INTERNET PREMIUM SERVICES FOR FLEXIBLE FORMAT DISTRIBUTED DEVICES

Brigitte Oesterdiekhoff
University of Paderborn
& Siemens Business Services, C-LAB
Fuerstenallee 11
33102 Paderborn
Germany
brigitte@c-lab.de

Abstract: This paper presents the provision of an internet premium service on different format output devices, which are embedded devices. In particular, we developed a tool for automatic generation of different profile depending target formats, which are used to present the service information on distributed mobile embedded devices like mobile phones, personal digital assistants (PDAs) or smart phones. In this approach XML-[Extensible Markup Language]-based user interface descriptions will be transcoded into other target formats. Used examples are cHTML [compact Hypertext Markup language] for web-enabled mobile devices and WML [Wireless Markup language] for WAP [Wireless Application Protocol]-enabled mobile devices.

Keywords: Transcoding, User Interface.

1. INTRODUCTION

The huge amount of information possibly much unstructured that is received by users every day for example by internet, email or newsletter make it difficult to select important and individual user information out of it. Users like to get special very personal information. Additionally users work more and more with mobile devices like PDAs, mobile phones and smart phones and wish to have their information on these embedded devices. Dealing with this problem a service called MEMPHIS[1] [1] is

[1] MEMPHIS [Multilingual Content for flexible format Internet Premium Service] supported by the European Commission: IST 5th Framework Programme

developed and implemented. This service system collects premium service information according to user profile depending topics, transforms these information in various ways like extraction, summarization and translation and transcodes these information to special target output formats. Information will be provided in form of push or pull services. For the pull service on distributed mobile devices the transcoding tool performs the automatic generation of different target formats. In fact, as an example a XML-based description will be transcoded into cHTML and WML format descriptions.

The increasing use and the growing variety of different mobile devices induce the introduction of special purpose content presentation languages, like WAP [Wireless Application Protocol] / WML [2] and W3C [World Wide Web Consortium] / cHTML [3] as well as techniques for automatic conversion of traditional HTML [Hypertext Markup language] format to these formats by using XSLT [Extensible Stylesheet Language Transformation] methods [4]. Further developments are transcoding tools for automatic conversion of arbitrary different formats [5], which are based on generic rules in the description language RDL/TT [Rule description language for tree transformation] that operates on the DOM [Document Object Model] tree representations of HTML or XML-based documents [6], Additional work is spent for comparing different methods [7]. A classification of transcoding functions with respect to user and hardware profiles can be realized by a Fuzzy-RDL/TT [8].

This contribution is organized as follows: Section 1 describes briefly the architecture of the internet premium service. The transcoding mechanism is discussed in section 2. The portals on the different mobile devices are described in section 3. The next section 4 gives examples of the internet premium service. The final section 5 comprises a summary and an outlook.

2. INTERNET PREMIUM SERVICE ARCHITECTURE

The internet premium service collects premium service information according to user profile depending topics, transforms these information and distributes individual information to users. The rough architecture of the Internet Premium Service (Figure 1) contains three main parts, namely acquisition, transformation and distribution. Participating to premium service information needs a registration of user data to the system. The user can select different service profiles and he has choices of a variety of device profile definitions. The premium service information

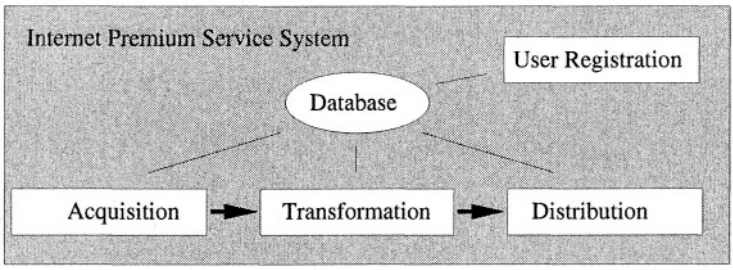

Figure 1. Internet Premium Service Architecture

and the user information will be managed by a user and information document database.

The acquisition part works with mobile agents that collect high premium information according to user profile depending topics from special databases or news providers like nationwide newspapers.

The transformation part (Figure 2) transforms the information in var-

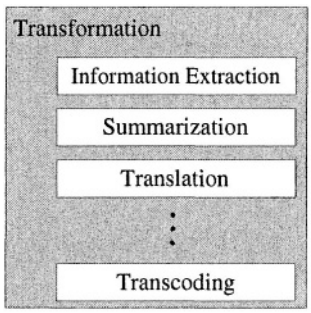

Figure 2. Components of Transformation

ious ways like information extraction, summarization of information, combining of several information that belongs together, translation in different human languages and transcoding to special target output formats depending on users device profiles. In our approach of internet premium service the human languages English, German and Italian are supported. Output formats that are supported in our demonstrator are WML and cHTML, i.e. we focus on limited mobile embedded devices. In section 2 the transcoding mechanism that produces the different output formats on mobile devices is described in detail.

The distribution part delivers the formatted service information to the users. The user has the option to get information by a push service and also by a pull service (Figure 3). Concerning the push service the user

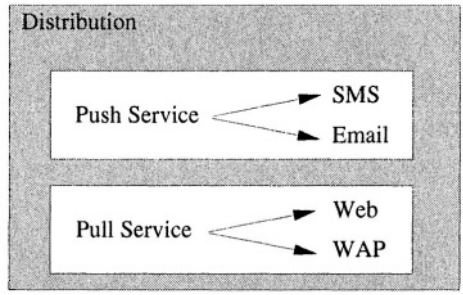

Figure 3. Distribution

gets his information by SMS on his mobile phone or by email. The pull service uses the formats that are produced by the transcoding tool. The output information that are produced in special content presentation language formats can be pulled either by a web-browser or WAP-browser so that the user can browse in his personal information for example on PC or on small mobile clients like PDAs and mobile phones. The Portal for the pull service is described in section 3 in detail.

3. TRANSCODING TOOL

The Transcoding Tool component of the transformation layer formats the output information for different small limited devices. The users can get the formatted information by the pull functionality of the service (see section 3). Because of a great variety of mobile devices a generic transcoding tool is used. This tool generates automatically output formats depending on the output device parameters. The transcoding tool is a rule based system to transform automatically between different markup languages like HTML, XML, cHTML or WML by passing the DOM tree presentation of XML-based user interface descriptions with the deapth-first-search method and modifying for example tags, attributes or content. Therefore the transcoding system needs some parameters like device profiles, rule description files and tool settings (see Figure 4).

In our use case of internet premium service, special structured XML-files are transcoded to cHTML-files and also to WML-files by passing the DOM-tree of the XML-file and modifying the tree according to the

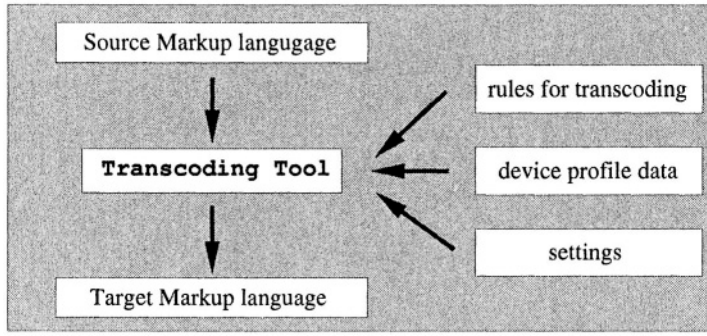

Figure 4. Conceptual overview of the transcoding tool

rules in rule-description-language-file. The following example shows an XML-based description for books.

```
<BOOK doc-lang="en">
  <TITLE>The Official Price Guide to The Beatles Records
  and Memorabilia</TITLE>
  <SUBTITLE>2nd Edition</SUBTITLE>
  <AUTHOR>Perry Cox</AUTHOR>
  <ISBN>0-676-60181-2</ISBN>
  <PUBLISHER>House of Collectibles</PUBLISHER>
  <RESELLER>Random House</RESELLER>
  <YEAR>1999</YEAR>
  <SUMMARY_ANALYSIS>
    <tu id="7" weight="12.5" rank="1">The Official Price
    Guide to The Beatles:  Records and Memorabilia has
    everything to please, please you--including CD and
    record listings (artist compilations, singles, EPs,
    and LPs from Meet The Beatles!  to Abbey Road)
    </tu>
    <tu id="8" weight="8.744023868654244" rank="3">-
    COMPLETE DISCOGRAPHIES for The Beatles, Apple label
    artists--plus the individual albums of John, Paul,
    George, and Ringo.
    </tu>
    <tu id="10" weight="11.454508341506713" rank="2">
    Valuable information on pricing and grading records
```

```
    and memorabilia, what to expect when selling your
    records to a dealer, and a handy chapter on
    authenticating Beatles autographs.
    </tu>
  </SUMMARY_ANALYSIS>
</BOOK>
```

This example will be transformed by special rules for example to the following WML-desription. WML-files are divided in special cards and each card will be one site on the mobile phone. The transcoding will be done by rules that are implemented in a rule-description-file.

```
<wml>
<card id="first" title="MEMPHIS">
<p>-- NEW BOOK --<br>
<b>The Official Price Guide to The Beatles Records and
Memorabilia</b>
<br>2nd Edition
<br>BY Perry Cox<br>
<a href="#second">BOOK-INFORMATIONS</a><br>
<a href="#third">SUMMARY</a>
</p></card>
<card id="second" title="Book-Informations">
<p>BOOK-INFORMATIONS<br>
<b>ISBN</b>0-676-60181-2<br>
<b>PUBLISHER</b>House of Collectibles<br>
<b>RESELLER</b>Random House<br>
<b>YEAR</b>1999<br>
</p></card>
<card id="third" title="Summary">
<p>
<b>SUMMARY:</b><br>
The Official Price Guide to The Beatles:  Records and
Memorabilia has everything to please, please
you--including CD and record listings (artist
compilations, singles, EPs, and LPs from Meet The
Beatles!  to Abbey Road)  
Valuable information on pricing and grading records and
memorabilia, what to expect when selling your records
to a dealer, and a handy chapter on authenticating
```

```
Beatles autographs. 
- COMPLETE DISCOGRAPHIES for The Beatles, Apple label
artists--plus the individual albums of John, Paul, George,
and Ringo. 
</p></card>
</wml>
```

The produced WML or cHTML formats will be used for the representation of information for the individual users. The representation will be described in the next section.

4. PORTALS ON LIMITED DEVICES

In this section we describe the pull service of the distribution part by explaining the portals on small mobile devices like mobile phones and PDAs. The users can login to the service and can browse in his personal information. PDAs have own browsers, often http-browser for example a special Internet Explorer on Pocket PCs. Mobile phones use WAP-browsers.

4.1 Pull Service on PDAs

The internet premium service offers a pull service on PDAs by the Web. This functionality offers the possibility to get service information by a Web-browser on the PDAs.

Users often work with PDAs when they are on the way and when they have no online connection to their office or private PC. In order to support this use case, PDAs use conduit-browsers. That means users synchronize their PDA and PC at some points of time and afterwards they use their PDA offline. In our case of internet premium service system it is possible to configure the conduit-browser in such a way that the user can synchronize the PDA and PC and afterwards he can read his personal service information offline.

Usual online browsing on the PDA just like browsing on a PC will also be supported.

By calling the Internet Premium Service portal page on the PDA, a start page for the input of login and password will be presented. Additionally a function for password forgotten is implemented. The user can ask for his password and gets an email with his password. Otherwise the user can enter the portal and gets the home page of the system by username and password.

Once the user has logged in the system he gets some web pages, in which he can navigate. In these web sites the functionalities L (logout),

H (home), A (archive), S (Search) and U (user data) are implemented. We work on small display clients, so that we use only one letter to describe a function. Additional there is a button, where the user can choose the language for representation of the websites and of service information content. The language which the user has selected during the registration to the internet premium service is used optionally. The available languages will be English and German. The default language will be English.

In detail, the functions on the web sites work in the following way. After clicking L for logout the user will leave the pull service portal.

If the user goes to home by clicking H, he get a site containing a list of service information items which have been selected by the system according to the users service profiles since the last users login. Each list item contains an icon that hints to the topic of information and a links to a new page with a more detailed description of the information.

New information will not be deleted at once, they will at first be written to an archive. These information will appear in the archive functionality during the next login of the user. This functionality by clicking to the letter A will present all the items of the information list, which have been read once by the user and which are not older than 30 days. The archive function will be designed in a similar way as the list on the main page. That means there are also icons that hint to the topics and links to the information description.

The function U for user data allows the user to get to the internet premium service registration portal and allows to modify his user data and his service and device profile data. This functionality is only available in the online mode and not for the offline application, because there is no back writing during the next synchronization.

An additional function in the Portal is S for searching. By this function the user can search for a special term in the database of the internet premium service system.

The user can configure a notification email alerting service for his pull service in the registration portal, which will remind him that there are new information arrived. The default value for this alerting service is every 7 days, but the user can change this value or he can stop this service by the registration portal.

4.2 Pull Service on Mobile Phones

The second part of the pull service is a WAP-service on mobile phones. The portal for this service is designed in a similar way as for the Web-service on PDAs, unless one has to design several cards instead of sites.

When the user browses in his information per WAP he is always connected online to the Internet Premium Service System, so that all the functionalities in the portal could work.

The user can configure a notification by sms, which will send him an SMS to remind him that new information are arrived. The notification sms connects automatically to the right site in the WAP-Portal and the user can read immediately his personal information.

5. EXAMPLE

As an example we implemented an internet premium service for new book publications and financial news on small clients like PDAs and mobile phones. For each of these two cases the user can select personal individual topics.

6. CONCLUSION AND OUTLOOK

This paper presents an internet premium service for flexible format limited output devices. In particular we implement a rule based system to transcode XML-based user interface descriptions to cHTML and WML in order to present premium service information by Web and WAP on embedded devices like mobile phones, PDAs and Smartphones. It is possible to enhanced the system by speech generation and to support graphics.

However, the idea and the tool of a rule based system for automatic transcoding is universal and can be used in other applications that work also with a variety of different devices and consequently with a variety of different output formats.

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