Distributed Digital Content Access In a Virtual Community Based E-Learning Platform

Rafael Pastor, Salvador Ros, Roberto Hernández, Timothy Read, Manuel Castro
National Distance Learning University of Spain (UNED), rpastor@scc.uned.es, sros@scc.uned.es, roberto@scc.uned.es, tread@lsi.uned.es, mcastro@ieec.uned.es

Abstract - Eight years on from the start of the development of the aLF (active Learning Framework) platform, by the Innova group (in the UNED, Spain), we have approximately 100,000 users grouped in more than 500 virtual learning communities. The development of an integrated space of communities and courses has provided a unified model adapted to the new European Higher Education Area (EHEA). In the first part of the paper the fundamentals of aLF are discussed, and the service model provided based on the concept of virtual community.

Following the description of aLF, how the official digital repository (based on an application of Fedora) has been integrated into aLF to allow professors and students to search for (and retrieve) digital content (audio and video generated from more than 30 years of UNED activity and references from papers) is described. The paper will discuss the application developed together with the advantages of using it: recorded classes reused in the courses, access to institutional library material in a distance education model and a simple way of consulting related content to help students in their learning activities.

Index Terms – Digital content, E-learning, Federated Repositories, Virtual communities.

INTRODUCTION

After 8 years using the aLF (active Learning Framework) platform, developed by the Innova group at the UNED, [1] [2] [3], there are more than 100,000 users, nearly 5 million registered working sessions and almost 500 virtual learning communities. A new integrated space has been created with communities and courses adapted to the needs of the European Higher Education Area, as applied to distance learning. Furthermore, specific work spaces have been provided to attend to the needs of departments, faculties and technical schools within the UNED.

The first experience of aLF in the UNED (September 2000), served to train the online lecturer-tutors, via the course TutorT-UNED. Since then, an ambitious plan for training lecturers in the UNED was started in the Tec-InFor unit (Unidad Técnica de Investigación y Formación en Recursos Tecnológicos; Research and Training in Technological Resources Unit) of the IUED (Instituto Universitario de Educación a Distancia; University Institute of Distance Education). It covered underlying aspects of the use of any platform and was centred on online courses, such as WebEduca [4].

aLF was also used to explore what was, then, a new way of organising collaboration and learning using network-based tools. This conception of learning, which can be denominated ‘virtual learning communities’, consisted of the unrestricted formation of user communities (initially students) based upon shared common interests. In the first few months more than 70 student communities were formed, mainly with students coming from the Computer Science School in the UNED.

During this period there were more than 30,000 registered work sessions involving more than 1200 assiduous users of the platform. Community support was given to many different groups including ones in the regional study centres of the UNED (for example, Cervera), national training courses (FORCEM), research groups, and mainly special interest groups (on subjects such as, for example, WebDL, XML, Data Bases), different student groups (UNED Student Association, grant holders in different faculties and schools of the UNED, Computer Science students of different subjects, etc.), subjects in different faculties and schools of the UNED (including for example, Macro-molecules from Chemistry, English Grammar, Law, Hispanic Philology, etc.).

Since then, the development of aLF has centred on the provision of a new more robust platform oriented toward collaborative work (including the planning of group work, spaces for the storage of files using version control and access rights, shared interest links, public annotation of available elements, etc.), and more recently, to the inclusion of so called support tools for collaborative learning.

To give an idea of its usage, some data can be provided: there are 107,548 registered users (near to 65,000 with activity since the start of 2008), 4,934 news messages, 5,885 forums with 258,024 messages, 1406 surveys/assessments and 72,074 files distributed in classes and collaboration groups.

Experience gained during this process permitted the identification of some of the main problems present in e-Learning in the UNED. Firstly, a lot of courses are based exclusively upon the collaborative model of simple question-answer schema (forum interaction based), where
the students ask the questions and the tutors answer them. Secondly, the contents and spaces used in communication are not interrelated - the contents used in these courses are seen as the solution to the problem of learning. Thirdly, a great deal of time was employed in formatting the contents for different media (e.g., Web, hard copy, presentations etc.). The same contents are reedited over and over in the different media. Sometimes the same contents are reconfigured when they have to be accessed through a different environment. Moreover, in the majority of platforms there are difficulties to deal with administrative management and learning control tasks. For example, there are no facilities available to enable a student’s reasoning process to be followed [5].

In order to deal with these and other related problems, the decision was made from the beginning to build an e-Learning tool upon which it would be possible to undertake development adapted to the needs of any group or course required in a distance higher education model of the UNED and on which the didactic scenario would be clearly collaborative, based on tools for group work. The idea was to provide the adequate technological support so that the UNED could provide a technological and methodological response to the problem of e-Learning, given the then foreseeable (and today real) importance that this issue has reached in our university.

**ALF fundamentals**

The priority of the work undertaken on aLF has been to give support to learning communities more than courses. This conceptualisation comes from the general notion of virtual community [6] and is intended to potentiate the fundamental aspects underlying this type of work group: namely, reputation, confidence and intimacy [7]. Furthermore, emphasis is also placed upon other elements that are essential for the success of such groups, including the way in which users: (i) have an objective, some interests or a common activity, (ii) are frequently involved in active interactions, (iii) have access to shared resources, (iv) are provided with communication services for the interchange of information, and (v) are given a behaviour and communication protocol is published [8].

The foundation of the work undertaken on aLF had two pillars: firstly, the technical collaborative development of open and flexible tools. Secondly, the experience acquired during the four years in which support was given to the development of courses undertaken by large number of students, in which the scaling factor was a crucial aspect, and where the needs didn’t always coincide with the tools provided by the majority of tools present in the majority of e-Learning platforms.

Finally, another of the premises on which aLF is supported is the shared development undertaken with so many other prestigious universities and research groups. It was therefore established from the beginning that a didactic environment would be developed, called aLF1, whose nucleus was based on one of the most advanced applications at the time, particularly in applications of e-Business, ACS (Arsdigita Community System). Subsequently, the nucleus of ACES (ACS Educational Solution; especially conceived for educational applications, which evolved into the current software dotLRN; supported by Open ACS, the current open version of ACS) was used in the development of aLF2 [1]. The UNED has 8 years of experience of using this type of nucleus, and given the objective of unifying efforts to work on the nucleus, a workshop has been organised that will launch the new network of “dotLRN Developers and Users in Spain and Latin America”.

**ALF services**

In order to solve the two first problems described in the previous section (interaction schema and interrelationship between courses), the development of aLF was focused on two aspects: the addition of collaborative interaction tools (first problem) and to provide several workspaces where to share information from different groups, classes or communities (second problem).

So, from the user’s viewpoint, aLF provides a large variety of tools organised around three clearly distinguished workspaces: a personal one, the communities (to which the user belongs) and the courses (being undertaken by the user). The services offered, therefore, depend on the environment in which the user’s interaction takes place:

- **Communities**: the organization of different types of work groups (teaching teams, research projects, various associations, departments, faculties, etc.) is made possible. To this end, several communication tools are offered (forums with notification services in e-mail and news), work management (documents shared with version and access right control, links of interest to the group and surveys) and task sequencing (agenda with appointments and weekly task planning).

- **Courses**: apart from the general services already mentioned for the communities, the following are included: document management (tasks, summaries, notes, course guides, and FAQs), activity planning (weekly planning integrated with the course tasks) and several resources (links and shared course files, inclusion and edition of web pages with the course contents, exams, management of students and marks, etc.).

- **Users**: all aLF users have an agenda, a space for documents, links of interest and personal pages in the work area of any user/teacher/student which integrates with the rest of the services offered in the different communities or courses to which the user belongs. Furthermore, tools are offered for different types of users. Hence, the administrators and teachers have specific tools for following the work undertaken by each user and for each type of user. For example,
statistics can be accessed by value and by user in each community or course.

In each case, when a user enters aLF, he first accesses his personal workspace (“my portal”), from which he can efficiently access all the novelties that have taken place in any of the communities and courses to which he may belong. In fact, one of the most highly valued aspects by users is the possibility of efficiently accessing any novelty, i.e., a new file added in such groups, the new lines in the agenda, the messages in the forums, the tasks and notes in the courses, the news, etc. Another question related to the management of novelties is the fact that the aLF forums can be managed through automatic response notification services. This allows the user to be warned of any novelty sent to the forum, without the need to be connected to the platform. Furthermore, the user can choose whether to receive news sent by a specific user (e.g., the teacher) about a certain subject and/or to receive an instant warning or report of the novelties that have taken place in the last few days.

Finally, aLF facilitates the organization of the interconnections between the different workspaces, both those related to the personal and collaborative work in the different communities and courses, and those related to the groups and subgroups defined in such communities and courses.

As has been seen above, aLF provides several advantages: customization adapted to the UNED methodological model; a robust and scalable solution focused in corporate environments; and an integrated portal environment for virtual communities (classes and work groups). There are several systems used in different institutions. Maybe two are the most referenced: WebCT and Moodle. The UNED has been using WebCT since 2000. WebCT supports big institutions (like the UNED) and it is a consolidated solution for enterprise environment. Moodle is an open software solution which has a great projection, but it does not have implementations on big systems (the UNED has nearly 200,000 users). Furthermore, both of them solutions are based upon the concept of course with no interaction between courses and group works, and no sharing of educational services between courses. aLF provides these features, sharing all the objects available in the groups (calendar entries, tasks, assessments, news and so on) publishing them in different group targets (for example, from a personal space it is possible to share, not to copy, owned documents to a class, allowing to rich the learning environment [9].

**PROVIDING AN INTEROPERABLE PLATFORM FOR DIGITAL CONTENT**

As has been seen above, the two first e-Learning problems described in the aLF sections are “fixed” with the structure of aLF, but now we have a new challenge to solve the third problem: how it can avoided to edit/use/move the same material on different formats in different sources, to provide a single edit point and multiple use/move environments. In this case, the solution is to use a repository to provide a centralized store of digital content, accessible from multiples environments, like the aLF platform. Also, an important specification to select the final repository consists of the need to undertake federated searches, i.e., the UNED has several sources of digital content and a unified “view” is needed, whilst maintaining the organizational structure of sources (relevant business units from the organization). The solution selected was Fedora [10].

Fedora (Flexible Extensible Digital Object Repository Architecture) is an open source digital repository system that meets the challenge of managing rich content offered by institutions and organizations which demands delivering rich digital content (complex multi-media content that combines text, images, audio, and video). Delivery of rich content is possible through a variety of technologies. However, delivery is only one aspect of a suite of content management tasks. Content needs to be created, ingested, and stored. It needs to be aggregated and organized in collections. It must be described with relevant metadata. It must be available for reuse and refactoring. And, finally, it must be preserved.

Fedora does this by combining a number of key features including:

- **Powerful digital object model**: The digital objects, or units of information, in Fedora may combine any number and variety of data streams. These data streams can be local to the repository or may reference content anywhere on the web. For example, one digital object may aggregate a scholarly document in multiple text formats, and another may combine the text, images, and video that are the basis of a rich web page.

- **Extensible metadata management**: Because metadata and data are treated uniformly in the digital object model, any number and variety of metadata formats may be stored as data streams, alongside content, in a digital object.

- **Expressive inter-object relationships**: Digital objects contain metadata that can express any type of relationships such as membership in collections, structural associations like articles in journals or pictures in albums, or taxonomic Fedora Open Source Repository Software relationships. Relationship metadata is indexed and can be searched using semantic web query languages.

- **Web service integration**: Fedora fits in with n-tier applications because of two types of web service integration: (i) Dynamic content delivery: Web services can be associated with any of the data streams in a digital object. As a result, a digital object can deliver dynamic content: the output of a web service processing data in the digital object. For example, an image processing service can be associated with a digital object that contains an archival tiff image, making it possible to convert the image to other formats (jpeg, gif, etc.).

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DIGITAL CONTENT IN A FEDERATED ENVIRONMENT

The UNED, with more than 30 years of distance learning experience, has a large amount of accumulated didactic material organized into three business units (federations). Essentially, the majority is digital content produced as traditional TV and Radio multicast (National coverage) and then digitalized in the CEMAV (Audio-Visual Contents Centre, first federation) and delivered in a Web based approach with a single security strategy (user and password realm). The UNED also has an electronic library (second federation) catalogue that allows different electronic books, thesis, scientific journals to be accessed, as well as the standard management of loaned books. In the last two years, a new initiative for innovation has been developed in the regional study centres of the UNED (called Associated Centres, a very important part of the UNED structure, third federation). This initiative consists of the use of new content delivery IP tools to produce, cast and store all the tutoring classes produced in several different associated centres, sharing all the knowledge with the rest of the UNED students (not only the ones that attend the seminars).

In the following sections, a brief overview is made of these three sources/federations of digital content.

I. Library References

The UNED library contains the largest library catalogue in Spain, and it has its own virtual space for searching in the general catalogue [11] and the Fedora objects [12]. As can be seen, this interface provides a simple way for finding relevant information oriented to stored books and journals, but no digital references to content is included. The only way to access that by using a separate interface [11], which provides no way of adding references directly in the educational platforms for use in real courses (communities). This digital information is a valued resource in the learning activities, so a simplified way of introducing them into the core university activity of facilitating learning must be found.

II. UNED Institutional video and audio

The institutional repository of video (National Spanish TV programs) and audio (RNE, National Spanish Radio programs) have been growing steadily since the beginning of distance learning activities of UNED. The support these materials can provide to learning courses by means of modern technologies (advancing quickly) has been a concern in the UNED. A large number of different distributional formats have been used in the UNED: including cassettes (audio and video), television, video conferences and seminars (institutional or courses oriented). The multicast possibilities of Internet have provided an important technological vehicle in the UNED for delivering this digital content to our students and the general educational community (tutors, professors, staff, etc.).

To provide an entry point for searching and using digital audio and video, a simple to use platform called TeleUNED [13] has been developed, including two major features: (1) Multicasting of live events, and (2) Retrieval of digital material, using a “video on demand” approach.

In the same way that the library references could not be directly integrated into our e-learning platform, these videos and audio recordings could also not be included. The only way to reference such materials is by the direct use of URL objects, retrieved by external tools which access the library and TeleUNED, permitting the inclusion of such digital objects in learning activities.

III. Recorded Classes with AVIP

The last of the digital content sources for the learning design of courses comes from the AVIP (Audio-Video Internet
Protocol) program, an initiative developed as part of the ATECA plan (Educative Technological Architectures for Associated Centres) by the INTECCA group [14]. The work consisted of the development of an educative tool based upon IP technologies for using the video and audio transmitting capabilities of devices (complex high-quality video conferencing systems used in associated centres together with simple web conferencing used from students' houses). The AVIP tool is used in supporting the seminars and telematic tutoring of students from all over Spain (including both off-line and live seminars).

It provides a technological support to the tutoring system recording sessions and making them available to the rest of UNED students (nearly 160,000). The AVIP tool has different service levels:

- **Level 1:** AVIP rooms, using complex video conferencing systems and interactive digital blackboards (using Multipoint Control Units), allow the interconnection of several associated centres.
- **Level 2:** AVIP web, storing the AVIP sessions emitted from AVIP rooms in FEDORA, allowing them to be retrieved and viewed on demand.
- **Level 2+:** AVIP IP Tool, providing simple access without any necessity for a video conferencing system, just using a plugin for a Web browser (to access the AVIP server) and connected Web cam. This allows to students to participate in live seminars in a interactive way.

**A PLATFORM GATEWAY TO FEDERATED DIGITAL CONTENTS**

As can be appreciated in the previous section, all the digital information is available in different sources (federations) based on URL objects, but there is no integrated way to include them in the UNED e-learning platforms. To solve this problem, it was necessary to use a common digital repository system to catalogue all the possible objects, and publish their properties in order to enable the retrieval of an object's URL. This was done by tagging the library, TeleUNED and AVIP objects using Fedora. Then a simple interface was developed to add the searching and retrieval functionality of Fedora objects to aLF, thereby enabling the tagged objects to be included into the document space of aLF. This can be done in the personal portal (My space in aLF) or in the groups (courses or communities).

Hence, every user is able to undertake searches in the federated repository, providing a unified interface to retrieve digital resources (from the UNED library, Audio and Video material, TeleUNED and AVIP resources) from aLF. In figure 1 the Fedora portlet developed by the Innova Group in the personal space within aLF is shown. The interface is very simple in order to provide users with a way to retrieve and use these resources, so only three tags are used in the search process: author, title and description (tags from Fedora objects). However, a combined search is possible by means of selection several text fields and the corresponding check boxes.

**FIGURE 1**

*ALF INTERFACE TO RETRIEVE DIGITAL CONTENT FROM UNED SOURCES.*

When the searching is undertaken, a similar window to the one shown in Figure 2 is presented to the user. The results are presented in a table format, in order to provide all the necessary information of the objects: title, author and description. Additionally, fedora object reference information is added to the table for viewing their properties (with more tags, and relationships with from with the domains defined by Fedora). This feature is intended for advanced users and needs a working knowledge of Fedora concepts, so it is not typically used in real situations. For example, in this case the URLs of the objects (icons al right side of window) can provide information about the origin (source) of the object. The first two URLs are http://62.204.194.45:8080/fedora/get/teleuned:apartado-8952 and http://62.204.194.45:8080/fedora/get/bibliuned:714 , so it can be seen that here we are using a video (tag teleuned) or a reference from library catalogue (tag bibliuned). Furthermore, this is not a common action for users to undertake, so if the object title is clicked upon, a preview of the object is open in a new window of the Internet navigator (an audio digital object in first case and a pdf file in the second case).

Finally, if the users are interested in using the digital object in their community (course) they need only select the relevant object and click upon the Add button to incorporate it in the document space. In Figure 3 the three objects added as learning resources (shown by the dotted red square in the figure) ready to be used as part of learning activities (discussions, reading, evaluation, etc.) is shown.

**CONCLUSIONS AND FUTURE WORK**

In this article Fedora has been proposed as a digital federated repository that enables relevant digital material to be used in e-learning platforms, in this case aLF/.LRN. The different physical locations of the digital material are addressed by the federated nature of Fedora. In the case of the UNED, three important sites are joined together to produce an unique source of information: the library, digital video and audio resources (TeleUNED) and recorded classes (AVIP program). A single interface has been generated that is very useful for students, tutor, and lecturers in their online learning activities. In order to facilitate the successful general adoption of Fedora (and its underlying digital content) in the UNED for learning activities, the
interface was developed to be as simple as possible, thereby facilitating the incorporation of this kind of material. In the future, the learning objects generated within the aLF platform will be federated into the UNED Fedora repositories to provide a similar approach to reusing information, such as LOM (Learning Object Model), but keeping the interface as simple as possible, so that the different types of users of aLF find its use to be very intuitive. Currently, the UNED is creating a group of experts to explore the possible ways of including metadata tags defined by different standards like IEEE-LOM or DC.

REFERENCES


AUTHOR INFORMATION

Rafael Pastor, Innovation Manager, Centre for Technological Innovation and Development, National Distance Learning University of Spain (UNED), rpastor@scc.uned.es.

Salvador Ros, Learning Technologies Manager, Centre for Technological Innovation and Development, National Distance Learning University of Spain (UNED), sros@scc.uned.es.

Roberto Hernandez, Dean, Computer Science Faculty, National Distance Learning University of Spain (UNED), roberto@scc.uned.es.

Timothy Read, General Manager, Centre for Technological Innovation and Development, National Distance Learning University of Spain (UNED), tread@lsi.uned.es.

Manuel Castro, Head Department, Electrical Engineering, Electronic and Control Department, National Distance Learning University of Spain (UNED), mcastro@ieec.uned.es.