

INTEGRATION SOFTWARE ARCHITECTURE OF E-LEARNING SYSTEM WITH FACEBOOK

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Abstract: *One of the main challenges of e-learning systems is to increase the openness of e-learning systems and allow integration and interoperability with other system, while maintaining effective distributed environment. In this paper software architecture is proposed for the integration of institutional e-learning system with learning object capabilities and Facebook (FB), which allows incorporation of social networks (SN) in learning activities. In order to increase the interoperability between Learning Management System (LMS) that uses the structure of learning objects and FB, web services and service-oriented architectures are used. Of particular interest is to show integration of Learning Active Management System (LAMS) with Facebook.*

Keywords: *E-Learning, social networks*

1. INTRODUCTION

Developments of diverse technological tools have opened up opportunities for educators by providing new ways for implementation of technology-supported learning. With new opportunities of diverse technologies, also come challenges on choice of the most appropriate tools that provide effective learning, collaboration and interaction between teacher and students. Social networks (SN) have been one the potential web tools that were explored to increase the interaction and communications between students [1].

In order to be able to explore effectiveness and potentials of using SN with e-learning systems it is necessary to allow integration of external web tools with institutional e-learning system. Studies have shown that students spend significant amount of time on SNs [2]. On the other hand, the way in which technology is used is more important than the amount of time spent on it [3]. Usage of external web tools can be challenging, as additional external tools can be confusing to students. In addition to this, course instructors are usually constrained with using the institutional e-learning system and the functionalities provided by it. Inclusion of external web tools can have a slow implementation with institutional e-learning system due to the slow evolvement of the institutional e-learning

system itself. This is why it is important to develop a flexible and scalable system that allows easy integration with other third party tools.

The main approaches to integrating software applications are: multitier architecture based on service integration and mashup integration. Multitier architecture can include event driven architecture [4], classic integration patterns [5], and service oriented architecture (SOA) [6]. SOA is based on Web service (WS) that enables communication between distributed components using web standards. WSs can be designed using several different models: (i) Simple Object Access Protocol (SOAP) services which present independently developed, deployed and managed software component supporting specific business functionality; and (ii) Representational State Transfer (REST) services, designed as accessible, independently-developed, deployed resources, supporting specific data, defined by its URL [7]. SOAP WSs are invoked over a network, synchronously and independently of the platform on which they are implemented. SOAP WSs are suitable for professional enterprise application integration [8]. On the other hand, RESTful WSs are used for mashup Web applications where information from different service providers should be gathered and displayed to the user through user interface of a new

application. [9]. SOAP and RESTful WSs support the same conceptual design but differ from technological aspects such as transport protocol, message format, service description and service discovery.

In this work we propose a software architecture model that allows integration of institutional e-learning system that supports learning objects with Facebook, in order to allow additional support to learning activities and to increase the communication between students and teachers, as well as to increase interaction and collaboration among students. SNS are perceived as common space where people can share information that can be viewed and commented by others. The goal of introducing Facebook into the online learning is to utilize on the social interaction of the community, in which community consists of teacher and students [10]. The objective of the community-based discussion is to allow students to collectively work towards solving a problem or completing a task [11]. Furthermore, since learning objects are allowing learning materials to be presented in smaller chunks of knowledge, it can be helpful to instructors and students to allow discussions and interaction for one or more learning objects within the lesson.

Generally, when there is a need to enrich institutional e-learning system with an external Web tool, an integration architecture that enables integration of both user interfaces is needed. Using some REST-inspired communication techniques usually accomplishes this integration. Also, the external tool should have possibility to interact with institutional e-learning system using a set of services published as web services (SOAP or RESTful)[12].

Paper is organized as follows. Section 2 describes elements of the software architecture for integration of Learning Management System and Facebook. Section 3 gives one possible scenario of usage from the point of you of learning activities, followed by the example of integration in Section 4. Paper concludes with Section 5.

2. SOFTWARE ARCHITECTURE ELEMENTS OF INTEGRATION OF LMS AND FACEBOOK

Figure 1 presents the software architecture that couples institutional e-learning system with learning object capabilities (ILSLO) and Facebook (FB). Integrating FB with ILSLO allows incorporation of FB functionalities into learning activities. The integration is done through learning management system (LMS). LMS is a part of the

entire ILSLO, but can be considered as its “front face.” LMS provides a teacher to create and deliver learning content, monitor student and assess student performance. LMS also provides students to have ability to assess them self during learning process. In this work, the technological infrastructure for integration of LMS with FB is proposed using WSs and service-oriented architectures.

As it can be seen in Figure 1, software architecture of ILSLO is composed of three subsystems: authoring tool, LMS and a system for the storage and manipulation of learning objects (LOs), which is usually realized as a Content management system (CMS). In this architecture, different authoring tools can be used, such as Articulate Presenter, Snap, Raptivity, Xerte, Course Lab, Atutor, GLO Maker, Microsoft content developer [13].

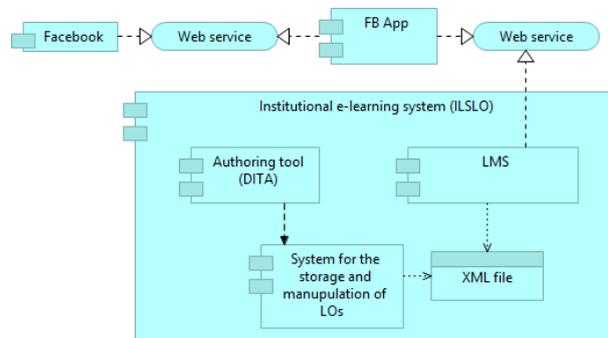


Figure 1. The software architecture for integration of institutional e-learning system and Facebook

For the purpose of this study an authoring tool that supports IBM’s Darwin Information Typing Architecture (DITA) framework as content structure ontology is used. This tool enables the structure of each LO to be presented as DITA topics. DITA topics are composed of different components such as LO title, LO content, related links, glossary, and learning sub-objects. Authoring tool directly saves DITA topics in the LOs’ storage and manipulation system, which in the e-learning system with LOs capabilities also serve as a role of a LO repository. After LOs are created and stored in the repository, LOs can be retrieved and further combined into DITA maps that specify the chosen learning design model.

The system for LOs storage and manipulation is not based on relational database, as this is usually the case when there is a need for data storage and manipulation. In order to present DITA topic and DITA map a concept of document is taken into account.

In order to export previously stored content of DITA topics and maps from the system for LOs’ storage and manipulation to the LMS, a DITA XML (eXtensible

Markup Language) file is used. Furthermore, LO's content is exported into DITA XML file, after which this file can be imported into LMS. XML file enables the LO's content to be used and adapted to the technology-specific requirements of LMS.

In order to integrate LMS and Facebook, a new software component is needed, in order to serve as integrated user interface for both LMS and FB, while gathering information from both platforms. A software component that is proposed for this architecture is the new FB application (FB App). FB App is created on Facebook platform and provides more flexibility than choosing to connect directly LMS and FB using WSs. However, WSs are still used to integrate FB App and FB, as well as FB App components and LMS. This integration is based on REST-inspired communication techniques and enables that user interface from LMS and FB is integrated and presented on FB App.

When students start learning on FB App, after an announcement that a new lesson and related tasks are published on LMS, lesson's content and activities are visible on FB App. Student is able to use functionalities and content of both LMS and FB from one application, which is FB App.

3. INTEGRATION SCENARIOS

In this section model of learning activities that present a usage scenario is presented. The intent of this section is to give a possible scenario that a student would experience when using an e-learning system that is integrated with FB. The model of learning activities is shown in Figure 2, and it can be described as follows:

1. When the instructor publishes new lesson in LMS, announcement is created by Facebook Application (FB App), but also published on the Facebook's Course Page. This announcement will link them directly to this lesson, but will display lesson content and activities on FB App, where they can start their learning activity. It should be noted here that student could choose to study using LMS only without FB functionalities. Students can also post directly information, resources and discussion on the FB Course Page or using FB App. FB App will ensure that all discussions related to that task or a problem posted on FB Course Page, will appear only in the discussion space for that particular task.
2. When creating a lesson, teacher may post tasks, problem or projects that relate to a specific LO, multiple LOs or the entire lesson, that student should complete. This task is published on LMS and also on FB App and FB Course Page.

3. As FB App serves as an integrating interface between LMS and FB, student will most of the time spend on the FB App while still having "feel of Facebook" for discussions and resource sharing, while having an access to learning materials. In their efforts to complete this task, students can share resources and materials, their observations, and discussions about their current activities. These activities and discussions will be conducted within FB through the FB App.
4. Teacher can also point out useful resources, and can in addition post smaller tasks that will help students and guide them to the final goal of solving the problem or completing the task.
5. FB App design ensures that student can stay in the FB App without needing to switch back and forth between LMS and FB. However, it is expected that student would go back and forth between learning materials and discussions, as needed, in search of materials they need to accomplish their task.
6. Once the student feels that they have sufficiently mastered the concepts, student can take the self-assessment test, which is usually in a form of a quiz. Student can access the self-assessment through FB App, even though the self-assessment is actually stored on LMS side, similarly as the rest of the learning content. FB App provides access to all LMS content without the need to actually leave FB App. As the self-assessment is graded, the learning process for this lesson will be completed after the self-assessment has been successfully passed, otherwise, instructor may wish to direct a student to revisit the learning material and the assigned task/problem.

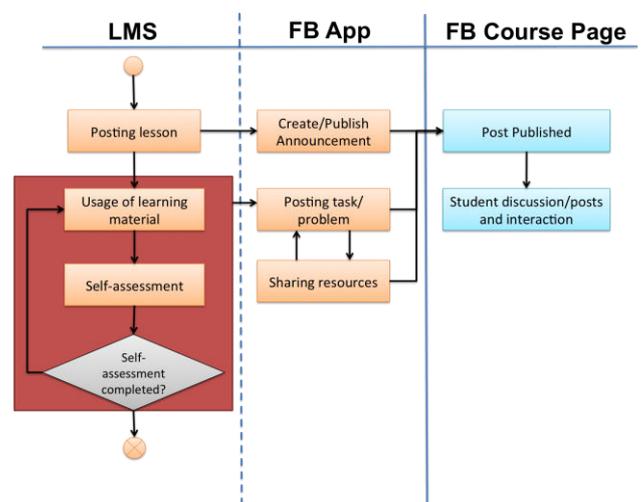


Figure 2. Model of learning activities

4. IMPLEMENTATION AS A PROOF OF CONCEPT

In this section example of integration of the proposed software architecture for integration is described. The deployment diagram for this architecture is shown in Figure 3. There are three main components: ILSLO, FB App and FB.

For the deployment architecture Learning Activity Management System (LAMS) was chosen for the LMS, as an LMS that does have LO capabilities. LAMS is an open source tool for designing, managing and delivering online learning activities. As it can be seen in Figure 3, proposed DITA authoring tool is QDITA. QDITA desktop application was created by modification of an open source authoring tool that supports DITA. QDITA can be customized for the specific institutional needs, primary related to the integration with LAMS [14]. In this example, LAMS is connected to QDITA for the purpose of uploading LOs, while the role of Alfresco is to serve as the LOs storage system. LOs XML packages are delivered from Alfresco and later imported and published in LAMS.

It is proposed to implement communication between LAMS and FB via FB App and integration between FB App and FB using RESTful WSs. RESTful WSs were chosen, because they provide direct access from FB App to LAMS as well as FB information. Furthermore, RESTful WSs communicate using HTTP protocol, JavaScript Object Notation (JSON) as message format that are described in informal, textual manner. This provides more flexibility when integrating diverse software architectures.

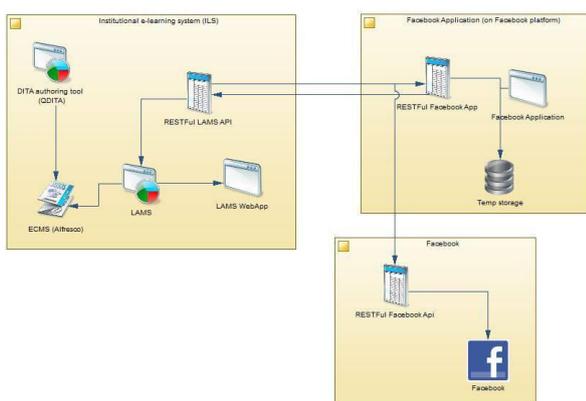


Figure 3. Deployment architecture of the integrated system

Development of open APIs is essential issue. FB has its standard RESTful Facebook API that is used by FB App in order to gather information from FB. By using FB RESTful API, any announcements about new learning

events can be posted on FB App and/or student's FB wall. Also, discussions and resource sharing about announced learning events, posted on the FB Course Page, will appear on FB App. In order for this to be a successful event, RESTful FB App is also needed. When there is a need to publish learning activities from FB App to FB wall, FB App RESTful API can send POST method using following URI:

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graph.facebook.com/{user-id}/feed?message={message}&access_token={access-token}
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where user-id is Facebook user id and access token is user token for authentication to Facebook [15].

LAMS does not have its own RESTful services API and in order to synchronize data with FB App RESTful API services is needed. To do this, direct access to database and to source code of the LAMS is necessary. WSs between LAMS and FB App consist of their respectful APIs, LAMS RESTful API and FB App RESTful API. Using LAMS RESTful API, FB App is able to gather latest information from LAMS lessons and learning activities, and can display them. Moreover, LAMS RESTful API has a role to get responses from FB App about student's activity within FB App, including results from the self-assessments.

An example of FB App user interface is shown in Figure 4. In this example FB App shows a task announcement for Lesson 5 in the course IT101. It can be seen that students can discuss and post comments below this announcement in the manner used for Facebook SN.

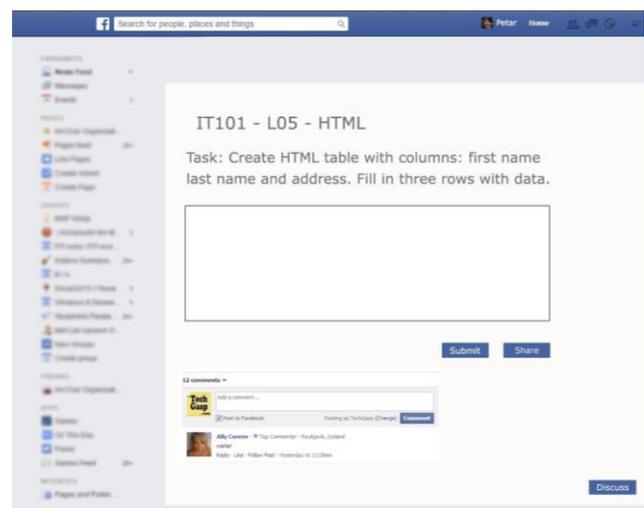


Figure 4. FB App user interface

5. CONCLUSION

In this paper software architecture is proposed for the integration of institutional e-learning system with learning object capabilities and Facebook (FB). This integration allows incorporation of FB functionalities into learning activities. The proposed architecture is based on a new FB App component that enables the inclusion of FB user interface into institutional e-learning system interface, by using RESTful web services. In the presented integration scenario, it was shown how to integrate LAMS and FB, using FB App as an integrated interface of both platforms. Future work should focus on analysis and improvements of the proposed architecture.

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