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UOC API Site, a seed for new eLearning applications.

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Abstract

Nowadays the evolution of mobile devices and their cost reduction are favoring a new scenario for educational technologies. Students and teachers of Technical degrees, regardless the lack of investment in crisis time, have enough knowledge and skills to carry out innovative projects to take advantage of this fact. The UOC API Site project deals with this matter proposing a framework with the aim of giving support to the campus existing services for the BCS/MCS final projects and later, for the integration of new tools to the UOC Campus in favor of all its community members. Furthermore, this solution is scalable to other educational institutions using interoperability standards.

Keywords: Educational tools; BSC and MSC final projects; Campus information

1. Introduction

The evolution of mobile devices and their cost reduction are favoring a new scenario for educational technologies. When Internet arrived to most of student's houses, universities and other education centers, most of the classical resources and teaching strategies had to be redefined. The educational institutions realized that there was an opportunity to evolve in order to make profit of it. Then universities migrated their information to the web, created new learning resources, developed new learning techniques and so on. Nowadays, the scenario has changed again. Internet is not only at home for students and teachers, it is everywhere because of the existence of new mobile devices. For instance, it is possible to look for any

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kind at of information wherever you are, write documents or send emails whenever you want and so on. Therefore, there is a new scenario and teachers and students can take advantage of it again. However, we are on crisis time and resources for investments in improving learning techniques or creating new learning resources at the university are scarce.

In the current context the universities have the knowledge and initiatives of their members, as the most important active to advance forward. Moreover, in the case of the technological studies, students and teachers have the required skills to give support to this transformation, aiding to adapt the university to their new necessities. Both communities can be involved in this transformation. Students can contribute by means of their BSC or MSC final projects, while teachers can apply for and to lead innovation projects as well as presenting new project proposals for students and monitoring them. However, there is a lack of bases and procedures of certification to carry out such projects and make them useful for the university community. In this way and in order to aid for this purpose, we propose a framework to help in the creation of new tools that offer secure mechanisms to access to the university virtual campus, getting all information in it and using their eLearning resources. The API UOC Site project, presented in this paper, will provide a secure framework to facilitate the creation and certification of new eLearning applications for mobile devices.

The API UOC Site main goal is to create an environment in order to give support to the organization, documentation and access to all required tools that make possible the integration of new developments into the UOC's campus platforms. Although our proposal is for the UOC's Virtual Campus, it will be defined over interconnectivity standards, mainly based on the Open Knowledge Initiative (OKI), therefore it is exportable to other educational centres.

The structure of this paper is the following. In the second section, we present some related works. The third section presents our proposal: its motivation, objectives, the methodology, the evaluation criteria and the expected benefits and its impact. Later, in the forth section the preliminary results are presented and finally, the fifth section concludes the paper.

2. Related work

Firstly, we analyse the developed systems and strategies for projects dissemination, both the BCS/MCS final projects and innovation projects. Secondly, we explore some works on developing applications for universities, and more concisely, applications developed for mobile devices. Finally, we present a previous developed project, the UOC Campus project, in order to understand the architectural basis of our proposal.

2.1. Projects dissemination

Although it is common to make publicly available the code and reports resulting from innovation projects and the BCS/MCS final projects, the huge amount of projects carried out by students and teachers in all the universities and other educational centres makes really difficult to find and access them.

In spite of there are several initiatives to organize the BCS/MCS project proposals, to make them easily accessible to the final year students [(USASK Mobile application), (Harvey Mudd College), (Johannes Kepler University Linz)], developed projects are often doomed to sink into oblivion.

The most common destiny for developed projects are the university library catalogue, which often have a specific section for their students projects [(University of Bristol (Dept. of CS)), (Universitat Oberta de Catalunya (UOC))], where their reports may be accessible, but the source code is often missing. This situation is the main reason to explain the fact that except in the case when the same advisor

proposes a continuation of a certain project, it is difficult to find new projects based on the results of other previous projects, moreover if the projects are from different universities.

In the case of innovation projects, they usually are economically supported by universities and their diffusion usually is mandatory and promoted by the own university. Because of that, all universities usually have their own innovation website, where all information is provided [(City University of Hong Kong), (Universitat Oberta de Catalunya (UOC))].

A part of these institutional resources, there are other private and community initiatives which offers ideas for the BCS/MCS final projects [(Trinity College)] and disseminate already done projects (IT Projects for Students).

2.2. *Educational mobile applications*

Most of the universities are adapting their websites and public information to be accessible for mobile devices. In many cases, the combination of small economic resources and the large amount of users supported by the institutions and the large diversity of mobile devices to be considered, force to adopt a mid term plan, scheduled for many years, In order to give a fast response to their students, some universities are designing mobile optimised templates for their existing website, which suppose quick win at a relatively low cost.

Another interesting approach is to create a framework for community collaboration. As some other universities, the University of Saskatchewan[†] released a mobile application [(Source Codes World)] providing their students with a framework application, where they can access the class schedule, check their grades or navigate the campus. The interesting point of this case is that they not only provide the application, but helped to create the bases for an easy introduction of the same technology to other educational centres [(College Mobile)].

Recently, some universities started projects to involve their community in the transition of their websites to the mobile devices era. One example is the group created at the Stanford University [(Stanford University)], with the aim of modernizing their websites and at the same time, to define a new standard on mobile applications.

2.3. *The* UOC Campus project

The UOC campus was created more than 10 years ago and it has evolved through the UOC campus project (UOC, 2006). The aim of the UOC Campus project was developing a technological infrastructure to provide online training using open source tools. In order to achieve it, an open and service-oriented approach was adopted.

The interoperability between tools and with other systems was a strong requirement for the architecture design as well as the use of open standards and exactly, the use of the OKI-OSID OSID (Open Service Interface Design) specification)[(IMS Global)].

The UOC Campus architecture was designed to pursue a two-fold objective: 1) to share the UOC eLearning tools with other institutions and 2) to integrate and use e-learning tools from other institutions at the UOC. The architecture of the UOC Campus is presented in the Fig. 1.

The architecture shown in the figure 1 is according the three-layered architecture model recommended by the IMS DRI (Digital Repository Interoperability)[(IMS Global)]. On the top layer the modules corresponding to the tools and applications that extend the LMS functionalities. On the bottom layer the eLearning platforms as the base of such infrastructure. And just in the middle, the intermediate layer,

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[†] http://www.usask.ca

which acts as a bridge between modules and the eLearning platforms. The middleware is just composed by OKI-bus and the gateways for each learning platform.

The OKI-bus is the most important part of the middleware. It has the mission of solving all the problems related to the communication protocols, remote communication between applications, performance optimization measures and so on and the gateway of each learning platform facilitates the integration of the platform to the OKI-bus. More detailed information about the UOC Campus project can be found in [(IMS Global), (Rius, Santanach, Conesa, Almirall, & García Barriocanal, 2011)].
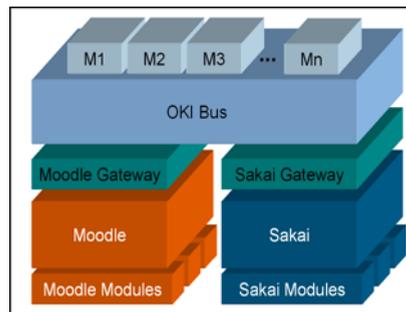

Fig. 1: Three-layered architecture using the OKI in the middleware

To sum up, the UOC Campus is constructed using interoperability standards like IMS Learning Tools Interoperability [(IMS Global Learning Consortium)] and OKI-OSID specification [(IMS Global)]. Such kind of recommendations encourages in providing a middleware for making easier the integration of software modules to the Campus in spite of the learning system's platforms and other technological issues. This fact permits to take advantage of the current new scenario in order to integrate new applications to the UOC campus.

3. The API UOC Site project

The API UOC Site Campus is a project founded by the UOC Innovation Program and the EIMT (Computer Science department) to carry out some innovative projects that can be really useful for the UOC Community. Its duration is one year from March of 2012 and it is developed jointly by a team composed by some EIMT lecturers and members of the Learning Technology department.

Having in mind the architecture of the UOC campus and more specifically the standards of interoperability used in it, the API UOC Site project is presented in detail in the following subsections.

3.1. Motivation

Up to now the UOC Campus and the new developments for the UOC's virtual campus have been carried out by the Learning Technologies department. Therefore, the members of this department are the only who can integrate new tools in the UOC campus.

Recently some interesting tools have been developed as a result of some EIMT's BCS/MCS final projects. These tools could be integrated as part of the UOC Campus in favour of other students. Moreover, it can be used at the UOC University for learning or organizational purposes, as well as for facilitating other new developments. Although, the integration of such tools into the campus is not an

easy task, because there is no documentation about the functionalities that campus provides, neither the public mechanisms to access to them.

Our proposal addresses this problem trying to solve to the detected lack of information and providing integration mechanisms for new applications to the UOC campus. The aim is to take advantage of the new technological scenario through a project called the API UOC Site.

3.2. Objectives

The main goal of the API UOC Site project is creating a public and mobile application program interface (API) in order to give support to the organization, documentation and access to all required tools, which made possible the integration of new developments into the UOC's campus platforms. As it has been said our proposal can be extended to other learning environments, if they are using interoperability standards that make easy the integration of new tools into the campus.

But there are other more specific goals of the project, which are the following:

- Definition and implementation of the UOC Campus API and its data. The campus data must be accessed from multiple channels, in particular from web and from mobile devices.
- Creation of a web site. This site must gather all descriptions and documentation related to the virtual UOC campus, the source code of programs and some use templates.
- Creation of an automatic register mechanism of new applications. All the applications using this API by means of the web site must be registered automatically.
- Use of the API in the practices and the BSC/MSC final project of students of the EIMT (Computer Science department at the UOC).

The framework we propose is an extension of the UOC Campus architecture. The UOC Sites can be seen as a new layer on the middleware of the architecture the UOC Campus gathering a set of API with the aim of providing secure access to the campus data and facilitating the integration of new tools as software modules. Graphically it is represented in Fig. 2.
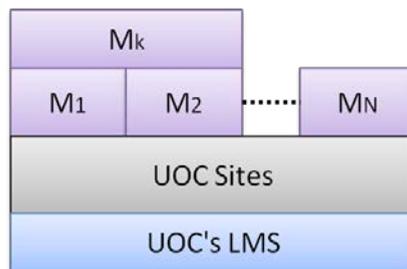

Fig. 2: The framework proposed for integrating new application on the UOC Campus architecture

It is important to notice that the UOC Sites project, although it constitutes a new layer on the UOC Campus architecture, it is absolutely scalable. It can also being used in any other campus with middleware based on the OKI-OSID specification, or even other interoperability standard able to isolate the learning platforms from the applications according standard recommendations.

3.3. Methodology

The methodology used in this project is the AGILE and iterative development. Therefore, each action returns feedback to the others, not the only previous ones, the simultaneous too. So, expected results are

obtained from the first moment, although the refinement process will continue. Furthermore, the testing in a real environment is being done from the beginning because there are open BCS/MCS final projects working with the UOC API services.

The project implementation has been divided in two phases, each of them planned to be executed in an academic semester.

In the first phase some tests and API refinements are carried out in order to identify and adapt the initial set of services to the extern developments. In this phase the API definition, the API development, and the design of the site are planned. In particular, security policies are considered, as well as the design according to quality, security, and easy-use criteria.

In the second phase a set of testing processes are planned. During this phase, the whole API is tested, checking all functionalities and verifying that all information is available. The goal is to detect problems and gather suggestions, allowing improving the site before the ending of the project. Finally, the dissemination of results will take place.

3.4. Evaluation

The evaluation results will take place during all the testing mainly. In order to collect them, the following instruments will be used:

- User test: The API and other components will be tested using a user sample by means of some usability tests.
- Inquiry to the students: The students who take part in the tests will receive a questionnaire that will allow assessing the suitability of the web and the API according to the given programming needs.
- Interview: The advisors of BCS/MCS final projects will be interviewed to collect its feedback.
- Monitoring data (log files of the campus): All API services will generate its data tracking, which will be gathered as source information for the evaluation. For instance, information of the number of visits to the web site, the number of applications created and the number of calls to the API will be stored.

3.5. Impact and benefits expected

The expected benefits for this project are classified according to the following items:

- Implication: It will involve the students in the improvement of the UOC virtual campus and its classrooms.
- Motivation: It will stimulate the creativity of students offering them ideas and tools to integrate their BSC or MSC final projects into the campus.
- Reusability: It promotes the reuse of the technological components already developed.
- Accessibility: It will enable the secure access from any device or computer.
- Evaluation: It will offer tools for the competence assessment.
- Institutional: It will promote the creation of a developer community around the teaching and the learning as well as it will give more visibility to the UOC virtual campus and its community.

4. Results

A set of existing services has been identified, standardized and partially documented for the first version of the public APIs.

These services are not only related to the course but also to the whole UOC's Virtual Campus. The functionality they provide comes from general information of the user, such as public data and its relationship with the University, to course specific information like classmates and course's communication tools.

Security policies for the API's have been defined as well, choosing the OAuth 2.0 specification.

Meanwhile the services were standardized and documented; we already have some BSC/MSC final projects developing applications for accessing UOC's Virtual Campus for Mobile devices. These projects have early access to the website. That is, despite not being publicly available, there are students using them for their projects.

5. Conclusions and future work

We propose an environment that can be seen as a seed for new learning applications that has a double goal: First it has the aim of giving support to the practices and for BSC and MSC final projects. On the other hand, it contributes to organize some issues that the university has not solved yet. So its learning applicability seems to be clear.

At the end of the project the expected results of the API UOC Site project must be reached, so the future work expected to achieve is:

- The public API services availability. A set of web access services and other mechanisms for the integration of new tools to the campus will be published. They are going to be available for the user campus and for external developers, if they are previously authorized and accredited. We are referring to the mobile applications, digital blackboard applications, website applications and so on.
- The web site for developers. A site where anyone can find the user manuals of these API, deliver possible incidents and register and certify the developments.
- The source code of the client libraries of the API campus. All the necessary components to download for new developments using the campus services provided and other support elements. For instance Android or iOS libraries.
- The API campus documentation. The general purpose documentation and the technical documentation about the API and the client libraries.
- The BSC and MSC final projects of the selected students for the testing.

Beyond all of it, the UOC as institution is especially interested in the results obtained from this project because, far away of being a show case for the BSC and MSC final projects, it can be seen as a link between the innovative applications of the UOC and the open development tools offered to other universities and the world in general, positioning the UOC as innovative educational institution.

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