COMBINING XML AND DATABASE THEORY

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ABSTRACT

Most advanced database systems courses focus on core aspects of relational design, data modeling, transaction processing, and distributed database issues. Given the ever increasing importance of web enabled databases generally but particularly the influence of XML (eXtensible Markup Language), an alternative approach would be to teach the traditional core principles while integrating an XML module into the course. The focus of this paper is to elaborate on how such an integration would be accomplished in an advanced database course.

INTRODUCTION

Advanced database courses traditionally cover the theory and concepts behind the design and implementation of relational databases. In recent years there has been mounting pressure to weave into this discussion content on integration with the Web as much e-commerce is facilitated by web-enabled databases. The purpose of this paper is to show how we enriched an advanced database class by adding an XML (eXtensible Markup Language, the emerging standard technology for database / web integration) module that extended a typical a real world database example with an integrated XML component. To do this we developed a database using Microsoft's SQL Server 2000, referenced several online tutorials, and created assignments to "pull" data from this database using the XML technology [1].

The importance of XML is supported by the fact that Microsoft SQL Server 2000 supports XML, and the result sets can be returned directly in XML format, or data can be retrieved from an XML document as if it were a SQL Server table.

Moab Medical Clinic – the Background Context for the Module

One of the challenges of database instruction is creating interesting cases relevant to students. Many of Utah State University students are avid outdoor enthusiasts and our campus in located next to the entrance of a national forest with extensive biking trails. The biking trails around Moab are internationally famous, and the authors believe that students will easily identify with the nature of mountain biking and understand the common injuries from this sport. Many students have visited a clinic or emergency room for an injury at some point in their life, so a clinical model was chosen to illustrate principals of database design and to facilitate the student's comprehension of the queries that are assigned. Their familiarity with the material should assist them to interpret the correctness of the output of their queries and to formulate appropriate queries.

The Moab Medical Clinic (MMC) is located just outside of Moab, Utah near many of the famous slick rock mountain biking trails and off-road vehicle trails. It was primarily designed to handle emergency cases that result from accidents involving mountain bikes and off road vehicles. It was located near

many popular sites so that emergency response times could be minimized. Common cases at the clinic include fractured bones, concussions, abrasions, and puncture wounds from these outdoor accidents. Most of the patients entering the clinic will have common injuries and report pain.

The case approaches the design of the clinic's functions using a simplified model of care. Students are not expected to be familiar with medical clinic operations, and this teaching case builds upon common experiences in receiving medical care to determine the entities and relationships in the database.

Entity Relationship Modeling

Students are given a textual case based on the MMC. The students are to read the case and "ferret out" relevant database information. Students then determine the relevant entities and relationships based on information provided in the case. After the entities and relationships are determined, students create the database while enforcing the key constraints and business rules.

A patient presents herself and may be admitted to the MMC. In the process of being admitted, her address, date of birth and other identifying information are recorded along with the patient's self-reported symptoms. MMC staff record the patient's injuries and classify them according to a list of standard injuries. If a medication is prescribed, the name, time and dosage amount are recorded. MMC staff then record the patient's response to the medication. Since patients may frequent the clinic, each admission is separately recorded, though all patient and injury information can be collected and aggregated. Billing information and data on payments are collected for each billing cycle.

Logical Relational Modeling – Specifying Tables and Fields

In the full version of the paper, we explain the full relational design of the tables and the data types of the fields. We include the following tables: patients, patients admittance, injury, admissions injury, medications, patients medications, symptoms, patient symptom, and billing.

Moab Medical Clinic XML Module

When the students finish creating and populating the database, they are ready to start learning about XML and how to apply it to the MMC. The students will learn about the basic structure of XML, how to format XML on the web, the use of validation tools and how to bring the data into a database from an XML file. An example of part of the XML portion can be found in Appendix B.

We include links to several tutorials found in the XML Module [1]. Upon completion of these tutorials, the students will be given assignments designed to teach the different methods of accomplishing a given task, and then the student uses this new knowledge to complete a correlating assignment. The online tutorials come from several popular and well known computer companies, like Microsoft and Sun Microsystems. The tutorials coincide with the assignments, teaching the students how to 1) create the database; 2) create an XML document using SQL Server 2000; 3) attach an XSL-FO document; and 4) bring a XML document into an existing SQL Server database. There is also a section in the XML Module that references how to setup the Microsoft SQL Server to view XML in a query analyzer.

The first assignment involves creating the MMC database, as stated in the previous section. The rest of the assignments are interrelated and build upon each other. This is important because the XML module is designed to provide students with a solid XML experience.

The assignments were developed as part of the active learning method. The students will take what is learned in the tutorials and will then complete the assignment to reinforce learning and master the material. Because this module is being used in the advanced database course, the solutions are available upon request.

After completing the tutorials the students then must work on the assignments. Because the tutorials are all online, the students can reference these while completing the assignments, thus creating a reference base of future resources. As the students complete the tutorials about a specific technology, they should move to the correlated assignment before moving on to the next XML technology.

CONCLUSION

We have created a comprehensive teaching case that demonstrates the integration of a XML module into an advanced database course. XML is becoming an increasingly important technology, yet few schools are teaching students how to retrieve, format and display XML data. Based on a sound relational database built in earlier assignments, students proceed through a number of tutorials that develop their familiarity with key components of XML technology. We believe that this method offers a couple of advantages. For a complete version of this paper with all the ER diagrams and XML code, please ask one of the authors.

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