Multi-Dimensional Context-Aware Adaptation of Service Front-Ends

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1 Abstract

This document provides an overview of the activities that the SERENOA consortium has undertaken in the area of collaboration during the first 6 months of the project, and provides indications about how the consortium plans to carry out them in the next months. In particular, the document focuses on collaboration with projects in the area of software and service of the ICT EU programme, which could represent for SERENOA Project key interlocutors with which to exchange information and potentially initiate further deeper synergies in connected areas.

1 Introduction

Collaborations and liaisons of SERENOA consortium with other relevant ICT stakeholders interested in topics relevant for our Project (e.g. other EU Projects) represent a key factor for exploiting possible synergies and also increasing the impact of the general ICT initiative, in Europe and outside it. Indeed, by means of such collaborations, the involved entities should reduce duplicated efforts, and –more importantly- learn from each other in order to obtain more important results. Therefore, in our Project we plan to give a relevant role to such collaborations, by driving our efforts towards the current actions promoted under the aegis of the European Commission.

1.1 Objectives

The purpose of this document is to provide an overview of the activities that the SERENOA consortium plans to undertake in the area of collaboration (updated to the first 6 months of the project).

1.2 Audience

This document has a public dissemination level, so theoretically it is open to consultation by the general public. However, one of its key audience is represented by Project reviewers, officer, other EU projects in the area of Software and Services, as well as any research/scientist who is interested in the topics addressed by SERENOA.

1.3 Organization of this document

After introducing some summary information about the main content of the document ("Abstract" Section), in the "Introduction" (Section 1) some related information about the document is given (objectives, planned audience,..). Section 2 ("Collaboration Plan") represents the key content of the document, by providing the main collaboration actions the SERENOA Partners are planning to follow i) within the context of initiatives promoted/supported by the European Commission and ii) within some liaisons with other European Projects currently working in connected areas. Section 3 ("References") will provide pointers to relevant references.

2   Collaboration Plan

We have identified the main area for collaboration with other EU projects in the Service Front Ends Working Group because the main topic addressed in SERENOA is supporting novel solutions for adaptation for such service front ends. SERENOA is also a NESSI project, so we plan to relate our work to the evolution of such platform. Lastly, the Future Internet initiative is a large scale strategic initiative, thus we deem important to position the contribution of our project in it.

We have also carried out an analysis for identifying the existing projects more relevant for SERENOA, and provide a short discussion about the possible synergies can be activated with the identified projects.

2.1   Service Front Ends Working Group

The Services Front End (SFE) Collaboration Working Group (http://sfe.morfeo-project.org/) aims to set up a collaboration schema among projects in order to effectively deliver: i)a common vision on the technologies and architecture associated to Service Front Ends in the future Internet of Services; ii)open specifications and, potentially, open source reference implementations of components in the envisioned architecture.

Then, the SFE Collaboration Working Group aims to provide a playground for collaboration between projects in this field, addressing evolution of current front-end web technologies and following possible standardization of results. As a first result of this collaboration, the SFE Open Alliance (http://sfe.morfeo-project.org) was launched in order to define an open reference architecture for the

front-end part of the future Internet of Services, through setting an open global alliance aimed to effectively

deliver a common vision on the technologies and architecture associated to SFE. Some SERENOA Partners (SAP, Telefonica, ISTI, UCL) already joined the Open Alliance on Service Front-Ends. They are currently collaborating to the SFE WG discussing with experts of other FP7 Projects belonging to this group for creating a research agenda for this area. They also plan to continue to actively participate in the SFE Collaboration WG, by presenting the SERENOA project and delivered results, and discussing with other projects issues and solutions in design and development of context-dependent interactive applications, and

ideas for future projects. In addition, apart from exchanging ideas and concepts, they might also envisage possible exchange of deliverables and even tools between projects, in order to make this collaboration more focused and concrete.

2.2   NESSI Platform

The mission of the Technology platform NESSI (Networked European Software and Services Initiative) is to develop a visionary strategy for software and services, which should be driven by a common European Strategic Research Agenda, where research innovations and business strengths work in close collaboration to

define a common result, namely the NEXOF concept (the NESSI Open Service Framework). Within this initiative it is relevant to mention the NEXOF-RA IP Project (http://www.nexof-ra.eu/), whose goal is to address service-oriented software system architectures and specifications and build a Reference Architecture for the NESSI Open Framework - ranging from the infrastructure up to the interfaces with the end users.

SERENOA was submitted as a NESSI labelled project. However, currently the NESSI platform is under reorganization and we need to better understand how it will evolve in order to propose how SERENOA can collaborate with it.

2.3   Future Internet

SERENOA followed the European initiatives around the Future Internet area. Within such initiative, the project is particularly interested in participating in the discussion regarding what research challenges are associated with the Future Internet Architecture and functionalities, especially those related to context-aware adaptation.

There has recently been a call for projects in the Future Internet area: the core platforms and a number of use cases. TID and SAP are members of the consortium involved in developing the design of the core platform. Thus, we plan to analyse in the near future how the SERENOA project can contribute in the design of some parts of the core platform for Future Internet.

2.4   Relevant EU Projects

We have carried out an analysis of what can be the most relevant EU Projects in the area of SSAI (Software & Service Architectures and Infrastructures), which could be of potential interest for SERENOA Project. In this section we provide key information about them.

2.4.1   HOLA!

HOLA! aims at supporting the research community in the creation of a critical mass of SSAI stakeholders working together in building concepts for services in the Future Internet. It will be achieved by implementing successful mechanisms for long-term collaboration and knowledge management. In particular, HOLA! is especially focused on providing effective collaboration mechanisms by managing existing ones (e.g. organisation of workshops, and the European Community for Software & Software Services website) as well as enhancing them in order to overcome their main limitations. In this way HOLA! will help increasing the visibility of projects in the area of SSAI (and outside), so maximizing their impact and contributing to raising consolidated knowledge from the European Research Projects within the SSAI area.

This Project could be relevant for SERENOA since it could help us to disseminate our results related to the Internet of Services and also link us with other possible interlocutors in the EU economy (e.g. SMEs) and

society (e.g. potential users).

Further info at: http://www.eu-ecss.eu/

2.4.2   I2Web

The I2Web Project, for its prototype work, will focus on three application domains: Web 2.0, Ubiquitous and Mobile Web, and IPTV/iTV. Their work is based on the latest accessibility and mobile Web standards. This should provide both industry and the public sector with tools and frameworks that support seamless accessibility integration in distributed development environments.

These objectives are expected to be achieved by developing user models based on existing accessibility standards and combined with an analysis of user requirements for people with special needs and older people in relation to ubiquitous Web 2.0 applications, in which multimodality and delivery context are key components. In addition, I2Web Project plans to extend existing device models, to cope with the needs of other devices, and such models will also include assistive technologies and mechanisms to modify themselves according to different user characteristics. Moreover, I2Web will develop open information models and generic application abstractions, that can deal with information aggregation, cloud computing applications, Semantic Web and mobile/ubiquitous Web 2.0 systems. Finally, I2Web will implement feedback mechanisms of compliance results to be integrated into existing development environments, which will provide to users, developers, and managers information on accessibility and usability issues of their applications. This information will be integrated into their standard development workflow and will be implemented via Service Oriented Architecture components.

Since our SERENOA Project will also investigate on adaptation taking into account the characteristics of users, we could discuss with I2Web consortium the effectiveness of our delivered methods and techniques when considering specific categories of users like people with disabilities and the elderly, to the aim of developing inclusive Future Internet services.

Further information at: http://i2web.eu/index.html

2.4.3   MobiWebApp

The MobiWebApp Project supports the use of Web technology for developing mobile Internet services. One of the goal of this Project is to increase awareness of W3C's work on Mobile Web Applications in Europe's software industry and mobile Internet services domain, as well as to increase the number of developers capable of developing applications for the Mobile Web. Indeed, European application developers (especially in SMEs) need to be targeted in order to be trained to create mobile Internet applications that are Web-based, rather than using traditional native programming languages: the costs will be reduced while increasing the speed of development.

A further objective is to provide more extensive test suites for mobile Web application standards, since today's Web browsers and runtimes contain a range of incompatibilities, often caused by lack of standards conformance. To this aim, MobiWebApp Project aims at doing more extensive test suites covering a higher percentage of Web standards in order to increase the level of standards conformance.

Finally, an additional objective for this Project is to further strengthen European standards activities in Mobile Web Applications, in order for Web application technology to become a viable platform for developing mobile Internet services. This standardization activity should be targeted at Web browser manufactures, big European actors/industries, as well as European SMEs who need to be specifically targeted to increase their participation in standards efforts.

Relevant collaborations with this Project could be put in action by our SERENOA Consortium regarding the development of best practices for the mobile web (such collaborations could be also facilitated by the fact that W3C belongs to both the two consortiums).

Further information at: http://mobiwebapp.eu/

2.4.4   OMELETTE

This Project aims at researching on the development, management, governance, execution and conception of converged services with a specific focus on the telco domain. In particular, among the OMELETTE objectives there are:

1. *Define extended usability concepts for end-user service creation*
   To this aim OMELETTE will focus on: i)Human-centric composition concepts: end users are expected to have different strategies for creating services than implementers that need to be inspected an accounted for when designing a mashup editor; ii)User requirements for service features: services may be used in different contexts that require a different set of features and interfaces to other services; iii)Cognitive concepts for goal-based search: goal-based search is dependent on contexts and intentions which requires models that define a plausible mapping of the services.

2. *Define and provide an open interoperable service platform for converged mashup services*
   One problem of currently mashups (e.g. Yahoo Pipes or WSO2) is that they are tied to one mashup platform and, hence, portability is not guaranteed. OMELETTE will therefore research on i)the specification of a mashup reference architecture through the use of typical modules, concepts and technologies (e.g., RESTful services and the SOA) that characterize the mashup world; ii)the definition of a description language for mashup services and properties, covering both the sources to be mashed up and the final mashups; iii)the specification of a standard proposal that will aim at interoperability and portability of mashups and mashup sources (e.g., widgets) among multiple

platforms. All these items aim at enhancing portability and interoperability among different vendors and versions, providing mashup re-utilisation across mashup platforms (focusing on both design time and runtime).

3. *Research on innovative approaches on converged service engineering integrating telecommunication capabilities in multimodal mashup-based interaction.*

Telco application development has a very different development life cycle than web applications. OMELETTE Project will research software engineering methods that enable the development of converged services, providing a multimodal interface, taking into account its multi-device access, and a special focus on engineering for service evolution and mashing up, namely the possibility that in an open environment, services should be engineered with the ability to be integrated with other available services, and be evolved by end users thanks to its simplicity. In particular, the OMELETTE project will research on several types of services for mashup:

   a. *Web services*: Omelette will research on the combination of web services (like e.g. Google Maps or Yahoo Pipes) -whose usage has proven a successful engineering method for speeding up development- with real time services.

   b. *Speech services*: This project aims to research on the convergence of speech mashup services (AT&T WATSON) in a standard mashup platform, allowing the interaction among other kind of services.

   c. *Multimedia streaming services*: OMELETTE will research how to mashup these services (like e.g. video call, video on demand, living broadcast, online music, IPTV) and how they can be composed.

4. *Research on the relationship of widgets and mashup technologies, taking into account governance and security issues*

W3C Widgets 1.0 provides a first public specification of widget technology. OMELETTE will research providing facilities for widgets to be used in mashups, taking into account their security model, interaction and update needs. In addition, OMELETTE will research how device-specific capabilities (e.g. GPS, SMS, address book/PIM) can be incorporated into mashups, working with emerging specifications such as W3C Device API and Policy and OMTP BONDI.

5. *Enable automatic service description and discovery in order to provide automatic mashup composition in an open Future Internet of Services*

Current composition techniques, such as piping and wiring, are static. Services cannot evolve and they cannot adapt to the failure of one component. On the other hand, full dynamic composition can provide a changing and unfriendly environment for end users. OMELETTE will research on automatic service description, based on lightweight semantics, which should allow easy and dynamic composition techniques.

Interesting discussions could be envisaged between our Project and the Omelette consortium, especially as far as adaptable, end-user mashups/compositions (and related usability) are concerned.

Further information at http://www.ict-omelette.eu/

2.4.5 SEQUOIA

The SEQUOIA support action measure the potential impact of already funded projects by developing a sound socio-economic methodology for the measurement of this impact.

SEQUOIA will emphasise the self-assessment, rather than the evaluation, of research projects in the area of Software as a Service and Internet of Services (SaaS and IoS). SEQUOIA aims to support research projects in maximising their socio-economic impact through the application of a self-assessment methodology that the projects should be able to adopt and apply on their own.

While the principal aim of SEQUOIA is to maximise the impact of SaaS and IoS research projects, and also support the transfer of results to SMEs, to reach this objective the SEQUOIA partners deemed it important to firstly measure the potential impact of already funded projects. This will be done by developing a sound socio-economic methodology for the measurement of this impact.

Secondly, it was deemed necessary for the methodology to be applicable by new projects on their own, without the help of this support action. Therefore, methodology will be applied accordingly to 25 projects launched under Call 1 of the FP7 ICT Programme, and then, after optimization, be communicated to the projects that will be funded in Call 5 of the same Programme.

In this way, the new projects will be able to self-evaluate their potential output in terms of socio-economic benefits, and possibly re-orient their activities in order to improve such impact.

Whereas the NESSI platform has in principle addressed in a comprehensive way the essential aspects of technological interoperability and architectural harmonization for the SaaS domain, and is well-placed to do the same for the emerging Internet of Service (IoS), Internet of Things (IoT) and Internet of Content (IoC) areas of the Future Internet, many practical obstacles remain.

The clearest challenge is how to move from the collaborative context of EU projects to the competitive context of the marketplace. Market institutions by themselves struggle to provide adequate support for the large variety of private players and economic agents as they leave the shelter of public funding, especially in the context of the growing importance of the Knowledge Economy in the Future Internet.

Then, it is in this context that 25 projects will be studied by SEQUOIA, namely 24 IPs/STREPs, and 1 Network of Excellence. In addition, 3 Support Actions have been funded under Call 1 of the FP7 ICT Programme.

When SEQUOIA starts, these projects will have completed their second year of activity, so that this support action, with the help of the European Commission, will be able to support them when they will enter their maturity phase where their results will first be made available.

Regarding this Project, it is worth mentioning that SERENOA members have been already contacted by SEQUOIA consortium and have participated to the the 1st Focus Group organized by that Project in

February through audioconference tools.

Further information at http://www.sequoiaproject.eu/

2.4.6 SOCIETIES

The goal of SOCIETIES is to improve the utility and scope of future Internet services by merging social and pervasive computing through the design, implementation and evaluation of an open scalable service architecture and platform for self-orchestrating Community Smart Spaces (CSS). This will be achieved through the following four key objectives:

- To facilitate the creation, organisation, management and communication of communities via Community Smart Spaces, where pervasive computing is integrated with social computing communities;
- To provide an enhanced user experience for both individuals and entire user communities, based on proactive smart space behaviour and dynamic sharing of community resources across geographic boundaries;
- To design and prototype a robust open and scalable system for self-orchestrating Community Smart Spaces;
- To evaluate, through strong involvement of end-users, the usefulness and acceptance of the developed CSS software via three user trials with three radically different types of users: *enterprise users, students, disaster relief experts.*

Collaborating with the SOCIETIES Project could lead us to broad the consideration of users from *single* users to dynamic *communities* of users, and therefore to better cover specific aspects of the context in adapting applications (e.g. context dimensions like the current social environment of the user).

Further information at: http://www.ict-societies.eu/

2.4.7 SOFI

The goal of SOFI is to complement EU R&D projects in the area of Internet of Services, Software and Virtualisation (Objective 1.2) through specific support activities. SOFI aims to ensure the position of European research as a leader in the definition and realisation of the theoretical and technological foundations of the Future Internet of Services, as well as European industry's competitive advantage in the creation of value and new opportunities from its use. SOFI will build upon and complement the current efforts around the Future Internet Assembly, and particularly the service related working groups, most specifically the Future Internet Service Offer WG (FISO).

The specific objectives of SOFI are:

- Support the organisation of the Future Internet Assembly, and in particular to pursue the activities of and further develop the Future Internet Service Offer. SOFI will lead the work of producing an annual book with results from the Future Internet Assemblies. This approach will be complemented by a further effort to coordinate European Future Internet activities with corresponding programs in the USA, Japan, and elsewhere, ensuring EU Future Internet initiatives related to software and services are timely and that European industry and society can be at the helm of the Future Internet.

- Support dissemination of the Internet of Services community results in order to strengthen and extend the impact of supported collaborative research projects, as well as to also help raise awareness among European businesses and public stakeholders of technological solutions enabled through the Internet of Services, and facilitate the steady and systematic adoption of these technologies.

- Implement the Future Internet portal and collaboration measures to ensure cohesion and alignment of strategies, objectives and results of projects and initiatives within the Future Internet initiative. In particular, SOFI will collaborate on an improved and regularly updated Future Internet portal, communicating results from the services community and publicizing technical solutions to the research and industry. Also, SOFI plans to participate in collaboration measures such as a European Vision on the Future Internet Architecture and roadmapping for FP8 research.

This Project could be relevant for SERENOA since it could help us to disseminate our results related to the Internet of Services activities.

Further information at: http://www.sofia-project.eu/

2.4.8 Webinos

The Webinos (previously called WAX) project will define and deliver an Open Source Platform and software components for the Future Internet in the form of web runtime extensions, to enable web applications and services to be used and shared consistently and securely over a broad spectrum of converged and connected devices, including mobile, PC, home media (TV) and in-car units. By promoting a "single service for every device" vision, Webinos will move the existing baseline of web development from installed applications to services, running consistently across a wide range of connected devices, ensuring that the technologies for describing, negotiating, securing, utilizing device functionalities and adapting to context are fit for purpose. Innovations in contextual description are meant to include device capabilities, network access, user identity and preferences, location, behaviourally induced properties and finally the more complex issue of the users' social network context and social media engagement.

Therefore, Webinos will boost the industry migration towards web-based services, by providing inter-operable, standardised, open source technology utilizable across domains with direct commercially exploitable value.

The strong focus of Webinos on interoperable and web-based technology of services which run consistently across a wide range of connected devices and contextual conditions make this Project a potential interlocutor for relevant discussions on related topics,

Further information at http://webinos.org/

2.5 Other Relevant EU Projects

2.5.1 Other Relevant EU Projects at ISTI

In the Call 1 projects ISTI-CNR was coordinator of OPEN (which also involved SAP) and partner in ServFace (coordinated by SAP and involving also W4). In OPEN a platform for migratory user interfaces was designed and developed. In that platform a first solution for desktop-to-mobile adaptation was developed. In SERENOA we are developing a novel solution for adaptation to another platform, the vocal one, which is acquiring an increasing interest given the improvements in the associated technology. In ServFace we developed an authoring environment for multi-device user interfaces: it exploits descriptions at various abstraction levels to obtain user interfaces for different types of devices: in SERENOA we plan to extend it in order to allow customization of the transformations, adaptation to the designers' choices, and generation of adaptive techniques. CNR-ISTI is also a consortium member of the SMARCOS project (http://www.smarcos-project.eu/), which is an ARTEMIS project led by Nokia Research and in which several companies are also involved (Philips Research, Indra, Honeywell, Barco, just to cite some). SMARCOS aims to support users of interconnected embedded systems by providing them with applications and services with a high level of so-called "*inter-usability*". This should be obtained by enabling devices and services to communicate through UI terms and symbols, exchange context information, as well as other information like user actions and semantic data. In this way applications should be able to follow the user's actions, proactively predict his/her needs, and react appropriately even to unexpected actions. Then, since in SERENOA Project we plan to build a platform aimed to support an effective adaptation onto different devices, we foresee the possibility to disseminate such results in SMARCOS.

2.5.2 Other Relevant EU Projects at SAP

This section summarizes the outcome of a first discussion in SAP related to finding out the synergies between SERENOA and OMELETTE projects. Apparently, it seems that for some components, both of the projects are doing similar kind of work, but targeting different domains at the same time at different levels. Also, since the targeted goals of both of the projects are different, a promising collaboration is apparently not evident. However, at a deeper level, we see a strong collaboration in terms of augmenting the area of applications of OMLETTE and vice-versa. On one hand, by the end, the OMLETTE project will provide us with:

- an open interoperable service platform for converged mashup services.
- concepts for end-user service creation.
- innovative approaches on converged service engineering by integrating the telecommunication

capabilities.

- building the relationship of widgets and mashup technologies by incorporating the governance and security issues.
- the ability of automatic service description and discovery for automatic mashup composition in open future Internet of services.

while on the other hand, the SERENOA project will provide us with:

- the new concepts, languages and tools to support multi-dimensional context-aware adaptation of Service Front Ends (SFEs).
- an intelligent runtime that takes care of adapting the SFEs to the particularities and variations imposed by the target context of use in its multiple dimensions.
- open adaptive system, which means that new adaptation plans (e.g. unplanned contexts of use) can be introduced during runtime.

By using the results of OMELETTE in SERENOA, we can devise a future healthcare scenario, which is an extension of one of the healthcare scenarios of the SCALLOPS[1] project.

Future Healthcare Scenario

Mikka spends his summer vacations in Portugal. Unfortunately, after one week in Lisbon he becomes seriously ill, suffering from a disease unknown to him. In this emergency situation, he activates his personal Health-SERENOA application (SFE) on his PDA with an integrated phone for help, as shown in Fig. 1. The SFE quickly finds and calls the nearest local emergency center in Portugal, and Mikka describes the observable symptoms of his disease. At the same time, his Health-SERENOA SFE transfers general, non-sensitive information about Mikka and his current location to the patient database of the emergency center. The local representative at the Portuguese emergency center quickly recognizes that Mikka's symptoms are very serious and strongly recommends him to immediately visit the nearest hospital. Hospital contact information including geographical map and how to reach the ambulance station are transmitted to Mikka's PDA by the Health-OMELLETE emergency center service. Mikka readily arrives at the hospital's ambulance station by taxi, passes his individual *Health Patient Card* (HPC) to the physician, and authorizes him to access his patient record. Mikka may decide whether he wants to get full treatment at the local hospital or at a hospital of his choice back home in Helsinki. In order to make a reasonable decision, Mikka uses his personal Health-SERENOA SFE on his PDA for appropriate assistance in this matter.

Given task and requirements, the Health-SERENOA SFE contacts the Health-OMELLETE service of Mikka's health insurance (HI) for approval of full coverage of travel and medical expenses in both cases. The HI service contracts the Health-OMELLETE service of an emergency medical assistance (EMA) company in Helsinki to investigate transport options and cost estimations with respect to the regulatory constraints of the

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[1] SCALLOPS Project; http://www.dfki.de/scallops

insurance fund. For this purpose, the EMA service plans a *composite service* to go home and have his treatment in Helsinki. Appropriate services in the network check the availability of regular or charter flights from Lisbon to Helsinki, accommodation and medical escort of Mikka to and from the airport, and the availability of a physician for Mikka's treatment at the hospital in Helsinki at the time of his arrival. Optional plans of patient transport and costs are reported back to the HI service, which negotiates options for Mikka's treatment with the local hospital service in Lisbon and pharmacy agents in the network for purchasing the required drugs for his treatment. All services involved use the information of some individual experience while handling similar emergency cases in the past. The results of both kinds of negotiations enable the HI service to make its decision through individually composed health care expense approval service of Mikka's insurance fund according to his membership status. In this scenario, the HI service confirms full coverage of expenses for local treatment and recreation in Stockholm, as well as return flight, but no emergency transport with escort back home.
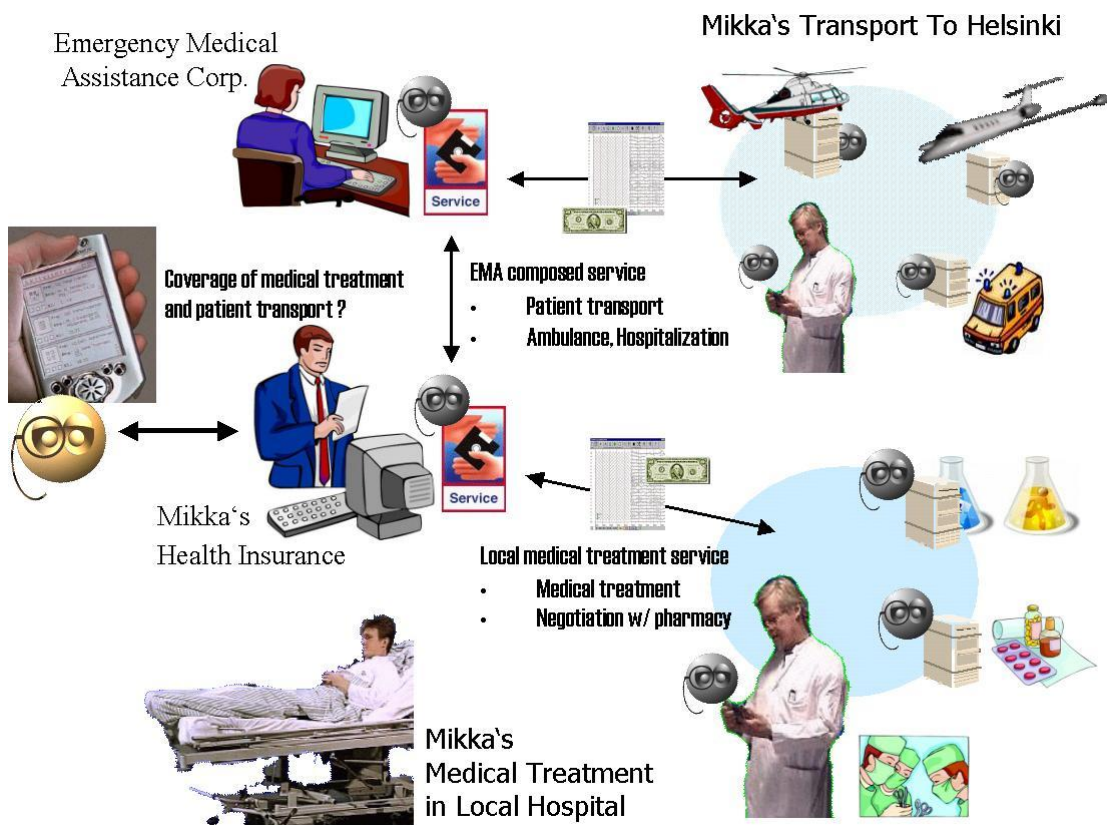

Fig. 1: Future Healthcare Scenario

Finally, after two weeks treatment in the hospital and one week of full recovery in a recreation area in the outer bound of Stockholm selected by his insurance fund, Mikka returns to Helsinki and continues his summer vacation with his family.

2.5.3 Cost Action Proposal

Another action involving some SERENOA partners (CNR-ISTI, UCL, W3C) is a COST action proposal with the goal to harmonize the ongoing research on abstractions, languages, and integration mechanisms as well as to provide bridges via a cross-domain knowledge exchange in order to increase research efficiency across the boundaries of research projects and national boundaries within the EU. The proposal preparation is coordinated by Gerrit Meixner (DFKI).

Currently, research in these fields is fragmented into groups focusing on different abstractions, languages and tools. These groups are parts of larger, mostly disjoint communities (e.g., human-computer-interaction, software engineering, design) each with their own e.g., scientific publications, conferences. Their communication and co-operation needs to be improved by providing a new networking platform. A COST action is the best option and an ideal tool to achieve this goal, as the research of the groups planning to participate in the Action is already funded by European research programs and national funding agencies. Needed is additional funding for cooperation and exchange to overcome the fragmentation of the field, co-ordinate the research, and foster collaborations.