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MDROID: ACCESS MOODLE LMS ON THE MOVE

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Abstract: *Modern societies are based on knowledge and constant improvement and learning are necessary for person to keep track with civilization development. Today, people are more mobile, spending more time in transportation, changing places constantly. The way of life dictates the way we learn. Therefore, education methods evolve and new technology provides us with new ways for accessing learning material according to our needs. Mobile learning enables us to learn 'anywhere, anytime' using mobile devices. M-learning basically extends available e-learning concepts by putting access to learning material in our hands. This paper presents our prototype of Android application mDROID for accessing Moodle LMS. Our goal is to develop application that will be extensively used by students in order to help them to engage in new e-learning processes. The paper also describes system architecture and presents application details.*

Keywords: *M-learning, Smartphones, Moodle LMS*

1. INTRODUCTION

The process of education consists of all activities that are used in order to transfer knowledge and skills from one person to another [1]. Traditionally, the basic learning model that is used is face-to-face learning which implies teacher and one or more students with direct contact in classroom. Nowadays, various countries are trying to achieve the "society of knowledge" and invest rapidly in their education institutions in order to increase the rate of population with higher education [2]. This implies more students applying for universities and more demand for education, which available institutions cannot support. Therefore, new learning models have been developed.

Lately, emerging new technologies provide new means for supporting education [3]. Nowadays, term e-learning is used for a subset of distance learning that uses contemporary information and communication technologies in order to provide new means for establishing learning process [4]. Software that supports communication between professors and students and among students, sharing electronic learning materials, taking tests and other learning activities are called Learning Management Systems (LMS) and are used to support e-learning. Besides in educational institutions, e-learning is widely used in companies for continuous education and improvement of their workforce. Lately, HR departments in companies are using LMS software to deliver learning material, various documentation and reference manuals to their workforce [5]. Nowadays, students, employees and other interested parties are mobile and frequently need to access LMS from remote locations without using computer. In cases where mobile technologies are used for making learning process ubiquitous, e-learning becomes m-learning.

Mobile learning (or m-learning) [6] refers to the use of small, portable hand-held devices (personal digital assistants or PDAs, smart phones, mobile phones, tablets) that usually operate in a wireless environment, and have a connection to the Internet. M-learning promote the use of 'anytime, anywhere' learning, allowing users to transcend the limitations of the traditional presence-based classroom.

One of the most popular Free (Libre) Open Source Software LMS systems is Moodle [7]. Moodle LMS is widely used Web application worldwide for e-learning activities and has more than 56000 registered sites [8]. Moodle is also used on the University of Nis, Faculty of Electronic Engineering, Computer Science Department since the year 2004. At the moment our installation of Moodle has 43 courses and more than 1400 registered students. The number of students is constantly rising since each year more students apply for studies on our Department. However, the level of adoption among students can be considered modest and new ways of delivering learning content need to be devised in order to improve it. We expect that implementation of m-learning concepts by providing access to course material using mobile devices can improve the adoption of Moodle especially among freshmen. Also, m-learning will provide better tracking of course which will help students to be prepared for important events during semester by having constant access to Moodle.

For supporting access to Moodle using mobile devices the prototype application mDROID has been developed. The

platform of choice was Android since it is widely used mobile platform supported by mobile devices from various companies. mDROID supports functionalities that are most commonly used by students on everyday basis.

The reminder of the paper presents our solution for remote access to Moodle LMS from mobile devices using mDROID application. The second section presents contemporary solutions and best practices of m-learning found in literature and discuses them. The third section gives the overall system architecture emphasizing the role and position of mDROID within it. The fourth section discusses implementation details of application and approach used for accessing Moodle. The final section concludes the paper and gives directions for future research and development.

2. STATE OF THE ART

M-learning is a form of distance learning (d-learning) [4] and relies heavily on the mobile devices adoption and developed cellular and wireless network infrastructure. In many countries like Australia and Canada distance learning is often used as a primary education method. In remote rural areas mobile and wireless infrastructure development can be consider modest compared to urban more populated areas leading to lower Internet bandwidth. Also, the higher demand for further education of people that are already employed also causes higher d-learning adoption [2]. M-learning can be used as an answer to mentioned scenarios because of its flexibility. In provides the possibility of accessing learning material in short time intervals and "on the move" [9] like during launch or coffee breaks, during to/from work travel etc. It can exchange smaller amount of data compared to classic Web applications and provides access from different locations. Lately, the term "ubiquitous learning" (u-learning) is used for mobile learning where learning material is offered to the user of the mobile device according to his context. Such approach makes use of different sensors available on mobile device such as GPS, accelerometer, compass, temperature etc. [10]. Therefore, teachers and students will be more and more oriented to mobile access to learning material in the future [7]

According to [4], m-learning, as a subset of e-learning, is usually implemented as mobile client for accessing LMS software (usually Web applications). In order to support such mobile access to LMS, different approaches can be found in the literature. LMS can be accessed using mobile Web browser allowing users to access all the information available through standard Web browser. With this approach, application should look the same and support same features. However, this approach requires transfer of large amount of data (entire Web page) and in most cases LMS is not optimized for mobile device small screens, hence the entire page cannot be seen at once. Also, application user interface can vary depending on the mobile browser used.

Better approach is to create special plug-ins optimized for mobile Web access that needs to be installed on the server. Moodbile project aims to extend Moodle access to mobile phones. It is a PHP based Web application that uses native Moodle Web services to provide mobile users with access to certain Moodle's learning tools using mobile browsers [11]. This way, access to Moodle is provided for different mobile platforms as long as they have installed mobile browser and the bandwidth used is considerably lower compared to classic Web page loading. The downside is that this approach cannot support offline working mode which is important in areas where mobile client is not connected (for instance tunnels or subway) or where the signal is weak. Also, mobile Web page introduces some data overhead compared to sole Web services output.

The other approach for developing m-learning clients is creating thick mobile client rich application which communicates with LMS using Web services. This way user interface can be adjusted for mobile devices, data transfer is considerably lower and formatting for display is done within application. Such applications perform faster and are easier for use on mobile devices. The biggest downside of this approach is the need to develop similar applications for different mobile platforms. Also, if LMS doesn't support Web services, it is necessary to develop them and install on server side.

Within Moodlbile project mobile application approach has also been tested [7] [12]. Rich client application is developed using J2ME, an open development platform that can be executed on large number of different mobile devices. Application communicates with Moodle Web services and implements selected Moodle functionalities. The main advantages of such application is the possibility of execution on large number of existing and older devices and the ease of distribution. The main problem is that J2ME applications cannot be natively executed on emerging mobile platforms for smartphones such as Android, iOS or Windows Phone 7.

Another developed prototype of rich client application is presented in [1]. It is a PocketPC based mobile client integrated with SOAP Web Services accessing Moodle data. PocketPC and Windows Mobile based PDA devices offer bigger screen and computing capabilities and therefore provide better usability compared to classic mobile phones but are in most cases intended for enterprise users and is rarely used by students.

Nowadays, smartphones with operating systems such as Android, iOS, BlackBerry OS and Windows Phone 7 are holding around 70% worldwide market share [13][14]. In such environment, m-learning applications for accessing LMS need to be developed for respective platforms. Application that enables access to Moodle LMS using iPhone is mTouch. It provides users with rich user interface and easy access to Moodle learning tools. The fact that iOS applications are distributed using iTunes and that source code needs to be checked before published for public download prevents such applications from being open for community the way Moodle LMS is. Nevertheless, mTouch is a good option for iPhone users accessing Moodle. Besides mentioned, there are also

other mobile applications for accessing Moodle listed on [15].

Android OS for mobile phones and tablets is gaining ever more users every day. According to Gartner and IDC, its current world market share is around 38.5% and is expected to reach 43-49% in the year 2015 [13][14]. Android applications can be executed on large scale of mobile devices from different manufactures. Additionally, it is not necessary to use Google Market for application distribution and application code can be made public for community. Therefore, we think that Android platform is the best choice for developing future m-learning applications.

3. MDROID ARCHITECTURE AND INTEGRATION WITH MOODLE

In order to provide mobile access to Moodle LMS, we decided to develop a rich client application prototype called mDROID. Developed application is based on Android platform and can improve student interaction with Moodle and provide means of accessing learning material without using computer. The application is primarily intended to support modules used in Moodle of the Computer Systems Department on the Faculty of Electronic Engineering Niš. We expect that in future, large number of our students will be able to use it.

Moodle provides many activity modules natively and each new version is extended with new ones. Also, community contributes Moodle with large number of additional modules. The aim of mobile client should not be to fully support each module available using classic Web interface but to provide user with possibility of accessing Moodle in short time intervals. User should be able to access important information and to do necessary updates. Therefore, mDROID implements only limited set of functionalities that are necessary for students.

In order to provide communication between mobile client application and Moodle LMS, Web services on the server side must be used. Moodle provides native Web services (MWS) supporting SOAP, REST and XML-RPC communication protocols. Nevertheless, MWS provide only limited set of methods and does not support some important functionalities, for instance accessing forum or calendar [16]. Standard MWS functionalities can be extended using Web services developed by third party contributor OK Tech. Using these services, a much broader set of functionalities can be implemented compared to MWS.

The overall architecture of the system is presented on the Image 1. The server side consists of Moodle LMS 2.0 with enabled Web services and installed OK Tech Web services [17]. Web services access moodle database and files stored on server in order to provide data for clients. Each Web service method returns XML file with requested data. Although SOAP protocol is not recommended as the best practice for mobile device-server communication because of the XML that introduces extra formatting data, hence more expensive bandwidth is used, at the time of the implementation REST Web services using JSON were not fully developed for Moodle.

Client side is Android application that consists of:

- Java classes and XML files for each implemented activity
- Server.java class for communicating with Web services
- K2SOAP libraries that implement SOAP request and response functionalities
- Additional resources (images, themes etc.)

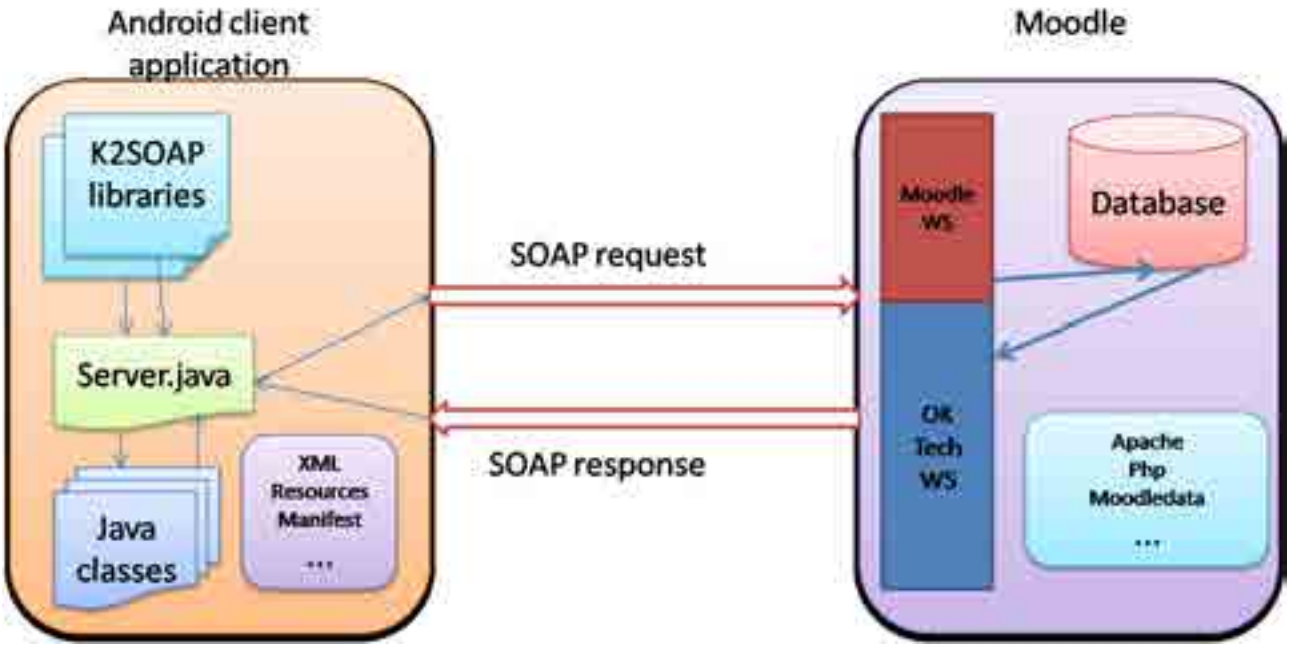

Image 1: System architecture

Each supported functionality in application is available on separate application screen, hence implemented in separate Activity. Activities are implemented in separate Java classes with additional XML file containing user interface description. AndroidManifest.xml file binds each java class that implements Activity with appropriate XML file. Server.java class is implemented as the Singleton pattern and is responsible for communication with Web services. It contains methods for sending and receiving SOAP requests for each Web method needed. Server.java class uses K2SOAP library which implements native SOAP protocol

Presented architecture does not require considerable resources and amount of data for activities such as displaying of start page, browsing events, courses and forums, profile editing etc. All user interface formatting,is done on the client side. Each Activity presents a container for parsed data received as a SOAP response. This way, communication between client and server is minimal compared to whole Web page and acquired data can resides on mobile phone thus providing possibility for offline working mode.

Moodle has strong security mechanism which presumes that roles and permissions must be defined for each user. User accessing Moodle from mobile device trough Web services, must have proper user privileges defined. Besides enabling Web services and protocols that will be used, new role that extends predefined roles (such as student or teacher) must be defined and assigned to each mobile user.

4. MDROID APPLICATION DETAILS

Application mDROID is organized as a set of Activities each supporting predefined functionality based on the modules available on our Moodle. It consists of following pages:

- Login page
- Main menu page
- Start page
- Announcements page
- Discussion page
- My Courses page
- Course page
- Course details page
- News page
- Forums page
- Send Forum Post page
- Calendar page
- My profile page
- Change profile page

After the application is started, the user is prompted for its credentials on the *Login page* (Image 2). If the credentials are wrong, application informs user and waits for new input. Successful login leads to the *Main menu page* with listed main options (Image 3). Options are regular Moodle modules that are available in menus of each course using standard Web application. Each option opens appropriate page with requested data. Pages can be divided into:

- general
- user related
- and course related pages.

Image 2: Login page

General pages present information that are visible to all users that login to Moodle and include *Start page* and *Announcements page*. *Start page* contains welcome text available on the main Web page of the Moodle while *Announcements page* allows users to browse important general news that are not course related. Students are not allowed to post announcements.

Image 3: Main menu page

User related pages are *My Courses page*, *Calendar page* and *My Profile page*. *My Courses page* lists all the courses the user is enrolled in and provides access to each of them. Events are very important feature of Moodle and provide users with important schedule of different semester activities that are not necessary related to course they are listening. *Calendar page* is used to provide access to important events submitted to the calendar presenting event name, event details and time scheduled. *My profile page* and *Change profile page* (Image 4)

provide user with the possibility to check or to change its Moodle profile.

The rest of the accounted pages are course related and are generated according to the courses the user is enrolled in. *Course page* (Image 5) contains all the available modules for the course chosen from the *My courses page* menu. From this page user can access course details, course forum and news. Each of these options leads to the appropriate page for selected module. User can list forum topics, browse forum discussions, send forum posts, browse news and course details. This group of pages are fully dynamically created based on received data because different courses comprise of different modules.

Image 4: Change profile page

Each page (Android Activity) implements method *void onCreate(Bundle savedInstanceState)* that is called upon its creating. Method calls appropriate SOAP request encapsulated in Server.java class that retrieves data needed for page content. For instance *onCreate* method of *My courses page* calls *getCourses()* method of Server.java class. SOAP request is created using get_my_courses method from K2SOAP library.

Image 5: My courses page

Pages that have options (buttons) that can be selected implement *void onClick(View v)* method for calling appropriate *Intents* according to the index of the selected oprion. Each *Intent* defines which the next Activity will be called, hence which page will be created.

5. CONCLUSION

Nowadays, m-learning becomes important method in learning process, it extends d-learning and e-learning methods by providing users with access to learning content "on the move". Numerous researchers are trying to develop m-learning applications that will be used by educational institutions as well as companies trying to constantly improve education of their workforce. Most common m-learning implementations are mobile extensions for known LMS software, especially for Moodle as one of the most popular.

Android OS is one of the most common mobile OS for smartphones in the world and it is estimated that will cover almost 50% of the world market in the near future. Therefore, we developed mDROID application for Android platform that will enable mobile access to Moodle LMS through the use of Web services on the server side. Our prototype application provides users with set of functionalities that are most commonly used when accessing Moodle. OK Tech Web services are used on the server side to extend Moodle natively supported Web services functionalities. Our students will be able to access necessary information about their courses only by using their Android mobile phones.

In the future, better performance of the presented application will be provided by using Web services supporting REST protocol and JSON instead of XML in order to lower the amount of the bandwidth used for communication. Additionally, new functionalities need to be added as downloading important course files and learning material and support for different languages. Also, server push mechanism should be added in order to provide users with up-to-date information considering new material, announcements and forum discussions.

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