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

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Serenoa Roadmap

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Executive Summary

This document is to provide an overview for the definition of the roadmap of the SERENOA technological and research issues. In particular, the document provides some insights on the current scientific and technological trends/challenges that partners have judged relevant to be reflected in the roadmap of the Project. Then, this deliverable describes the vision and perspective that each member owns of the Project, as well as the contribution that each partner plans to provide in order to support its concrete realisation.

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1 Introduction

1.1 Objectives

The purpose of this document is to provide an overview of the planned SERENOA roadmap in terms of current scientific and technological challenges. In addition, it will provide an overview of the perspective that each partner individually owns of the Project, as well as their expected contribution. Since various versions of this document are expected to be delivered in during the lifetime of the Project, the proposed objective is to define, from time to time the priorities in the research and development of the technology through the different cycles of the project. So, at the end of the project this roadmap document will reflect the outstanding challenges and the future research work to be done.

1.2 Audience

This document has a public dissemination level, so theoretically it is open to public consultation by the general public. However, a key audience is represented by Project reviewers and officer, as well as any researcher/scientist who could be interested in the topics addressed by SERENOA.

1.3 Organization of this document

The "Abstract" Section provides some summary information about the main content of the document. Then, Section 1 ("Introduction") gives some related information about this Deliverable (e.g. objectives, planned audience,..). Section 2 ("Current Trends") describes the main trends -both scientific and technological- that we are currently facing, while Section 3 is dedicated to the vision that each partners owns of the Project. Section 4 provides some conclusions and in Section 4 ("References") pointers to relevant works can be found.

2 Current Trends

2.1 Current Technological Trends

The technological trends relevant for the SERENOA project are those related to:

- Interactive devices in the mass market;
- Software for service front ends;
- Software for adaptation in service front ends (including authoring tools);

In terms of interactive devices there are two main trends:

- people are going to use more and more devices. Thus, the number of devices per user is going to considerably increase (see Figure 1).
- the interaction capabilities of the available devices will increasingly vary, because some current devices will increase their capabilities and new interaction devices are becoming available in the mass market.
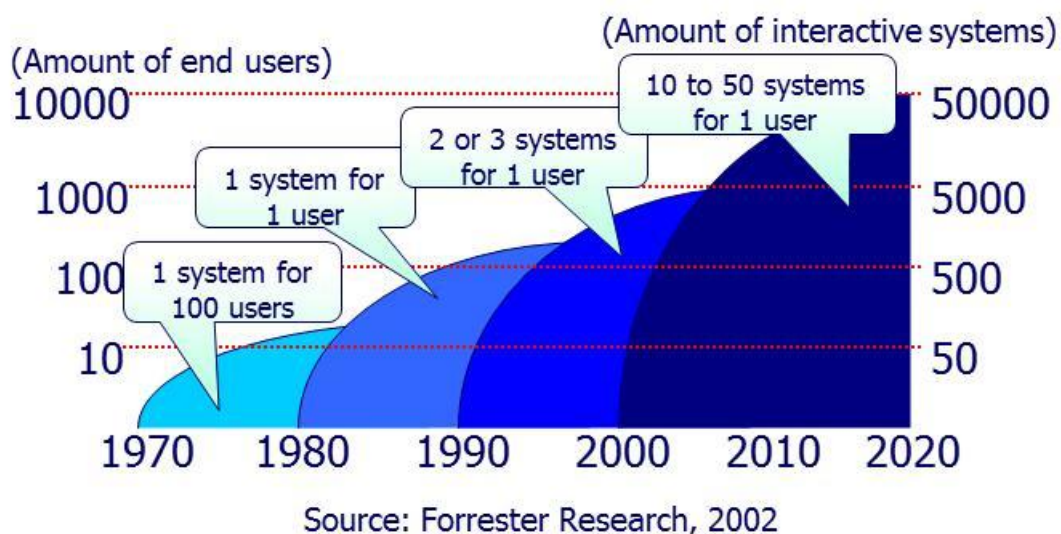
Figure 1: Expectation of number of device per user in the next years.

In the area of interactive devices in the mass market in recent years there has been an explosion of smartphones, with increasing screen resolution, supporting touch-based interaction, and various sensors (GPS, accelerometers, …). This trend seems oriented to continue in the next years. According to the Moore Law screen resolutions will further increase in mobile devices, even if the screen size cannot increase too much in order to continue to be easily manageable by the users. The quality of the experience of applications on these devices, which can exploit location, motion and other contextual information in their behavior, is leading customers to interact preferentially through mobile devices.

The technology associated with vocal modality is steadily improving as well. This modality is important because it allows users to access their applications when the visual channel is busy (e.g. when driving) or when they are visually-impaired. Various mobile devices support speaker independent vocal interaction (which thus does not require training in order to be used), and both vocal recognition and synthesis are becoming more and more accurate. This makes possible services such as vocal searches and map navigation by Google or others. Vocal interaction has some fundamental limitations, such as it is problematic in noise environments or when the user has for some reason speaking difficulties. Thus, we expect that it will be often used in combination with some other modality.

A platform that seems going to play an important role in the near future is the digital TV. Indeed, TVs are more and more used with large screens (from 40 inch up) and they are going to be integrated with Internet connections. Thus, we can expect that soon it will be possible to have multiple windows on the TV, some associated with broadcast programmes and some with local interactive applications, and some with Web applications.

As shown in the following Hype Cycle, Interactive TV and Speech Recognition are having a high-growth adoption phase, with a larger share of potential audience that is adopting the innovation.
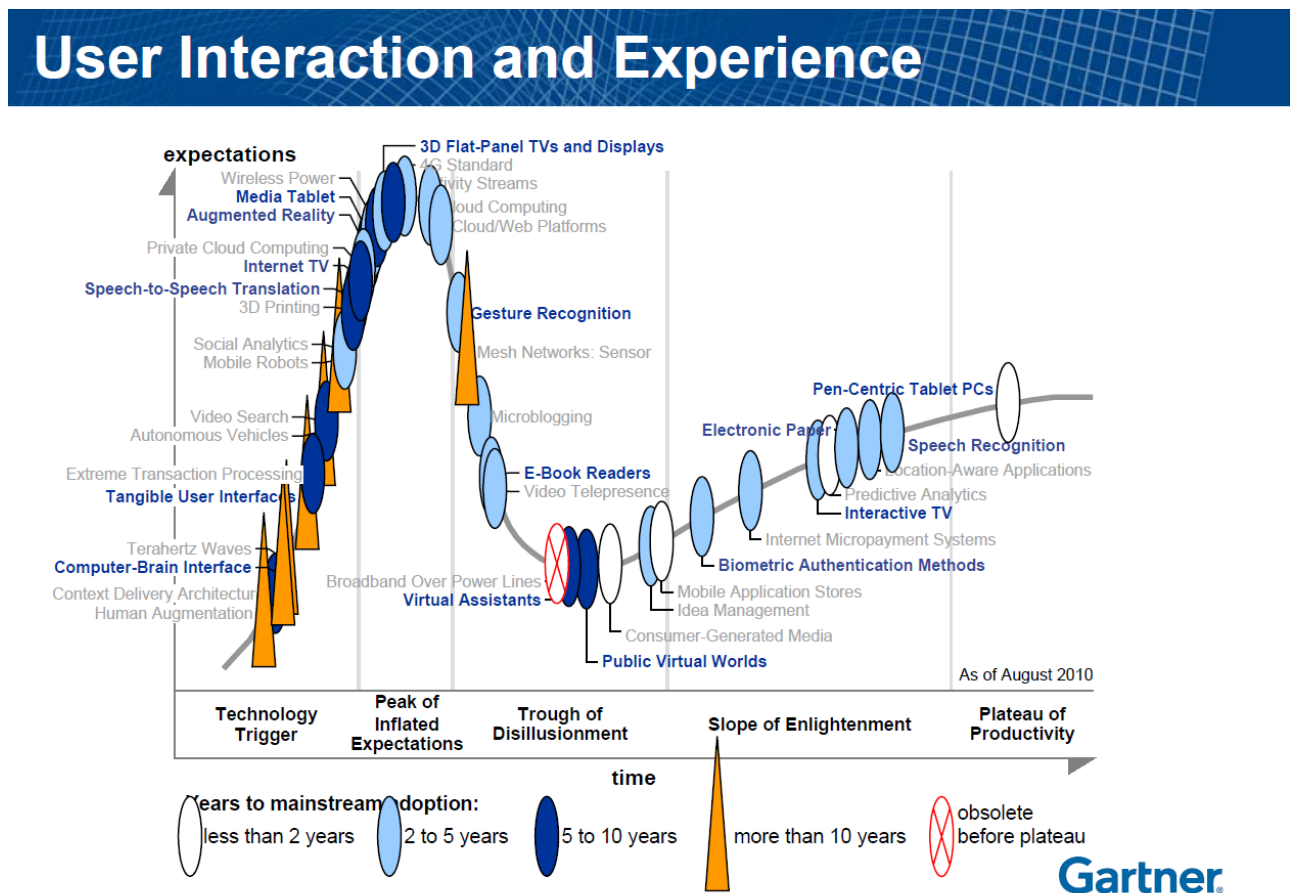

Figure 2: User interaction and experience Gartner emerging technologies Hype Cycle 2010.

Regarding software for service front ends there have been a number of evolutions stimulated by the

evolution of the available interactive devices and by the increasing familiarity with information technology by most citizens.

A contextually aware system anticipates the user's needs and proactively serves up the most appropriate and customized content, product or service. Context-aware computing centers on the concept of using information about an end user or object's environment, activities connections and preferences to improve the quality of interaction with that end user. The end user may be a customer, business partner or employee. Gartner predicts that by 2013, more than half of Fortune 500 companies will have context-aware computing initiatives and by 2016, one-third of worldwide mobile consumer marketing will be context-awareness-based. Since context-awareness means the ability to adapt to the various dimensions characterizing context, this implies that adaptation will be a key issue in the near future.

In terms of software for service front end adaptation we can notice that there is an increasing number of interactive applications providing some level of adaptation to the potential user interests. In some cases it is adaptable support, in which users select some predefined profile and then receive content and navigation accordingly. In other cases, it is adaptive support, in which the application automatically changes some content and/or navigation according to automatically detected users' interest (typical example, e-commerce applications indicating "those who bought this product also bought …").

Adaptation to the device can be carried out according to various architectural solutions (see Figure 3). In one case the adaptation logic is in the applications server, but this implies to duplicate it in all the applications considered. In another case there is a single adaptations server through which all the applications should be accessed. In the final case, the adaptation logic is on the client side. This implies that the client device is sufficiently powerful (in terms e.g. of memory, processing power, operating system, etc.) , to support its processing.

Application server-side adaptation

Server ← Request/Device capability → **Client**
Adapted Content

Proxy-side adaptation

Server ← Request — **Proxy** ← Request/Device capability
Content → Adapted content →

Client-side adaptation

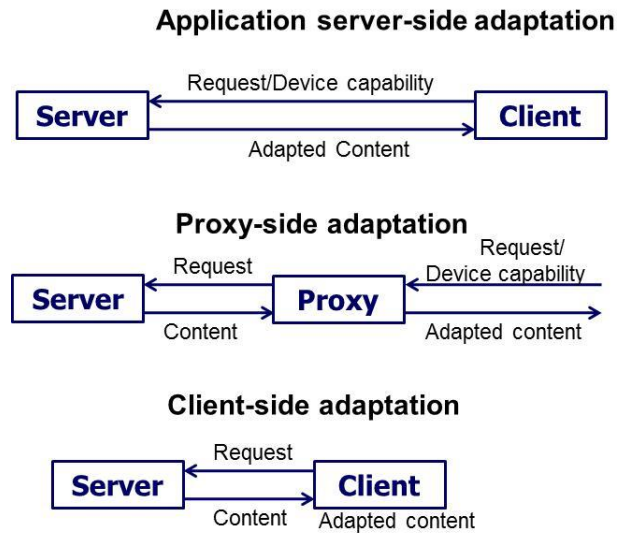**Server** ← Request — **Client**
Content → Adapted content

Figure 3: Possible adaptation architectures.

2.2 Current Scientific Trends

Recent progress in global digital technology has contributed to the impetus towards ubiquitous computing research with the aim of facilitating users' everyday activities through intelligent and widespread services and applications. The pervasiveness of technological equipment integrated/embedded into the physical environments in everyday life has, over recent years, produced a radical change in perspective. For instance, traditionally, the goal of interactive systems has been to help users in performing a task. Currently, the increasing and massive affordability of new devices and technologies available in disparate contexts and to different groups of people, as well as the diffusion of social networks and communities, have stimulated a shift in emphasis towards user interfaces that are not only task-oriented but also more natural, intuitive and accessible to all, as well as able to take into account aspects of human being that were not considered before like fun, pride, pleasure, surprise, intimacy, joy. The HCI research community has taken in such changes and so we are observing a number of key scientific trends and challenges in different directions:

Evaluation methods for assessing UX in ubiquitous environments

The conception of usability has been evolving, along with the emerging IT landscape and the ever-blurring boundary of the field of Human-Computer Interaction. User eXperience (UX) is broadly defined, including attainment of behavioural goals, satisfaction of non-instrumental (or hedonic) needs, and acquisition of positive feeling and well-being. However, there is limited understanding of how to design for and especially evaluate UX, particularly for ubiquitous computing, where the approaches and tools are still inadequate, since they mainly come from traditional usability evaluation. However, user experience is radically different

from usability. Indeed, the latter is characterized as task-oriented and performance-based, through the three canonical usability metrics – effectiveness, efficiency and satisfaction – which show as not appropriate to give a measure of what users actually feel about a system. As a consequence, classical quantitative usability indicators derived from lab settings evaluations (e.g. the number of errors, the duration of a task, etc.) are not enough for assessing user experience, which is characterised by being very subjective and deeply contextualised. Therefore, there is a need of new methods and approaches able to analyse cross-platform user experience in a holistic manner and considering users within their natural environments.

Adaptation

As hardware vendors produce novel technologies and devices which seamlessly appear in the marketplace and the computing technology moves away from a work and task-oriented tool towards a ubiquitous life support facility, a number of efforts are being made by researchers and practitioners to provide effective support to users who expect to interact with effective user interfaces thorough (even a group of) platforms and in different contexts. However, due to the radical differences that exist among such devices, there is a consequent substantial unfeasibility of solutions that aim at implementing ad-hoc user interfaces for them. Indeed, interactive devices are increasingly distributed in a wide spectrum of everyday life environments, have diverse form factors (from very small screen devices to surface computers) and portability characteristics, support a variety of interaction techniques and modalities (from tangible user interfaces, to wearable computers) can be used by a variable number of users who often expect to exploit them to access their applications regardless the device they currently use and the physical (and social) environment in which they currently are. Therefore, a trend to build UIs that adapt to the current context of use is emerging as ever before. This could lead leads to systems able to dynamically monitor and gather information on the context of use from a broad range of sources, analyse the gathered data and, even using machine-learning techniques, infer and learn new interaction patterns and incorporate them within intelligent and flexible algorithms and policies able to offer intuitive and adapted user interfaces also through an effective exploitation and integration of different interaction modalities. Sophisticated adaptation strategies can include the redistribution, migration or multi-modal reconfiguration of user interfaces.

End user programming

In general, the users of ubiquitous environments will be people familiar with the basic functionality and interfaces of computers who want to have more control over their environments, even if they are not software experts. Over the next few years, the goal of human-computer interaction will further evolve from making systems give a positive user experience to making systems that are also easy to develop. However, developing new or modified applications that effectively support users' requirements still requires considerable expertise in programming that cannot be expected from most people. Thus, one fundamental

challenge for the coming years is to develop environments that allow users who do not have a background in programming to develop or modify their own applications. End User Development (EUD) involves the design of systems that support modification by their users, aiming at creating from scratch or modifying an existing software artefact. Some forms of EUD have found widespread use in commercial software: e.g. recording macros in word processors, setting up spreadsheets for calculations and defining e-mail-filters. In the SERENOA area it would be important to introduce tools able to allow end users to customize the underlying adaptation rules in order to obtained more effective user interfaces.

(Model-based)Tools development

Over the years, user interface development tools have improved their support to designers and developers by offering enhanced visual support, more intuitive and effective development features, an increased number of UI elements and integrated guidelines, and increasing degrees of automation and flexibility which have overall substantially lightened their work. However, the advent of several different devices for which UIs have to be developed, highlighted a lack of effective cross-platform development toolkits able to make developers effectively manage the diversities of the various platforms at hand has arisen. For this reasons, higher-level model-based tools have already shown their potentialities in adequately managing issues connected with diversities in the considered target devices through the use of logical abstractions which abstract out the various hardware resources available and better focus on the interaction semantics. However, such tools are mostly visual tools: new techniques should be identified in order to allow designers/developers to more intuitively and effectively analyse and understand the resulting UI behaviour under development, even when diverse, non-visual modalities (e.g. speech and gestures) are included. In addition, such tools still have to be equipped with an increased agility, which could be a relevant factor for their larger adoption. Such tools will enable designers to develop and modify applications using familiar modalities, such as natural language, sketching and drawing.

Mobile Accessibility

The rapid aging of the population has made the elderly as a crucial aspect to consider, not only for a demographical viewpoint, but also for other IT-related implications. One of this is the need of accessible user interfaces, whose availability has been increased especially due to the stronger support and the role that standards, regulations and laws have recently played in various countries. However, one aspect that has been neglected so far regards enhancing accessibility on mobile devices. Indeed, the elderly have some various impairments (e.g. loss of visual acuity, motor control and coordination, etc.), which come to be as especially problematic for operating mobile devices, since such computing platforms might have quite small form factors and could require a dexterity that some people might not have. This problem can be easily generalised in the bigger scenario of improving the design of mobile devices for everyone (not only for people with

specific cognitive/physical impairments). Therefore, the availability of more accessible mobile applications is needed: this can be obtained also through the provision of suitable toolkits able to support accessibility through integrated UI guidelines and assistive technologies.

Social computing

As computer and network technologies become more pervasive, new challenges have emerged, requiring approaches that are able to go beyond the consideration of isolated users interacting with their systems, but rather effectively support the design of collaborative environments enhancing human-to-human communication and sociability in different contextual settings. Some of such systems have already successfully taken in such new emerging users' needs (an example of this is Facebook). However the consideration of all the aspects that could affect the new virtual social contexts in which users' interactions take place, have not yet included in an integrated and consolidated approach to designing for communities, able to take into account all the multifaceted related implications, one of the most critical one being the consideration of privacy aspects (as such social platforms extensively use personal data). Thus, it becomes important to consider social aspects in authoring environments to facilitate development of social interactive applications and also because the development process can benefit from social interactions among designers and developers.

3 SERENOA Roadmap: Partners' Vision and Expected Contribution

3.1 SAP Vision and Expected Contribution

This chapter describes the SAP vision and contribution, which is classified into four categories, namely the vision and contribution regarding the integration, the user experience, the business and general topics.

Talking about the integration part, SAP will provide a warehouse management prototype for logistics (WP5, Task5.2 Prototype Development). This prototype will be integrated as a demonstrator into the Retail Center situated in Regensdorf, Switzerland, which is a public place and can be visited by populace (academia, politicians, etc). Further, the CARFO ontology will be carved and populated, and the AAL knowledge will be captured (WP2, Task2.3 AAL Knowledge Capture and CARFO Population). As an outcome from the work package 4 (Task 4.5 Authoring environment and development tools) SAP will develop an authoring tool (executable code) and put emphasize on a strong visual interaction, an integration of guidelines and provide useable standard UI elements. The applications, which will be created with the authoring tool, need to be adaptive and platform-independent: they should run for instance on the iPhone, the head mounted display (HMD) and on a desktop computer where the system is automatically adapted. Thus, SAP will provide a platform-independent adaptation, as well.

Other topics, on which SAP will concentrate on, are:

- Gesture Recognition
- Wearable Platform
- Ambient Intelligence
- Bayesian Reasoning
- Extension of the Picking Scenario
- Exploitation of Ontology-based UI Integration
- Augmented Reality

Regarding the user experience SAP will run requirement analyses (functional, non-functional and business requirements) and evaluations of the prototypes (WP1, Task1.1 Identification, elicitation and analysis of requirements). Hence, a close cooperation with the end-users is very important. Additionally, new interaction concepts will be devised by means of finding design patterns and try to standardize them.

From the business perspective a market and competition analysis will be conducted and an overall exploitation strategy of the research results will be prepared (WP6, Task6.1 Exploitation Actions). SAP also contributes to the dissemination plan from the work package 7 (Task 7.1 Dissemination Actions).

General topics the SAP wants to focus on, is working in an agile mode and gaining a fundamental basis in order to define an agile methodology that supports the development of service front-ends (WP3, Task 3.4 Agile methodology for developing adaptive SFEs). Further, SAP will collaborate with the Omelette project (Reference) regarding the health care scenario.

3.2 TID Vision and Expected Contribution

TID's vision and expectations in the Serenoa project are to produce Multimodal, Multidevice and Multitask graphical user interfaces for Serenoa Scenario and generate a new definition of context-sensitive reference architecture. These targets will produce the development of a prototype of the scenario, which will show the following performances:

- Designed for Smart phones, tablets, interactive wall touch screen GUI for scenarios.
- Adaptation to users of different context in different tasks; optimize utility/usability characteristics.
- Selecting the user of the different ways of accessing the applications, adapting it to the use context of the scenario
- XLM Schema for the specification

As a global task, TID is involved in integration Works of the GUI and the Multimodal Interface.

TID contribution is linked regarding the integration and the user experience with multiple device and multimodal topics, besides the adaptation to users from different contexts.

In the integration part:

TID will provide a Multitask, Multimodal and Multidevice Home prototype for Home Tasks including e-Health tasks (WP5, Task5.2 Prototype Design and Development). This prototype will be part from the first beta release of a domestic product with an application of medical telecare (Telefónica I+D technology pilot SARA, Costa del Sol Hospital (Marbella)) that currently does not include either a multimodal or a multidevice interface and at the moment, it has not context-adaptative performances. This product will be the first of its type in being integrated in Telefónica Showrooms as the Flagship Store.

Concerning the User Experience:

- TID results will highlight a strong visual interaction, what it is a primary interest in SERENOA developments.
- TID will run requirement analyses (functional, non-functional and business requirements) (WP1, Task1.1 Identification, elicitation and analysis of requirements).

And regarding the adaptation to users from different contexts WP4:

In the future, an XML structure (WP3, enriched context of use (Environment, User, UI service, Situations)) will be defined. This structure will enrich the user context in the different applications developed in Serenoa.

- Another TID interests that could be included in Serenoa are:
- Experimentation with different devices
- Application of different user access ways to their applications
- TTS
- Speech Recognition

- Small and big format touch screens in different context, walls, tables, Smartphone screens, etc.
- The use of Avatars in visual interaction, where the avatars use expressiveness and gestural interaction to improve the quality of the message given to the user.
- Ambient Intelligence

TID also contributes to the WP6 (Task 6.1, Exploitation strategies) and WP7 (dissemination plan (Task 7.1 Dissemination Actions)).

3.3   ISTI Vision and Expected Contribution

Within the SERENOA Project the ISTI contribution will be oriented towards some main directions which are basically, context management, evaluation and adaptation languages and tools.

The first one is the provision of a Context Runtime Infrastructure (Task 4.4 Runtime infrastructure for the context of use), which will offer to the other components of the architecture up-to-date information about the context, so that appropriate adaptation techniques will be put in action. ISTI plans to model a rich set of context information (which could be gathered from a variety of sensors and technologies regarding various aspects, such as location (through GPS, RFIDs, WLANs, ...), environment (light, noise, ...), privacy (people

nearby, ...), device description repositories, ...) and by using logical specifications, which can be described by using XML-based languages, so as to more easily manipulate it by automatic tools. The Context Management Support is expected to include rich information on various aspects of context (the user, the environment, etc.) and be able to dynamically update the contained information so that the adaptation techniques that will be identified in the Project can effectively exploit them.

Another direction on which ISTI is expected to provide its contribution regards the *evaluation*, by i)providing a number of criteria to be used for evaluating the effectiveness of the context-aware adaptation that will be considered within the SERENOA Project; and ii) by evaluating both the developed prototypes and the introduced methodologies for context-aware SFE development (Task 5.3).

Regarding *adaptation*, ISTI contributes in the definition of a high level description language for expressing Advanced Adaptation Logic (Task 3.3: AAL-DL: Semantics, Syntaxes and Stylistics). This language will be targeted both to avoid writing code to express such a logic and also to allow domain experts without programming skills to create their own adaptation rules. The transformation language will exploit user interface descriptions at various abstraction levels in the MARIA language or in one of its evolutions. In terms of tools CNR-ISTI is working on a solution for automatically adapting Web sites for vocal navigation. This is adaptation can be obtained through rules that can be customized by designers.

3.4 W3C Vision and Expected Contribution

W3C could contribute to the development of demonstrators for Serenoa with practical implementation skills for Web application development for both client and server side components. Some particular aspects of interest include:

 * Mechanisms for discovering device capabilities

 * Mechanisms for detecting and signalling a change of context

 * Gestural, representational and intentional events

Where practical this should build upon existing standards or ongoing standards work at W3C, e.g. the Web Events Working Group, see [1]. It is envisaged that the Serenoa reference framework could be realized as a mix of client and server side components, for example, JavaScript libraries that map the Serenoa abstractions to the interfaces deployed in HTML5 Web browsers, together with server-side scripts that hide the implementation details for signaling changes across distributed applications.

In addition, W3C could contribute to enabling distributed live editing of the models for service front ends. This would be based upon mechanisms for real-time synchronization of changes to models, driven by mutation events. Finally, W3C could help with the development of editing tools that run within the Web browser using libraries that wrap UI components implemented with HTML, CSS, SVG and JavaScript.

[1] http://www.w3.org/2010/webevents/charter/Overview.html

3.5 UCL Vision and Expected Contribution

3.5.1 Vision

Our generic vision about the project consists in an intensive effort to produce resources that support the development of systems able to accommodate different scenarios of use, as well as wishes, needs and preferences of the users. The resources consist of (but are not limited to) methodologies, techniques, models, tools, languages and an adaptation engine able to receive context information as an input and apply pre-defined rules that prioritize this information providing appropriate outcomes (adapted interfaces).

The tools must consider context-awareness and a variety of application scenarios to perform adaptation. The adaptation must provide a high usability level.

3.5.2 Implementation Efforts

Our implementation efforts concern the elaboration of theoretical models: CADS and CARF, as well as a taxonomy to list context information, and adaptation rules in different abstraction levels, using machine learning concepts, such as Bayesian inference.

The CADS describes possible dimensions and levels for adaptation, the CARF organize adaptation

techniques regarding context information. In this sense a taxonomy is being elaborated to list context information regarding user, platform and environment, and a template is being filled for each adaptation techniques gathered. The adaptation rules will consider context information in order to adapt the applications aiming a better interaction, and considering the preferences, wishes and needs of the user in a given moment.

3.5.3 Expected Results

We expect the project to advance research and development in the domain of context-aware multi-dimensional adaptation. Mainly, the project contributions concern theoretic models, languages, engines and tools. The outcomes of the project, both in the domain of development and research, must consider: context information, varied scenarios of application (exploring different user profiles, platforms and environments), distinct levels and dimensions for adaptation.

3.5.4 Existing Technologies Related to the Project

Our current efforts involve analyzing and categorizing adaptation techniques and context of use in different dimensions and levels of adaptation. We have expertise in sketching techniques, user interface description language (UsiXML), and distributed computing.

Our work consists in analyzing related works to gather all existing adaptation techniques to organize them in a structured manner (CADS and CARF). Once the techniques were gather they will be associated with relevant context information, by means of adaptation rules. The inference will consider machine-learning techniques, such as Bayesian Networks.

The CADS and CARF represent theoretic models that are a unified approach to support the development of adaptive interfaces. They, together with an Ontology, compose the framework of Serenoa.

3.6 CTIC Vision and Expected Contribution

In this section, CTIC explains what they are going to do in Serenoa project, their contributions and expectations.

Basically, CTIC will work on the runtime engine development. CTIC has been working for the last 4 years in MyMobileWeb framework, which is a standards-based software framework that simplifies the rapid development of mobile web applications. Therefore, MyMobileWeb is a solid framework to demonstrate adaptation from the point of view of device independence. CTIC's intention is to reuse its experience on that as much as possible and put a special effort in the integration of this framework with the outcomes of all the work packages.

Due to the experience in the scope of device independence, CTIC could work hard in this part to get the goal of the project: a context-aware application authoring tool tailored to tasks, devices, preferences, abilities, etc.

We will contribute in dissemination actions, overall in communication to both the public and authorities

about the project. CTIC will also collaborate making the exploitation plan.

The tool should allow an abstract development and get a development-preview in design time at different devices or family devices. It could be done by means of the integration between:

- Real devices

- Emulators

- Remote desktops to real devices

In the same way, it should allow making adjustments according to the delivery context and dealing with the coherence between manual changes in some devices and new changes in abstract view.

3.7 W4 Vision and Expected Contribution

W4's vision and expectations of the Serenoa project is to be able to produce adapted graphical user interfaces from an 'existing' application. Two targets are currently considered as a primary goal and are targeted to be shown with a runtime implementation:

- Smart phones or tablets GUI based on an existing application (IOs and/or Android)

- Adaptation to users with disabilities of an existing application (Dynamic update to various disabilities: color blind, low vision, impossibility to use the mouse…). All users do not have the same disabilities.

3.7.1 W4's implementation effort

W4's planned contribution is to implement runtime engines in order to generate and/or show the adapted application in the specified environments described above. It is not our goal to develop a specific version of an application for a smart phone or for disabled users: we assume that the adaptation engine shall provide a mean of adapting dynamically the content of an application that was not designed originally to support these targets.

Input Information for the adaptation engine

- Existing applications (typically a web based application connected to a database and producing web pages including tables, forms, toolbars, menu bars, button bars, trees …) which can connect to physical data sources and access data (through a data layer), produce the structure of pages (without adaptation at this point) (through a view layer), implement the business login and validate user interactions (through a control layer). The adaptation engine has a runtime access to communicate with the original application.

- Page structure and content of the original application prior to adaptation

- Data model (definition of the data that are shown in the page : for instance if it is a creation form of an invoice, we have the definition of the invoice (fields, data types, optional/mandatory, data size) similarly as in a UML model

\- Transformation rules which could be modified /edited at design stage to enhance the transformation result and to configure how the adaptation is performed.

3.7.2 Expected results

\- Smart phone and tablet adaptation must use the particularities of the platform: the goal is not to provide a minor web page adaptation dedicated to a mobile web browser. Rather, the current vision is to have an application component installed on the targeted platform (downloaded from the vendor's store, for instance) which communicates with the application engine and generate a platform specific graphical interface.

\- Disabled users adaptation should be based on standards (WAI : Web Accessibility Initiative, WCAG : Web Content Accessibility Guidelines, W3C, French RGAA …) and should be measurable in order to communicate about the level of adaptation that is performed, using for instance WCAG 2.0 ratings : Gold (AAA), Silver (AA) et Bronze (A)

\- The adaptation engine should not be implemented for a dedicated application but should work for further implementations and applications. The transformation rules, however, should remain editable to 'customize' the adaptation for these new applications. Using the adaptation engine for a new application may require a methodology and some customization of parameters, but not heavy coding or strong knowledge of platform specific programming languages.

3.7.3 W4's existing technology related to the project

W4 may propose its existing technology as a contribution to the project to create the demos for the adaptation engine and possibly some tools supporting the associated methodology.

From a model described with classes, typed attributes, properties and resources, W4's LEONARDI is able to automatically generate a GUI deployable either as a fat client (Swing/SWT), or as a web client (DHTML/Ajax). This instantly ready application allows browsing the data, offering various forms to the final user, for example to fulfil the CRUD actions (Create/Read/Update/Delete).

Therefore, the LEONARDI design environment (Application Composer) could be enriched to generate the 'server part' and communicate with, or invoke the adaptation engine and its transformation rules.

4 Conclusions

In this deliverable we describe an overview of the SERENOA Roadmap. It includes the current main challenges (both from a technological and scientific perspectives) and also provides the vision that each SERENOA partner owns of the Project, as well as their expected contribution.

The SERENOA Roadmap presented in this document is the first version (up to M6). At M18 we plan to deliver a second release, with an updating of the Project's priorities.