LONS: Learning Object Negotiation System

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Abstract. This system comes up as a result of the increase of e-learning systems. It manages all relevant modules in this context, such as the association of digital rights with the contents (courses), management and payment processing on rights. There are three blocks:

- A normalized application following the worldwide accepted standards or recommendations (SCORM, IMS, IEEE, etc.) containing the courses and implementing the organization of users and their subscriptions in the courses.
- Another application will be in charge of managing the digital rights of the courses following ODRL [1]. It considers the creation of these courses, its offers with different costs and its requirements.
- In order to negotiate the digital rights it is necessary another application implementing a device to manage and make payments using the secure payment methods currently used in the network.

Keywords: ODRL, e-Learning, web services, LMS, digital rights, payment.

1 Introduction

The project introduces a new idea about the current e-learning systems. Due to the expansion of the education in this area it is necessary to create and administer the digital rights [2] on the digital learning contents non-existent so far. This project aims to develop a prototype called "Learning Object Negotiation System" which will allow the management of economic/financial aspects [3] related to the e-learning process and the learning objects (figure 1).

This new education using e-learning systems is becoming a learning method increasingly used. This phenomenon can be observed in universities and higher education institutions, but also in companies where continuing training of employees is taken into account. Within this so wide topic, our aim is focused on the location, acquisition and secure payment of learning units by the members taking part in the electronic learning system.

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The contents are stored in repositories and designed so that it is not necessary a previous knowledge of the structure. This way, it is possible to contain the resources as the metadata. The reference model for access to the repositories has been determined by the specification DRI (Digital Repositories Interoperability).

Therefore it is aimed the reuse of educational resources and the access to the stored resources from:

- Learning management platforms (LMS: Learning Management System), where EDVI will be used.
- Learning content management systems (LCMS: Learning Content Management System)
- Content search portals (for example search systems of digital libraries, Web searchers, etc.).
- Any application or software agent developed to access to this kind of information.

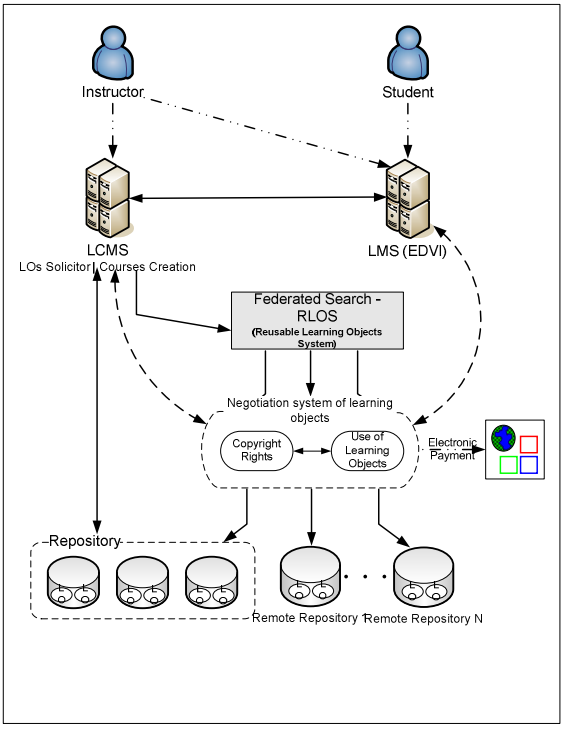

Fig. 1. Architecture of LONS

The means of payment give way to the commerce in the Internet and transactions, although its development is slow, mainly due to user's lack of confidence to the existing means of doing it. So, it is necessary to provide mechanisms that help to alleviate these security deficiencies.

In addition to the user's distrust, there are organizations that want to create digital learning contents in a market where the pertinent standards are not defined. There is a difficult and unprofitable situation:

- Each client has his/her own platform in which it is difficult to integrate his/her contents (courses) without a previous adaptation, which requires an investment of time and money.
- There is no control on the use and access to the contents, so rights from the copyright can be broken copying or distributing materials without permission.
- The use monitoring and access to the contents must be manually done, together with the control and pay associated to the use of those digital resources.

It will be necessary the creation of the following items for the execution of the system able to solve this needs of the user and the organization:

- A new way of specifying the copyright rights in the learning objects.
- The specification of the way of carrying out the monitoring of courses and learning objects.
- The mechanisms needed to integrate the system with the existing electronic means of payment in the Internet.

This enables us to determine the restrictions to be satisfied for the developers and distributors of contents, from the use of those carried out by the platform users.

Therefore, the basic idea lies in the distribution, reuse, management of rights and pay per use of Learning Objects, understanding as Learning Objects the minimum units in which virtual courses can be organized. For an effective search, location and reference of Learning Objects it is necessary that those objects are built using world-wide accepted standards of recommendations, such as the ones developed by SCORM, IMS [4], IEEE, etc. Likewise, for the effective management of digital rights it must be adjusted its definition to the existing rules and standards, such as the ones developed by ODRL as a language for expressing rights. Finally, to make the system valuable to the different interested organizations, it must be integrated with the existing commercial payment methods in the Internet to carry out the economic transactions (VeriSign, Western Union, ClickBank, Pay-Pal, CyberPack, 2CheckOut, E-Gold o Telepago 4B).

2 Main AIMS

The aim of this project is to correct all problems and deficiencies in the e-learning education systems. As a main aim it must be a system to manage the learning objects, so they can register its digital right. To meet this aim we have EDVI. To manage the digital rights of each learning object we will focus on the outline provided by LOM (Learning Object Metadata).

This schema defines a category that allows describe intellectual property rights and conditions of use of the learning objects. LOM [5] will be completed using the Open Digital Rights Language specification (ODRL), because the base outline provided by LOM can be extended in the way that best suits (figure 2).

The proposed idea tries to take advantage of the description of Digital Rights and the possibility of extending LOM to include a reference in a XML [6] file describing the Digital Rights of the Learning Object. This reference will be done including a small XML structure (with the file imsmanifest.xml) in the description, including all the courses that follow the standards ADL SCORM [7] and IMS-Content Packaging. The specification identifier of Digital Rights (ODRL) assigned to the Learning object will be there. It can be seen in the following picture:

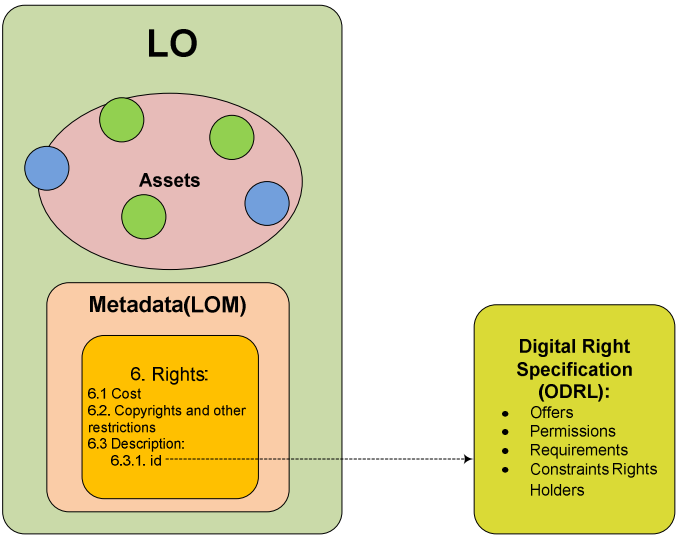

Fig. 2. LOM with Digital Rights

This allows the inclusion of Digital Rights [8] within the Learning Object, making it possible to control the payments. Moreover, this proposal allows the reuse both of Learning Objects and Digital Rights.

There are two systems; EDVI, with its own database to manage learning objects and the students using such objects, and the Digital Rights solicitor.

Digital Rights management aims to implement an application to manage all issues related to digital rights of the learning objects.

Some of the aims of this module are:

- Creation of digital rights: it will allow us to create, display and modify them. It must be an offer associated with the rights.
- Creation, modification and display of offers associated with digital rights.
- Participants can be created with the different information fields. After creating them, they must have the possibility of being associated with the diverse created offers.

- Assignment of permissions or what is allowed to do with the learning object. There are several types of permissions such as use (print, execute…), transfer (sell, rent…) and management (delete, duplicate…)
- Requirements can be created to associate both offers and permissions. The characteristics include defining the possible cost of the learning object use and the kind of payment to be done (prepay or postpay).
- The possibility of add constraints to the permissions, such as temporary constraints (time of use) or user constraints (use by the user or a group).
- The IMSManifest must be updated with all defined and finished characteristics in order to include the digital right in the learning object.
- Together with the provided web server it allows the formation of the document according to the specification ODRL required to make the payments. It implies all previous aims must meet the ODRL specifications.

Once we have the digital rights with the learning object, we have to manage the means of payment for the economic/financial data of the clients and information related to the associated students and the receipts and invoices for the courses of each client. The aim of this module is to make the prepayment and post-payment of the followed courses.

Therefore they can be separated in two independent modules for a better management.

- Means of payment: One of them is responsible for managing the information of the clients, that is, data related to the company and each one of the students belonging to that company. All this information must include the company VAT number, address and phone number. Students must include in the information his/her identificator, name, surname and the company VAT number. Also there is a part in charge of add and modify the means of payment of each company. That is, the means of payment shall be added for a company with all information related to the collection. If we want to add a payment by paypal, it will be necessary the company VAT number and the associated e-mail address to the paypal account. While a transfer will require the current account number and VAT number, and by credit card it is necessary besides the just mentioned, the card number and expiration date.
- Payments: The second module within the payments management is in charge of making the collection, and it is divided in two types. Independently, the student must be registered in the course. To make the payment with any method the specific type of the digital right must be defined. There are two types of payment: prepayment and post-payment. Prepayment is done before the student starts the course; s/he is required to make the whole payment before the beginning and post-payment is done when the student has a whole course; all outstanding courses shall be automatically paid for each client.

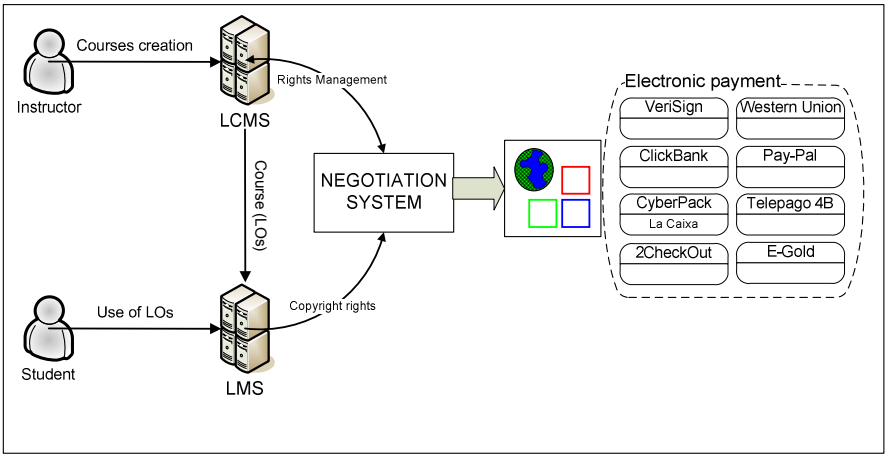

Fig. 3. Payments with LONS

This could not be carried out if there is not a database managing all information related to the client, such as the means of payment available for each client, storing information about the type of transaction (transfer, credit cards, paypal…).

Also, it takes into account the students belonging to a specific client, the identificator within the EDVI system, this way it can be obtained the amount and information for each student (and the courses s/he is registered in) and hence the client's transactions. The modules Payments and Means of payment use a common database which allows them to communicate with the different modules in order to make the payments.

It must be taken into account that the application will have different profiles in each module, and each one will perform a series of functions, whilst other task won't be allowed. This is logical, since a system administrator (for example) will have access to information related to the system users that the rest does not have. Basic profiles are required; such as the administrator, mainly in charge of the administration of users accessing to the system; an advanced user able to perform all functions related to the module without including the administration of the system users; and a limited user capable of accessing to some information.

3 Description of the Developed Project

Here is described the LONS system specifying its scope, technological environment and main users.

3.1 Determining the Scope of the System

This project is set out because of the absence of an element regulating the digital rights associated to learning objects. It is a system able to locate, obtain and manage learning objects so that they may become commercialized through digital rights.

The system is made up of the following elements:

- A learning management platform (LMS) such as EDVI. It will work with its own database and will have the IMSManifest file.
- A web application called Digital Rights Management with its own database in charge of modifying the IMSManifest file containing all the characteristics related to the digital right of the learning object.
- The system in charge of managing the clients' data and their means of payment to make the payments. It uses the bd_mp database.
- The other system involved in the collections' management. It is responsible for making the outstanding payments to the different clients. As "means of payment" it uses the bd_mp database.
- Web Services in charge of integrating the different applications making up a single system.

This makes it possible to make the commercialization of the different learning objects, depending on the needs and requirements. Ie, it is possible to sell a whole course, allowing its use to a group of students or any other type of uses depending on the purpose that those learning objects have. Thus the use is regulated depending on the characteristics:

- First there is a learning object with specific characteristics.
- The digital right is included through a IMSManifest file depending on the defined characteristics, among the associated parameters they are the offers, participants, permissions, requirements and constraints.
- These characteristics will indicate us the use of the learning object and how we can make the collections to the different clients.

This project provides a range of opportunities for the commercialization in the e-learning field, respecting the copyright rights and having a greater control on the use of learning elements.

3.2 Identification of the Technological Environment

Here it is given a high level definition of the technological environment required to complete the system use requirements, specifying its possible conditions and constraints. To do that it is taken into account the technology for the correct system functioning.

It must be taken into consideration that object-oriented programming tools have been used; in this case java has been used together with JSP. and XML to integrate the data with the application. It is necessary to have this system as web applications integrated with databases.

3.2.1 Area of Action

They are web applications, so they shall be used from anywhere with an Internet connection, while the system shall be set in one equipment or separated ones communicated with a network.

3.2.2 Databases

Since the use of databases is something crucial for this system, they can be taken into account different approaches about the distribution of databases. In the database context they have been used:

- Hibernate: it has been used to facilitate the integration of the database with the system.
- PostgreSQL: it is a database management system which holds the three databases belonging to the system: the EDVI database, the database of digital rights and the database for the means of payment (used by the applications Payments and Means of Payment).

3.2.3 Web Applications

As the databases the applications will be included in a server. Regarding to the location of each one of these applications, the most logical thing would be to include all of them in the same server, this way the integration would be easier and quicker, since it would be unnecessary to request certain data to other equipments.

These web applications have to be set up on a web server; the Tomcat application has been chosen for this task. As mentioned, all applications would be included in this server, making its management easier.

The four web applications making up the system are:

- EDVI: as a learning management platform which has learning objects (courses).
- Digital Rights Management: application for the creation, modification and display of digital rights associated to learning objects.
- Means of payment: it manages the clients' information and the means of payment available for each of them.
- Payments: it makes the collections with the clients with outstanding payments.

3.2.4 Web Services

For the integration of all applications web services integrating them are required. These web services are implemented on the Axis 2 application. At the same time Axis2 is implemented on Tomcat as another web application. Hence the most logical thing is to include the same server where all web services are placed. Although it is possible to have separated applications and the integration web services in the different servers making all applications connect with each other. All these possibilities give a greater portability to the project.

3.2.5 SSL

The application has been developed thinking on security improvements, so web applications are accessible from a secure channel. SSL (Secure Sockets Layer) produces a Server authentication, and the creation of a certificate is needed. In this case an unsigned certificate has been created, although it allows a secure connection, it does not appear very secure to the final user.

3.3 Identification of Participants and End Users

It is important to define the users who will use the different applications, since it is a project where the user profiles play a great role.

3.3.1 Administrator

This user is mainly responsible for managing the users. This user provides to the different systems the possibility of creating, consulting, modifying or deleting the users and assigning them the profiles. This profile is included in the three groups of applications: EDVI, Digital Rights Management and Payments-Means of Payment.

3.3.2 Student

This user will just use EDVI application; s/he will take the courses and will belong to a company which will pay for the courses that s/he takes. In this way s/he will not have to use any other application.

3.3.3 Client (company)

This user is responsible for making the outstanding payments of the students belonging to a company. The user must have an advanced user profile in the system in order to access as "client". This user can just access to the Payments application, where s/he can make the outstanding payments of the students in the different courses.

3.3.4 Advanced User

This user can perform the administrative tasks of each application, that is, s/he will be the real user of the application. EDVI will allow s/he to manage the information about courses and statistics. In the case of Digital Rights Managament s/he will be the user in charge of all tasks related to the creation of digital rights, offers, permissions and their management and modification. Finally s/he will manage information about clients and students; whilst add the means of payment in the clients application so that they can make the payments with the Payments application.

3.3.5 Limited User

This user will have the possibility of obtaining some limited information in the different applications, but s/he can neither modify nor add new data under any circumstance.

4 Conclusions

The carried study on the e-learning issue shows that there are several standards to facilitate the interoperability among the different applications and educational materials nowadays. In this way, the e-learning technology acquires a great power and it is increasingly used by the educational organizations.

It is important to reflect on several issues after the finalization of the project, such as:

- **Scope:** this project has been developed with the main idea of creating a prototype to determine the bases of the e-learning process and the learning object from an economic point of view. Therefore it could have repercussions on future developments of systems that manage the whole environment, including education.
- **Possible improvements:** Indeed, the application would have a more secure appearance if it would have a digital signed certificate from a certifying entity.

  In addition it should be considered an improvement for the integration of the applications for a greater system optimization. It could be developed an application integrating all the others, or unify Digital Rights Management, Payments and Means of Payment in the same application.
- **Acquired knowledge:** Once finalized the project there are technologies on which we have acquired new knowledge: XML, JSP, SSL, Hibernate and Servers.

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