Reflections about the construction of a platform LCMS in open code

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Abstract: The management of e-learning environments requires the existence of resources and software tools that make it possible. In the immediate past, there have been two large axes of development: the construction of LMS (Learning Management System) platforms that permit an adequate users management but lack of content management, and the CMS (Content Management System) platforms that permit an efficient management of the contents but not thus of the users. Nevertheless, neither one nor another way has a true LCMS (Learning Content Management System), mainly because they have not used the RLO (Reusable Learning Object) as the basic unit in order to build educational and formative resources suitable to the needs of the users. Anyway, the obtained products should adopt the standards (IMS, AICC, SCORM) in order to be exportable to other contents management environments. In this document, we review the main antecedents of the problem, the initially adopted solutions, some strategic decisions and the reflections that necessarily accompany the development of dynamic experiences, such in this case.

Key-Words: - e-learning, educational platforms, RLO, LCMS, Open Code.

1 Introduction
Information technologies advance continuous and inexorably; at the same time, the progresses in the knowledge how we learn provide us with opportunities of creating learning environments focused on the students. Besides, these environments are characterized by being interactive, efficient, easily accessible, flexible and distributed. Thus, today it is possible a scenario where people can learn on line.
The models that represent the processes of learning, such as e-learning, include several phases. Each phase requires an analysis on how to use the potential of Internet, but keeping in mind, the educational principles and the design of environments for e-learning. For example, [1] points out eight aspects or organizational axis to be considered in an e-learning scenario: technological, pedagogical, institutional design, interface, evaluation, management, support and ethics of use. Each dimension has several secondary dimensions summarizing as many as 90.

Last years, technologies have evolved in a series of phases [2] with an increasingly impact on the speed, creation of contents, cost, flexibility and advantages of the business about the e-learning. The born of content libraries marked the first phase, the second one was characterized by the evolution of LMS (Learning Management Systems) and the third by a tendency to leave this kind of services out of the organizations (outsourcing). Finally, the expansion of LCMS (Learning Content Management Systems) distinguishes the actual phase. LCMS join the functionalities of LMS and CMS (Content Management Systems).

Other authors ([3]) analyze the evolution of e-learning from a functional point of view and focus on the technology used or the economic sector of reference.

2 Characteristics of LCMS platforms
A LCMS platform should make easier the creation, storage and delivery of contents, with the following characteristics [4]:

1.- Simple tools to facilitate the creation of contents. Authorware enclosed in the system, like WYSIWYG editors, in order to eliminate the need of handling HTML editors.

2.- Flexible systems for the design and delivery of courses which offer the possibility of being adapted to the learning paces of the users and the needs of organization and systems.

3.- Possibility of reusing the objects of learning; in fact, each piece of knowledge should be a Reusable Learning Object (RLO) and they should be
available for designers that may need to use them in the design of their courses.

4.- Tools for the administration of the system that allow: registration of enrolments, monitoring of the learning process, use of timetables and schedule, traceability of users, adaptation of contents, etc.

5.- Tools for the initial assessment, as well as for the assessment during the course. This evaluation can be applied to the whole course, in general, or to the learning objects, in particular. The system should provide resources to evaluate learning in different ways and under different levels of difficulty.

6.- Connectivity with other LMS and, in general, adaptation to current standards such as IMS, AICC or SCORM.

7.- Tools for communication and development of collaborative learning. They should include synchronous and asynchronous resources in order to make easy student-to-student communication as well as interaction between student and teacher. Some features aimed for collaborative learning, like capabilities for resource sharing or working in team, are also desirable.

8.- Mechanisms to assure the security and protection of all the stored knowledge. Documentation uploads, downloads and access to data will be controlled in terms of the access privileges of different users and the different roles they play inside the organization.

9.- Simple migration of contents in order to make easy the adaptation to different needs of training.

10.- Easy installation in order to make unnecessary the adaptations, localizations, customizations and other operations that would increase the price of the product and delay the process of installation.

2.1 The RLOs and the LCMS

One of the critical aspects of the LCMS is that related to Reusable Learning Objects (RLO), or objects of learning that allow the modularization of contents and their integration in products adapted to the needs of the users (faculty and students). RLOs are components that exist as individual objects with own identity and can be incorporated to database with their description in terms of metadata (IMS/SCORM/AICC). These objects can be assembled subsequently for the creation of courses, lessons, etc. For [5] a RLO is any digital resource that can be used repeatedly to facilitate the learning. [6] defines it as a discrete and reusable collection of contents used to present and to facilitate the learning of a learning goal. The most complete definition is the one that we have found in [7]: A RLO is a digital resource based on a single objective of learning that includes presentation, activity, assessment and other complementary resources. The Scottish Electronic Staff Development Library [8] defined a similar concept called Granule, which consists of the smallest unit of necessary information to teach a concept. Nowadays, most of the software created to carry out the previously described tasks does not permit to access to source code. The latest arrival of open code applications (open source) make us wonder about the question that this paper tries to answer: Can a platform with LMS and content management capabilities (LCMS) be built using open code? Many research groups working in e-learning try to answer this question and the solution is emerging, though it is still germinal and not sufficiently satisfactory from the point of view of the obtained products. Up to now, the only product of this type that we know is ATutor, which it was developed by Sourceforge [9] in Canada as part of a project headed by the Adaptive Technology Resource Center of the University of Toronto (Canada). The URL of reference for the project is http://sourceforge.net/projects/atutor/. Its first stable version Atutor 1.0 dates from December of 2002. It is written in PHP and has a GPL license. The 1.4 version was presented in May 2004. A similar product, also based on open source, is OpenUSS, which it was developed under the auspice of Das Ministerium fuer Schule, Wissenschaft und Forschung of Landes Nordrhein - Westfalen, Germany. Our appraisal of both products is that, in terms of their conception, they are closer to a LMS than to a CMS. The content management functions are insufficient and they still do not solve the question regarding how RLOs are handled and how they are integrated inside a repository that facilitate the building of courses that fit the needs of users. Nevertheless, it is important to emphasize that the mentioned product is the first one that really would deserve the name of LCMS inside the community of open code. It observes the norms AICC/SCORM and the builders were checking the fulfillment of the IMS standard.

The MIT has created Open CourseWare [11] and 900 courses have been published in the web with CreativeCommos license. It is not a LCMS but it
has an important impact in the e-learning environment.

Currently, the European group that has tackled this challenge with greater emphasis and resources works around the EDUZOPE project [12]. Although its objective is the construction of a LCMS in open source, there are not concrete results. These types of projects are being object of attention from the European Union.

3 A proposal for integrating products

Our initial proposal of design, in order to undertake the proposed problem, requires the integration of three products from the community of open code: ZOPE [13], CMF [14] and PLONE [15]. The most recent are CMF (September 2004 for the version 15.0 Beta) and PLONE (February 2003 for the version 1.0.1). The model of integration should keep in mind the characteristics of these products:

ZOPE is a framework for developing web applications. Web applications allow the user a high interaction with the pages of the website. The information served by the Zope applications can be customized according to the user. The more remarkable features of Zope are the following:

- Object Orientation. Inheritance and acquisition (objects can “acquire” attributes and characteristics of those that are above them)
- Multiplatform
- Adapted to open standards: XML-RPC, SQL, ODBC, XML, FTP, http, SOAP...
- DPT pattern and DTM scripting languages
- Flexible and very efficient object oriented database, anyway, an external one can be used if you prefer relational databases
- API for access to database
- Dynamic programming with scripting languages and high level languages: ZPT, DTML, python, perl
- Zserver or an external web server
- Access to contents via http, ftp and webDAV
- Possibility to undo changes
- Efficient security system and access control
- Publication system based on workflow
- Very powerful web administration Interface (ZMI)
- Open Source License
- Extensible through products developed by the open source community

CMF is a product of Zope that contains a set of tools that provide most of the important services to manage the web contents. CMF can be used alone but its performance is greater when it is used along with Plone. Its more notable features are:

- Zope contents management environment
- Collaborative Edition of documents, files, folders, images, links and news
- Log-in and log-out with a simple management
- Meta-information associated to each object
- Search engine
- Inherits from Zope all its power of workflow, security, access control...
- The CMF products can be easily integrated ones with others

Plone is simply a Contents Management System whose hub is an open and powerful workflow engine. Plone is spreading out thanks to the support of a large community, its easy configuration and its remarkable management of users and workflow. Other features of Plone are:

- It expands the functionality of Zope + CMF
- Menu of navigation that presents automatically the options according to the role of each user
- Events calendar presents any event declared by any user in any part of the portal
- Publication of news by any user anywhere in the portal
- Internationalization and localization
- Consults can be hierarchically organized, allowing the user to organize the information automatically by content and not by position in the gateway
- Syndication of objects with RSS (XML-RPC)
- Management of users and workflow more extended than Zope

4 Taking some strategic decisions

The work done by now has oriented us to take several important decisions for the future of the project; these are:

1. Maintaining together the functionalities LMS and CMS because both of them are essential for the configuration of a platform LCMS

2. Orienting the functionality of the platform to the e-learning environment.
3. Leaving the contents management functionality to Plone and not using CMF due to its redundant characteristics

4. Splitting, in a first step, the contents management and the production of contents. Our experience advises us to maintain, on the one hand, the focus on the development of the LCMS platform and, on the other hand, to develop a tool for RLOs generation. This last tool should work in autonomous way as well as integrated in the platform, so it will allow us the scalable production of contents and their integration and further management in the platform under development.

5. Using XML to store the RLOs in the databases. This format allows us to isolate the content from the information for presentation and facilitates the multi–channel publication (html, flash, pdf, rtf,...) as well as the reusability for courses with very different styles and formats.

6. Adherence to those W3C standards that are going to lead the internet in a short time (XHTML, XSLT, CSS, MathML, RDF, WAI, XForms,...)

7. Providing the platform with a suitable management of users, classrooms, courses, etc by means of a product for Plone (GrufSpace). GrufSpace allows adding members in separate groups and controls interaction among members within each group. Thus, a GroupSpace is a space of collaborative work and it is the element that allows us to separate the different work environments. One can establish different roles for a user or for a group with GrufSpaces. Available roles:

   - **Student**: This role does not allow publishing (creation of content), just visualizing. Students will be only able to publish content inside a concrete folder. Allowed operations:
     - Viewing of contents
     - Sending emails
     - Making use of the forum
     - Publishing in the own folder
   - **Teacher/Faculty**: This role will allow editing and publishing content within the level of classroom. Allowed operations:
     - Editing and publishing of content
     - Sending email
     - Making use of the forum
     - Publishing news within the level of classroom
     - Accessing to folders of every student in a classroom
   - **Coordinator**: Allowed operations:
     - Editing and Publishing of content within the environment in which he/she is coordinator
     - Visualizing, publishing and rejecting lower level environments contents
     - Sending email
     - Publishing news

   These roles can be modified and adapted to the needs of environment to be developed.

   This product has its own specific workflow composed by two states:
   - Open: any member can see any object in any environment.
   - Closed: only the members belonging to a GroupSpace can see the objects contained in the reference group

8. Keeping in mind, therefore, the two basic concepts that should drive the new platform: users and contents. A single visualization module would be required in order to process RLOs or any combination of them. The distribution of courses would be performed by a tool that allows us to associate documents with those GroupSpaces where the classrooms are located.

9. Needing to integrate in the workflow of the LCMS the management of the license politics under which teachers share their resources

5 Conclusion
The open-source community lacks of a suitable LCMS platform as base for the on-line learning. An analysis of this kind of products results in the need to develop such a platform in order to meet the requirements on-line learning imposes. Instead of building this platform from scratch, we decided to extend some already developed products that have turned out to be a good starting point (integration of Plone and CMF on Zope). After that, we took some structural decisions (leaving sideways CMF and integrating GrufSpaces) and some functional decisions (splitting the production of contents and their management in a first step in order to get a final platform with joint management of contents and users).

Those changes we made, from the initial theoretical proposal, should be contrasted with the practice. In that sense, we believe that the results we are obtaining in the prototype phase will validate the decisions we took and orient us in the adequate direction.
References:


[8] (SeSDL) Scottish Electronic Staff Development Library. Interesting for the examples of granularity they are working there, in http://www.sesdl.scotcit.ac.uk:8082/resources.html. 2002


[14] CMF In http://www.zope.org/Products/CMF/