PeerAssist

A P2P platform supporting virtual communities to assist independent living of senior citizens

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A P2P platform supporting virtual communities to assist independent living of senior citizens

Final Project Workshop

28 June 2013 at the Athens Development and Destination Management Agency (ADDMA) (former AEDA)

09h30 – 10h00: *Participants arrival and coffee*

10h00 – 10h15: Introduction – Peerassist overview
(Lazaros Merakos – UoA)

10h15 – 10h30: Peerassist system architecture
(Nikos Passas – UoA)

10h30 – 10h45: The peer-to-peer communication platform
(Christos Xenakis – UoA)

10h45 – 11h00: The semantic layer
(Emilia Cimpian – seekda)

11h00 – 11h15: *Coffee break*

11h15 – 11h35: The user interface
(Foivos Demertzis - UoA)

11h35 – 11h55: Trials and evaluation results
(Blanca Morales – Ingema / Sofia Makedou – AEDA)

11h55 – 12h10: *Coffee break*

12h10 – 12h30: Future plans and exploitation opportunities
(Nikos Giannopoulos – Inaccess)

12h30 – 13h30: Demo and panel discussion
(coordinator Lazaros Merakos)

13h30   : **Light meal**

PeerAssist

Project overview

Prof. Lazaros Merakos

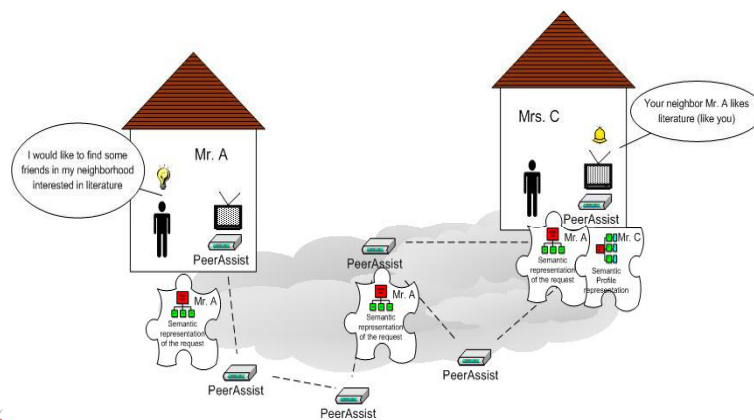Dept. of Informatics & Telecommunications

University of Athens

Project Scope

The conceptualisation, design, implementation and demonstration of a flexible Peer-to-Peer (P2P) platform, which will allow elderly people (not necessarily familiar with ICT technologies) to build virtual communities dynamically based on interests and needs they share.

We are getting old

Ηλικία 65+	
1950	5.2 %
2010	7.7 %
2030	11.8 %
2050	16.1 %

Specific objectives (1)

- To design and develop an intuitive user interface (open, flexible, multilingual, adaptable)

- To design and implement the PeerAssist end-user device

- To propose artificial intelligence methods for matching expressed queries to peer context

- To provide a P2P communication platform to enable peers to build virtual communities.

- To implement an open end-to-end platform prototype to support the interaction between elderly people sharing common interests.

Specific objectives (2)

- Five services
  - peer-driven organization of social activities (such as going out, going to the movies, exchanging books, organizing a social gathering)
  - soliciting peer help with housekeeping and other daily activities
  - allowing support organizations to "push" relevant content
  - allowing caregivers, facilitators and family members to receive alerts if certain expected home activities of the elderly people are interrupted
  - responding to emergency situations that may ask for immediate action

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Innovative features

➢ Specially designed user interface for easy access to the service.

➢ Peer-to-peer communication for improved security and data protection.

➢ Semantic representation of information for efficient matching between queries and data.

Peerassist terminal interconnection
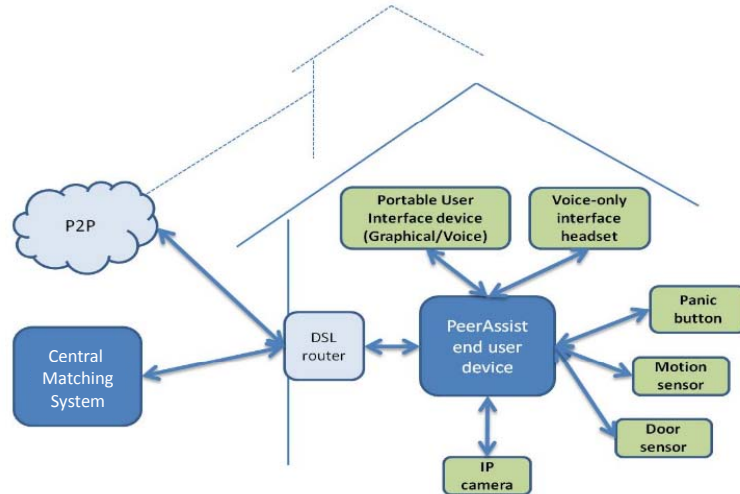
A network of peer nodes
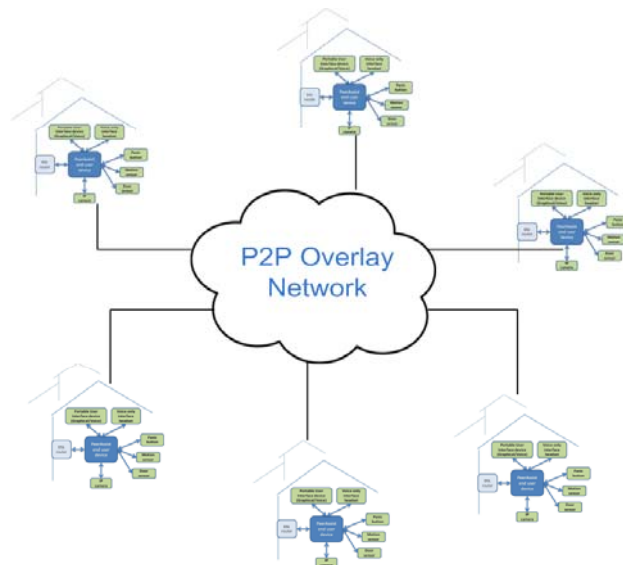
PeerAssist terminal integration

Trials

- Demonstration activities in two different cities (San Sebastian, Spain and Athens, Greece).

- Trials in Athens included home tests to validate the proper functioning of the integrated components of the system in a natural home environment.

- 40 (20+20) users participated.

- Evaluation process with actively involved end-users.

The consortium

Partner	Type	Country
University of Athens – Communication Networks Laboratory	Academic	Greece
Seekda GmbH	SME	Austria
InAccess Networks	SME	Greece
Warp Networks, S.L.	SME	Spain
Fundación Instituto Gerontologico Matia	Non-profit organisation	Spain
Municipality of Athens Development Agency	Public authority	Greece
Semantic Technology Institute Innsbruck	Academic	Austria

Partners' Main Roles

UoA: Coordination, context representation, P2P layer, security, testing and validation

Seekda: Semantic representation and matching

IAN: End-user device, system integration

Warp* : User interface, evaluation

Ingema: User aspects, evaluation & trials

AEDA: Trials, workshop

STI-IBK: User and context modeling, semantic representation

*resigned at the end of 2012 due to bankruptcy – could not take part in evaluation

PeerAssist
System Architecture

PeerAssist Terminal Interconnection
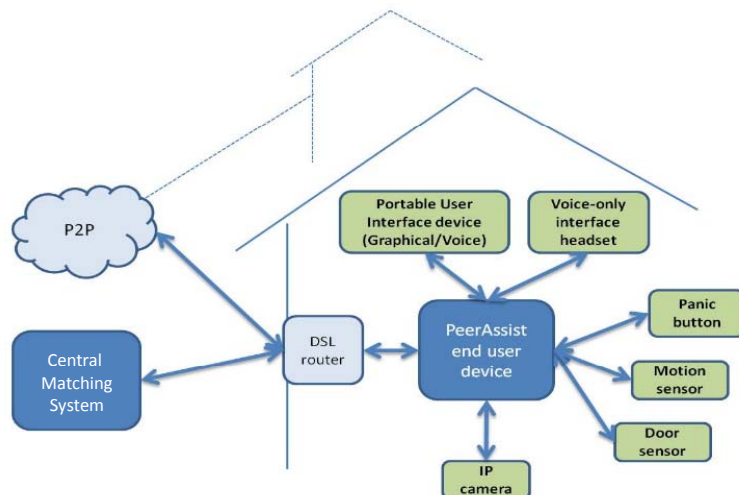
Network of PeerAssist nodes
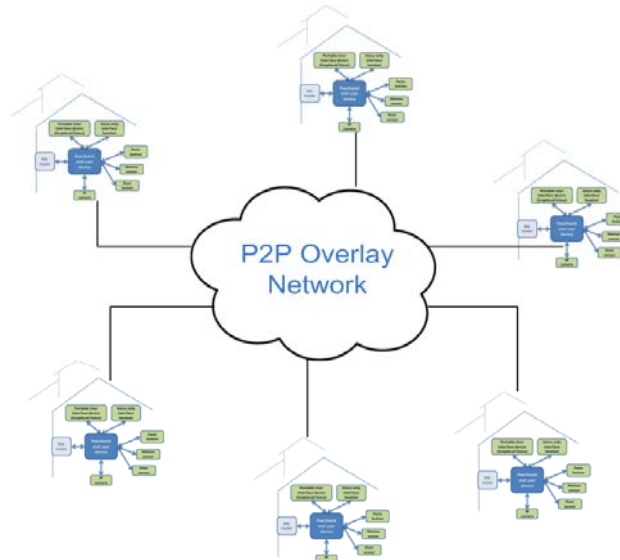
Layering in PeerAssist
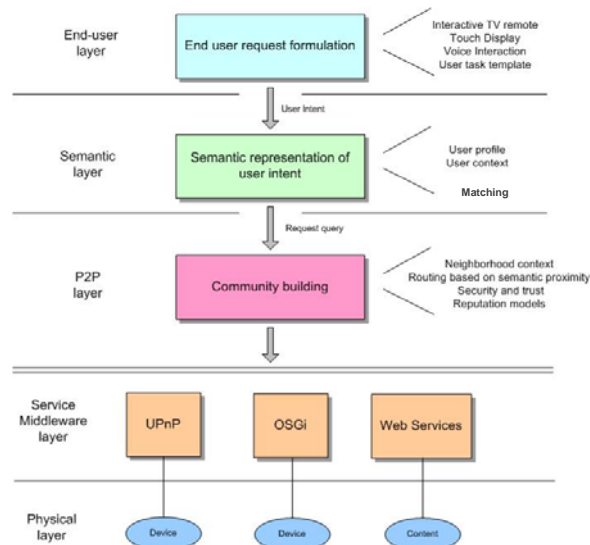
Open Service Gateway initiative (OSGi)

- Integrated environment for application development based on Java.
- Each application may be devided in a set of bundles that communicate through OSGi.
- Able to add, delete, change a bundle without a need for restart.
- Able to make changes remotely through the Internet.

The PAnode Architecture - Components
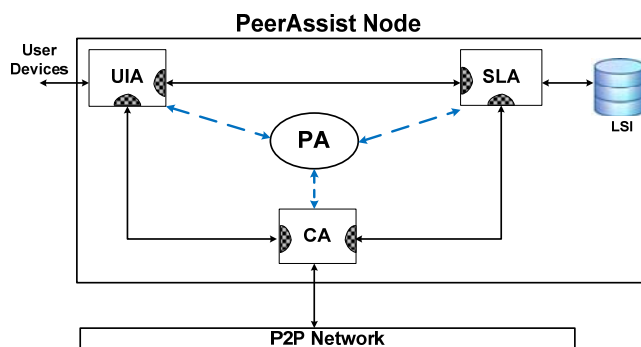
User Interface Agent (UIA)

- Captures user intent
- Forms user queries, presents results

Semantic Layer Agent (SLA)

- Maintains user profile and context information
- Interacts with the central matching system

The Communication Agent (CA)
- Handles all P2P communications, security, trust

The Personal Assistant (PA)
- Mediates whenever needed to facilitate interaction with the end-user

# Use case distributed execution in PeerAssist
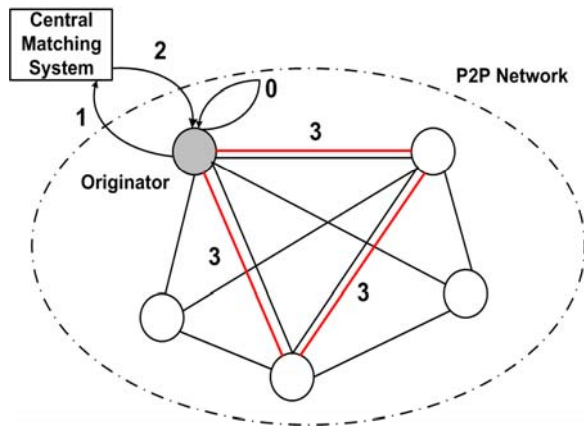
Steps

0 : End-user at the originator PAnode node wants to create a new peer group

1 : Formulates query and sends it to the CMS for matching

2 : CMS returns the IDs of the matched peers ranked. Originator sends invitations to peers

3 : Pipes are opened between all peers that accept and execution starts

Remarks

1. Semantic matching is performed at the central matching system.
2. Central matching system resides outside the P2P network and can be accessed using web services.
3. Services can be either local to each peer node, or accessible through the server


User Interface Architecture
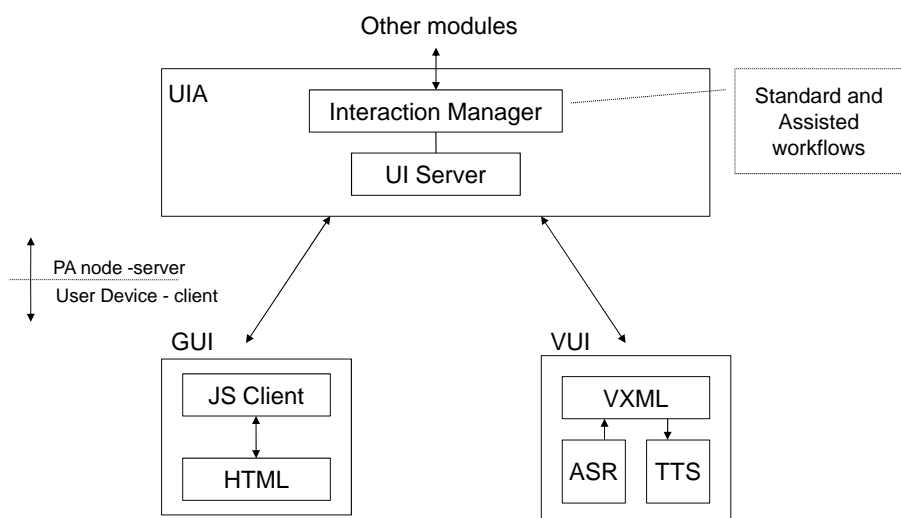
User Interface Access
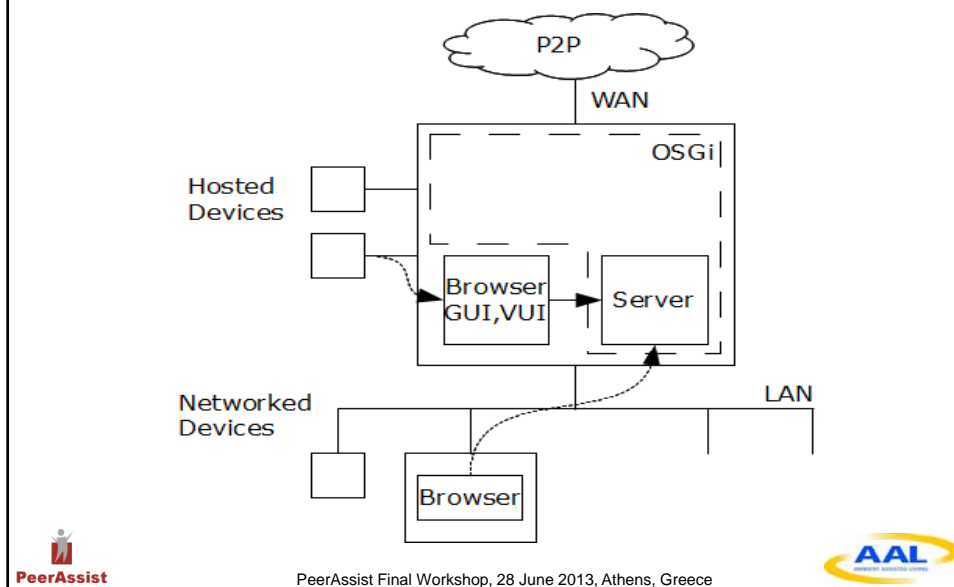
Semantic Layer Agent (SLA)

- Each PeerAssist node stores locally at the SLA information for:
  - User profile (interests, needs, etc.) and
  - Users, groups,, services that the user is related to.
- Part of this information is posted to the Central Matching System (CMS) to be retrieved by other users' searches (e.g., interests).

Semantic Layer Agent – Communication with the Central Matching System
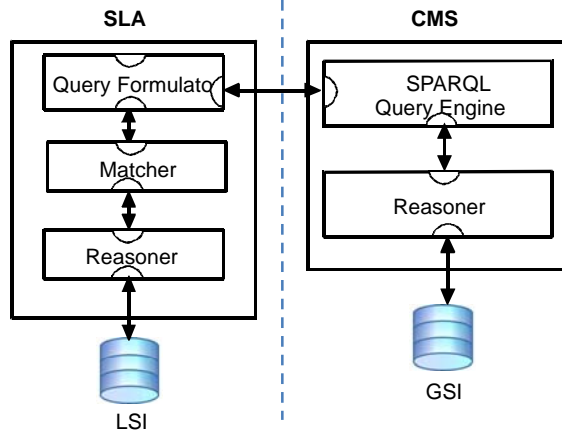
- If a user's query requires access to CMS, a request if sent through SPARQL.
- Search is performed at the GSI.
- The result is returned to the SLA and forwarded to UIA.

- LSI – local semantic information, τοπική βάση δεδομένων
- GSI – global semantic Information, κεντρική βάση δεδομένων

Communication Agent (CA)
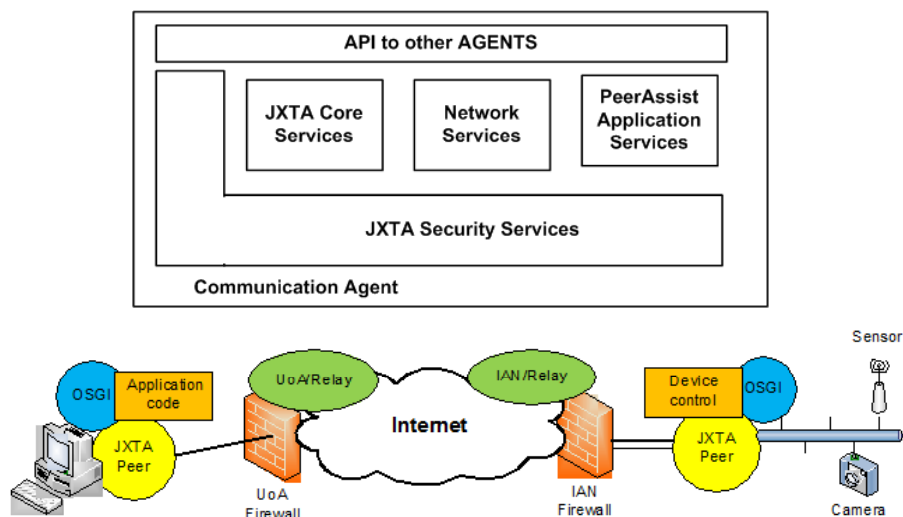
Personal Assistant

- **Coordination of the entities**
  – Coordinates the actions between different entities at the PAnode
- **Suggestions**
  – Suggests users, groups, services, compatible with the user profile (e.g. when the user requests for a new group creation).
- **User surveillance and alarms activation**
  – Receives messages from the Home Automation Controller and activates alarms towards the caregivers group.
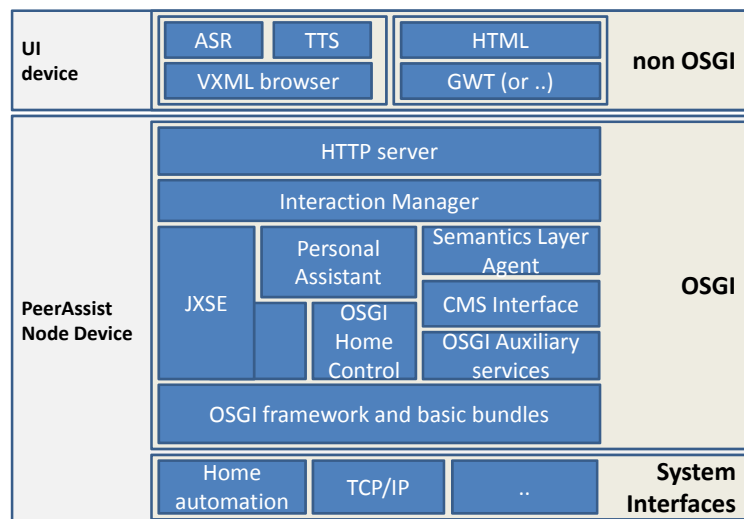

Home Automation Controller
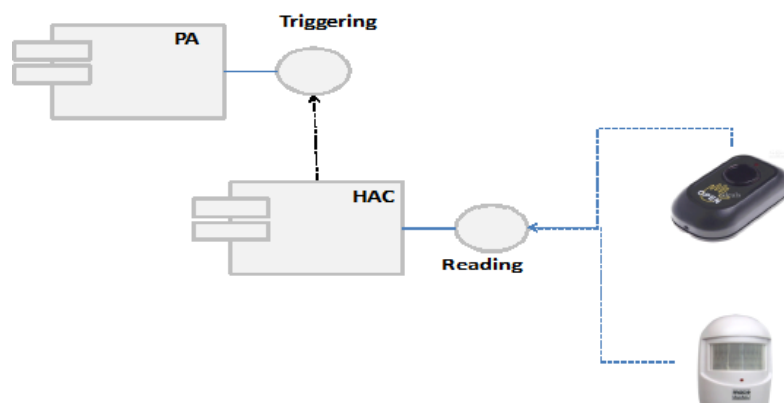
Situation Awareness mechanism

IF an elderly person presses the panic button

THEN alert the elderly person's caregivers group

IF an elderly person did not enter/appear in the
living room after 10:40am

AND habitually she is located in the living room after
10:00am

THEN warn the elderly person's caregivers group

Integration of the PeerAssist terminal

UI device	ASR	TTS		HTML		non OSGI
	VXML browser			GWT (or ..)		

PeerAssist Node Device / **OSGI** / **System Interfaces**

- HTTP server
- Interaction Manager
- JXSE
- Personal Assistant
- Semantics Layer Agent
- OSGI Home Control
- CMS Interface
- OSGI Auxiliary services
- OSGI framework and basic bundles
- Home automation
- TCP/IP
- ..

Integration of the PeerAssist terminal

PeerAssist

P2P Communication platform

Prof. Christos Xenakis

Evolution of P2P technology

- **P2P** has **evolved** through a number **of success stories**
  - **Communication** (ICQ, Skype)
  - **File exchange** (Napster, Gnutella, Kazaa, BitTorent)
  - **Anonymous file exchange** (Freenet)
  - **Distributed computing** (SETI@home)
- **Centralized** indexes and repositories
- **Flooding** broadcast of queries
- **Distributed Hash Tables (DHTs)**

Evolution of P2P technology

- Advantages associated to P2P
  - **Maximizes** the utilization of **resources of clients**
  - **Reduces network traffic**
  - **Cost savings** in material and maintenance
  - **Faster information delivery**.
  - **Scalability and Self-organization**
  - **Network fault tolerance**
  - **Service pervasiveness**
  - **No central control**

Candidate P2P tools & platforms

- We have analyzed and evaluated the followings
  - **JXTA**
  - **Microsoft Windows P2P**
  - **Peer to peer Trust Library (PtPTL) - Intel**
  - **JINI provided by Sun and based on Java**
  - **Enterprise Service Bus – Mule**
  - **Unmanaged Internet Architecture (UIA)**
  - **MACEDON and its successor Mace**
  - **Ezel**
  - **Microsoft Groove**

Evaluate them

- **Platform selection criteria**
  - **Connectivity – Communication**
    - **Any user** should be able to **connect** and **communicate** to **each other**, **regardless** of their **position** in the **network**
  - **Group management**
  - **Open** and **extensible** environment
  - **Interoperability**
  - **Scalability - Efficiency**
  - **Provides** a high level **API** for the development of **p2p** applications

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Evaluate them

- **Platform selection criteria**
  - **Decentralized** system architecture
  - **Security** and **trust**
  - Support **OSGI**
  - Support a wide range of **end-user devices**
  - **Abstracts** the complexity of the **physical infrastructure** (i.e., firewalls, NATs, etc.)

The most appropriate is JXTA

Developed JXTA testbed
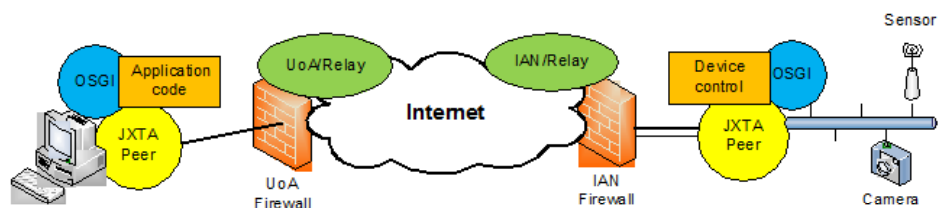
JXTA functional Components

- **Architecture**
  - **JXTA core**
    - The **minimal** & **essential** primitives that are common to P2P
  - **Services layer**
    - Network services that may not be absolutely necessary but are common or desirable
  - **Application layer**
    - Includes implementations of integrated applications

JXTA functional Components

- **Peer**
  - **Minimal-Edge peers:** implement only the core JXTA services
  - **Full-Edge peers:** core & standard JXTA services
  - **Super-Peers:** implement & provide resources to support JXTA
    - **Relay:** Firewall & NAT presence
    - **Rendezvous:** maintain global advertisement indexes and assist in advertisement search
    - **Proxy:** provide support for Minimal-Edge peers

- **Peer group**
  - A collection of peers that have agreed **upon a common set of services or interests**

JXTA functional Components

- **Service**
  - Discover a service, load a service and run a service
- **Supports OSGi**
- **JXTA messages**
- **Pipes**
- **Sockets**
- **Advertisements**
- **Security**

Available functionality

- **ID management functionality**
  - Assign a unique ID to a peer
  - Delete an ID of a peer
  - Modify an ID of a peer
- **Grouping functionality**
  - Create a group,
  - Delete a group,
  - Join into a group,
  - Remove from a group
  - Merge groups

Available functionality

- **Service functionality**
  - Advertize a group
  - Advertize a service
  - Discover a remote service
  - Discover a remote peer
  - Create a communication channel between peers
  - Delete a communication channel between peers
- **Security functionality**
  - Authenticate a peer
  - Encrypt a communication channel
  - Check for data integrity
  - Check for data authenticity

P2P in PeerAssist
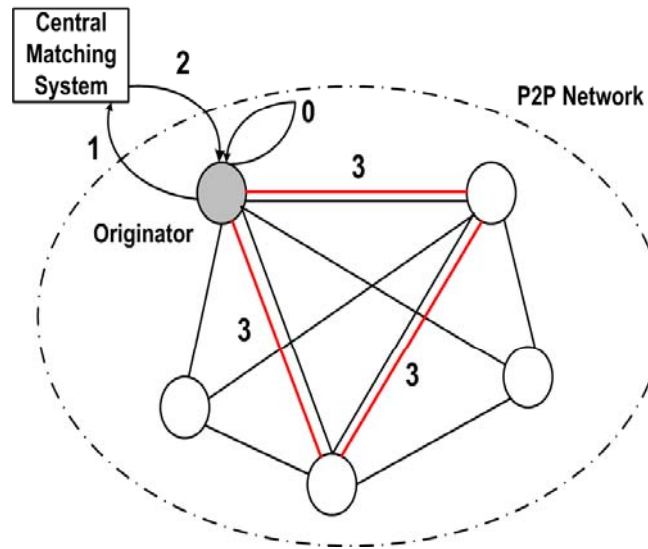
PeerAssist Semantic Layer

Content

- Sematic Layer, part of the PA Architecture
- Central Matching System
- Semantic Layer Agent
- Conclusions

Semantic Layer = SLA + CMS
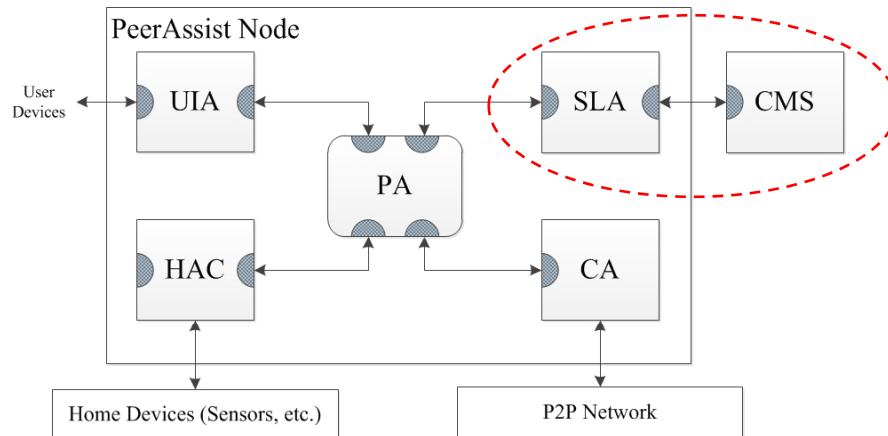
CMS

- Central Matching System
- Requirements for CMS design
  - password protected repository where all the PA data can be stored (PA general Ontology & personal data);
  - The repository has to be accessed by a manager for maintaining operations;
  - The repository has to be accessed by the SLA, allowing different operations performed via the PeerAssist user interface.

CMS Architecture

CMS
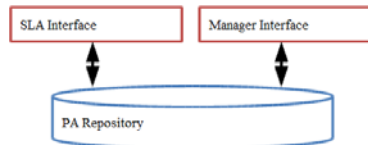
SESAME
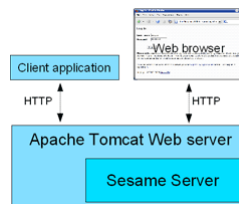
- CMS architecture perfectly maps over the SESAME Server installation under Apache:
  - SESAME server provides support for storing the ontology;
  - the manager interface is available via the browser
  - the SLA acts as a client application

PA Repository
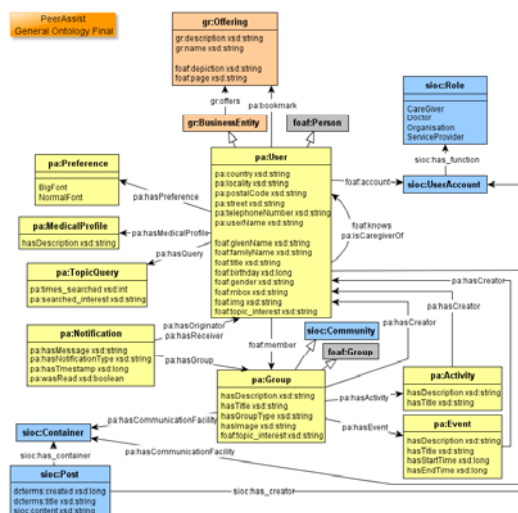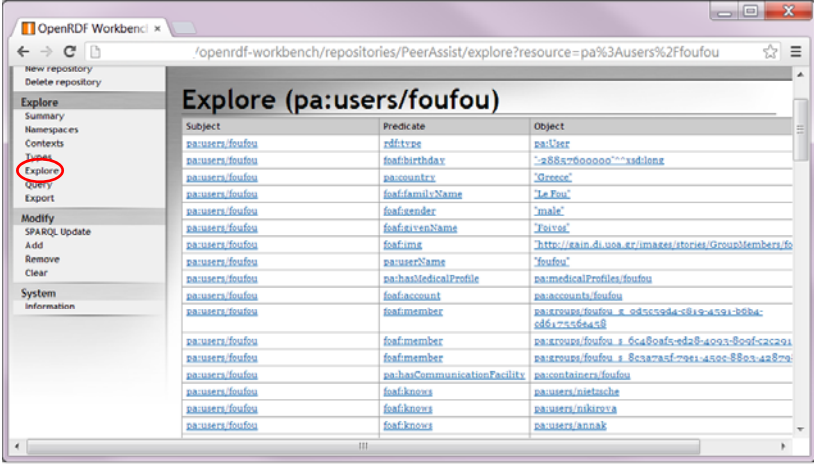
Manager Interface
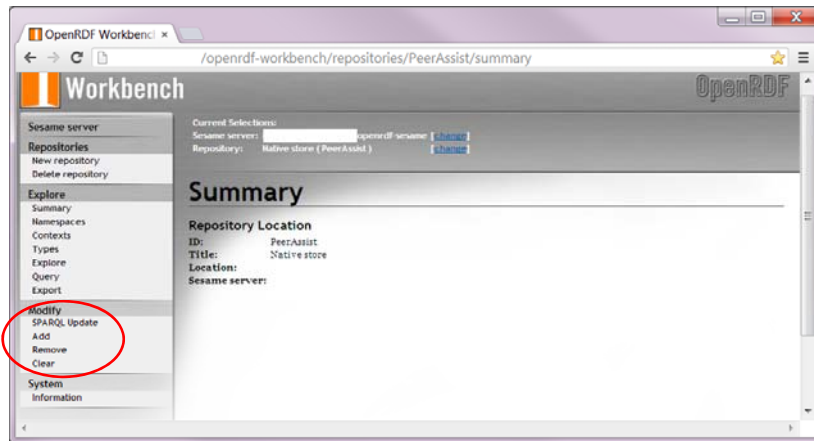
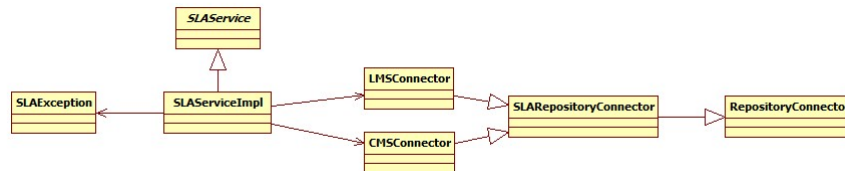# Manager Interface (II)

Manager Interface (III)

SLA

- Semantic Layer Agent
- resides within each PeerAssist node
- accessed solely by the Personal Assistant
- redirects queries to the Central Matching System
- maintains user profile and local context information

SLA Software Description

SLA API

Provides programmatic access to CMS

- Collection<User> searchUsers(Map<String, String> queryParams)
  - Search users according to query parameters.
  - The query parameters may refer to any user attributes, for example users from Greece interested in cooking

- User getUser(String userId)
  - returns all information regarding the user with the given Id

Conclusions

- CMS password protected and maintained by a manager
- The manager can perform any update operations using the dedicated manager interface
- Two CMS installations available, main and back-up
- SLA accesses the CMS from within a node
- Restrictions are checked and imposed by the Personal Assistant

PeerAssist
User Interface

Foivos Demertzis
University of Athens

Google Web Toolkit Overview

The PeerAssist User Interface is based on Google Web Toolkit (GWT), an open source development toolkit for building and optimizing complex browser-based applications.

- GWT toolbox consists of:
  - The GWT SDK contains the Java API libraries, compiler, and development server.
  - The Plugin for Eclipse provides IDE support for Google Web Toolkit and App Engine web projects.
  - GWT Designer lets you create user interfaces in minutes with tools for intelligent layout assist, drag-and-drop, and automatic code generation.

GWT Projects

GWT projects are organized in a structured way which makes it easy to identify which code is intended to run on the client browser, the server, or both:

- Standard Directory and Package Layout
- Modules: Units of configuration
- HTML Host Pages

Standard Directory and Package Layout

- GWT projects are overlaid onto Java packages
- Under the main project directory the following directories should be created:
  - src folder - contains production Java source
  - war folder – contains the web app
  - test folder – contains JUnit test code
- src package contains:
  - a project root package
  - a client package
  - a server package to differentiate between the client-side code from the server-side code
- Project root package contains the module definitions
- war directory contains all the static resources (host page, CSS, images).
- Client and server packages contain the web app code in an organized structure.
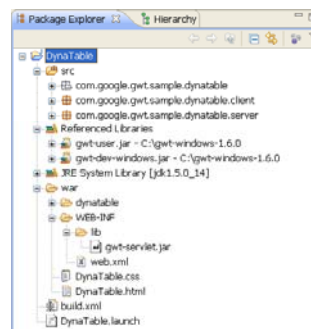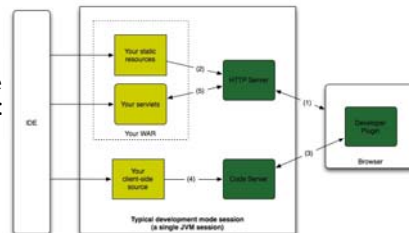
Modules: Units of configuration

• Individual units of GWT configuration are called modules. A module bundles together all the configuration settings that a GWT project needs:

- inherited modules
- an entry point application class name; these are optional, although any module referred to in HTML must have at least one entry-point class specified
- source path entries
- public path entries
- deferred binding rules, including property providers and class generators

• Modules are defined in XML and placed into project's package hierarchy.

HTML Host Pages

• GWT modules are stored on a web server as a set of JavaScript and related files.

• In order to run the module, it must be loaded from a web page of some sort.

• Any HTML page can include a GWT application via a SCRIPT tag.

• This HTML page is referred to as a host page from the GWT application's point of view.

```
<html>
<head>

<!-- Properties can be specified to influence deferred binding -->
<meta name="gwt:property" content="locale=en_UK">

<!-- Stylesheets are optional, but useful -->
<link rel="stylesheet" href="Calendar.css">

<!-- Titles are optional, but useful -->
<title>Calendar App</title>

</head>
<body>

<!-- This script tag is what actually loads the GWT module.  The -->
<!-- "nocache.js" file (also called a "selection script") is    -->
<!-- produced by the GWT compiler in the module output directory -->
<!-- or generated automatically in development mode.            -->
<script language="javascript" src="calendar/calendar.nocache.js"></script>

<!-- Include a history iframe to enable full GWT history support -->
<!-- (the id must be exactly as shown)                          -->
<iframe src="javascript:''" id="__gwt_historyFrame" style="width:0;height:0;border:0"></iframe>

</body>
</html>
```

Build the User interface

- GWT offers a powerful and easy to use bi-directional Java GUI designer
- GWT Designer is built as a plug-in to Eclipse
- With GWT Designer you can easily add any component to a container by using drag-and-drop

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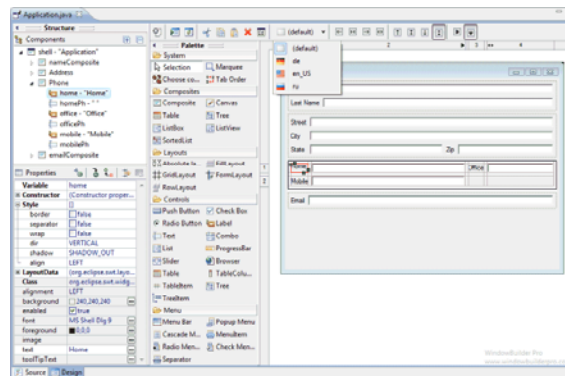
Home

1/2

This is the Home page

Home

The user can click the buttons to go to each section

He can always click **Home** to come here, or **Back** to go back one screen.

He can select the language he wishes.

See new notifications.

He can have anytime the Personal Assistance's help.

Welcome to PeerAssist! Click the buttons to go to each section. You can always click Home to come here, or Back to go back one screen. You can also see your notifications and alert the caregivers.

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Profile

The user can see, edit and update his profile information.

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Profile

To change his info and create a new blog.

Profile

Navigation to *Profile* section through a video.

Social

The user can see the lists of his Friends and his Groups. He can search for new friends and groups or to create his own group.

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Social

Users search:

Groups search:

... Name
... Country
... Gender or
... Interest

... Name
... Description or
... Topic

Create a group:
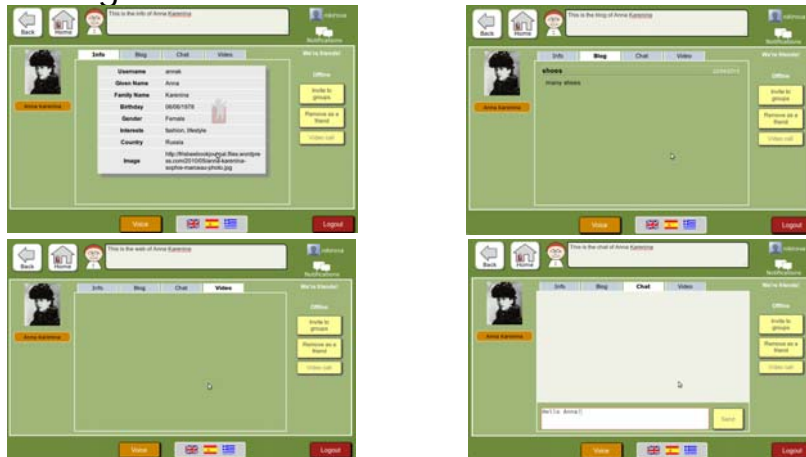

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Social

(3/4)

The user can visit the profile of his friends, see their blogs, communicate with them via instant messages or via video conference.

PeerAssist Final Workshop, 28 June 2013, Athens, Greece

Social

(4/4)

Navigation to *Social* section through a video.

PeerAssist Final Workshop, 28 June 2013, Athens, Greece

Services

The user have access to the offered services, choose the service he wish or discover new.
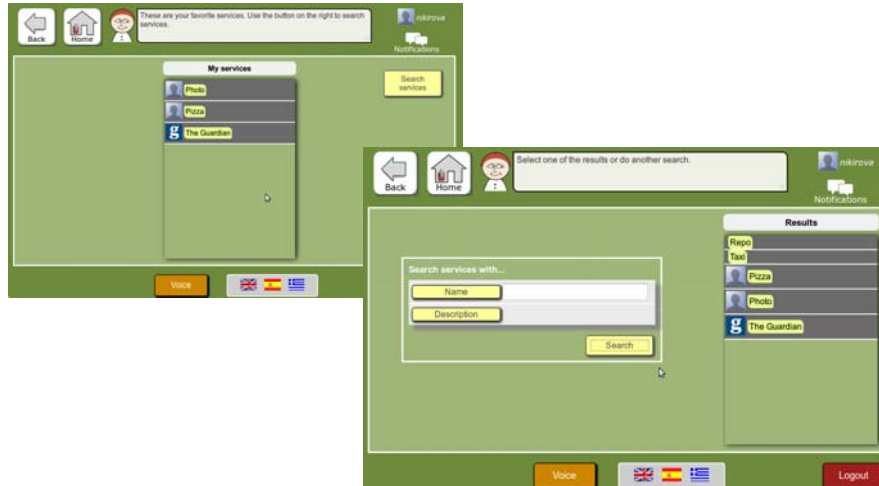
PeerAssist Final Workshop, 28 June 2013, Athens, Greece

Services

Navigation to *Services* section through a video.

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Care

The user's Caregivers presented in a list.

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Care

Caregiver info

PeerAssist Final Workshop, 28 June 2013, Athens, Greece

Care

Navigation to *Care* section through a video.

Trials and evaluation results
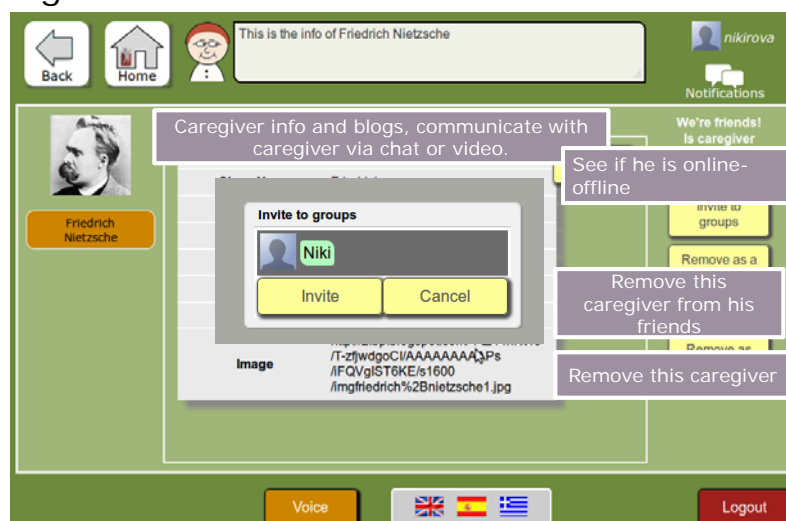## Blanca Morales – Ingema / Sofia Makedou – AEDA

Methodology

- 19 participants in Spain and 21 in Greece

- Informed consent

- Questionnaire with sociodemographic data and questions for scenario usability, accessibility and acceptability

- The users followed the same route in order to be able to interact with other participants:
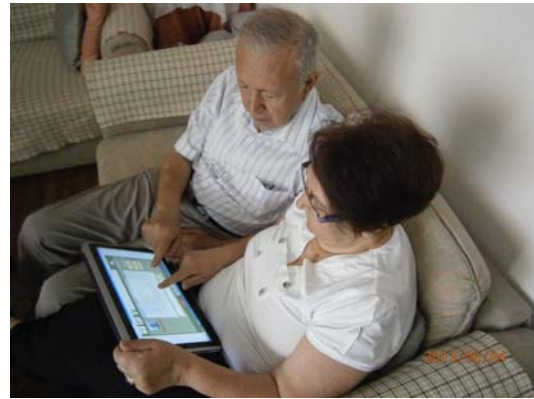

- The Spanish users came 2 times to Ingema laboratory with a gap of 15 days

- The greek trials were conducted in AEDA premises and users' houses.

Photos (1/3)

Spain

Greece/Users' houses

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Photos (2/3)

Greece/Users' houses

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Photos(3/3)

Greece/AEDA premises

Spanish GUI

| Home | Me | People | Services | Care | PeerAssist | Alert | Notifications (3) | Back |

Me

People

Services

Care

Welcome to PeerAssist! Click the buttons to go to each section. You can always click Home to come here, or Back to go back one screen. You can also see your notifications and alert the caregivers.

Greek GUI

Sociodemographic data of Spanish users (1/2)

Sociodemographic data of Spanish users (2/2)

How often do you use a computer?
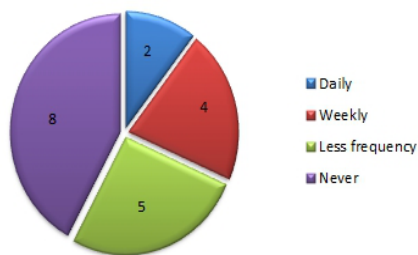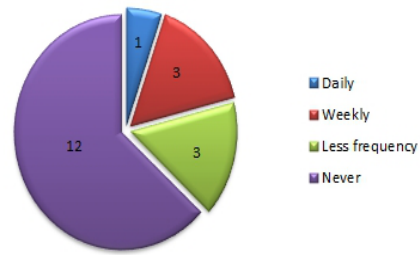
2	■ Daily
4	■ Weekly
5	■ Less frequency
8	■ Never

How often do you use the internet?

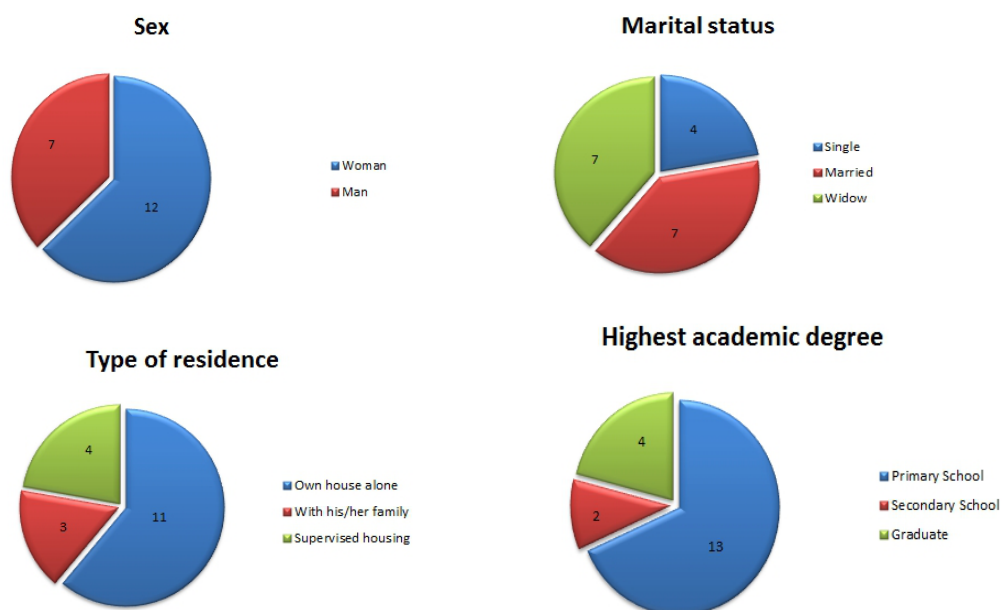|	
1	■ Daily
3	■ Weekly
3	■ Less frequency
12	■ Never

Sociodemographic data of Greek users (1/2)

Sex

10	■ Woman
11	■ Man

Marital status

3	■ Single
15	■ Married
3	■ Widow

Highest academic degree

2	■ Primary School
10	■ Secondary School
9	■ Graduate

Highest academic degree

2	■ Primary School
10	■ Secondary School
9	■ Graduate

Sociodemographic data of Greek users (2/2)

How often do you use a computer?

- Daily
- Weekly
- Less frequency

1
3
17

How often do you use the internet?

- Daily
- Weekly
- Less frequency

1
3
17
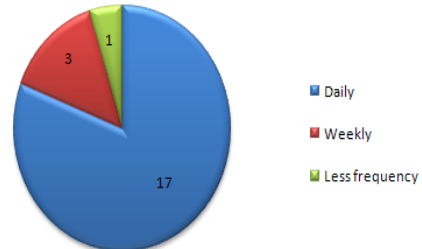
Scenario 1 – Personal profile

Scenario 1: Edit profile and add a post in the blog.

- In Spanish trials, the users were more familiar with the system the second time.
- In Greek trials, there was a significant improvement with the new interface.
- Likert scale (1.Fully satisfied – 7. Fully dissapointed) regarding the following:

1. Usability

2. Time needed

3. Support information
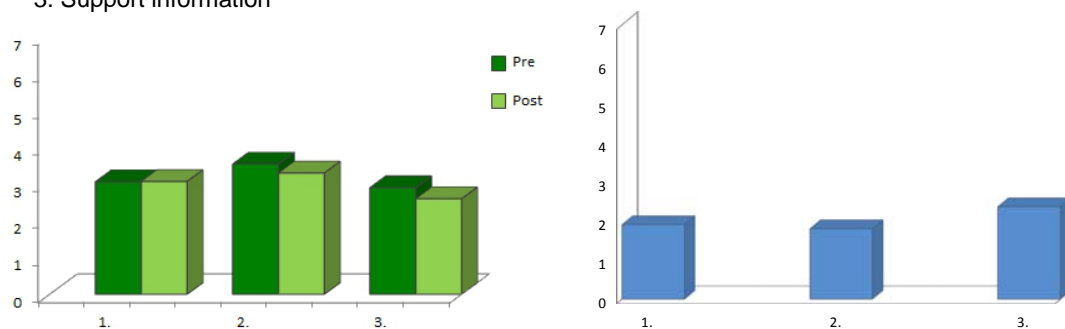
Scenario 2 – Social profile (1/2)

Scenario 2: The users were navigated to the main functions of the Social section and perfomed the following tasks:

- Search a user and send friend invitation /Accept invitation
- Check the information and blog of the new friend
- Chat with a friend
- Video call a friend
- Search a group and send invitation / Accept invitation
- Chat with a user within the group

Scenario 2 – Social profile (2/2)

- In spanish trials, the users were more familiar with the system the second time.
- In greek trials, there was a significant improvement with the new interface.
- Likert scale (1.Fully satisfied – 7. Fully dissapointed) regarding the following:

1. Usability

2. Time needed

3. Support information

Scenario 3 - Services

Scenario 3: Search services (e.g. find taxi)

- In spanish trials, the was no significant differentiation between the first and second time.

- In greek trials there was significant improvement with the new interface.

- Likert scale (1.Fully satisfied – 7. Fully dissapointed) regarding the following:
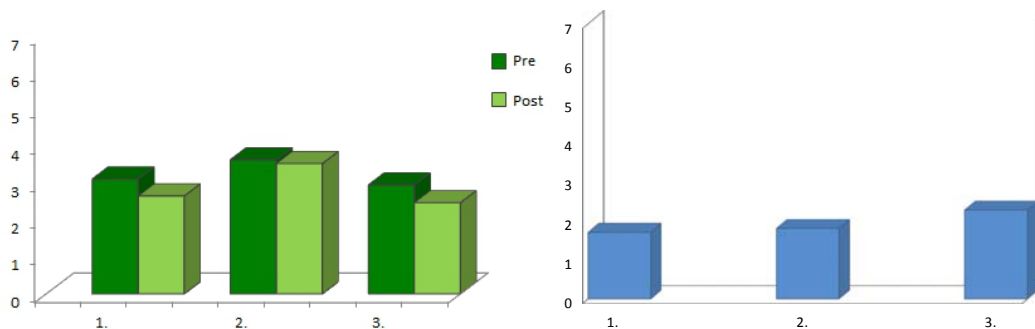
1. Usability

2. Time needed

3. Support information

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Scenario 4 - Caregivers

Scenario 4: Here, the users requested medical consultation from their caregivers.

In spanish trials, this scenario was not performed.

In greek trials, this scenario was performed.

Likert scale (1.Fully satisfied – 7. Fully dissapointed) regarding the following:

1. Usability

2. Time needed

3. Support information

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Scenario 5 - Notifications

Scenario 5: Check notifications

There was no significant differentiation between Greece and Spain

Likert scale (1.Fully satisfied – 7. Fully dissapointed) regarding the following:
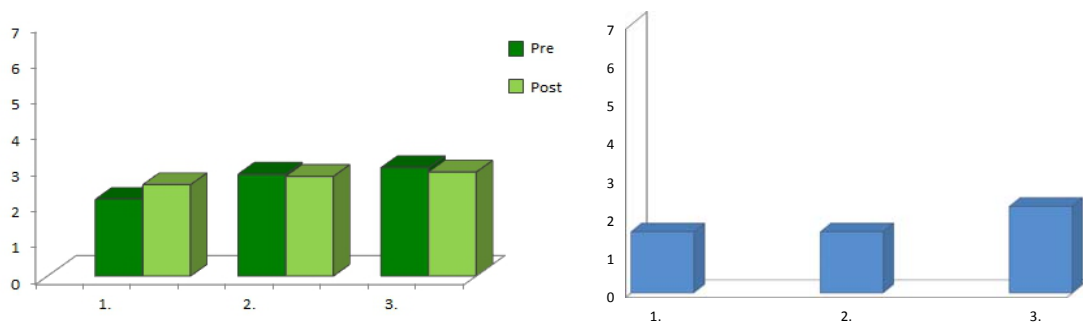
1. Usability

2. Time needed

3. Support information
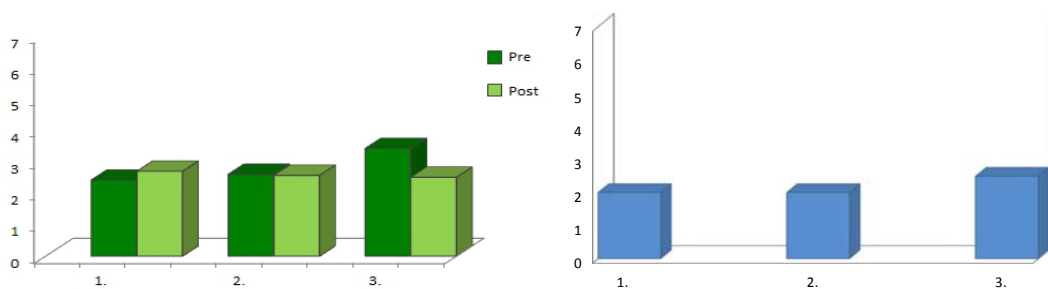
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System usability

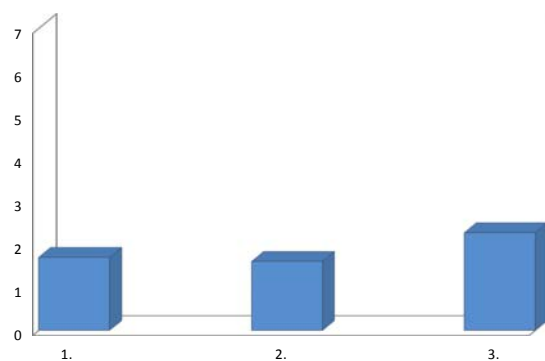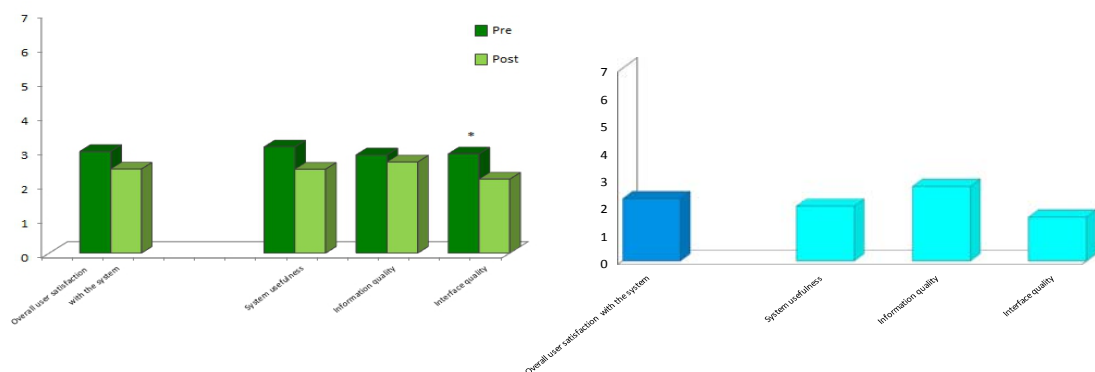Despite the fact that the Spanish users were able to distinguish the text, fonts and colors, they wanted a better graphical interface.

The results were better with the renewed graphical interface.

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Conclusions

The differences between the Greek and Spanish results are primarily due to the renewed user interface and the greater familiarity of the Greek users with computers.

Overall, the results would be much better if all the users were more familiar with computers. For example, many users did not know terms such us blog, chat, video call etc.

Especially in Spain, some users needed the help of the assistants in order to accomplish the scenarios.

Most of the users said that with some more training and hands-on experience, they would be able to use the system without any difficulty.

Both Greek and Spanish users said that they would prefer video calls instead of chatting, because no keyboard is needed and they do not want their writing difficulties to be perceived (slow writting etc.).

Finally, despite the fact that the users liked the idea of the service, they would hardly pay to buy it. Alternative funding resouces must be considered (public, advertisement, etc.).

PeerAssist

Future plans and exploitation opportunities

Nikos Giannopoulos

Introduction

- Ambient Assisted Living: a very promising market that
  - Combines automation systems and modern ICT technologies
  - Targets autonomy and security of elderly people or people with disabilities
- PeerAssist: an integrated system
  - With comparative advantages
  - With novel technological solutions
- Exploitation:
  - In a very challenging international environment
  - Through refinement, advertisement, colaborations at European level.

market analysis
different players

- **End-users**
  - Elderly people
  - Caregivers
- **Professional users**
  - Doctors
  - Service providers (networking organizations, supporting organizations, etc.)
  - Mobility porviders (tourirm, transportation)
- **Care providers**
  - Research institutions
  - Enterprises : telemedicine, ICT providers, help-at-home
- **Supporting organizations**
  - Social security

market analysis
market size

- Different numbers by different sources.

- A study by Frost and Sullivan [Somsainathan, 2010] estimates that the European AAL market raised up to $154 million.

- The annual increase until 2015 is estimated at 22.3%, but is getting affected by the economic crisis.

- An estimation for 2011 by MarketsandMarkets.com [smart-homes-385, 2011] was at $174.15 million.

PeerAssist
comparative advantages

PeerAssist integrates services for all five areas of interest for the market:
- ✓ Surveillance
- ✓ Data processing and decision making
- ✓ Automatic control
- ✓ User interface
- ✓ Communication

providing a set of advantages:
- ✓ Social interaction, remote caring and telemedicine support
- ✓ Simple and easy user interaction through a small portable device
- ✓ Open platform able to extend and adjust
- ✓ Peer to peer communication for improved security

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exploitation options

Two different exploitation paths:
- **Business-to-customer (B2C)**
  - Through sponsors or advertisements
  - Subscription for a time period
  - Pay per user
  - Free use targeting external services

- **Business-to-business (B2B):**
  - Technology provider (e.g. Consortium, companies)
  - Service provider (health services company, government)
  - Customer (an organization that offers the service to end users)

possible clients

PeerAssist

B2B
- Hospitals, public organizations, social caring, municipal authorities (friendship clubs)
- Advertisement through public organizations and caring centers
- Interfacing with alternative providers for external services

B2C
- Direct offer to end users through various charging schemes

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revenue sources

PeerAssist

Depends of the business model to be followed:

- **Selling the system** (PeerAssist-in-the-box)
- **Software licences and support**
- **Service subscription-based**
- **Service usage fee**
- **Cost for external services offered**
- **Advertisements**

channels

- Direct sales «PeerAssist-in-the-box»
- Targeted agreements with public organizations
- Internet
- Conferences and commercial excibitions
- Resellers, strategic partners

next steps

➤ Improvements based on the results for the trials

➤ Large scale testing

➤ Functionality to cover the selected business model (e.g. Charging scheme for pay-per-use)

➤ Selection and integration for further hardware (e.g., sensors)

➤ IPR management

➤ Network of suppliers, customers and partners

partnerships

Network of suppliers and colaborators

- Hardware suppliers for the PeerAssist box:
  - Sensors
  - Terminal
  - Control devices

- Strategic partnerships:
  - With service providers to improve competitiveness and extend usability scenarios

exploitation planning

In two directions:

- **Commercial**
  - **New plans for service extensions** : Improvements to cover more usage scenarios, scalability, etc.
  - **New and improved services**
  - **Dissemination**: in commercial/scintific conferences and possible customers

- **Research**
  - **Use know-how for new research projects**
  - **Teaching, theses support**
  - **IPR protection**
  - **Publications**