Anyone, anywhere access to community-oriented services

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ABSTRACT

This position paper describes and discusses PALIO[1], a new project recently funded by the European Commission's Information Society Technologies (IST) Programme. PALIO builds on previous European research and technological development efforts to provide a novel understanding of anyone, anywhere access to community-oriented services.

INTRODUCTION

In recent years, there have been several efforts in the direction of mainstreaming accessibility issues to provide universal access to general-purpose community-oriented services. This trend, which is likely to continue, is indicative of the technological advances which have taken place over the years and the increasing appreciation of the need to address diversity in the Information Society as a design challenge.

In this position paper, we aim to report on experiences towards universal access to interactive applications and services, which have been accumulated over the years from participation in European Commission supported collaborative research and development activities. In particular, we aim to show how novel concepts about universal access have progressively moved from formation to realization. This will be attempted by drawing upon early efforts to provide user interface software tools for user interfaces for all [8], then reflecting upon their application in a large scale project, namely AVANTI [11, 12] and finally, considering their relevance and influence on the PALIO project.

UNIVERSAL ACCESS

The notion of universal access to the Information Society [9, 13, 14, 15] is rooted on the concept of universal design, as it has evolved over the years. Universal design refers to the conscious effort to consider and take account of the widest possible range of end user requirements throughout the development life-cycle of product or service [10]. In recent years, it has been applied in interior and workplace design [7], housing [6] and landscapes [10].

In the context of Human Computer Interaction (HCI), design for all implies a proactive approach towards products and environments that can be accessible and usable by the broadest possible end-user population, without the need for additional adaptations or specialized (re-) design [14].

There have been several efforts in the form of technical research and development projects, which have aimed to provide insights towards new user interface development frameworks and architectures that account (explicitly or implicitly) for several issues related to accessibility and interaction quality. Examples include the European Commission funded project TIDE-ACCESS TP1001[2] [1], the Japanese FRIEND21 initiative [5] and more recently the

[1] The partners of the IST-PALIO project are: ASSIOMA S.p.A.(Italy) - Prime Contractor; CNR-IROE (Italy); Comune di Firenze (Italy); FORTH-ICS (Greece); GMD (Germany); Telecom Italia Mobile S.p.A. (Italy); University of Sienna (Italy); Comune di Siena (Italy); MA Systems and Control Ltd (UK); FORTHnet (Greece).

[2] The partners of the TIDE-ACCESS consortium are: CNR-IROE (Italy) - Prime contractor; ICS-FORTH (Greece); University of Hertforshire (United Kingdom); University of Athens (Greece); NAWH (Finland); VTT (Finland); Hereward College (United Kingdom); RNIB (United Kingdom); Seleco (Italy); MA Systems & Control (United Kingdom); PIKOMED (Finland).

AVANTI Project[3] [Emiliani+Bini]. Many of the concepts introduced by these projects, were subsequently taken up by industrial initiatives in an attempt to comply to legislative clauses or as a result of genuine interest towards increased access to interactive systems and services. For instance, the notions of *abstraction*, *platform independence* and *interoperability* as well as the notion *of pluggable-look and feel* [6] are now being considered in both Microsoft's Active X technologies and SunSoft's accessibility initiatives.

UNIVERSAL ACCESS TO COMMUNITY-ORIENTED SERVICES

Building upon the results of earlier projects, such as ACCESS and AVANTI, we are now pursuing the universal access challenge at another level. Specifically, the PALIO project sets out to address the issue of anyone and anywhere access to community-wide services. This is an extension of previous efforts, as it accommodates a broader perspective on adaptation and covers a wider range of interactive encounters beyond desktop access. In what follows, we will briefly overview how this project addresses the issue of universal access and how it advances the current state of affairs by considering novel types of adaptation based on context and situation awareness.

The PALIO system

PALIO is a project, which is funded by the EC's IST Programme. The main challenge of the PALIO project is the creation of an open system for accessing and retrieving information without constraints and limitations (imposed by space, time, access technology, etc.). Therefore, the system should be modular and capable of interoperating with other existing information systems. In this scenario, mobile communication systems will play an essential role, because they enable access to services from anywhere and at anytime. One important aspect of the PALIO system will be the support of a wide range of communication technologies (mobile or wired) to access services. In particular, it will be possible for a user equipped either with a common cellular phone or an advanced WAP phone to access services wherever he/she is; referring to Figure 1, the *Augmented Virtual City* (AVC) centre will adapt the presentation of information to the different access technologies.

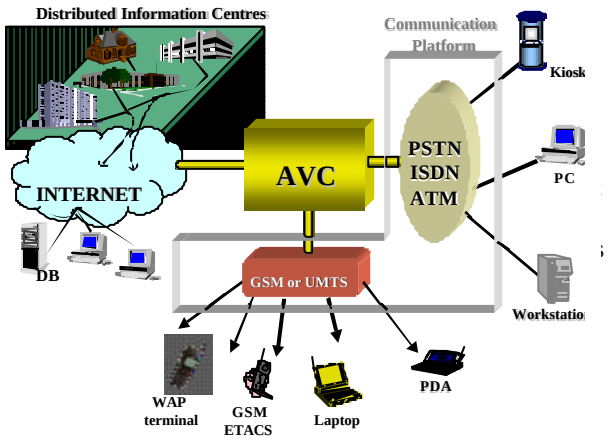

Figure 1. PALIO architecture.

The PALIO system envisages the adaptation of both the information content and the way in which it is presented to the user, as a function of user characteristics (e.g., abilities, needs, requirements, interests); user location with the use of different modalities and granularities of the information contents; context of use; the current status of interaction (and previous history); and finally used technology (e.g., communication technology, terminal characteristics, special peripherals).

The PALIO information system consists of the following main elements (see Figure 1):

1. **A communication platform** including all network interfaces to inter-operate with both wired and wireless networks;
2. **The AVC centre** which is composed of the main adaptation components, a service control centre, and the communication layers from and to the user terminals and the information services;
3. **Distributed Information Centres** in the territory**,** which provide a set of primary information services.

The AVC centre is the architectural unit, which manages diversity and implements the mechanisms for universal access. The AVC will be perceived by users as a system, which groups together all information and services that are available in the city. It will serve as an augmented, virtual facilitation point from which different types of information and services can be accessed. The context- and location- awareness, as well as the adaptation capabilities of the AVC, will enable users to experience their interaction with services as a form of 'contextually grounded' dialogue, e.g., the system always knows the user's location and can correctly infer what is 'near' the user, without the user having to explicitly provide information to the system.

The envisaged main building blocks of the AVC are depicted in Figure 2, and can be broadly categorised (according to their role within the project) into the adaptation infrastructure; the service control centre; the software communication layer to and from the user terminals; the distributed information services and their integration infrastructure. What is of interest to this workshop is the adaptation infrastructure, which is briefly elaborated below.

Adaptation infrastructure

The Adaptation Infrastructure will be responsible for content and interface adaptation in the PALIO System. It

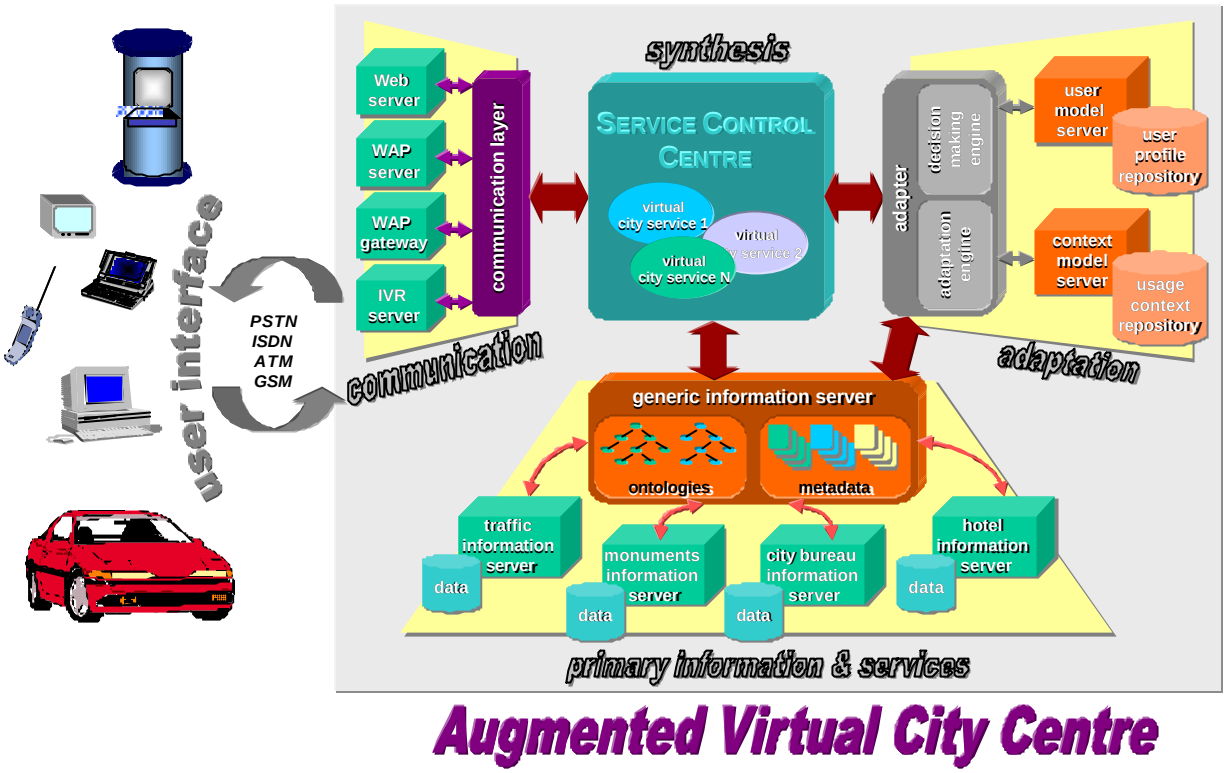

Figure 2. AVC centre architecture.

will be composed of the Adapter, the User Model Server and the Context Model Server.

The **User Model Server** (UMS) will integrate and manage information concerning user characteristics (e.g., interests, interaction style, disabilities), in the forms of both individual user profiles constructed during interactive sessions, and user stereotypes for groups of users that share a number of characteristics. The UMS will contribute to the provision of support for adaptation at the information content and presentation levels, by making user-related information available to the Adapter. User-related information will be provided directly by the user. However, the system will be designed so as to be functional even in the case where users do not provide the required information when requested for it (e.g., through interactive question-answer sessions). Furthermore, the system will formulate assumptions about the user at run-time, on the basis of interaction behaviour. The UMS will retain individual user profiles in the User Profile Repository. When permitted by the user, these profiles will be maintained between sessions. The latter case (i.e., having profiles that contain information from multiple interactive session of the user with the system) is expected to have particular added value in the use of the system, as some of the characteristics and interaction patterns of users can only be observed over a longer period of time, and not within the usually limited temporal constraints of a single session.

The **Context Model Server** (CMS) will assemble the context profiles, using information retrieved from the **Usage Context Repository**, and will inform the adapter about the current context. Context related information includes, for example, the user location, the characteristics of the terminal and network used to access the system, etc. It should be noted that, in order to collect information about the current context of use, the CMS will communicate (directly or indirectly) with other components of the PALIO system, which will be the primary carriers of such information. These first-level data collected by the CMS will then undergo further analysis, with the intention to identify and characterise the current context of use. Similarly to the UMS, the CMS will be able to respond to queries made by the Adapter regarding the context, as well as to relay notifications to the Adapter about important modifications to the current context of use, which may necessitate the triggering of specific adaptations.

The **Adapter** will constitute the basic adaptation component of the system. It will integrate information concerning the user, the context of use, the access environment and the interaction history, and will adapt the

information content and presentation accordingly. Adaptations will be performed on the basis of:

- ?? user interests (when available in the User Model Server and/or resulting from the ongoing interaction);
- ?? user characteristics (when available in the User Model Server);
- ?? user behaviour during interaction (provided by the User Model Server);
- ?? type of telecommunication technology and terminal (provided by the Context Model Server);
- ?? current service state and the session history (provided by the Service Control Centre);
- ?? location of the user in the city (provided by the relevant information services, e.g., GPS);
- ?? type of input request;
- ?? etc.

The Adapter will itself comprise two main modules, the **Decision Making Engine** (DME) and the **Adaptation Engine** (AE). The DME will be responsible for deciding upon the need for adaptations, based on: (a) the information available about the user, the context of use, the access terminal, etc., and (b) a knowledge corpus that will relate specific (types of) adaptations with such pieces of information. Combining the two, the DME will attempt to make decisions about the most appropriate adaptation for any particular setting and user / technology combination addressed by the project. The AE will be complementary to the DME and will undertake the instantiation of the decisions communicated to it by the DME. The decoupling of reaching adaptation decisions and effecting them (resulting from the presence of the DMS and the AE as two distinct functional entities), bestows the PALIO system with high levels of flexibility, as new (types of) adaptations can be introduced into the system very easily, while the rationale for arriving at an adaptation decision and the functional steps required to carry it out can be varied separately.

It should be noted that one of the very important properties of the described architecture is the fact that there is continuous monitoring of the interaction between users and the PALIO system, so that modifications in the user behaviour, the context of use, or the status of communication facilities and devices can be identified, interpreted, and used to trigger the appropriate type of adaptations (e.g., inclusion of links to relevant information, spatial or temporal restructuring of information elements, modification of presentation parameters such font, colour, voice gender, volume, etc.)

CONLUDING REMARKS

We have briefly reviewed how PALIO, a European Commission funded collaborative project under the IST Programme, seeks to advance a novel understanding of universal access in community-oriented services. PALIO constitutes a substantial extension over previous efforts on universal access, since it introduces and explicitly accounts for novel types of adaptation and new interactive encounters beyond the desktop. Accordingly it pursues an architectural model of interaction which is expected to be of wider applicability in service communities other than tourism.

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