AMBIENT INTELLINCE LANDSCAPE, A SCENARIO FOR TOURISM

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ABSTRACT

Ambient Intelligence (AmI) - a seamless environment of computing, advanced networking technology and specific interfaces – is considered to be the basic aspect of our technological future, triggering a paradigm shift in all aspects of life. A future AmI landscape in tourism industries is presented in a scenario for a hypothetical visit of an artist at the island of Lesvos. Scenario analysis demonstrates that g-work systemic framework – namely a personal Grid e-workspace for every citizen and enterprise – is the major intermediate step in order to realize AmI vision.

Key Words: Ambient Intelligence, g-work, tourism.

INTRODUCTION

Our analysis is driven by a scenario referred to a hypothetical visit of an artist at the island of Lesvos. The major scope of this visit is to participate in an international conference held in North Aegean Sea. By applying the Ambient Intelligence's (AmI) methodological framework (Aarts et al. 2001; Aarts, 2003; Ducatel et al. 2001) we ideate the future of tourism industry. In the second section, the proposed scenario triggers an investigation of technological and organizational issues arising from the implementation of an interoperable knowledge, software and hardware grid. Ambient Intelligence is considered to be a basic thematic area for the European Commission and is funded by the 6th and the 7th Framework Programme. AmI is based on the convergence of three key technologies: Ubiquitous Computing (Dertouzos,1999), Ubiquitous Communication, and Intelligent User Friendly Interfaces and according to the vision statement: "on convergence humans will be surrounded by intelligent interfaces supported by computing and networking technology which is everywhere, embedded in everyday objects such as furniture, clothes, vehicles, roads and smart materials even particles of decorative substances like paint" (Ducatel et al. 2001). AmI represents a paradigm shift for how people can cooperate and it offers new chances for both personal and social economic development. In the next section, the AmI technological framework is supplemented by the g-work paradigm, namely a personal Grid e-workspace for every citizen and enterprise which is decomposed in four interconnected parts: (a) Digital Storage, (b) Network Traffic, (c) Processing Power and (d) One-stop Web Services [Vafopoulos, 2005; (Vafopoulos and Angelis, 2006; Vafopoulos et al. 2005a; Vafopoulos et al. 2005b). G-work for a local community member enables hyperconnectivity[1], glocalization[2] and establishes an organized collaborative working environment by integrating software and hardware infrastructure. G-work is based on Semantic Web (Berners-Lee et al. 2001; Berners-Lee, 1998) and Grid computing (Ong, 2003) technologies and drives research and practice to the AmI vision. The fourth section is devoted to the European and national aspects of an organizational scheme towards AmI realization. "Dark" scenarios of AmI are presented in the fifth section. Sixth section concludes.

THE SCENARIO

In 1999, IST Programme Advisory Group (ISTAG - http://www.cordis.lu/ist/istag.htm) first advanced the vision of 'Ambient Intelligence' (AmI) by providing fictitious scenarios as food for thought to the research community. Based on initial scenarios and recent research studies we form the following scenario for tourism in the future AmI landscape.

"During June 2007 is organized in Lesvos Greece, by the Department of Cultural Technology and Communication an academic conference entitled "Innovative technologies and regional cultural planning – IREP 2007". Invited speakers and participants in IREP 2007 include scientists, professionals, businessmen and

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[1] The availability of people for communication anywhere and anytime.

[2] Constraint-free communication combining global and local connectivity in order to work and commune together on a common task or shared interest.

artists from the digital arts industry. Petros, a Thessaloniki-based artist receives in his Personal Digital Assistance (PDA) a newsletter in order to participate at IREP 2007. Since Petros is interested in cultural planning and digital art decides to visit Lesvos and fills out an electronic application form at www.IREP2007.eu by using his handheld. Additionally, books boat tickets and he arranges to stay at the designed hotel. Unfortunately, at the day of departure a massive protest is taking place at Thessaloniki centre. The PDA-enhanced GPS system promptly informs Petros for alternative routes to the port, in order to avoid the traffic jam. RFID e-pass technologies existing in "Nissos Lesvos" ship detects automatically Petros' electronic ticket and feeds his PDA with information concerning his ten hours travel to Lesvos island. He also receives an automatic instant message invitation which contains information – photo and short curriculum vitae - about participants of IREP 2007 who are on board and want to meet Petros. Petros accepts Kostas' invitation, who works as a 3D software designer and Maria's, who is an archaeologist in Schinousa project. They discuss about Greek cultural policy and the country's "frog leap" in high technology infrastructure taking place in 2006. Their handhelds announce that are approaching Limnos island and offer the option to receive touristic information about the second biggest island of Prefecture of Lesvos. Petros, Maria and Kostas choose just to get trip data like the remaining time and expected weather conditions in IREP venue. Since Kostas has visited Lesvos before, advise Maria and Petros to visit the traditional village of Molivos and the petrified forest of Sigri. At 23:00, after five hours on "Nissos Lesvos", Kostas and Maria are sleeping on their cabins and Petros is searching for touristic information for Molivos and Sigri and decides to rent a car extending his visit in Lesvos. At 06:00 "Nissos Lesvos" arrive at Mytilini port and GPS software drives them to Petros' car and "Erato" hotel. A warm welcome from the hotel receptionist is followed by an electronic check-in dialog box in Petros, Maria and Kostas handhelds. The OK button press by all three participants results room adaptation in personal preferences (temperature, lighting, location, decoration etc). After a relaxing bath, Petros receives voice information from his PDA, about shopping and night life in the local market but decides to work on his presentation. Logs in the local *Grid service system* and updates his 3D artworks with local elements. During next day's breakfast Petros is informed that the venue of IREP 2007 has changed due to technical problems. Personal Digital Assistance drives Petros to the new venue, signs-in the conference and receives presentations program and abstracts. Unluckily, two interesting presentations are in the same time and Petros chooses to attend a keynote speech from an Italian historian concerning digitalization and knowledge management of Greek and Italian artworks between 18th and 19th century. Petros adjusts his PDA in Italian-to-Greek translation mode and selects to receive a video from the other synchronous interesting lecture. Also, turns on the answering PDA system, which answers his calls instead of him depending on caller id. At 18:00 IREP is over and all presentations and comment data are transferred to his handheld. Petros returns to "Erato" hotel and gets a nap in order to follow the conference dinner at 20:30 and Lesvos wild night life. Wakes up at 19:30 and PDA informs him that dinner time have changed to 21:30 due to Minister's late arrival. After the dinner, Petros together with Kostas and Maria find and visit mainstream night clubs. At 03:00, suddenly Kostas feels strong headache and chest pain and uses the emergency button of his PDA, which informs both local hospital and national insurance service for his medical profile and location. After five minutes a doctor is calling him and offers medical advise. Next day at 11:00 Petros wakes up late for the IREP domestic tour and his PDA has put him out from the bus list 10 minutes before the beginning of the excursion. He observes that Maria is not at this tour list and decides to invite her in a personal tour of Lesvos. Maria loves the idea but has different preferences. Their PDAs try to match the two dissimilar routes and the short journey starts with the Monastery of Madamados. Personal Digital Assistant warns Petros that there are only three open gasoline stores in their way and gives detailed information about the Monastery of Madamados. Maria decides to make an anonymous offer to the Monastery through e-banking. At 13:00 after visiting Madamados they are driving to Molyvos traditional village. They get information about sightseeings, restaurants and beaches and after a quick sea swimming they are having lunch at a traditional fish tavern. Next destination is the petrified forest of Sigri. Physical and real-time multimedia information for every element of the museum amazed Petros and Maria who decided to order - through their PDA - many replicas of petrified stones and plants. Since Moni Limonos is forbidding women to visit it's place of public worship, PDA advice them to have lunch at Kalloni sardines taverns. On Monday three hours before departure, Port Authorities send instant messages to all passengers to Thessaloniki that the ship is going to be late for two hours. Since Petros has arranged important meetings, asks his PDA to find alternative means of transportation. At last, Petros travels by plane with an one hour flight to Thessaloniki. Through the PDA sends his comments to the *Lesvos g-work portal*, updates his personal digital diary and shares video and images with friends."

SCENARIO ANALYSIS

Our scenario is short, service-oriented and does not include artifacts[3]. It is just an indicative scenario of primitive AmI explaining what existing and emerging technologies could achieve in the tourism industry. In the following Table 1 the basic concepts of PDA, RFID, GPS, Grid Services and Semantic Web are presented.

Table 1

Basic technologies of the proposed AmI scenario in tourism

PDA	Personal digital assistants (PDAs) are ***handheld devices*** that were originally designed as ***personal organizers***, but became much more versatile over the years. A basic PDA usually includes ***date book***, ***address book***, ***task list***, ***memo pad***, ***clock***, and ***calculator*** software. Newer PDAs also have both color screens and audio capabilities, enabling them to be used as ***mobile phones***, ***web browsers*** or media players. Many PDAs can access the ***Internet***, ***intranets*** or ***extranets*** via ***Wi-Fi***, or ***Wireless Wide-Area Networks*** (WWANs).
RFID	Radio Frequency Identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. An RFID tag is a small object that can be attached to or incorporated into a product, animal, or person. RFID tags contain silicon chips and antennas to enable them to receive and respond to radio-frequency queries from an RFID transceiver. Passive tags require no internal power source, whereas active tags require a power source.
GPS	The Global Positioning System (GPS) is the only fully-functional satellite navigation system. A constellation of more than two dozen GPS satellites broadcasts precise timing signals by radio to GPS receivers, allowing them to accurately determine their location (longitude, latitude, and altitude) in any weather, day or night, anywhere on Earth. GPS has become a vital global utility, indispensable for modern navigation on land, sea, and air around the world, as well as an important tool for map-making, and land surveying. GPS also provides an extremely precise time reference, required for telecommunications and some scientific research, including the study of earthquakes.
Grid Services	Grid computing is an emerging computing model that provides the ability to perform higher throughput computing by taking advantage of many networked computers to model a virtual computer architecture that is able to distribute process execution across a parallel infrastructure. Grids use the resources of many separate computers connected by a network (usually the Internet) to solve large-scale computation problems.
Semantic Web	The Semantic Web is a project that intends to create a universal medium for information exchange by putting any type of digital content with computer-processable meaning (semantics) on the World Wide Web. Currently under the direction of the Web's creator, Tim Berners-Lee of the World Wide Web Consortium, the Semantic Web extends the Web through the use of standards, markup languages and related processing tools.

The realization of our scenario requires an efficient broadband communication network based on innovative technologies (i.e. WiMax, ADSL, GSM, GPRS, 3G), interoperable local information and infrastructure system. The basic idea is that the information systems of:

- Petros, Kostas and Maria (personal information system),
- University of the Aegean (academic information system),
- Port Services, Tourism Authorities and Local Hospital (government information system),
- Tourism industry (business information system).

interoperate in order to provide user-centric services and achieve their goals in an effective, unified and profitable way with minimum effort. Case-by-case analysis of the proposed scenario is provided in Table 2. Since the provision of touristic services involve information management and exchange, Semantic Web is the major enabling factor in most cases.

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3 Components (i.e. sensors, actuators, processor, memory, wireless communication modules) which can receive, store, process and transmit information.

Table 2

Technological framework of the proposed AmI scenario in tourism

scenario	*technologies*
.. receives in his Personal Digital Assistance (PDA) a newsletter in order to participate at IREP 2007.	**SW** he has e-registered before in the University's of the Aegean information service
... fills out an electronic application form..	**SW**
...books boat tickets and he arranges to stay at the designed hotel.	**SW -**local g-work portal provides information
The PDA-enhanced GPS system promptly informs Petros for alternative routes to the port...	**SW – GPS -** traffic information come from Ministry of Transports
RFID e-pass technologies existing in "Nissos Lesvos" ship detects automatically Petros' electronic ticket and feeds his PDA with information concerning his ten hours travel..	**RFID – SW** Petros has agreed before for this transaction
...receives an automatic instant message invitation which contains information – photo and short curriculum vitae - about participants of IREP 2007 who are on board a...	**SW -** Petros, Maria and Kostas have agreed before for this transaction
...handhelds announce that are approaching Limnos island and offer the option to receive touristic information ...	**SW - GPS** local g-work portal provides information
....to get trip data like the remaining time and expected weather conditions in IREP venue.	**SW – GPS -** data are transferred from ship's information system and other sources
... is searching for touristic information for Molivos and Sigri and decides to rent a car extending his visit in Lesvos.	**SW -** local g-work portal provides information
...GPS software drives them to Petros' car and "Erato" hotel.	**GPS -** local g-work portal provides detailed geographical information
...electronic check-in dialog box ... room adaptation in personal preferences (temperature, lighting, location, decoration etc).	**artifacts -smart buildings** collaboration between hotel's and our personal information systems
Logs in the local *Grid service system* and updates his 3D artworks with local elements.	**Grid services** paid Grid service hosted at the Department of Cultural Technology and Communication
...is informed that the venue of IREP 2007 has changed due to technical problems. Personal Digital Assistance drives Petros to the new venue..	**SW – GPS -**IREP information system handles this piece of information
...signs-in the conference and receives presentations program and abstracts.	**SW -** IREP information system handles this piece of information
...adjusts his PDA in Italian-to-Greek translation mode and selects to receive a video from the other synchronous interesting lecture.	IREP information system offers translation in real-time
...turns on the answering PDA system, which answers his calls instead of him depending on caller id.	smart answering service using our voice
...all presentations and comment data are transferred to his handheld.	**SW -** Petros can choose this option at any time
...PDA informs him that dinner time have changed to 21:30 due to Minister's late arrival.	**SW -** IREP information system handles this piece of information
... find and visit mainstream night clubs.	**SW -** local g-work portal provides information
...uses the emergency button of his PDA which informs both local hospital and national insurance service for his medical profile and location.	**SW - GPS** basic e-Health service based on Ministry of Health infrastructure

scenario	technologies
... his PDA has put him out from the bus list 10 minutes before the beginning of the excursion.	**SW -**IREP information system handles this piece of information
...their PDAs try to match the two dissimilar routes...	**SW -** special PDA software resolves this conflict
...warns Petros that there are only three open gasoline stores in their way and gives detailed information about the Monastery of Madamados.	**SW -** local g-work portal provides information
...make an anonymous offer to the Monastery through e-banking.	**SW -** local g-work portal provides information
...get information about sightseeings, restaurants and beaches ..	**SW -** local g-work portal provides information
Physical and real-time multimedia information for every element of the museum amazed Petros and Maria who decided to order - through their PDA - many replicas of petrified stones and plants.	**RFID – SW** local g-work portal provides information in co-operation to Museum's infrastructure
... PDA advice them to have lunch at Kalloni sardines taverns.	**SW -** local g-work portal provides information
...Port Authorities send instant messages to all passengers to Thessaloniki that the ship is going to be late for two hours.	**SW -** Port Authorities information system interoperates with Hellenic Seaways passenger list
...asks his PDA to find alternative means of transportation.	**SW -** local g-work portal provides information
Through the PDA sends his comments to the *Lesvos g-work portal...*	**SW -** local g-work portal provides information
...updates his personal digital diary and shares video and images with friends."	**SW**

G-WORK AND AMBIENT INTELLIGENCE

The vision of Ambient Intelligence (AmI) implies a seamless environment of computing, advanced networking technology and specific interfaces. According to Kameas et al (Kameas et al, 2005) "Technology becomes embedded in everyday objects such as furniture, clothes, vehicles, roads and smart materials, and people are provided with the tools and the processes that are necessary in order to achieve relaxing interactions with this environment...An important characteristic of AmI environments is the merging of physical and digital space (i.e. tangible objects and physical environments are acquiring a digital representation). As the computer disappears in the environments surrounding our activities, the objects therein become augmented with Information and Communication Technology (ICT) components (i.e. sensors, actuators, processor, memory, wireless communication modules) and can receive, store, process and transmit information..."(p.122)

ISTAG believes that it is not essential to provide a compact definition of the Ambient Intelligence concept, but it would be better to conceive AmI as "a set of properties of an environment that we are in the process of creating" and not as a set of specified requirements (ISTAG Group, 2005). ISTAG lately defined six basic prerequisites that will promote the societal dissemination of AmI (Ducatel et al. 2001). AmI should:

1. Facilitate human contact.
2. Be orientated towards community and cultural enhancement.
3. Help to build knowledge and skills for work, better quality of work, citizenship and consumer choice.
4. Inspire trust and confidence.
5. Be consistent with long term sustainability both at personal, societal and environmental levels.
6. Be controllable by ordinary people.

Figure 1 represents the holistic approach addressed towards the realization of the AmI vision. In my perception, full implementation of AmI will introduce systems of immense complexity and many intermediate steps need to be taken in this long and uncertain pathway. The major step towards AmI realization is considered to be the g-work systemic approach, because it offers a comprehensive bundle of user-centric web services

coupled to processing power resources. Particularly, g-work was initially introduced as a personal grid e-workspace for every citizen (Vafopoulos, 2005) and defined to have four interconnected parts:

- Digital Storage.
- Network Traffic.
- Processing Power.
- One-stop Web Services.

As Vafopoulos (Vafopoulos, 2005) argues "The first three aspects are related to technological infrastructure investments. The fourth aspect, one-stop web services, is the fundamental one for ICT exploitation. In this context, HyperClustering Framework is introducing an innovative, complete and direct method to employ ICT for local development by offering a creative and functional environment, which encourages, structures and diffuses personal and social knowledge instauration. At the first stage, we develop synergies among human activities by mapping implementation paths for the most popular of them. Based on this structured information standard, a web-based Virtual Organization (VO) is constructed, which integrates all the major activities of a local economy. The final stage of HyperClustering constitutes the creation of personal grid e-workspace for every citizen and company. …Specifically, operates on a semantic web portal basis as the unique electronic gate for a specific geographical region promoting:

- Established web services like e-mail, yellow pages, maps, tour guides.
- Innovative web services including semantic e-commerce and auctioning services for local goods, human resources, and raw materials based on grid computing technology.
- Advantageous mega-marketing features by aggregating marketing expenses under a single umbrella achieving economies of scale.
- Personal and entrepreneurial productivity upgrade.
- A structured, no disposable, comprehensive and expandable social knowledge base available to all citizens.
- E-Inclusion and direct democracy schemes in practice.

An innovative environment where new ideas and individual creation can emerge and diffuse in less cost."

Figure 1

User-centred, participative, Ambient Intelligence (ISTAG, 2005)
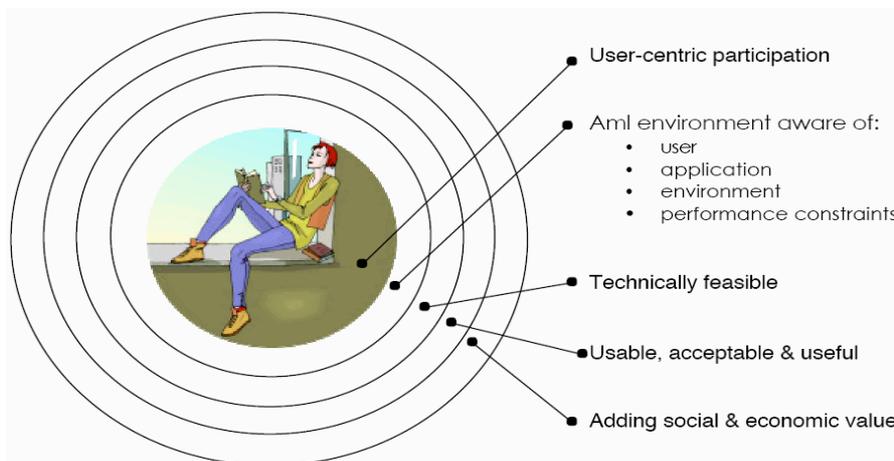
ORGANIZATIONAL ISSUES

Innovation and technological development are the cornerstones of economic growth in regional level. Small and Medium Enterprises (SMEs) in Greek tourism industry are facing a substantial time lag in new technologies' adaptation. The major reason for that is considered to be the lack of critical mass in the level of resources and turnover. In this context, European Union promotes the Single European Electronic Market (SEEM) in order to resolve small markets' isolation problem. The Single European Electronic Market (Matthiesen, 2005) is defined as a knowledge-based people oriented network-centric environment allowing

collaboration between individuals and with their environment as well as amongst value chains, where individuals/businesses from any location in Europe can link into any chain without any access or interoperability problem. In this setup, the role of central government, local authorities and academia is to create an organizational, financial and technological g-work environment which encourages the introduction of innovative services and collaborative business practices (Vafopoulos and Angelis, 2006).

Greek Government through Information Society's operation plan finances a vast set of actions for the creation of technological infrastructures in all sectors of economy. Specifically, Call 78 – "Development of an electronic platform for the presentation of cultural-tourist reusable content in regional level" (Greek Information Society, 2006) – which encourages the creation of a single national cultural-tourist Semantic Web portal, can constitute the core for the creation, organization and exploitation of digital cultural content for tourism purposes in regional level. Complementary role in realizing g-work environment and AmI landscape for tourism will play investments in broadband services, Grid infrastructure, complemented by the interconnection of public institutions and e-business financing programs.

DARK SCENARIOS

As in many cases, the advantages of an action are followed by disadvantages, which in the particular case are concreted in the personal data privacy and the likely exclusion in access for specific groups of people. After 9/11 2001, the scientific research widely anticipates the concept of the "Control or Surveillance Society", because security and surveillance operations – including e-mail and Internet monitoring – become first priority in public policies and funding. AmI vision according to Vafopoulos (Vafopoulos, 2006) "... is concentrated in an opportunity: more and better input in every citizen's information set, and a threat: personal data privacy.

The trade-off is not conspicuous but is fundamental: more personal data in a collaborative working environment means more chances to work, co-operate, interact, learn and develop your personality, but also increase possibilities for personal data abuse". The above general trade-off can be complemented with potential case specific problems in AmI's everyday use. The so-called "dark" scenarios have been presented by Alahuhta et al (Alahuhta et al, 2006) and are covering many cases of fully operational AmI environment including artifacts and various augmented objects. In opposition to our positive scenario we present two "dark" scenarios from Alahuhta et al. The first refers to a case of disclosure of location information which violates privacy and results an embarrassing situation.

Dark scenario 1

"In Munich, I experienced an awkward situation after I located a former colleague of mine using the "friend-locator" function (LBS) of my Personal Wrist Communicator (PWC) I just wanted to say "hi", but when I walked up to him, I was surprised to see that he had a good-looking, younger woman with him who obviously was not his wife. He blushed, mumbled a few words and disappeared in the crowd. It seems difficult to keep secrets these days..."

The second scenario refers a potential denial of transportation case and the consequent awkward situation and loss of control.

Dark scenario 2

"At Munich station, we met our old friends Brigitte and Peter as planned. The four of us proceeded to meet up with the travel group in the new bus terminal, just next to the station. After Alessandra, our Italian tour manager for the next days, had welcomed us to the tour and introduced herself, we finally started to pass through the security gates in order to board the bus. I guess I'll never feel comfortable with all these safety measures you have to endure when travelling: biometric ID verification, detectors for drugs and explosives, etc., especially if they reject you erroneously. Imagine, one of our fellow travellers, Michael from Baden-Baden, was denied access to the boarding area of the terminal, although he had a valid ticket and even could present the receipt from his travel agent! Apparently, some kind of data mismatch between his personal ID, the e-ticket and the information stored on the central server had caused the problem. The security personnel at the terminal were absolutely stubborn and unwilling to make an exception, despite several interventions by Alessandra and Peter, who, by the way, is a good friend of Michael."

CONCLUSION

Last years, ICT-based or Knowledge-based development (OECD, 2003) is becoming first priority for developed and developing countries resulting investments in broadband telecommunication infrastructure and Web services for citizens and enterprises. Today, classic World Wide Web have reached it's usability limit since

information overload (Toffler, 1970) creates a bottleneck in knowledge production and diffusion. Especially, for tourism industries which are fully globalized, service-oriented and involve every economic sector, the above bottleneck slows further development. G-work and AmI systemic frameworks provide a great opportunity to link, disseminate and interoperate local cultural-tourist information with every individual, government and business user. This fact generates a large number of business opportunities in tourism industries, but in the same time shapes a very competitive and fast moving market environment. In this setup, it will be too expensive for a country or a specific geographical region not to participate in an AmI landscape for tourism.

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