

# Ubiquitous Access to Information Through Portable, Mobile, and Handheld Devices

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## INTRODUCTION

Use of mobile devices for supporting our everyday communication has become part of our daily routine. Recent statistics illustrate that the penetration of mobile devices in everyday use has reached (and in some cases even surpassed) the penetration of fixed communication devices (ITU, 2004). As a consequence, use of mobile devices for accessing data information also increases, assisted by the rapid development of new technologies especially designed to support multimedia communication. Within the next years, third-generation (3G) wireless services will proliferate, offering multimedia capabilities such as streaming video (BERGINSIGHT, 2005; Raghu, Ramesh, & Whinston, 2002; UMTS forum, 2005). All of these, combined with the establishment of Internet and portal technology as the standard way for information exchange, entertainment, and communication, have created a new scenery that is characterized by access to data “anywhere,” “anytime,” and by “anyone” (or “any means”). Design issues concerning the particularities of access devices, communication technologies, and volume of information exchanged are very important in the provision of mobile portal services (Microsoft, 2006).

In this article, we address the issue of providing portal services to users with portable devices such as personal digital assistants (PDAs) or smartphones. We propose a reference architecture for providing mobile portal services, based on the distribution of information between the portal servers and the user devices.

## BACKGROUND

The need for mobile portal services lies in the penetration of mobile devices in the global market. However, the services offered today are not widely adopted by the mobile users.

Surveys that have been carried out have revealed that cost, both in terms of devices (such as PDAs) and operation/subscriptions, constitutes a prohibitive factor. Furthermore, complexity has been mentioned as another reason for avoiding such services. Many people have also expressed their interest in more personalized content tailored to their profile, or in having the ability to create their favourites and set their preferences. In addition, users consider access speed as a key factor, meaning that they prefer minimum-step navigation, since they are not willing to spend much time and money to reach the information. Last, but not least, the applications that offer mobile services are not offered by the mobile operators or are not preinstalled in the devices, but are sold by third-party vendors. Consequently, many people are not aware of available mobile services.

Despite the aforementioned impediments to the explosion of Web services offered to mobile users, mobile-enabled information and market will define the near future scenery. Besides, this story bears similarity to how mobile phones pierced the whole world. The transition from generic Web portals to mobile portals should not be only associated with the adaptation of the content to the display size of the mobile devices. Mobile services should meet the varying needs of a “moving” user. A mobile user may need immediate access to crucial information, or may be in the process of waiting in a queue or for his flight to take off. Furthermore, mobile portals should focus on supporting concrete services for different target groups.

An attempt to organize mobile portal services into categories, according to global practice (GSA, 2002), leads us to the following categorisation:

- **Information Services:** General news, weather forecasts, financial, and sport news.
- **Food and Lifestyle:** Restaurants, bars, music halls, theater, cinema, events list.

- **Travel Services:** Flight/hotel listings, travel guides, maps, position location, and direction guidance.
- **Entertainment:** Online games, horoscopes, and quizzes.
- **Mobile Commerce (M-Commerce):** With real estate, Web banking, shopping, and auctions.
- **Messaging:** MMS, SMS, Chat, e-mail services.
- **Personal Information Management:** Calendars, contacts, photo albums.

The end-user experience is enhanced by the improved interfaces, use of graphics, touch pads, and technologies, such as VGA screens and cameras built into the devices (*Mobile Tech Review*, 2005). Many mobile portals have been launched combining information from the previously mentioned categories (GSA, 2002).

## REQUIREMENTS

The basic idea behind the reference architecture proposed in this article is to overcome the limitations imposed by the handheld devices capabilities (display size, battery) and the cost of network connectivity into a platform that provides ubiquitous access to a large portfolio of services. Initially, we define the requirements set for the system design.

### User Friendly Interface for Users Unacquainted with Computers

Up to now, use of mobile and portable devices in our everyday life for communicating and entertaining ourselves has been a common practice. However, the concept of accessing information through PDAs instead of desktop PCs is quite new and, therefore, special care should be given to the design of applications services and the corresponding user interfaces.

As opposed to the case of voice communication and music entertainment, where the functionality of the device is limited to simple dialling or play-forward-rewind-stop, handling information presents several challenges. The user has to select the information that he needs to access, and then decide whether the result of his/her selection meets his/her demand. Furthermore, links between different types of information have to be specially designed in order to facilitate navigation. The small screens of mobile devices introduce an extra challenge: the “shrinking” of data so that the same level of information fits to much less than a quarter of minimum display of an average desktop computer.

### Coherent Site Map to Minimize Navigation and Facilitate Users' Experience while Reducing Network Connectivity Costs

This is actually a requirement for any portal design. However, PDA terminals have special characteristics, that make minimization of navigation steps and connectivity costs very crucial. These characteristics are the low processing power and memory of portable devices, as well as the limitations in network connectivity that is provided over GPRS. Therefore, reaching information with minimum interaction is a key point for successful design of Web pages.

### Up-to-Date Content

Ubiquitous access to information places an extra effort for portal designers. If we take into account the nature of information that is expected to be requested from a mobile device (news, weather updates, financial information), then it is obvious that the majority of user requests will be for dynamic content, constantly updated. Therefore, the designers and administrators of mobile portals should focus on data update and back-office mechanisms.

### User Notification and Push Content Mechanisms

One major difference between “conventional” portals and mobile portals is the inability of these devices to maintain permanent connections to the portal. Therefore, for example, in a mobile portal that provides information about the stock market, updates on the price of stocks could be provided to desktop users through long last sessions (even for hours). This is not possible in mobile devices, not only due to the nature of the underlying communication infrastructure (GPRS-UMTS), but also due to the fact that deployment of other applications on the device (a phone call) may interrupt the session. Furthermore, the use of the mobile device is not the same as that of a desktop computer that is confined in a certain position on a desk.

For this, special mechanisms for notifications about data updates, and also push content mechanisms should be provided for information that is constantly changing, and this change has to be immediately reported to the user. The case of Blackberry devices (Research In Motion, 2006) and remote management capabilities in Windows mobile 5.0 (Microsoft, 2006) are excellent examples of such mechanisms.

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