display, Pointing with Viewport)

Recommendations from a user perspective:

Appropriateness: Making use of arbitrary artefacts in the environment of a smart home only makes sense, if it brings an added value for the user. This added value can only be realized, if appropriate devices and input/ modalities are chosen for coupling. For instance, a large TV screen allows for a more convenient perception of visual information than a mobile phone. However, when it comes to writing a short message, the controls on the phone make up for a better interface than scribbling on a large display. The automatic composition of devices should therefore either be based on the body of knowledge from modality theory (cf. Bernsen et al.), or be based on manual assistance, so that the users can choose which devices they want to couple.

Large displays and small control devices: Many of the scenarios focus on the issue of remotely controlling large displays with some kind of personalized device which might identify the user or even provide videos or other visual media. The notion of inhabitants walking around with personalized gadgets that control the stationary environment seems to be an application scenario predominant enough to state the necessity of considering it in the Amigo project.

Recommendations from a technical perspective:

Broadband access: Many of the scenarios focus on visual animated information such as movies to be streamed over multiple output devices, e.g., from a PDA to a wall. In order to achieve this, sufficient means of providing rich multimedia data must be realized. This explicitly includes wireless communication.

Modular software design: In order to not limit the Amigo infrastructure to certain, pre-defined interaction devices, it is essential to deliver a component based software platform that allows to upgrade, add, and replace the software components needed to drive devices and allow them to connect to each other. Such a component based software platform was even explicitly demanded in the scenario 1B.

Modelling of ownership and device cardinalities: When devices in the home are to connect to each other automatically, we must make sure that private, public, and shared owner states as well possible transitions between these states are inherently modelled. This also includes the modelling of cardinalities, i.e. which devices X can be mapped to users Y. Some devices such as the ambient wall display in the Connecting Remote Teams scenario require reacting differently depending on private, public or even shared information disclosure.

Suitability ontology: In order to automatically couple interaction devices in a meaningful way, it is essential to find an ontology to describe in how far each device is suitable for different kinds of information and different interaction demands. Such an ontology could be based on modality theory in order to provide the most fitting descriptive categories for the devices.

1.6.1.2 Implicit, Multimodal & Non-Standard Interaction

Implicit, Multimodal & Non-Standard Interaction defines means of interacting with a computer system that go beyond the traditional WIMP interfaces found on current desktop computers. The rationale behind the provision of these interfaces is to facilitate a more natural user experience that is not bent to the requirements of a computer system, but to that of a human.

Most of the scenarios cover this concept:

1A: Voice Command Based Home (speech, PDA)

2A: Interactive Background Portal (Wand-like device)

2B: EasyLiving (physical sensors, active badges etc)

2C: Gemini (physical sensors, no explicit interaction with Gemini)

2D: Context aware information retrieval (implicit interaction e.g. via sensors for cooking activities)

2E: Context aware multimedia browsing (Proximity of physical objects triggers actions)

3A/B: Design Meeting (ID Tags, speech, PDA, Wall Displays)

3E: Connecting Remote Teams (Sentient, ambient wall display, Pointing with Viewport)

3F: Mirror Space (Proximity modifies interaction richness)

Recommendations from a user perspective:

Support for all human modalities: The aim of each of the many non-standard interaction techniques found in the state of the art scenarios is to ease the interaction of human users by

providing them with means to use their innate interaction preferences. When providing or creating an interaction design, we should thus place the human in the centre of our thinking and analyze how a human would preferably interact in a given situation.

Concurrent modalities: There is a wealth of scenarios presented that deal with multimodal and non-standard Interaction.

With few exceptions such as scenario 2B, the scalability problem of several users concurrently interacting with multimodal systems are not explicitly addressed. In an envisioned smart home environment that is typical within the scope of Amigo, there will definitely be several potential users that operate multiple services at the same time. While this clearly relates to technical issues to tackle, there are also implications from a user perspective. For instance, what happens if someone talks to a computer system and another user enters the room?

Appropriate definition of implicity: Implicit interaction techniques are especially attractive, since they do not demand any or only very limited explicit actions from the users. In contrast, they reason the intentions of the human users by analyzing their behaviour. In very simple cases, sensing physical properties or events such as someone entering a room, opening a door, etc. can directly lead to appropriate actions from a computer system, but proactive computer behaviour for slightly ambiguous cases might lead to wrong decisions and user frustration. The presented scenarios use implicit interaction with care: Mostly tags or proximity detections are used that leave the users in control, additionally, complex context reasoning techniques using context histories are used to guide implicit interactions.

Recommendations from a technical perspective:

Conflict resolution: In contrast to the presented scenarios that each focus on a single or only few interaction techniques concurrently used, we will face situations in Amigo where multiple sources of interaction involving multiple users have to be integrated. This requires careful and robust system design, especially since several interaction channels might interfere or be used concurrently by multiple users. For instance, more than one user at a time might want to use gesture recognition or even speak to a computer system.

Proximity and ID: Almost all of the scenarios that describe implicit interaction methods require the identification and location of users. For most of the scenarios, it is sufficient to model the nearness to a corresponding interaction device (i.e. stepping close to the mirror space in 3F), instead of providing a fine-grained position within a room. Nevertheless, it does not seem to be sufficient to sense the identification of users only when they are close to a certain interaction device, because the kind of information a user in a room gets presented will likely vary with the presence of other persons (e.g., family members versus strangers or visitors).

1.6.1.3 Integrating Custom Devices with Standard Devices

Not only natural and non-standard interaction is covered in many of the scenarios, but also the integration of these dedicated techniques with traditional means of computer interaction. Obviously, the computer “as we know it” is not to disappear completely, but to be used complimentarily to other, more human-centered means of interaction. This co-existence and even tight coupling is presented in:

2A: Interactive Background Portal (Web-Browsers vs.decorative smart objects)

2B: EasyLiving (standard WIMP, remote controls, physical sensors)

2C: Gemini (Custom Gemini device connects to game consoles to provide contextual input)

2D: Context aware information retrieval (PDA interacts with custom pen-based displays)

2E: Context aware multimedia browsing (Custom Sepia device connects to various stationary objects)

3D: Astra (Mobile Phone and Postcard metaphor-homebound device)

Recommendations from a user perspective:

Using standard computers: Even though not every human might be especially fond of today's technology, people are used to perform certain, mostly complex tasks with standard devices. Prominent examples include E-Mail, Word-Processing or Web-Browsing. To allow for a smooth transition to novel interaction techniques and technologies, it might thus be daunting to take traditional computer devices completely away from the user. In Amigo, the user should be provided with parallel access to legacy interfaces, where applicable.

Cool Gadgets: If we manage to offer new and fancy interaction means or devices to the that operate with the technology they already know, they will appreciate the newly added value that complements and does not entirely replace their prior knowledge, skills, and habits.

Recommendations from a technical perspective:

Abstraction of task and interface: When regarding scenarios such as 2A, we can deduct that depending on the nature of the task, multiple ways of accessing a certain functionality should be offered. It is therefore important to separate the core of an application or a service from the actual interface and make sure that different interfaces for different types of users can be implemented easily without redesigning the entire application ("plasticity" of user interfaces).

Modelling of users: Related to the abstraction of task and interface is the necessity to model potential users appropriately, in order to offer them different and suitable means of accessing a service (e.g. through a simple dedicated device that allows a natural interaction or through typical computer interfaces for power users). Thus, user modelling should not only include access rights for certain services, but also access preferences based both on profiled information related to their interaction histories and the provision of default interfaces based on the modelled capabilities of a user.

1.6.1.4 Social Awareness/ Sharing of Experiences

An important issue of networked home environments seems to be the provision of social awareness or the sharing of experiences in the sense of an added value impossible or hard to realize with non-sentient homes. The scenarios below positively underline the benefits for users to gain (ambient or explicit) awareness of other users:

1C: A Multimedia Telemedicine Home Platform (Doctor and Patient, video conferencing)

2E: Context aware multimedia browsing (synchronous and asynchronous data transfer between homebound device and mobile device, sharing of photographs)

3B: Tele Worker (Exchange of media from remote place to company lab)

3D: Astra (asynchronous data transfer between homebound device and mobile device)

3E: Connecting Remote Teams (Remote users are provided with ambient awareness)

3F: Mirror Space (Remote users are provided with ambient awareness)

Recommendations from a user perspective:

Need for awareness: One of the real strengths of networked ambient intelligence is the capability of providing awareness information in multiple convenient ways and with different degrees of exposure. Obviously, it is a basic and innate need for humans to be able to share their experiences on the one hand and to be able to get awareness about friends and families on the other hand. Without networked infrastructures awareness and sharing in natural ways is cumbersome to achieve, therefore Amigo should definitely follow the good examples from the body of related work to provide multiple means of awareness and sharing of experiences.

Synchronous and asynchronous modes: While the ability to gain awareness and share experiences is a strong point in its own, the scenarios also point to the great benefits that a

flexible and appropriate use of synchronous and asynchronous awareness channels may hold. Similar to the joint success of mobile telephony (synchronous) and SMS (asynchronous) communications, awareness information should also be synchronously and asynchronously available depending on appropriateness of situations and capabilities of the communications media used.

Recommendations from a technical perspective:

Privacy models: Since users will definitely share private and intimate information in home environments, it is highly important to provide strong and flexible privacy modes that protect intimate data, but also allow the easy sharing of this intimate information, e.g., when showing private photographs to visiting friends. Since a lot of the data transfer in Amigo will be wireless due to convenience reasons, special care must be taken to secure the network traffic, probably with state-of-the-art encryption technologies.

Integration of information from outside the home: Co-located family members will most likely need far less electronic awareness support and means of exchanging data, because they have the capability of both communicating directly with each other and of deriving awareness information out of contextual or peripheral sources such as mimics or gestures of other persons near them.

To play out the full advantage of awareness provision, Amigo must realize reliable and diverse communication channels to the extended home environment that take both privacy issues into account, e.g. authenticating the remote users and their computer equipment, and that also make best use of the available quality of service that may differ greatly for reasons outside the control of the networked home. For instance, full-fledged duplex video connections might automatically switch to less demanding media when the available communication bandwidth deteriorates.

1.6.1.5 Intelligent Room Infrastructures

Intelligent Room Infrastructures are building blocks that enable the realization of most of the other common issues identified. In this respect, they are mostly means to an end. Nevertheless, their frequent appearance in the scenarios justify addressing them as an issue of its own. We discuss them with the requirements to deal with the other topics and issues presented.

Intelligent Room Infrastructures are addressed in these scenarios:

1A: Voice Command Based Home

2A: Interactive Background Portal

2B: EasyLiving

2D: Context aware information retrieval

2E: Context aware multimedia browsing

3A/B: Design Meeting/ Tele Worker

3C: Ozone

Recommendations from a user perspective:

No salience of IT (disappearing computer): The optimal intelligent room infrastructure rests calmly in the background and is either never noticed by the user, or only noticed when the user intends to interact with it. The scenarios presented do not propose active ambient entities that get on the users' nerves by proposing things he might not be interested in and disturb him without absolute necessity.

Ambient intelligence: Nevertheless, if the room infrastructure does not only provide the services that it is asked for by the users, but also implicitly senses their intentions and acts accordingly, this will be perceived as a great benefit. Great Care must be taken, however, to always perform exactly the actions that the users would expect, otherwise frustration and loss of control might be summoned up. Due to the positive formulation style of the scenarios, this danger has not been explicitly addressed by the scenarios, but is only implicitly included. Instead of risking a wrong action, an ambient room infrastructure should ask the user or better wait for the user to initiate the corresponding action.

Recommendations from a technical perspective:

Tracking: Most of the scenarios presented make heavy use not only of detecting the user's positions and inferring their actions, but also track their interaction devices and allow an easy integration of various standard or non-standard devices that might be brought to the room infrastructure from the outside.

Quality of context prediction and aggregation: In order to sensibly provide services through implicit user interaction, it is essential to interpret context data from various sources and aggregate them in a sophisticated way. In the home environment, where habits and interaction histories take a predominant role, it is also important to take past behaviour and preferences into account in order to provide well-suited profiles. Therefore, interaction histories should be combined with current sensor data.

1.6.2 Concluding remarks

Most of the recommendations presented in the preceding sections relate to topics of importance, but do not suggest a specific implementation or system design. This is due to the nature of the scenario technique: None of the scenarios presented provide an in-depth discussion of possible realizations and alternative solutions that might have different implications, but function equally well or perhaps even better. The scenarios, in contrast, provide us with one single implementation and neglect alternatives.

Even worse, we usually do not find a thorough discussion of the advantages and disadvantages of this single implementation ("positive" scenario formulation). Therefore, our discussion of the SOTA revolves more around the identification of important topics than their realizations and we thus do not formulate "requirements", but "recommendations".

Another implication of the scenario technique is the implied focus on user experiences and user interfaces, since scenarios are mostly presented as a scenic description from a user's perspective. This results in most of the scenarios being relevant and focusing on user experiences and not so much on topics such as security or context collection. Consequently, the discussion of the state-of-the-art should provide the most valuable recommendations for the user interface related work packages.