Two Approaches to Bringing Internet Services to WAP Devices

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ABSTRACT

The next big challenge of the Internet is mobile access. More and more information is available on the Internet and intranets and mobile users will also need access to it. Wireless Application Protocol (WAP) based devices make it possible to access Wireless Markup Language (WML) based services with mobile browsers. The first WAP compliant devices have already been released on the market and more are to come.

In the future there will be a need for Web services that are specially targeted for mobile users. We have studied this mobile-aware approach to service design by implementing a WML application and evaluating it on three different WAP platforms. Based on our evaluation results, we recognize challenges for future WAP devices and mobile-aware services.

We have also studied if it would be possible to access the already existing Internet information with WAP devices. We have developed an HTML/WML conversion proxy server, which converts HTML-based Web contents automatically and on-line to WML. This approach gives the mobile users transparent access to their familiar Web pages from their mobile phones and other mobile devices. Our study indicates that if HTML-based Web services follow certain guidelines, they can be converted automatically to WML and adapted to the client device. In principle these guidelines already exist as W3C Web Content Accessibility Guidelines and W3C Note for HTML 4.0 Guidelines for Mobile Access.

Keywords: WAP, mobile access, HTML/WML conversion, usability, evaluation

1. INTRODUCTION

The rapid growth of Web services has led to a situation where companies and individuals rely more and more on material that is available on the Internet and intranets. An increasing number of people use Web services both at work and at home. The next step is to gain access to Web services for mobile users too. Already before WAP some simple interactive services have been available on mobile phones. These services are based on the GSM short message service (SMS) and include

schedules, news, sport results, weather forecasts and so on. Although the available SMS-based services are quite awkward to use, they have become very popular. This indicates a need for additional mobile Web services. Access itself will probably be the killer application for the mobile Internet. [5]

Wireless Application Protocol (WAP) together with Wireless Markup Language (WML) constitute an open architecture for mobile Web services. They make it possible to provide markup-language based services for different mobile devices equipped with WAP browsers. The selection of WAP devices is expected to range from mobile phones to palmtop computers. The international specification work on WAP is still going on (February 2000) in the WAP Forum and several details must still be worked out [12]. The first WAP-compliant devices were introduced to the market during the fall of 1999. The WAP services currently available are not generic but they have been tailored to specific WAP devices.

How should the service providers create services to the growing variety of mobile clients? Simultaneously with the ongoing international specification work of WAP, we have studied two different approaches to bringing Internet services to WAP phones and other mobile devices. The mobile-aware approach is to design and implement totally new services that are specially designed for mobile users. A more generic approach is to develop techniques with which current Internet services can be converted transparently and in real time suitable for mobile users. We have implemented and evaluated both kinds of solutions. As an example of a mobile-aware application, we have implemented a Business Card Search Service (BCSS). Our mobile-transparent solution is an HTML/WML conversion proxy server. Through the proxy server, the users can in principle access exactly the same Web services as from their desktops. If it is possible to convert services transparently to mobile users, the service providers will save a lot in implementation and maintenance costs. However, we assumed that this mobile-transparent approach would not produce results as good as services designed specially for the mobile clients.

In this paper we first describe our technical framework as well as the implementation of the mobile-aware application and HTML/WML conversion. Then we describe our iterative design approach, evaluation methods and results. Finally we analyze the evaluation results and recognize possibilities and challenges for future WAP devices and applications. We also point out recommendations for Web page design.

2. THE TECHNICAL FRAMEWORK

2.1 WAP devices

Symbian has classified future mobile devices into three categories: communicators, smartphones and feature phones. The classification is based on input methods and display size. Display sizes vary from 48x48 pixels in a feature phone to full VGA in certain communicators. The main input method for communicators is a QWERTY keyboard or an emulated keyboard on the screen. A keypad is recommended for smartphones. [8]

WAP devices will include all of Symbian's categories. In addition to the display and input methods, future WAP devices will also vary by accepted content types and network connections. During the fall of 1999, WAP devices began to appear on the market, the first two being the Ericsson MC218 palmtop computer with a WAP-browser and the Nokia 7110 WAP phone.

Because the variation of WAP devices will be very wide, the services have to take into account the capabilities of the mobile clients. The WAP specification defines the User Agent Profile (UAProf), which will be used to transmit information about the client. It includes device hardware and software characteristics as well as application and user preferences. The UAProf specification was not

published until November 1999 in the WAP Forum [11]. That is why we could not yet utilize it in our design.

2.2 Development environment

The contents of the WAP services are implemented in Wireless Markup Language (WML) and WMLScript. XML (eXtensible Markup Language) is a metalanguage for describing other markup languages. As a metalanguage XML makes it possible to define customized markup languages for different purposes [6]. WML is an XML-based markup language designed for low-end devices and slow, unreliable networks. WML provides basic means for document formatting and user interaction but presupposes little of how they are actually implemented. Developers of WAP services only design the interaction logic in the application. Each client device then implements these interactions in its own way. [12] [13]

As an example of a mobile-aware application, we have implemented a Business Card Search Service (BCSS) in WML. Our mobile-transparent solution is an HTML/WML conversion proxy server. Through the proxy server, the users can in principle access exactly the same Web services as from their desktops. These two design approaches are illustrated in figure 1.

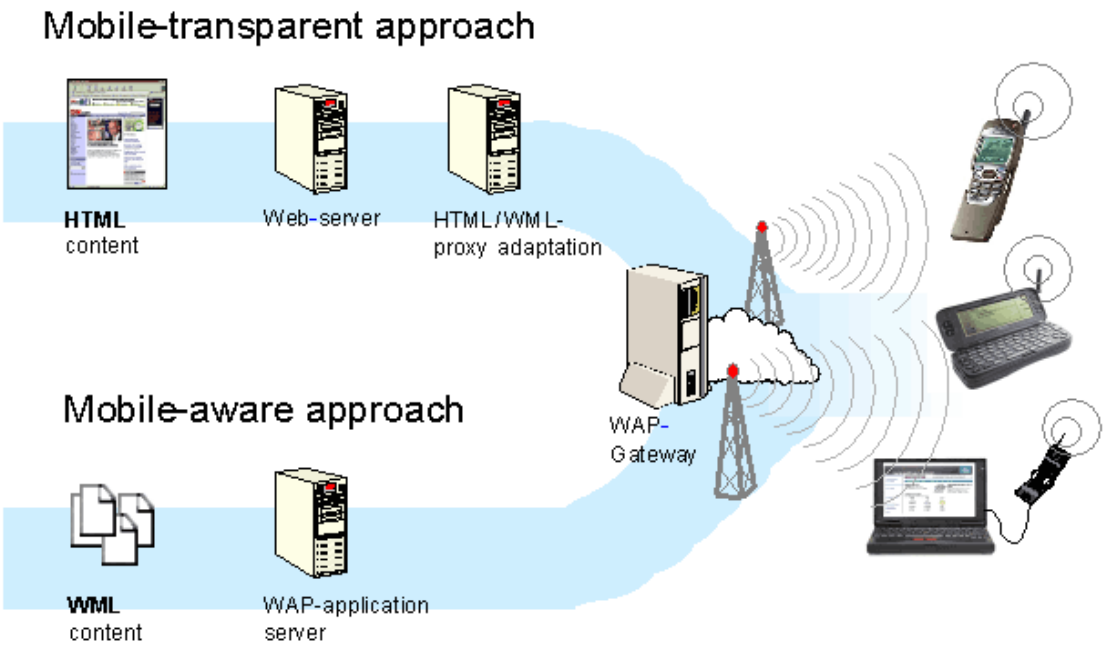


Figure 1 Mobile-transparent and mobile-aware approaches to Internet access

As test platforms, we have been using three WAP device simulators. The UP.Simulator 3.1 (UP) by Phone.com (www.phone.com), Nokia WAP SDK 1.01 and Nokia WAP Toolkit 1.1 (Nokia, www.nokia.com) offer WAP phone simulators. Wireless Application Reader by Dynamical Research Systems Ltd. (DSR, www.wap.net) simulates a palmtop-computer-like device with a resizable display window. All the simulated browsers run on the Windows operating system and handle WML version 1.0 or 1.1. The test platforms can be seen in figure 2.

3. BUSINESS CARD SEARCH SERVICE (BCSS)

With our Business Card Search Service (BCSS) the user can search contact information by making queries to a business card database. We could not utilize User Agent Profile (UAProf) specification yet but we studied how the same WML code would work on different devices.

3.1 Functionality

The Business Card Search Service (BCSS) offers three different query forms. The so-called simple search form uses only last and first name as search criteria. The extended search form includes additional search possibilities for title, organization, etc. With the free text search the user can search a string from any of the business card fields.

The search results are displayed as a list of names. The user can set the application up to show either organizational, phone, email or address information in addition to the name in the result list. If several persons meet the query criteria the user may decide to make a new, more refined search or browse through the list to find the correct person. When the user finds the right person she/he can get the full business card information by following the corresponding link in the result list. The user can also browse the business cards or the included photos without returning to the result list.

3.2 Implementation

The structure of WML is based on deck/card metaphor. A WAP application may consist of one or several WML decks. A WML deck is divided into cards. A deck is sent from the server in one transaction but the browser usually shows only one card at a time. Typically all the contents of a card do not fit on the screen of a WAP phone so the user has to scroll the screen to see the card in full. [13]

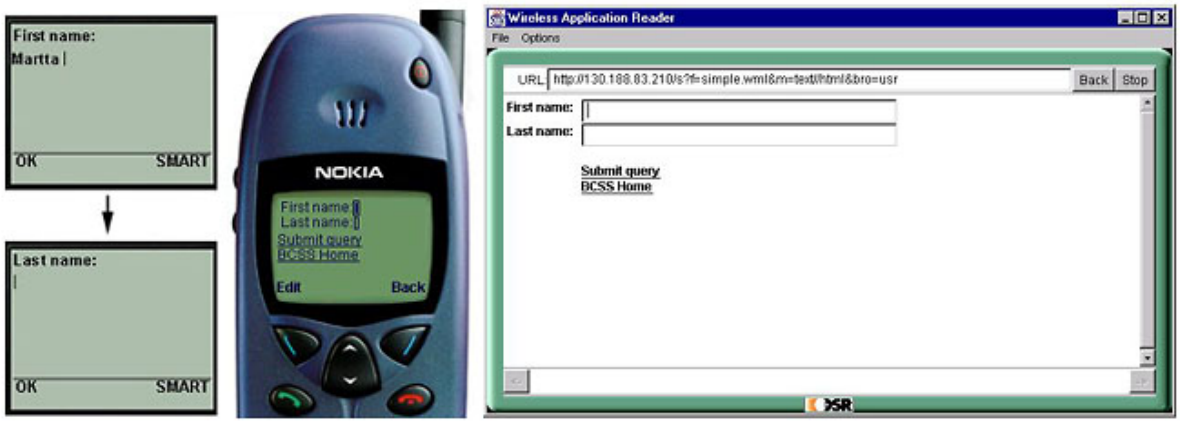


Figure 2 Business Card Search Service (BCSS) on the test platforms: UP, Nokia and DSR

The Business Card Search Service consists of an LDAP (Lightweight Directory Access Protocol) database, WML and WMLScript document templates, and server software written in Java. The content format of the business cards is based on vCard defined by the Internet Mail Consortium (IMC) [9]. The server fills in WML document templates with data extracted from the business card database.

3.3 Implementation issues

During our Business Card Search Service development process the specification work of Wireless Application Protocol (WAP) and Wireless Markup Language (WML) was still going on. The three browsers that we used in our tests each used a different content type for WML documents. The image format was a problem too. In the beginning of the implementation none of the WAP device simulators accepted the WAP bitmap (WBMP) format. The UP simulator handled only the BMP format and the DSR Wireless Application Reader accepted only GIF images.

In the Nokia simulator, the application could not redefine the texts for the soft keys. That is why we decided to avoid soft keys and used links instead.

In our initial design we divided the result deck into three cards. The first card contained the business-related items and the second contained more personal information like home phone number and a photo. The third card of the result deck was a prefilled query form to be used as a template for making a new query. Only the DSR simulator supported navigation between WML cards. The links to the following cards required several user actions on the other two browsers. Our expert evaluation suggested that a single scrollable card would be easier to use. So we rejected our initial design and implemented the business card as a single WML card.

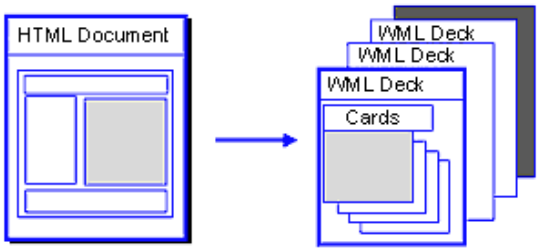
4. HTML/WML CONVERSION

4.1 Implementation

Web environment may include separate specialized proxy servers that perform different tasks of conversion, caching and content adaptation. Proxies may support the adaptation of Web application content to different terminal and network environments. A proxy server can for instance try to minimize the information flow over low/medium speed wireless links. The proxy server may filter out some content types of HTTP streams (e.g., images, Java script or Java Applets). It can also modify the content (e.g., image depth and size) based on the user's preferences and channel throughput. [7]

Our HTML/WML conversion has been implemented into a proxy server (Figure 1). In addition to the conversion, the proxy server includes both caching and content adaptation. WML devices access HTML services through the proxy and thus get transparent access to the HTML services. The conversion first checks and validates the HTML document. Then, the server parses the document, converts the contents and rearranges the contents as WML decks and cards (Figure 3).

In addition, the conversion proxy aims to format the document according to the capabilities and preferences of the mobile client. Without the User Agent Profile (UAProf) [11] we could only adapt to the User Agent type (the browser in the client device).



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