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EXTENDING WEBSITES TO WIRELESS DEVICES: A WAP FRAMEWORK WITH AN EXAMPLE IN EDUCATION PORTALS

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Abstract

Web sites range in content from personal trivia to e-commerce. This content is accessed by a variety of browsers on many computing platforms. A subset of this content is now being made available on non-traditional computing devices such as Personal Digital Assistants and cell phones. This paper is an attempt at analyzing the requirements of such content and the issues involved in its delivery. The paper also addresses the implementation of such a solution in an education portal.

Introduction

Web sites range in content from personal trivia to e-commerce. The content format is a collection of HTML, graphics and media files. While the majority of web content is viewed in an HTML browser, a smaller subset is now being made available for special browsers that run on handheld computing devices (Kaasinen, et al., 2000). A significant part of the overall web content is dedicated to education. Universities now provide websites with course information such as syllabus, schedule, exam dates, and contact email addresses (Horton, 2000). To that end, this research is designed to explore and implement viable options for extending content to wireless devices via XML and its variants. It also looks into the advantages and disadvantages of using a technology like WAP.

This paper discusses the approaches to wireless data formatting and delivery. It also explains this process via the development and implementation of a database-powered course web site and its extension via the Wireless Access Protocol or WAP (WAP, 2000). The focus of the paper is on the WAP implementation. By utilizing a database, we are able to achieve better data definition and closer integration with existing systems on campus. Such implementations have existed in commercial sites for some time now, but are designed for a different consumer. We have modified this approach to suit academic budgets and needs, and in the process, we hope to add value to students’ course-related online experience.

Background

Commercial websites have been powered by automated page generation for a few years (Amstel, et al., 2000). The data design is either based on the Common Gateway Interface (CGI) model or are developed using Server Application Programming Interfaces (SAPI) model. Another concept that has gained popularity in the last few years is the use of a database to power the data requirements of a website. Instead of developing static HTML content, templates are developed to suit the structure of the data. The templates are populated with data extracted from the database tables via query languages such as SQL. This approach lends itself to strong data definition and data manipulation capabilities of web content. The same data can be "wrapped" in customized wrappers to support a variety of end-user platforms. This approach allows the content provider to release content in a variety of proprietary and non-proprietary formats. Therefore, access to online resources via a variety of wired and wireless portable devices becomes more feasible. This approach also reduces duplication and redundancy of content in different formats and reduces versioning problems (Amstel, et al., 2000).
From a user adoption perspective, the anticipated growth of WAP in the market is questionable (Bannan, 2000). Some researchers question its lack of features while others argue that the increase in wireless bandwidth will be able to support entire eXtended Markup Language (XML) documents (Bannan, 2000), thereby overshadowing the key features of WAP. Based on the literature and the current developments in wireless standards, it is difficult to assess the long-term viability of WAP. However, in the short run, it is a worthwhile technology that continues to fill a gap in the information delivery process.

System Design and Implementation

We designed our project to implement and demonstrate the use of WAP in an academic website. We chose an undergraduate course website that currently exists as a portal and is powered by a database. This website provides general information, course schedules, lab information and chapter outlines. It also provides students with authenticated access to their grades and online profile information. Of this website, we dedicated a small subset for WAP-based access. When selecting a data design model, we chose the SAPI approach. We opted to use PHP: Hypertext Preprocessor (PHP, 2001) for the development of templates and all server-side programming, supported by Apache web server, running on a distribution of Linux. This combination is portable to Unix, and all 32-bit Windows platforms. Due to the extensive support for XML in PHP (Ratschiller and Gerken, 2000), we will be able to migrate our current setup and scale to other full-fledged XML solutions in the future. The database chosen for our application is MySQL, an open source, multi-threaded, cross-platform, SQL-based database optimized for web access (MySQL, 2001). Since the use of a database is central to this work, we will describe its role briefly. We analyzed the data requirements of the original web site. Following principles of database design and normalization we created and populated a series of tables in the database and migrated the static HTML content to records in database tables. These tables are referenced and manipulated via standard ANSI SQL statements. The database also allows us to create indexes for fast queries, and the support of an internal search engine.

All the HTML documents that provide information from the database were converted to PHP documents. PHP allows us to embed data extraction methods inside HTML formatted documents. This feature allows us to retain the HTML characteristics of the documents (such as color, fonts, and table formats) while embedding SQL for data extraction purposes. We used such a combination of HTML and PHP to develop templates. In this project, we have successfully developed templates for schedule information, chapters, and student reports with links to internal and external documents. By including fields in tables that recognize release dates for events, we were also able to automate events such as assignment due dates, weekly chapter releases, and exam date notifications. By using features in PHP, we are also able to provide students with authenticated services to view/print grade reports and manage their online accounts.

To enable WAP access, we use two-fold approach. The first part is to modify the existing PHP-based extraction engine and provide a subset of the information via WAP. The original PHP extraction engine is designed to deliver content as HTML, suitable for a web browser. WAP uses Wireless Markup Language or WML as its underlying markup structure, which is based on XML (WML, 2000). It provides data in an abbreviated form designed for low bandwidth devices with small user interfaces such as WAP enabled cell phones and handheld Personal Digital Assistants (PDA). While the low bandwidth is only an anticipated bottleneck in such systems, the main concern is the small interface on which one has to view information. This restriction poses a challenge. WML however, is designed to deliver abbreviated web pages as a collection of cards bound together in an XML format called a deck. This allows the WML sites to be delivered under the stipulated 1400 bytes size for each deck (WAP, 2000).

The second part of the challenge is to provide appropriate headers for the content. Web servers deliver HTML content using the text/html MIME type (Freed and Borenstein, 1996). WAP uses the text/vnd.wap.wml MIME type, and unless the web server provides this information in the document header, the WAP gateway will not recognize the content as a WML document (Frost, 2000). PHP allows us to create this header on-the-fly, thereby signaling the WAP gateway to process the content as WML deck.

After creating the extraction engine for WML and customizing the headers for WAP, we proceeded to test the service on a limited basis via programs called WAP Emulators. These programs emulate a WAP service and use a WAP gateway for accessing websites, but are not restricted to the bandwidth limitations of a cell phone or a wireless modem. The preliminary results with a WAP emulator have been successful. The current WAP service presents limited information on schedule and exam dates. We are in the process of extending this to authenticated services for student grade reports.
Current Status and Results

While the service runs on a limited basis, we would like to examine the scalability of this service when used by a larger group. We plan to conduct studies on the use of WAP-enabled subset of the web site in the next academic year. The cost of providing WAP access on the user’s side continues to be an expensive challenge. At this point, we assume that the users will have access to their own WAP gateways through their service providers. The migration to a database has helped us in a better design of the course website. The database allows for a cleaner design of web pages and consistency in the website. With little effort, we have been able to successfully port this website to another course. The use of PHP, MySQL and Apache allowed us to keep the implementation costs near zero. Since the three components mentioned above are available as free open source downloads, this project can be replicated at other organizations with minimal effort.

Conclusion and Future Work

Wireless content delivery has several challenges. The main impediment continues to be a lack of bandwidth to sustain real-time content delivery. Future plans for wireless protocols and services are expected to address this problem, but currently it is difficult to support full-fledged XML document over wireless. WML with WAP provides an interim solution. In the long run, moving to a cross-platform format such as XML will allow users to access content not only as asynchronous XML documents, but also as synchronous XML streams allowing users to access value-added services such as live scheduling and instant messaging. One outcome of this research is that we have developed a foundation on which we can gather user feedback on the types of content that are most appropriate for wireless delivery. This distinction will enable us to design extensions of web content, which are tailored for wireless delivery. We also intend to examine if there are any significant differences in performance, based on synchronous vs. asynchronous access, nomadic vs. fixed access, and the use of XML vs. proprietary formats.

References

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