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## A system for mobile learning: a need in a moving world

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### Abstract

This paper presents MLEA, a mobile learning application that brings together functionalities of Android devices, Moodle LMS and needs of Mobile learning system users. The application is an answer to young adult learners 'preferences for mobile technologies. It also provides for professors to close the bridge with their students as well as the trends in higher education. The paper describes in detail the architecture of the design of MLEA, including the creation of web services through the project pattern DAO and a factory method to ensure flexibility.

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### 1. Introduction

A general classification of m-learning system suggests that such a system could include the diverse types of mobile devices, several communication technologies, asynchronous and/or synchronous communication between students and teachers, location, types of access and the information itself that could include learning materials and administrative information [1]. This paper presents an application for mobile learning as an answer to young adult learners 'preferences for mobile technologies. It also provides for professors to close the bridge with their students as well as the trends in higher education. The first sections describe the needs for MLEA, then the architecture of application and finally we present some conclusions and future work.

### 2. MLEA

MLEA is an educational technology for mobile learning. It is designed to seamlessly bring together functionalities of mobile devices, the Learning Management System (LMS) and the need of close connection between teachers and students. Students can have in their smart phones learning

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resources and course activities as if they were connected to the network through a computer with a wired or wireless broadband link, in addition to native functionalities of smart phones. It is stated that mobile learning technologies are those that allow users get access to educational resources using mobile devices such as smart phones, notebooks, tablets, and so on, anywhere and anytime [1].

MLEA application is designed to close the bridge between the subjects of the system. As shown in Fig. 1, a mobile learning system comprises three subjects – professor, student, and administrator. In general, the purpose of the first one is to keep the student engage during the whole course. Students might want only do what it is required to approve the course, and administrators do all the work for Moodle platform, the data base and connection with MLEA to run properly.

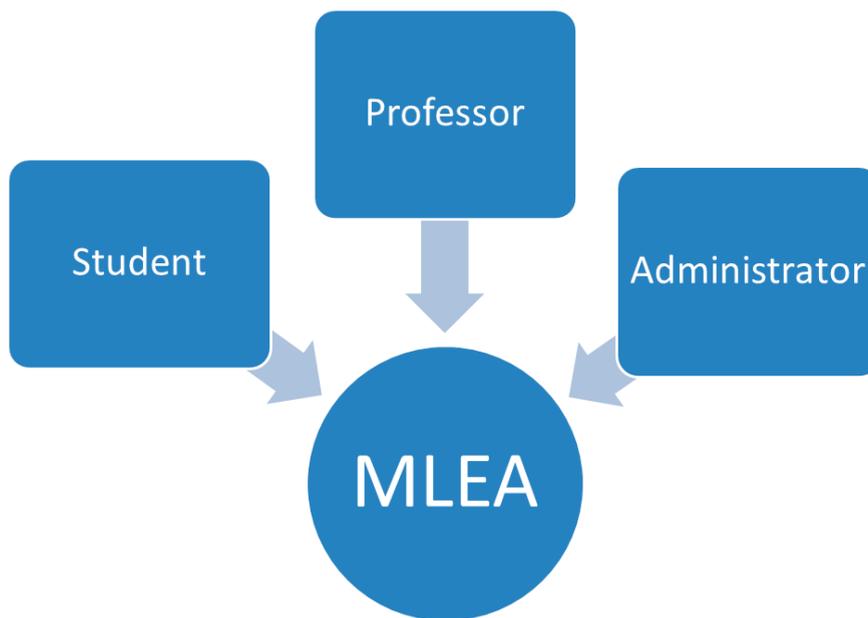


Fig.1 - Subjects of a mobile learning system

Moodle is an open Learning Management System (LMS) widely used all around the world that offers a number of functionalities that can be, using the proper tools and methodologies, extended and improved for mobile applications of mobile learning systems. Due to the fact that is open and it has vast documentation, its structure allows create external applications that can communicate with it fairly stable and effectively.

Given the trends of what today young people like, enjoy, and prefer regarding technologies, not MLEA allows students to actively participate in their learning process, but also allows professors to get closer to students. If one asks how students spend time, what kind of technological toys they are prone to, the answer is mobile devices. Therefore, if the idea of professor is to get students engage, then MLEA would make half of the job because they would have the course itself right in

their hand everywhere, anytime. The other half would be the course's structure, activities and content.

On the other hand, it lays the psychology behind young people today. Back in 2009, studies about preferences for technologies showed that 60% of young people under 30 consider a cell phone a necessity [2]. As in 2012, surveys show that 60% of people "can't live without their smart phones [3]," and not only that, but between 18 to 34 year old people are even more prone to such kind of devices, regardless their income [4]. In consequence, providing the means for higher education students to access course resources in their smart phones is a way to facilitate learning and keep them interested.

MLEA fosters virtualization, which is one of the new trends in higher education. Virtualization, the process of creating a virtual version of something reduces costs that would be needed for resources if actual versions were created. Therefore, many businesses and organizations are adopting these technologies as ways to centralize administrative tasks, improve scalability, and reduce costs. Already in 2009 forecasts stated that as many as 16 million desktops could be virtualized by 2011 [5]. Higher education institutions are not different from this, through Moodle servers and some other data centers and applications that provide users with the information they need. Higher education institutions that adopt any kind of virtualization system are ensuring items for accreditation in the globalized environment they are right now [6].

### **3. MLEA architecture**

The architecture of MLEA is compound of two sides. On one side there is the server that performs the integration with Moodle platform, while on the other side there is the client, which is actually the application developed for Android mobile devices for users to access Moodle services (forum, evaluation, messages, chat, etc.)

#### **MLEA SERVER:**

It is an application developed in JAVA and installed in an Apache TOMCAT Web server. The application is made up of a number of web services to serve as communication mean between clients and a Moodle server. It is through web services that clients can have access to Moodle's main resources such as forum, evaluation, messages, chat, files, localization, alarms, news, and courses, among others.

A service is a software component. It is an auto-content function, which receives calls and replays with a well-defined interface. Services do not depend upon the state of other functions or processes. A web service is a software component defined by an independent interface, available through a network connection. Operations defined in an interface will perform business functions [7]. MLEA server is accountable for accessing Moodle's database in order to retrieve and/or manipulate information that will process requests properly.

#### MLEA CLIENT:

It is a native application developed for Android mobile devices so that users can interact with services provided by MLEA server. Being a native application allows taking advantage of users' hardware and a more personalized experience than using a web based application [5]. Web services were developed using REST (Representational State Transfer) and JSON (JavaScript Object Notation) for data coding.

MLEA is based on SOA (*Service Oriented Architecture*) which eases module reuse. This is a software architecture concept that defines services use to support business requirements. Not only SOA provides a methodology and a working framework that allow building high scalable systems, it also offers a transparent and well defined exposition and invocation of services, which results in good interaction among different systems.

Service oriented architecture is both a working framework for software development as well as for implementation. Different from other architectures, SOA is made up of low coupled and highly interoperable application services. The idea behind this architecture is creating very high reusable software components.

The server side uses two project patterns to answer client requests. First of all, web services implement project pattern DAO (Data Access Object) to access and manipulate information from Moodle database. This project pattern offers an abstraction layer that splits up an application from a persistent mechanism, which results in more flexibility to modify the location where data is stored with no need to alter the program logic. Therefore, it is possible to implement several databases when information is stored in locally and/or remotely or even in files (not recommended). For each data type used there is a DAO interface that points out the operations that can be used with that specific type. The application data model owns the following data types, each with a specific DAO interface: Calendar, News, Grade, Chat, Configuration, Course, Download, Survey, Evaluation, Statistics, Forum, Localization, Discussion, Post, Message, and User.

Moreover, for higher flexibility, DAOs are not instanced by web services that use standard key "new," but by a factory that creates DAOS. This practice is aligned with use of the project pattern FactoryMethod, which guarantees that an entire application uses the proper DAOS according to the chosen setting. Figure 3 shows the implementation of the project patterns, where a bunch of web services use class FactoryDao to create instances for interfaces used to access and manipulate information in Moodle database.

#### Implementation of web services

The eight web services in the table below are part of Moodle's service "Moodle mobile web service", which are deployed in MLEA.

<b>Web service</b>	<b>Action</b>
moodle_enrol_get_enrolled_users	Retrieve the list of participants of a course
moodle_enrol_get_users_courses	Retrieve the list of courses of a user
moodle_message_send_instantmessages	Send messages
moodle_notes_create_notes	Create notes
moodle_user_get_course_participants_by_id	Retrieve users' profiles of a course
moodle_user_get_users_by_courseid	Retrieve participants by course
moodle_user_get_users_by_id	Retrieve participants by ID
moodle_webservice_get_siteinfo	Retrieve information about a site.

Some in-house developed web services for MLEA include alert resource, chat, choice, course, discussion, files, forum, grade, location, login, message, posts, quiz, among others. Since services provided by Moodle were not enough to provide for all the requirements of MLEA, all web services in the application were implemented independently of Moodle as there were implemented a few Moodle services that could be useful.

#### 4. CONCLUSION

This project is a solution to young learners' preferences for mobile technologies in the context of a mobile system. MLEA brings together functionalities of Android smart phones and Moodle LMS in a seamless way so that users might experience the benefits of mobile learning. MLEA architecture is based on SOA in order to facilitate reuse and extend the system scalability. Web services, an important element of the application, were implemented independently of Moodle given the lack of them in Moodle for all the functionalities that were required. In order to assure higher flexibility, web services were created using the project pattern DAO as well as a factory Method.

#### 5. FUTURE WORK

The application is completed and now in testing phase. It is expected to collect data in order to find patterns of use as well as other information that could lead to future proposal for new versions as well as extension to other platforms.

#### 6. ACKNOWLEDGMENT

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