An Automatic Conversion HTML/XML to WSDL for Ubiquitous Mobile Services

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Abstract New technologies for ubiquitous environment, like Wi-Fi networks and 3rd generation mobile phones, are offering the infrastructure to conceive information systems as ubiquitous information systems, that is, systems that are accessible from anywhere, at any time, and with any device. Ubiquity is not yet another buzzword pushed by emerging technologies, but is mainly a means to support new business models and encourage new ways of work. Web services are key applications in business-to-business, business-to-customer, and enterprise applications integration solutions. As the mobile internet becomes one of the main methods for information delivery, mobi le Web Services are regarded as a critical aspect of e-business architecture. In this paper, we proposed a mobile Web Services middleware that converts conventional internet services into mobile Web services. We implemented a WSDL (Web Service Description Language) builder that converts HTML/XML into WSDL. This is minimizes the overhead cost of rebuilding mobile Web Services and enables seamless services between wired and wireless internet services. Our main contributions are to overcome the latency problem of current Web Services and to provide an easy mobile Web service implementation. Our system can completely support standard Web Services protocol, minimizing communication overhead, message processing time.

Keyword: Mobile Internet, Web Service, Ubiquitous, WSDL

1. Introduction

The anywhere/any time/any means paradigm is becoming the challenge in conceiving, designing, and releasing next generation information systems. Over the last years most business processes changed on various dimensions due to market conditions, organisational models, and usage scenarios of information systems. It requires flexibility, interconnectivity, coordination style, autonomy. Mobile internet services enable users to access the internet from any location at any time providing flexible personalized information according to users' location and their information need[1]. The mobile internet can provide various value added services in addition to basic communication services. As the internet capabilities are widely understood and wireless technologies advance, mobile internet services will soon be a major mediator in information delivery and in business transactions [2]. Mobile internet services, however, still have physical devices, network and content limitations. Physical device and network limitations make supporting common internet standards such as HTML, HTTP, and TCP/IP difficult because they are inefficient over mobile networks. Therefore, new protocols such as WAP (Wireless Application Protocol) and WML (Wireless Markup Language) are proposed to address these issues. Content limitations encourage researchers to find a method that can support reusing current wired Web information. Some researchers focus on the conversion of HTML documents to mobile internet serviceable WML documents and direct access to databases, to provide efficient information delivery in the wireless environment[3],[4],[5],[6],[7]. However, these researchers do not focus on the capability that allows applications to interact over the internet in an open and flexible way, but on the capability that provides dynamic wireless internet service according to different network and device environments. In fact, the former goal can be achieved by implementing Web Services. If the implementation is successful, interactions between applications are expected to be independent from the platform, programming language, middleware, and implementation of the applications involved. Nowadays Web Services become key applications in business-to-business, business-to-customer, and enterprise applications integration solutions [8]. In this paper, we focus on an automated content conversion from HTML/XML to Web Services capable data format for ubiquitous mobile service, called WSDL (Web Services Description Language).The paper is organized as follows: Section 2 summarizes relevant research results, including HTML conversion and Web services technology. Section 3 explains our HTML conversion implementation. Finally, conclusions and recommendations for further work are described in Section 4.

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2. Literature Review

2.1 Adapting Content for Wireless Internet Services

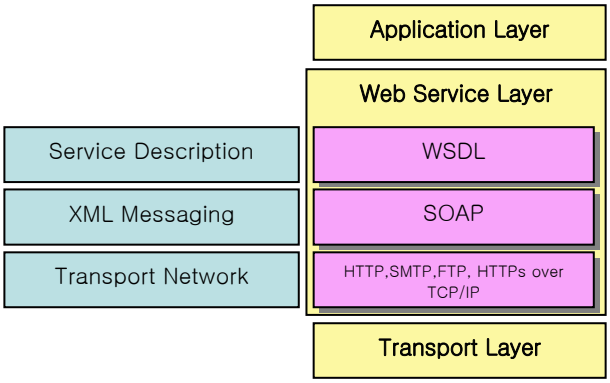
Nowadays users can access internet services by employing various devices including PC, mobile phone and PDA. Therefore, internet service providers should cope with these diversities to satisfy users' ubiquitous internet access needs. In this case, the main problems are how the service providers can provide seamless service for wired or wireless internet service content without significant additional costs and how they can provide sufficient content to clients. Adapting content from wired Web content to wireless content is regarded as a promising solution. Researchers usually focuses on HTML/WML conversion because the WAP is an alternative protocol for HTML in wireless internet services using Wireless Markup Language (WML), a small subset of Extensible Markup Language (XML), to create and deliver content. Kaasinen et al. and Dugas suggested an HTML/WML conversion proxy server, which converts HTML-based Web content automatically, and on-line, to WML [3]. Saha et al. suggested a middleware that is seamless and transparently translates a Web site's existing contents to mobile devices [6]. They also specified application integration, device independence, and optimal user interface as key challenges. Kurbel and Dabkowski proposed a dynamic user tailed WML content generation by using JSP (Java Server Pages) and JDBC-ODBC driver [4]. Magnusson and Stenmark suggested a CMS-based approach to visualise Web information in a PDA[16]. Pashtan et al. stressed context-aware wireless Web services, which can adapt their content to the user's dynamic content [7]. Again, we wish to stress these researchers focus only on HTML/WML conversion, not Web Services compliable conversion. Therefore, in spite of their importance, application integration aspects inside and outside enterprises have not been seriously considered by the researchers.

As the impotence of application integration over the internet becomes more important, nowadays Web Services are critical to any internet services, including the mobile internet service. They are regarded as key applications in business-to-business, business-to-customer, and enterprise applications integration solutions [11]. For this reason, we propose a method that converts HTML to WSDL. The WSDL files are used to provide Web Services with SOAP messaging protocols. More detailed explanation about the Web Services and its implementation issues are discussed in the following Section.

2.2 Application Integration with Web Services

A Web Service, as defined by the W3C Web Services Architecture Working Group, is "a software application identified by a URI, whose interfaces and bindings are capable of being defined, described, and discovered as XML artefacts. A Web service supports direct interactions with other software agents using XML-based messages exchanged via Internet-based protocols."[14-15]

Figure 1 illustrates the Web Service protocol stack in terms of the internet reference model. This stack is a collection of standardized protocols and application programming interfaces (APIs) that allows individuals and applications to locate and utilize Web Services. The Web Service Layer could be placed between the Transport and Application Layer and is based on several standard internet protocols, whereby the lowest three of which (WSDL, SOAP, and typically HTTP) should be supported by all Web Services implementations for interoperability.



(Fig.1) Web service protocol stack

Each vendor, standard organization, or marketing research firm, defines Web Services in a slightly different way. For this reason, the architecture of a Web service stack varies from one organization to another. In spite of this fact, Web Services can be considered a universal client/server architecture that permits disparate systems to communicate with each other without using proprietary client libraries. Therefore, this architecture simplifies the development process by effectively eliminating code dependencies between client and server [12].

Gottschalk explains Web Services from the service-oriented architecture [13]. The service provider creates Web Services and its service definitions and publishes the services with a service discovery agency. The interface of a Web service is described in an XML format called the Web Services Description Language [14-15]. A WSDL file contains descriptions of one or more interfaces and binding information for one or more services.

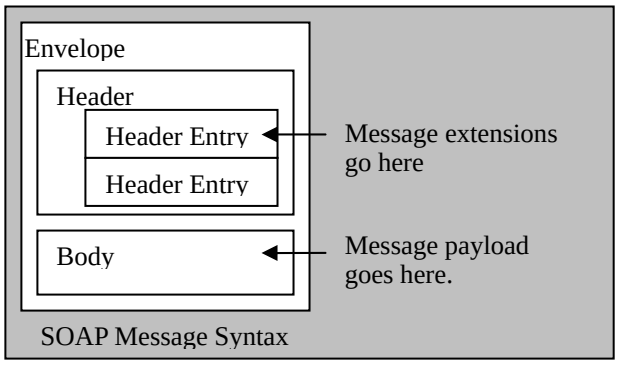
Typically the role of the discovery agency will be fulfilled by a registry, such as UDDI (Universal Description, Discovery and Integration). UDDI allows additional information describing the hosting business, and makes associations with the taxonomy to be published in association with the WSDL description so that others can access the service using a wide variety of search criteria, including category-based searches [8,11,13]. As the service registry is regarded as optional component, we do not discuss about anymore in the paper.

Once the Web Services are published, a requester may find them via the registry interface. The invocation of a service involves sending an XML message to the service provider and receiving an XML message in return. These XML interactions are governed by Simple Object Access Protocol (SOAP). A SOAP message is fundamentally a one-way transmission between SOAP nodes, from a SOAP sender to a SOAP receiver, but the SOAP messages are expected to be combined by applications to implement more complex interaction patterns. SOAP messages must be carried on a communication layer, which is usually the HTTP, but any other transport protocol such as SMTP, MIME, and FTP for public domains as well as CORBA and Message Queuing protocols for private domains, could be used [15].

A SOAP message consists of the following elements:

Envelope: The Envelope element serves as a container for the other elements of the SOAP message. As it is the top element, the Envelope is the message.

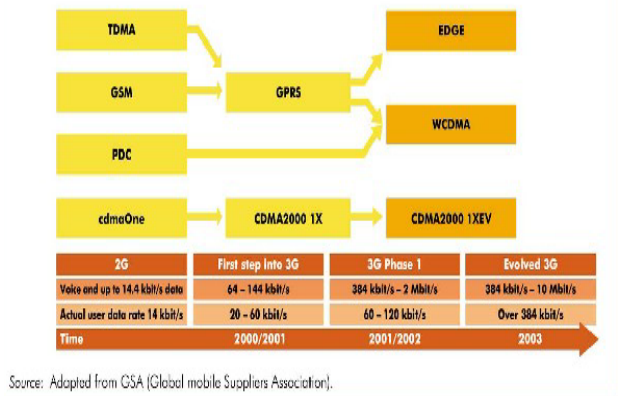
Header: The Header element is to encapsulate extensions to the message format without having to couple it to the payload or to modify the fundamental structure of SOAP. This allows extensions like transactions, encryption, object references, billing, and countless others to be added over time without breaking the specification. The Header element is optional therefore it may be eliminated.
Body: The Body element of a SOAP message is the location for application-specific data. It contains the payload of the message, carrying the data that represent the purpose of the message. It could be a remote procedure call, a purchase order, a style sheet, or any XML that needs to be exchanged using a message [16].



(Fig.2) SOAP Message Syntax

The evolutionary path from 2G to 3G has been mapped out for existing networks (see Figure 3). Migration differs depending on the existing 2G network.

In general, W-CDMA would require a brand new network to be installed whereas CDMA2000 1X requires less investment as an upgrade from existing second-generation CDMA networks. Among the five radio access technologies approved as IMT-2000, W-CDMA and CDMA2000 1X have gained the most support from regulators, mobile network operators and equipment manufacturers[17].



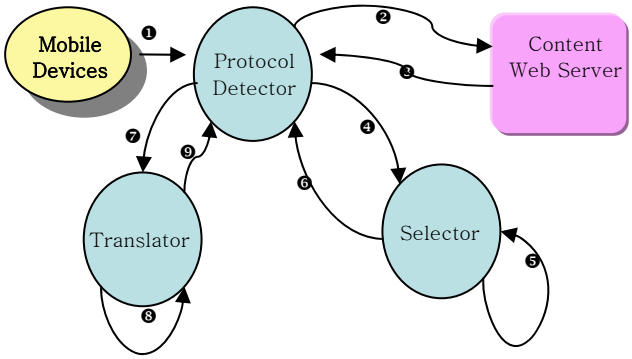
(Fig.3) Evolution of mobile systems to 3G

3. Implementation of HTML/WSDL converter

This Section explains our HTML/WSDL content converter system. It consists of three sub-modules: the rule script, the script engine, and the Mark-up Language converter. The rule script stores rules for content reformatting rules, which are created by the user with the management program. The rules include personalization information and display structuring information of mobile devices. Secondly, the script engine reconstructs contents by using script rules and client (device) information. The Mark-up language converter transforms Mark-up language if the Mark-up language that the server provides differs from what the client can process.

Script rules are created as follows. If a Web site address is supplied, our system reads and parses the Web site information. The parsed information is then presented by using a DOM tree, in which the user can select and save node information to be served as wireless internet content. The JML (Java Modeling Language) editor defines XML tags and attributes of the saved items. TITLE, BASEURL, LINK, HREF, CONTENT, and ELEMENT are XML tag examples and many attributes are also available to customize mobile contents.

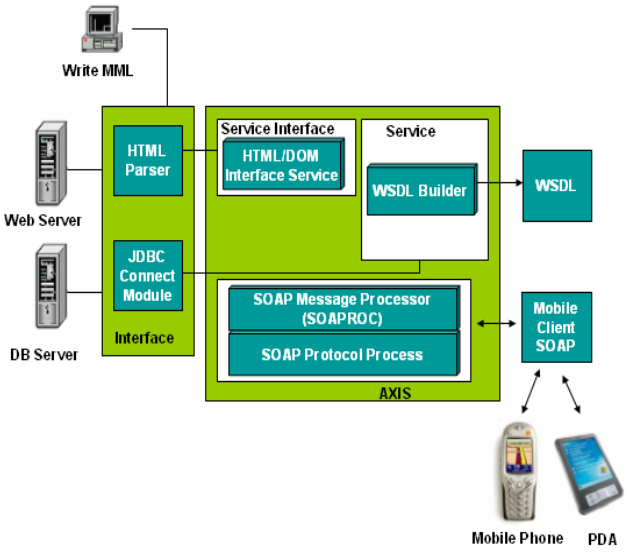
Figure 4 illustrates the operation of the converter. The user accesses the HTML/WSDL converter system via mobile devices and mobile networks.
The converter gets the user's mobile device information such as display size and colors, and URL information that the user requests by using the protocol detector. After getting this information, the converter requests URL information from the Web server.
The Web server generates a HTML response message and sends it to protocol detector. The protocol detector then passes this HTTP response message to the selector with client information. The selector chooses WSDL information from the HTTP response message by using the script rules and returns this information to the protocol detector. The protocol detector in turn sends this information to the translator, which performs Mark-up language transformation, image transformation, paging and cashing. Lastly, the converter sends this processed result to the user.



(Fig.4) HTML/WSDL Content Converter Operation

4. Implementation of SOAP Message Processor

In the Web Services, XML based SOAP messages are used when the clients request Web Services from the server or when the server sends Web Service response messages to the clients. In the standard Web Services implementation this is supported by Tomcat and AXIS. Figure 5 illustrates our Web Services system implementation architecture, in which a WSDL files are directly generated by the WSDL builder and SOAP messages are processed by the SOAProc system.



(Fig.5) A New Mobile Web Service Implementation by using the SOAProc and the WSDL builder

5. Conclusions

In the Ubiquitous environment, Mobile Web services are critical solutions in the internet service integration architecture. In this research we proposed a HTML/WSDL converter can support reusing current HTML based contents. This is essential for saving developing or maintenance costs and serving seamless internet services both wired and wireless . In this paper, we propose a method that extracts mobile service content from wired Web document by using content extracting rules. The rules are generated by using specific DOM tree and assigning its specific nodes as mobile service items. The JML editors are used to assign XML tag to these items. By applying these rules, the system generates WSDL files on the fly by which appropriate wireless markup files are generated.

In spite of successfully implement an intermediate content extracting adaptation system that support dynamic content publishing according to delivery context, still we need to study following tasks: There are various implementation issues on the HTTP form processing such as the HTTP “post” method processing, session management and java script processing. These kinds of implementation should be handled for more complete content adaptation system.

References

[1] Siau, K., E.P. Lim, and Z. Shen, Mobile commerce: promises, challenges, and research agenda. Journal of Database Management, 2001. vol.12, no.3: p. 4-13.

[2] Senn, J.A., The emergence of m-commerce. Computer, 2000. 33(12): p. 148-150.

[3] Kaasinen, E., et al., Two approaches to bringing Internet services to WAP devices. Computer Networks, 2000. 33(1-6): p. 231-246.

[4] Kurbel, K. and A. Dabkowski. Dynamic WAP content Generation with the use of Java Server Pages. in Web Databases/Java and Databases: Persistence Options (Web&DB/JaDa). 2002. Erfurt, Germany.

[5] Metter, M. and R. Colomb. WAP Enabling Existing HTML Applications. in First Australasian User Interface Conference. 2000.

[6] Saha, S., M. Jamtgaard, and J. Villasenor, Bringing the wireless Internet to mobile devices. Computer, 2001. vol.34, no.6: p. 54-58.

[7] Pashtan, A., S. Kollipara, and M. Pearce, Adapting content for wireless Web services. IEEE Internet Computing, 2003. 7(5): p. 79-85.

[8] Farrell, J.A. and H. Kreger, Web services management approaches. IBM Systems Journal, 2002. vol.41, no.2: p. 212-227.

[9] Kohlhoff, C. and R. Steele, Evaluating SOAP for high performance applications in capital markets. Computer Systems Science and Engineering, 2004. 19(4): p. 241-251.

[10] Magnusson, M. and D. Stenmark. Mobile Access to the Intranet: Web Content Management for PDAs. in Americas Conference on Information Systems 2003. 2003.

[11] Ferris, C. and J. Farrell, What are Web services? Communications of the ACM, 2003. 46(6): p. 31.

[12] Myerson, J.M., Web Services Architectures: How they stack up. 2002.

[13] Gottschalk, K., et al., Introduction to Web services architecture. IBM Systems Journal, 2002. vol.41, no.2: p. 170-177.

[14] W3C, Web Services Description Language (WSDL) Version 2.0. Web Services Description Language (WSDL), 2005.

[15] W3C, SOAP Version 1.2. SOAP Version 1.2, 2003.

[16] Cauldwell, P., et al., Professional XML Web Services. 2001, Birmingham: Wrox Press

[17] International Telecommunication Union, The Evolutional to 3G Mobile-Status Report, http://www.itu.int/itunews/issue/2003/06/thirdgeneration.html, 2003

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-Mobile & Ubiquitous Web Service platform, Real-time Multimedia Communication, Security Engineering

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