

# MOBILE – Secure services for mobile citizens

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## 1. Introduction

New communication technologies (particularly the Universal Mobile Telephone System – UMTS) as well as an increasing convergence of wireless devices integrating telephony, organizer functionality, and accurate localization by means of the Global Positioning System (GPS) will make current Wireless Applications Protocol (WAP) and iMode technology faster, more reliable, and more user-friendly. Studies show that in 2005 wireless devices will be the most frequently used means for efficiently accessing 3rd generation services. The market will be dominated by so-called Location Based Services (LBS) – services tailored to time, place, context and user's preferences.

Since current efforts to realize secure M-Commerce remain limited in scope, the MOBILE project aims to develop an agent-based platform for the day-to-day deployment of multilaterally secure dynamic services which are dependent on the user's time, place, and context. By taking personal preferences and settings into account, an individualized selection of available services can be offered. Ontologies with semantic knowledge will be used to support agent communication and to enhance personalization.

Security requirements and data protection issues for both service provider (e.g. authentication, reliable billing) and customer (e.g. control over personal profile data) need to be combined under the concept of multilateral security. Personal wireless devices will therefore have multilaterally secure communications, localization, and navigational functions. Transparent use of Public Key Infrastructures (PKI) and consistent use of digital signatures identifying services and users are therefore mandatory. The platform's capabilities are demonstrated within



Figure 1: MOBILE-Portal on a Compaq iPAQ

the context of a tourism scenario. Our demonstrator shows how a traveler can access a variety of services. The services on offer are dependent on his current user role and context, for example, if he is traveling for business or pleasure. A tailor-made sightseeing tour can, for instance, cater to his particular interests and address time constraints. Agent technology will enable relevant information on the traveler's immediate surroundings to be automatically delivered to him on the basis of his location determined by GPS.

## 2. Approach

Presently, there is a wide range of information available on the Internet stored in disjoint databases which to date can only be queried individually. Additionally, such publicly accessible databases are typically designed for proprietary access which may only be available on a limited number of computing platforms. Therefore, the

## German Abstract

Individuelle orts-, zeit- und kontextabhängige Dienste haben sich zu einem großen Hoffnungsträger im Mobilbereich entwickelt. Sowohl heutige Endgeräte- und Übertragungstechnologie als auch Sicherheitsmaßnahmen auf Applikationsebene bieten jedoch nur unzureichende bis lückenhafte integrierte Mechanismen, um ein ausgewogenes Sicherheitskonzept zu ermöglichen, das sowohl Nutzer als auch Service-Anbieter in solch einem Szenario berücksichtigt. Daher umfasst das Projektziel von MOBILE die Entwicklung einer Plattform, die ein mehrseitig sicheres, dynamisches und individuelles Angebot an orts-, zeit- und kontextabhängigen Diensten im täglichen Einsatz ermöglicht. Durch die Berücksichtigung persönlicher Präferenzen und Profile wird dem Nutzer auf dieser Basis eine individuell angepasste Auswahl verfügbarer Dienste angeboten. Der Einsatz des Multi-Agenten-Systems SeMoA als Middleware, die zahlreiche inhärente Sicherheitsmechanismen zur Verfügung stellt, trägt einen wesentlichen Anteil zur Realisierung einer mehrseitig sicheren Plattform bei. Die Nutzung einer Ontologie wird darüber hinaus die Inter-Agenten-Kommunikation unterstützen.

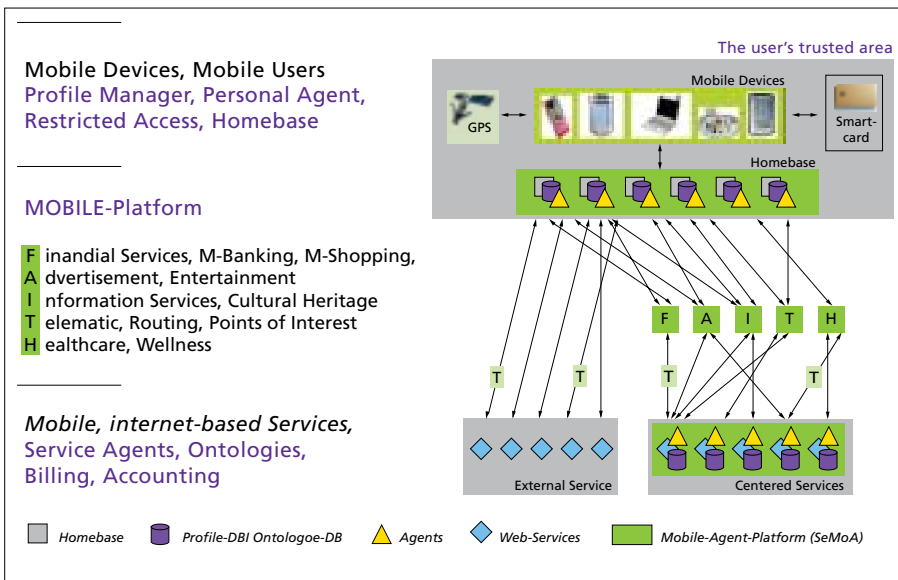


Figure 2: The MOBILE architecture

challenge remains to optimize the query methods of these discrete data sources so that information can be combined in order to achieve maximum benefit for the user. To this end, we propose the creation of so-called context-aware services.

We define this term as tailor-made services delivered to the user on the basis of a number of factors, which are as follows: user's current location, user preferences based on a personal profile reflecting his/her usual habits, time of query, and type of device to which service is being delivered. Thus, context-aware services can be seen as the next logical development of currently well-established location-based services. Commonly, these integrate multiple disjunctive data sources in order to fulfill their task.

Since it is no longer a problem to store large volumes of data, the problem has shifted towards the question of how to find specific information. Moreover, querying of different databases with totally incompatible table structures or even different storage concepts is a major problem, which has not yet been solved satisfactorily.

We use secure mobile software agents as proactive components that realize the combination of data sources according to their current task. Mobile agents offer the best solution due to their benefits regarding security, flexibility, and data compression.

We suggest a specific agent for each type of query in an application. If a query task has to be performed, the corresponding agent will be instantiated, migrate to a number of data sources, and return with a report which aggregates the results of its queries. Since it is sufficient for each agent to know the structure of the small number of specific databases it is working on to perform the query task, the development becomes very effective, scalable, and therefore manageable on a large scale.

The conjunction of two data sources becomes even more valuable when context-specific queries become involved as defined above. Besides, information about current time and the user's location usually used to provide location-based services, information about the user's current situation, his habits and needs allows us to focus the query on a small subset of available data and thereby enables effective context-aware data mining as an extension to »common« location-based services.

In other words: depending on the current user's context, a specific agent creates an application-specific link between two or more databases. This link exists just as long as the agent has to be active to provide the information. Of course, an agent could communicate its »experience« to other agents before it is terminated,

but since the user's context is highly dynamic as well, one would usually want to renew these database links for each query.

### 3. Architecture

To optimize the initialization process of services, the personal agent keeps track of the user's preferences. These include generic user preferences, program settings, and productive data such as calendar, phonebook, or diary. Agents will query the profile database via the personal agent if they require certain information about the user. A user will therefore not be inconvenienced by information requests unless a requested piece of information cannot be found in the profile. In this case it is the task of the personal agent as the interactive component to request the required information from the user. Of course the user has the possibility to alter generated settings automatically, add new settings, or delete particular entries from the profile. The underlying infrastructure implicitly defines several logical places, separated by means of different security domains, and is described in the following.

#### Mobile device

The mobile device acts as the standard unit of execution for the user's needs. Usually it has limited computing power, but high connectivity. It stores only the information which is actually needed and which enables the user to continue work even if a network connection is not available. The mobile device could be equipped with additional (generally pluggable) extensions, such as GPS receivers or smartcard readers.

#### User's home base

The home base maintains the user's personal profile through the personal agent. The user is always reachable by means of his home base since it remembers the mobile device that was most recently. Moreover, frequently used services can be installed on this host by means of mobile agent code. Administration of services as well as access to the personal profile is done through the user's personal web portal provided by the home base to which (authorized) access may be gained via the Internet.

