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Using Metadata for Managing References in the Educational Environment: METAREF

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Abstract. In this paper, the METAREF project is presented. It consists in an application that allows University students to read bibliographic references and comment on them. Metadata techniques are used to store the information that the students provide and the design of the application is based on the HTTP protocol. Thus, the application runs like a web service and any web browser can act as user interface. The project is also concerned about the students' learning process. In this sense, the passive role that students take, relying only on their notes for passing their exams, is analysed, and how METAREF can help them, by encouraging them to take a more active role, consulting and commenting on the references the lecturers propose.

1 Introduction

The main goal of METAREF is to establish a bridge between the educational environment and the bibliographic world. Basically, it consists in a system that allows University students to have bibliographic references classified and tagged. The referenced material can be all kind of published material, be it in electronic format – web pages – as well as paper format – books in an academic library–. The tagging of the material is done through metadata, following the last research results in the topic. In this way, the tool is also a milestone in our research in the field of metadata standard schemes and the interoperability between them.

First, the basic functionality of the tool is sketched. After the lecturer has proposed some references to complement the classroom explanations, the students can access to them and read them. Then, the tool allows them to judge the references

and to establish the relation with the course contents. This information can be used and rejudged later on by the other students, and so the metainformation increases, always under control and supervision by the lecturer. Furthermore, students can look up by themselves and propose new references that are evaluated by the responsible lecturer.

Then, the paper analyses the different metadata schemes suitable for the application, such as Dublin Core, IMS and IEEE LOM. We are considering IEEE LOM as a starting point and we are trying to align it with Dublin Core and IMS by developing, if needed, new application profiles.

In its educational aspect, the tool is intended to be used to foster an active role in the students during the learning process.

2 Background

At University courses, students are supposed to consult bibliographic references to complement the lectures they attend. In some cases, this consulted material is the basis of the subject, but in some other cases, the lectures are supposed to be more important and the bibliographic references are merely complementary.

We have detected in our studies (the Faculty of Computer Science at Universitat Pompeu Fabra, Barcelona) [1] that the students do not consult regularly the bibliographic references we propose. They eventually rely only on the notes they take during the lectures to prepare their exams. But often these notes are poor or incomplete, so the preparation is not adequate; and we are sure that a substantial number of failures are due to this bad preparation.

Our research work on the field of metadata schemes has inspired us to create METAREF. Our intention is to help students to better prepare their subjects, by encouraging them to consult books, web resources or whatever published material that can be useful, beyond their own notes. So we started a project to develop a simple application that allows students to have these resources classified, to comment on them, and to share this added knowledge with the rest of the students. All this information is stored in the form of metadata. This is why our research work on this topic has helped us to specify it and develop it.

The METAREF project consists of three parts: the definition of the application functionality, the design of the system architecture and the specification of the metadata scheme needed for the storage of the information managed by the application.

3 Description of METAREF

The lecturer provides the students with a list of references that can be consulted. If it is a published resource in the Web, the reference is its URL, and the student

only has to click on it. If the resource is a book, the student is supposed to go to the library and ask for it. Then, once he has read the reference, he can comment on it. The lecturer provides the students with a simple questionnaire, where things like relevance, accuracy, ease of reading, etc. may be asked to the student, as well as free comments or global ratings.

Then, the annotation remains in a "not published" state, until the lecturer reads it and considers it to be right. If not, he may talk to the student and argue about its comment. Once the annotation is right, the lecturer turns it to a "published" state, and so, all the other students can access it. Now, they may add new comments or comments about the first student's comments. The lecture may even initiate an open discussion if contradictory comments turn up.

The students have also the possibility of proposing a new reference, if they consider it to be relevant to the studied subject. The lecturer will validate it and add it to the system database, in order to be consulted by the rest of the students.

The discovery of the resources is not covered in this project. Its complexity justifies that it is not included in the tool but provided by an external specialised module. The system allows the users suggesting a new reference to be considered, but it does not provide proper mechanisms for their search and discover. That is, the tool concentrates only on the cataloguing and tagging of the references.

Anyhow, as it will be explained in the next chapter, the design of the system includes the possibility of establishing a connection to a module that offers powerful searches, like the one we have developed [2].

The system has two entry points: one for the students, and the other for the lecturer. Both are accessible via web, and thus this access is simplified, because you only need a web browser. The user interface for the students allows them to access the different references that are already proposed, the comments on them that have been already made and have been validated, and allows them to add new comments. Figure 1 shows the window that is used for it. It has three frames: in the main one the web page commented is shown; the one at the left contains the metadata about this page, and the one at the bottom is where the student writes his comments.

The user interface for the lecturers allows them to add new references, to access the comments provided for the students, and to publish them.

4 System architecture

The system architecture is shown in figure 2, where all the elements are depicted. The basic architecture of the system consists of two core elements: the database that contains the metadata (we call it "metadatabase") and the code that is executed by the HTTP server when it is accessed from the web browser. This code is written

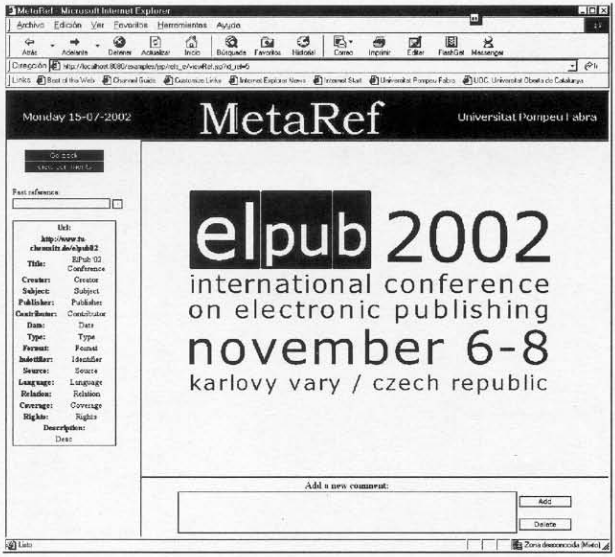

Fig. 1. *Window used to add comments*

in Java and is included in Java Server Pages (JSP). The database can be any relational one, accessible via JDBC.

As it has been explained, the system allows outer specialised modules to be connected, in order to increase the system functionality. A powerful meta-searcher would be an example for it.

The communication between the user interfaces and the server is done through the web service, so they do not need to be in the same local area network. The communication between the server and the metadatabase is through JDBC [3]. Between the server and the external modules any tool for distributed communications can be used, like RMI [4] or CORBA [5], if they are to be running in different machines.

5 Metadata

All the information about a reference, as well as the comments and the notes supplied by the students, are stored as metadata. So, a metadata scheme had to be established for our project.

First, we identified the most suitable ones, in order to decide which of them to choose. Among all the well-known metadata standards, Dublin Core Metadata Set, IMS Meta-Data and IEEE LOM are the ones that fit better in an educational environment.

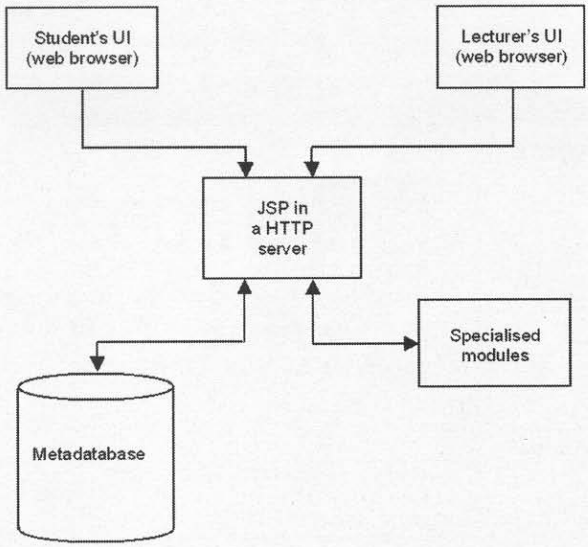

Fig. 2. *Window used to add comments*

IMS Meta-Data scheme has been developed by the IMS Global Learning Cosortium [6], whereas LOM (Learning Object Metadata) is been carried out by the LTSC (IEEE Learning Technology Standards Committee) [7]. Recently, there has been a process of convergence to reach a consensus between different organisations that has led to the first accredited standard for learning technology, based basically on the two mentioned projects. This standard is named "The IEEE Standard for Learning Objects and Metadata".

Dublin Core is developed by the DCMI (Dublin Core Metadata Initiative) [8]. The Dublin Core Metadata Set is simple and its usage is very widely spread. It aims to be very generic – it consists of only 15 elements –, so it can be used in different environments. However, this simplicity turns against it because it is often hard to apply to a specific topic. The elements are shown in table 1. Besides, qualifiers have been defined, which are used to refine the meaning of the elements.

Table 1. The 15 Dublin Core elements

Title	Description	Date	Identifier	Relation
Creator	Publisher	Type	Source	Coverage
Subject	Contributor	Format	Language	Rights

LOM is more comprehensive, but focused on educational resources. It consists on 79 elements, hierarchically organised into 9 categories, which make up the Base Scheme. It is shown in table 2.

Table 2. The LOM Base Scheme

General
Life Cycle
Meta - Metadata
Technical
Educational
Rights
Relation
Annotation
Classification

For the METAREF project, two types of metadata are needed: those that are to contain the objective description of the resource, and those that are to store the students' annotations about the resources. For the first type, any of both will do. But for the second type, Dublin Core does not have any element that suits well to the purpose. "Description" can be used, but it does not seem to be its right usage. On the other hand, LOM has a category called "Annotation" that fits very well to our needs. The elements included in this category are shown in table 3.

Table 3. Metadata elements defined into "Annotation"

Person
Date
Description

Again, we see that the metadata fit into these elements properly. LOM specifies that, if needed, several instances of an element can be added. This is also important to permit different students to comment on the same references.

So, we decided to use LOM to define our metadata set, and, in particular, the "Annotation" category to include the comments on the references that the students provide to the system.

But we do not want to lose sight of the interoperability aspect of our application. First, we need to add references to resources that can be stored in many places, following their own metadata scheme. In this sense, it will be interesting to use Dublin Core in some way, because of its extensive usage, and the high probability of these schemes to be Dublin Core-based. Besides, it will be interesting to allow searches from many outer applications. Again, the usage of Dublin Core will be very useful.

DCMI and IEEE LTSC are studying ways of aligning and harmonising their metadata schemes. While they do not issue a firm proposal, we are at the moment working in the creation of an application profile, which permits mixing elements from different schemes in order to adapt them to our needs.

Another interesting way of obtaining interoperability is by using an external module like the one we developed recently [9], where we defined an agent who provides with interoperability between metadata schemes in an automatic and transparent way. It can be connected to METAREF as an outer module, as it has been explained in chapter 3.

6 Conclusions and future work

In this paper, we have presented the METAREF project. Its main goal is to help students to better prepare their subjects by managing bibliographic references, and so they can succeed in their exams. The students are provided with a centralised access to the resources, and they are encouraged to comment on them. Next, the lecturer makes these comments public, so the other students can read them and also comment on them.

All the information that the application manages is stored in the form of metadata, and the IEEE LOM metadata scheme is used to structure this information. Dublin Core is also being considered, and the development of an application profile that allows the mixing of proper elements from both schemes is being studied.

The system architecture is been designed so as it allows the connection of external modules that provide extra functionalities, such as powerful and accurate search mechanisms to discover proper resources in the whole Web, or interoperability mechanisms between different metadata schemes.

Considering the educational aspect of the system, we think that students are taking a more and more passive role in their learning process, at least in the studies we know about. Consulting other material than one's own notes about the lectures is a way of taking a more active role, which is a greater guarantee of succeed in the exams. So, one major goal of METAREF is to encourage the students to make

these consultations, and to comment on them. Sharing this knowledge with their classmates and taking part in discussion forums about the references are also in that line of active participation.

The tool is ready to be used. In the next term, a pilot test is going to be run, in only one concrete subject, in order to bring out possible functional errors or deficiencies of the user interfaces. Once all arranged, we plan to extent its usage to all the subjects in our studies that would consider it interesting. Also, the integration of the tool in the educational telematic framework that is used in our University, which is called "Campus Global" [10], is a key milestone of the project.

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