A Collaborative Courseware Generating System Based on WebDAV, XML, and JSP

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Abstract

Today, with the use of global cooperation in education, more and more courses are given directly on the Web in a collaborative manner among geographically dispersed universities. Consequently, Web-based courseware generation is becoming increasingly complicated as this cooperation also introduces additional challenges for the courseware authoring and publishing process. In this paper, we present a courseware generating system which focuses on facilitating the courseware generating process taking advantage of recent Internet protocols and industry standards. We adopt a collaboration-friendly Internet protocol, WebDAV, to support collaborative courseware authoring, XML to represent meta-data of course contents, and JSP to realize dynamic courseware presentation. With its simple syntax, XML can on the one hand simplify the courseware authoring process in company with WebDAV, on the other hand, as a neutral meta-language, it can also separate course contents from courseware presentation in company with JSP.

1. Introduction

Since the summer semester 1999, the CS1 course "Introduction to Java Programming" (Info-1 for short) has been given on the Web in three German universities and one university in Italy. In this paper we will describe the latest incarnation of our courseware system used for the joint course Hannover/Bozen, which has been developed within the Virtual Campus Project and the cooperation with Bozen University. While such sort of Web-based distance education is on the one hand reducing the teaching costs, increasing teaching opportunities, as well as improving the collaboration among the partner universities, it raises additional challenges when we design the Web-based courseware in a collaborative manner among geographically dispersed lecturers.

First, we have to find an efficient mechanism in order to support collaborative courseware authoring.

The authoring of our joint Info-1 courseware is performed by different lecturers situated at Hannover and Bozen. To reflect the latest technology developments, we have to continually adjust and revise the courseware over the whole semester. In this process, an efficient mechanism is urgently needed to facilitate, as well as secure the collaborative courseware authoring process, e.g., facilitating opinion exchange among lecturers, preventing "overwriting" on each other's work, etc. According to our experience, the use of existing simple tools designed for supporting collaborative work, e.g., FTP, e-mail notification, etc., is difficult and cumbersome, while version management systems, which are providing required functionalities, require new client side programs and new commands, which distract the lecturers from the main task of actually writing the courseware, especially when the authoring process occurs over the whole semester. By adopting the collaboration-friendly Internet protocol WebDAV (Web-based Distributed Authoring and Versioning)[1] we have found a way to facilitate courseware authoring.

Second, we have to find an efficient mechanism in order to separate course contents from courseware presentation.

Because the course contents is continually changing during the teaching process, we need a courseware publishing engine which is cleanly separated from course contents and is able to immediately reflect any modifications of course contents. By adopting XML (eXtensible Markup Language) as the standard data interface, as well as JSP (JavaServer Pages) as the core of the publishing engine, we can easily separate course contents from dynamic courseware presentation.

Finally, we have to choose appropriate technologies in order to shorten the development process and test-cycle.

Courseware generating should be a "building" process rather than a repetitive "programming" process. By adopting some standard and "reusable" technologies, particularly XML Data-Binding Specification: JSR 031 [3] and JSP tag libraries, we have achieved above design goal.

2. Collaborative courseware authoring based on WebDAV and XML

Our courseware generating system consists of a courseware authoring module and a courseware publishing engine. The courseware authoring module comprises a courseware repository which stores course script files, and an XML file which represents the courseware structure. The latter, which is restricted by the pre-defined DTD, serves also as the standard data interface between authoring module and publishing engine. Any courseware validated by the DTD can be directly rendered by the publishing engine without the need of any reconfiguration.

The courseware authors can access the courseware repository and the courseware structure file via WebDAV protocol using a WebDAV-enabled authoring tool, e.g., Microsoft FrontPage 2000, Office 2000, or Adobe GoLive 5.0, etc.

Taking advantage of WebDAV, the lecturers can "in-place" (directly on the remote server) implement most activities needed for collaborative courseware authoring, e.g., editing course script files stored in the courseware repository, manipulating the repository's namespace, utilizing locking mechanism to prevent "overwriting", or manipulating properties of a specific course script file in order to exchange ideas and opinions among lecturers [2]. Since all WebDAV-enabled tools are aware of WebDAV's methods (Propfind, Lock, etc), they can "in-place" handle all "format-compliant" course script files without the need of explicit download and upload.

3. Courseware publishing based on JSP

The courseware publishing process has to go through three steps. First, the XML-based courseware structure has to be translated into corresponding Java objects (JavaBeans) utilizing JSR 031 [3]. Second, based on the generated JavaBeans, JSP tag libraries, which encapsulate commonly used JSP presentation templates, need to be developed. Finally, JSP tag libraries are further used to construct JSPs which are then directly accessed by Web browsers. In Fig.1. we illustrate the courseware publishing process.

Actually, the first and second step are the key to produce dynamic and reusable courseware presentation. JSR 031 is a Java Specification Request proposed by Sun Microsystems Company for defining an XML data-binding facility for the Java platform. Our purpose for

applying JSR 031 is mainly to automate the Java XML data-binding process and to reduce programming work. In fact, together with pre-defined DTD, the JavaBeans generated according to JSR 031 can essentially ensure the reusability of JSP tag libraries and JSPs.
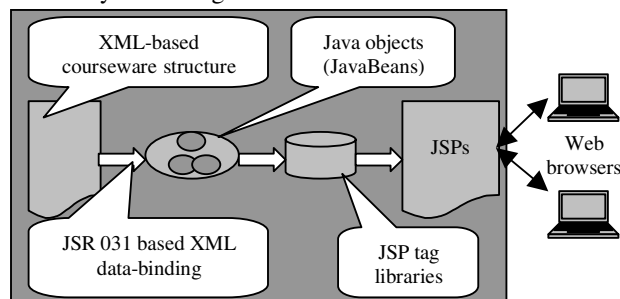

Fig. 1. Process of courseware publishing

Furthermore, as we can see in Fig. 1., JSPs applied in Info-1 are not directly constructed utilizing JavaBeans, but JSP tag libraries. Although JavaBeans plus Java in-line code can be directly applied in JSPs for realizing dynamic courseware presentation, we have to use relatively more Java code in JSPs to control presentation logic because we want to generate multi-views of Info-1 based on the same course contents. By utilizing JSP tag libraries, we can reduce the necessity to embed large amounts of Java code in JSPs and make the courseware publishing engine more robust and reusable

4. System implementation

The whole system has been built on Windows 2000, but also runs on Solaris. The standard Web server is Apache Web Server 1.3.14. The basic capabilities of WebDAV are implemented by Apache mod_dav 1.0.2 [4]. The JSP support is provided by Apache Tomcat 3.2.1, which is installed as an add-on to the Apache Web Server. In addition, the Apache XML parser Xerces 1.2.3 is installed to handle XML syntax.

5. References

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