

Home-Grown Courseware Management System

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Abstract In the past decade there has been a proliferation of courseware management systems being developed and promoted as a means of simplifying the creation and management of instructional websites. Implementing these systems can be resource intensive and require large budgets to cover aspects such as infrastructure, integration into legacy databases, training, maintenance and on-going support. With these costs in mind, deciding to implement such a system should be carefully considered. Are there other options? With the proliferation of many freeware applications, and powerful online databases, the ability to develop customised in-house solutions is now becoming more attractive and viable.

This paper considers the design and development of a courseware management system that was created in-house, according to the needs of an academic department. The application services over 2000 students, is easy to maintain and allows customised tools to be quickly integrated.

Introduction

The use of the World Wide Web to provide integrated environments for teaching and learning has received much attention in recent years. Almost every university in the world is providing some sort of web based management system to promote online learning and increase efficiencies in courseware delivery. Within this paradigm, commercial companies have seized the opportunity to promote their courseware management tools such as TopClass, WebCT and Blackboard. Claims are being made such as “easy-to-use environment[s] for creating sophisticated WWW-based courses that are otherwise beyond the ability of the non computer programmer” (ULT, 1999) and claim to “make it easy to transform existing instructor-led content into online learning materials” (WBT Systems, 1999). However, such claims are not always easy to justify.

The potential of courseware management systems being successfully implemented is dependent upon many factors such factors as the ease with which the course can be developed and administered within the application, and the quality of the interface for end users, as well as the extent to which the product provides flexibility in the development of on-line learning strategies. The following should be carefully considered before committing to a courseware management system (McMahon and Luca, 2000):

- Will the courseware management system be implemented across the whole university?
- Have the courseware tools been carefully considered for their instructional relevance?
- How easy is it to add customised features if needed?
- Has a budget been allocated for training lectures and students in how to access and use the new environment?
- Has a budget been allocated for central technical support and help desk?

- Will an instructional design advisory group be set up for to advise lecturers?
- Do all the levels of management support its implementation?

After experimenting with some of these systems at Edith Cowan University, and calculating the cost of implementation, as well as the lack of required features, we decided to create our own courseware management system. We hoped that this would give us greater flexibility and enable us to easily and cheaply develop pedagogical tools that suited individual's teaching styles and needs, without being handicapped by the structure of a commercial courseware management system.

However, even though the idea of developing a customised online courseware management system sounds attractive, careful planning and consideration is required. This paper discusses the strategic factors and issues involved in deciding how a courseware management system was developed at Edith Cowan University. The main objective was to develop an online courseware management system for making content available to students that was cost effective, easy to upload, maintain and provide flexibility.

Advantages and Disadvantages of Courseware Management Systems

To anyone already involved in the use of on-line teaching the potential of these integrated courseware management systems should be welcomed, as they provide a consistency, ease of use, maintainability and flexibility across whole schools, faculties or universities. The motives behind these developments are varied. Some of the stated aims for students include (Siviter, 1994):

- Enhancing the quality of the learning experience;
- Extending access to education by enabling more open learning and distance learning;
- Increasing the cost effectiveness of teaching and learning; and
- Giving learners more control over their learning.

Through the implementation of these systems, non-technical academic staff can be trained to independently create and produce online content, while maintaining a uniform look and feel of all on-line materials. This can be achieved by using instructional strategies that are integrated in workflow practices, so that improved teaching and learning strategies can also be implemented in the change process.

Even though there are clear advantages in providing on-line teaching and learning resources, the move to courseware management systems can represent a substantial investment in time, money and resources for not only upfront software costs, but also the investment needed in training technical support, lecturers, tutors, sessional staff members and students. Also, there can be serious technical infrastructure problems, as well as cultural problems associated with some staff adopting this new technology. With these considerations, the choice to purchase commercial courseware management systems should be carefully considered. What other options are available to tertiary institutions?

Most universities have a computer science school as well as research students, with the required skills to develop online computer applications. It would not be difficult for some of these staff to manage the development of an online courseware management system. Especially with the advent of powerful, and in many instances free web based database tools, this is now becoming increasingly feasible and cost effective. Advantages in creating a

customised solution include lower costs, streamlined software, ownership, flexibility of quickly being able to create required pedagogical tools, as well as the ability to freely integrate the plethora of freeware educational products that are now available on the web. This would allow academic staff the freedom to select different courseware tools and configurations to suit their style of teaching, with having to work within the restrictions of off-the-shelf products.

In the following section, an overview of a customised courseware management system is discussed, that was developed for the School of Communications and Multimedia (SC+M) at Edith Cowan University (ECU).

System Description

The School of Communications and Multimedia (SC+M) at ECU approached the issue of online unit support (aka. courseware management) by looking at the requirements of our evolving web presence, identifying the following basic requirements as important to an academic discipline within our setting:

- Support for course information such as programme structure and information for prospective and existing students;
- Support for online communication and unit-related resource management;
- Provision of basic communication tools which could support the delivery of courseware materials;
- Support for students accessing course materials in a password authenticated environment with some basic portal functionality;
- Support for staff of varying levels of IT proficiency in the creation of online unit web sites; and
- Integration of the above into a holistic system with some level of information re-use between different functions.

To meet the above requirements, a custom-built environment (scamOnline : <http://www.scam.ecu.edu.au/>) has been developed which supports the activities of SC+M. Our experiences here are informing the next generation system, currently in development, which enhances the above with a suite of pedagogical tools to further support online teaching and learning. The basic system structure of sc+mONLINE is shown in Figure 1.

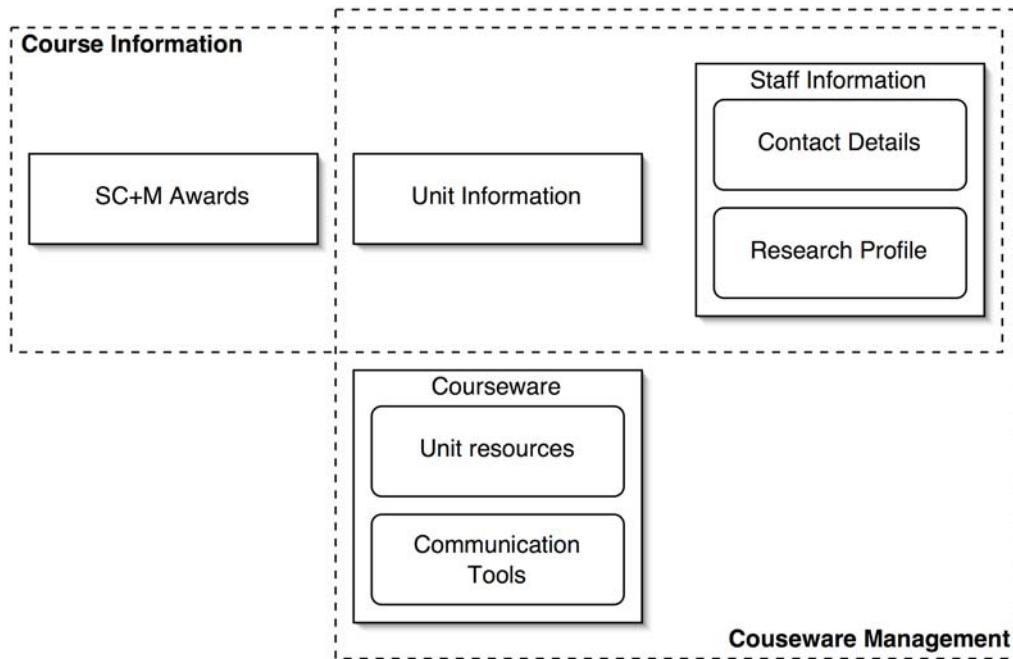


Figure 1: *sc+mONLINE* overview

The structure of the system is based about its two essential functions, delivery of course/school information and delivery of courseware resources. The course information function involves the dissemination of details of the programmes offered by SC+M and includes reference to programme structure, unit details and general information about SC+M. This involved the development of a database-driven system that included information at award, programme and unit level, as well as a staff/tutor database containing contact information and research profiles.

Courseware management is linked into the above function and essentially provides an automatically generated template for each and every unit into which teaching staff can add material resources for student access as well as providing communication tools for use by students. The aim is to provide a functional interface to course resources such as unit outline and assessment details, a weekly schedule incorporating resources and activities for each week of a semester. Staff have the ability to upload content for student download, post unit messages, provides links to online resources as well as providing categorised message boards and url-posting facilities. The primary goals with the development of this system was to integrate with the course information and to provide a simple interface which is a ‘snapshot’ of a unit schedule to be run during any given semester. (Figure 2)



Figure 2: Courseware access interface

The courseware access interface, shown in figure X, provides students with online resources and communications tools specific to their unit of study. The interface is designed to be printed as a schedule and to provide a clear and simple to navigate interface to the online courseware. In addition to the courseware access interface, the system also incorporates a courseware management interface that provides academic staff with the ability to manage the unit resources; this is shown in Figure 3 below.

The courseware management interface provides a simple tool for managing the variety of online resources and selected. The range of options available to the academic include:

- a schedule manager which allows a weekly schedule to be developed and propagated with the courseware elements relevant to that week;
- a file management tool to support upload of resources to the unit content area and subsequent linking to schedule entries;
- a discussion board manager which allows the creation of discussion boards and forums for use by students enrolled in the unit;
- a url posting manager which allows the definition of url-posting categories available to students who wish to tell others of useful links to other internet resources;
- a link and message manager for the creation of links and messages for the schedule view above.

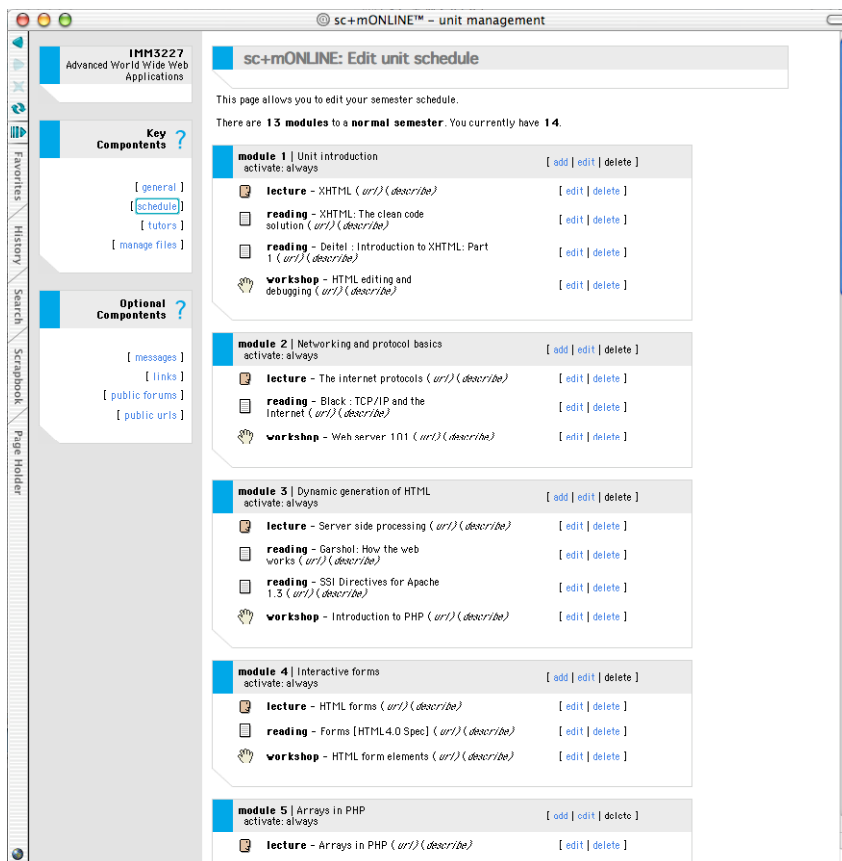


Figure 3: Courseware management interface

This fairly basic, yet fundamental, suite of tools is available for every unit registered with the system and provides a simple management and access model for use by staff and student users. Feedback from both types of user has been generally positive, although academic staff still need some level of training in order to make materials available via the system. This training is generally related more to the development of resources than using the system, difficulties arise from:

- dealing with the tools required to create resources for upload such as PDF development tools;
- understanding the workflow from resource (on paper or electronic) through some electronic format to web; and
- the mental model of a unit being broken into a schedule with weekly modules each containing a series of deconstructed resources (readings, lecture notes, activities) presented in a meaningful way.

As a result of using in-house expertise to develop customised solutions for our own courseware management system, a range of online applications have been developed at SCAM to help satisfy the requirements of academic staff. These include:

- SCAM content manager <http://www.scam.ecu.edu.au/>
- Online learning environment for project management — JoePM <http://joepm.scam.ecu.edu.au/>

- Mathematics Education On the Web — MEOW <http://www.scam.ecu.edu.au/meow/>
- Students projects and E-portfolios <http://studentprojects.scam.ecu.edu.au/> and
- Careers Web Site <http://careers.scam.ecu.edu.au/>

The process of designing and developing these applications has helped the School of Communications and Multimedia form a strategy to provide a range of resources to help students within their academic courses, and as well as providing career opportunities (Figure 4). The courseware management system provides students with the opportunities to create on-line portfolios, which consist of documentation, web sites and other work. These are then integrated into a careers web site that is promoted to the industry (as a free service) to help students obtain employment opportunities. The ideas and creativity used to develop these sites was a direct result of having the opportunity to design web sites using customised solutions and in-house production.

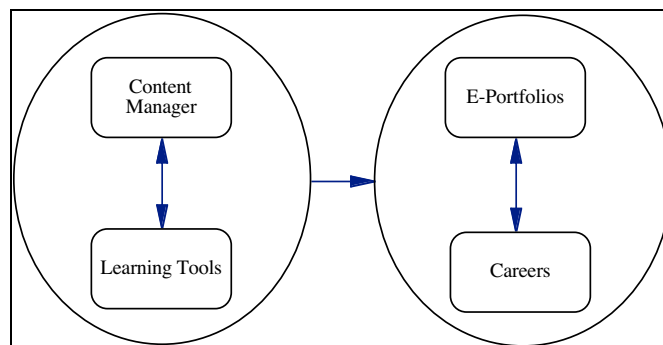


Figure 4: Overview of online applications at SCAM

Current Development

At present an updated version of the sc+mONLINE system is being developed within the School of Communications and Multimedia at ECU. The new system is a complete re-design from the ground up, using many of the latest open-source technologies. The technology jump has been made possible by the continued support that Apple have placed in providing open source technology in the Mac OS X environment.

Mac OS X server comes pre-installed with many of today's leading web technologies, including the Apache webserver, PHP and webDAV modules, Tomcat and JSP, MySQL and directory tools such as LDAP. These tools provide almost endless possibilities for online development without ever having to leave the "box".

It was the inclusion of these "free" and "open source" tools that inspired the re-design of the sc+mONLINE system. The principle plan was to create a turnkey solution for an entire school's needs, not just courseware management and delivery. The new design includes:

- The ability to define degrees and awards for both onshore and offshore programs.
- Onshore and offshore websites sharing a common back-end database.
- Customised student and staff portals, with news and calendars.
- Staff directory and profiles, including the ability to export "Vcards" for importing into address books.
- Email subscription features for mass communication via email through a variety of scenarios.

The re-design has been a multi-faceted operation involving;

- Enabling a truly dynamic website using PHP.
- Developing XML objects.
- Microsoft Active Directory Services (ADS) authentication via LDAP.
- Entire database re-design in MySQL 4.

PHP offers developers an incredibly large amount of programming tools for deployment of the web. A recent survey found 12,000,000 domains using php-enabled websites since January 1999 (PHP, 2003). PHP has enabled the new sc+mONLINE system to be truly dynamic application, with support enabled for MySQL and PostgreSQL databases, PDF generation, XML, XSLT, and LDAP.

The PHP web front-end has easily facilitated many tasks and procedures normally reserved for system administrators and programmers.

In our experience with various courseware management tools the biggest problem faced by system administrators is how to authenticate student and staff access to the courseware itself. In most cases the data is stored within the system itself, which involves maintaining student and staff records. We have found that these systems cumbersome as they require a high level of maintenance, in particular the creation of new records.

To combat this problem the sc+mONLINE system authenticates its student and staff against a central Microsoft ADS database maintained by ECU. Using the LDAP support built into PHP has enabled us to verify a student's login against the central record held by the university. For students, the ADS system contains personal information, the units they are currently enrolled in, their home campus, and their login account information for a variety of ECU services. This system is updated daily, meaning that as soon as the university processes the enrolment of a student into one of SC+M's units, the next day they automatically have a login into the sc+mONLINE system. Staff have a similar profile within the ADS, with the addition of the school they are employed in. This information is also updated daily, meaning as soon as a staff member is employed in SC+M, they automatically have a login account.

This has proved highly effective as students and staff can operate in the knowledge that their login account is created automatically and has removed the laborious student/staff record maintenance task normally reserved for system administrators.

MySQL was chosen as the database back-end having proven itself with an estimated 4,000,000 customers worldwide (MySQL, 2003). As an open source technology it provides a huge support base of developers and in our situation, 100% uptime. Another key feature of the MySQL database system is its operational speed, easily out performing the original FileMaker Pro driven website. With the release of MySQL 4 this has been improved even more with the ability to cache repetitive queries.

The new sc+mONLINE system uses a relational database structure comprising of 40 database tables. Most tables use a recursive model for relating data. We have found this model very effective in creating new tools that required the creation of a new table for storing data. Figure 4 shows how the recursive model is applied to the courseware schedule tool.

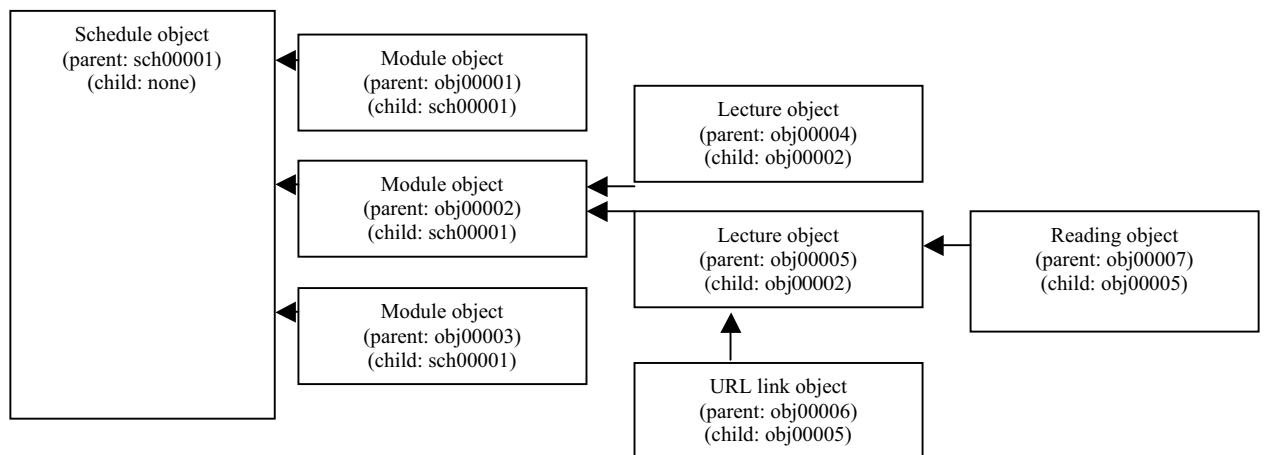


Figure 4: Recursive relational model applied to the courseware schedule XML objects. The output of this system can be seen in Figure 2.

This model uses another key technology employed in the sc+mONLINE system — XML. The courseware schedule item is made of many xml objects, defined by the system administrator. The system allows the administrator to create new XML objects for new data types that seamlessly fit into the existing structure without having to recode any of the existing schedule data or table structures.

Each xml object contains the parent-child identifiers outlined above, with each XML object relating to its higher parent if applicable. Once a new XML is created a XSLT style is then defined for outputting the XML object to the browser. All of the data necessary to facilitate this interface is stored within the XML object itself, meaning the table structure is very simple.

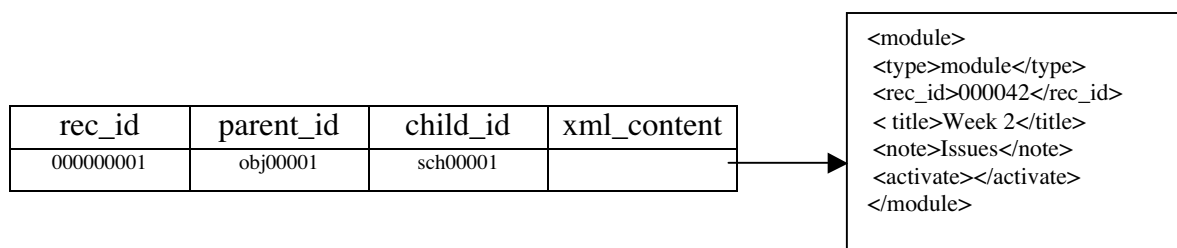


Figure 5: Outlines the courseware schedule table's structure for a module object.

The above figure shows how each XML object is attached to the schedule. Each object is created with the necessary data structure and then stored in the MySQL database. The web front-end then uses XSLT to transform the XML into a displayable form.

Summary

Based on the experiences of the academic staff in this case study, it would seem that the option of institutions developing their own customised courseware management system should be carefully considered. This approach allows the development of customised solutions that can provide simpler, cheaper and more efficient use of server and infrastructure resources. Even though they still require teacher training, instructional support and technical support, they can provide greater flexibility in design when creating learning environments for a range of different disciplines. Customised design and development also encourages the creation of solutions that help meet exact pedagogical needs, rather than having teachers trying to manipulate content to support the tools made available in the off-the-shelf courseware management.

The Mac OS X operating system has allowed the “out of the box” metaphor to take on new meaning. The built-in open-source technologies and simplified OS X installation procedure have meant that it is now possible to “buy an OS X box, and start building”.

Our experience has been that the process of designing and developing our own courseware management system has not only led to a cost effective and simple solution, but also has generated many ideas for the development of other creative and useful applications that have contributed to more robust teaching and learning scenarios.

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