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A Cloud-based Framework for Personalized Mobile Learning Content Management System (LCMS)

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Abstract: **- Mobile learning content the proliferation of Internet-capable mobile handheld devices and the availability of wireless broadband networks, mobile learning is increasingly adopted to deliver learning content anywhere and anytime to mobile users. Offering compelling mobile learning solutions faces several challenges. These challenges are mainly the adaptation of the learning material to the profile and preferences of the mobile user and the support of multiple devices. Other concerns include the storage, retrieval, and processing of learning content outside of mobile devices. Furthermore, building rich learning management systems requires the integration of learning content from third party providers. This paper describes our proposed cloud-based framework for delivering adaptive mobile learning services. The paper explains the benefits and requirements of cloud-based solutions for educational organizations, and describes the components of the proposed framework together with the process of integrating learning objects imported from third-party providers with in-house learning objects of the educational organization.**

Keywords: - Mobile Learning, Adaptive Learning, Cloud Computing, Learning Objects.

I. INTRODUCTION

Computer technologies and internet-based learning to be 'everytime, everywhere' learning experience. Grosso, 2003. As a result of the improved capabilities of mobile devices and the increasing availability of wireless networks, there are great opportunities for using mobile learning as a new channel to convey knowledge and complement the already established Web-based e-learning model. Mobile learning, there occur changes in learning environment, with the opportunity of learning independent of time and location, in this context, Keegan (2002 M. Shobanarani) . Standards will help in the area.(Richard Mobbs, December, 2003). The size of the device you are learning on Programs must be designed for either the larger computer screen, or formatted for the smaller screen of a mobile device. M learning programs must be designed with a simpler format due to the inability to run large graphics within the program.

Two main characteristics of mobile learning are ubiquity and mobility. Ubiquity represents the state or capacity of accessing computing technologies and learning material whenever and wherever the mobile learner needs them. Mobility represents the quality of being able to learn while on the go using various mobile handheld devices. Mobile learners can access learning services from anywhere, and anytime. Other characteristics of mobile learning include:

• Interactivity: mobile learners manage the learning process they are involved in as opposed to the traditional learning in which learners sit passively while the instructor feeds them with information.

• Ability to Access a Variety of Learning Material Anytime from Anywhere, which can help in understanding the learning concepts under study.

• Flexibility: mobile learning is spontaneous and not planned in advance.

• Collaboration: mobile technologies in addition to social networking technologies provide opportunities for collaboration between learners themselves and collaboration with instructors. Some case studies and projects investigated and experimented with mobile learning as a new channel to convey knowledge. Cavus et al. (Cavus, 2009) investigated the potential of using wireless technologies in learning new technical English words. Results of the study, in which forty-five students participated, showed that the students learned in an effective way new technical vocabulary using their cell phones. 9ine Consulting (Heinrich, 2012) investigated the use of iPads at Longfield Academy in Kent in which over 800 students had iPad across all levels of the school. The study revealed the value of the iPad as an educational tool, the involvement of the teachers, the motivation of

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the students in using the iPad, and the rising progress in the quality of students' work.

• Material Incompatibility: some materials designed for one particular system will not function properly on another (for example, the Apple Macintosh and the Windows PC).

Mobile learning can be used to support traditional learning (Wang, 2014) as well as distance learning (Mutlu, M.E & others, Barbara et al., 2012). Mobile learning, there occur changes in learning environment, with the opportunity of learning independent of time and location, in this context, Khalil Alsaadat (IJECE) October 2017)). Mobile learning can be used to support traditional learning (Wang, 2004) as well as distance learning (Mutlu, M.E & others, Barbara et al., 2005).

Subject	E -learning	M -learning
Content Access	classroom access or internet Laboratory	Access of learning from anywhere, anytime
Communication	Electronic-mail-to-Electronic-mail	Immediate messaging
Location scenario	Private location	No geographic boundaries
Content Delivery	To reach internet site it will take some travel time	Wireless internet connectivity so no travel time need

• Cloud-based Mobile Learning

The main cloud providers and technology companies such as Google, Microsoft, and CISCO are promoting their solutions for cloud-based education. For example, Google Apps for Education offers email, calendar, website creation and office applications, communications, to every student and staff member in the educational institution.

When building mobile learning solutions, the following technical issues need to be considered:

a) How to implement and manage the adaptation of the learning material to the learner's preferences and profile?

b) How to provide support for multiple mobile devices?

c) How to extend the solution with the learning material from third party providers?

In this work, we propose a mobile learning solution based on cloud -based services and multi-device support and adaptation. Student modelling allows handling the personalization process in a very flexible manner.

• Adaptive Learning

Several research efforts widely investigated adaptive learning and personalization of learning material according to the learner's model in web-based learning systems. Personalization of the learning material has been studied and evaluated in the areas of psychology of learning and teaching methods (Tennyson, 1988), (Litchfield, 1990). The empirical evaluation of these methods showed that personalized course material increases the learning speed and help learners understand better the teaching material (Brusilovsky, 2003).

Well-known projects include AHA (De Bra, 2001) (De Bra, 2002), DCG (Vassileva, 1998), and ELM-ART (Weber, 2001). AHA is a generic system for adaptive hypermedia whose aim is to bring adaptively to web-based applications. It supports adaptive content presentation and adaptive navigation. DCG is an authoring tool for adaptive courses. It supports adaptive sequencing and offers different levels of re-planning the course. ELM- ART is an on -site intelligent learning environment that supports example-based programming, intelligent analysis of problem solutions, and advanced testing and debugging facilities.

II. CLOUD-BASED MOBILE LEARNING

Cloud computing enables a service provisioning model for computing services that relies on the Internet. This model typically involves the provisioning of dynamically scalable and virtualized services. The advent of cloud computing has an impact on developers, end-users, and organization.

For developers, cloud computing provides greater amounts of storage than ever before and better processing power for running the applications they develop. For end-users, a user using the cloud through a native application or a web-based application can access his documents and files whenever he wants and wherever he is, rather than having to remain at his desk. Also, cloud computing opens the door to group collaboration as users from different locations might share documents and files at lower costs and in an efficient way. Small and medium-sized businesses might also benefit immediately from the huge infrastructure of the cloud without being concerned with its administration. They might store massive amounts of data than on their premises' systems. Therefore, their computing staff no longer needs to worry about upgrading software. Instead, they will be free to focus further on innovation.

Cloud services are applications or services offered using cloud computing. Cloud services delivery models include:

• Software-as-a-Service (SaaS): the cloud service application runs on the servers of the cloud provider. Users access the service via a Web interface or by using an API.

• Platform-as-a-Service (PaaS): businesses develop and deploy their business applications in a cloud environment by using software tools offered by the cloud provider,

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who is responsible for maintaining and managing the cloud infrastructure.

• Infrastructure-as-a-Service (IaaS): businesses rent compute, storage, and network resources and access them across the Internet or via a private network.

The SaaS delivery model, as demonstrated by the offerings of the main cloud providers and players, is the most appropriate cloud-based solution for implementing both e-Learning and m-Learning platforms that include Learning Management Systems (LMS), learning material repositories, authoring tools, and collaboration solutions like video conferencing and screen sharing. Indeed, educational institutions can easily and quickly implement SaaS-based solutions without incurring the maintenance costs, normally inherent to in-house solutions, while benefiting from the latest software updates and new features offered by the cloud provider.

Typical requirements for a compelling mobile learning solution include: (1) support for multiple devices, (2) storage, retrieval, and processing learning content outside of mobile devices, (3) integration of new learning content from third party providers, (4) user authentication, and (5) high scalability.

III. FRAMEWORK OVERVIEW

3.1 Context

We are considering a learning environment where learners take courses asynchronously. In this context, learners have personal desires to enhance their knowledge and careers. They often have long-term learning plans and do prefer flexible and personalized learning environments that take into consideration their preferences. Most of these learners are always mobile and require having access to their learning material from everywhere, anytime, and using diverse mobile devices. So, the context of this work takes into consideration the following requirements: asynchronous learning, mobile learners, heterogeneous mobile devices, tailored courses, and personalized interfaces with a similar look and feel.

3.2 System Architecture

In this context, we are proposing a cloud-based framework for implementing an adaptive mobile learning system that supports mobile learners connecting to the learning platform using various mobile devices. The cloud service of the training organization has the following components:

• Learner Profile Manager:

o Performing user authentication

o Acting as a central register for registering each new learner.

o Managing and assuring the consistency of the databases containing learners' profiles.

o Receiving service requests from terminals and giving access to user profiles data.

o Initiating the LPM on the remote device.

o Checking the version of LPM automatically download any necessary updates.

o LPM carries and manages a local copy of the learner profile (preferences and learner's model) on the learner's device.

o Providing the other components of the learner's device with the learner information (profile, identification).

o Managing and synchronizing the learner profile information with the training organization cloud service.

o Providing the local personalization of the learning material. In collaboration with the LCDM and LPM ensures the display of the learning material according to the learner's preferences and her device capabilities.

• Device Profile Manager:

oActing as a central register, where each new learner device must be registered.

o Managing and assuring the consistency of the databases containing devices profiles.

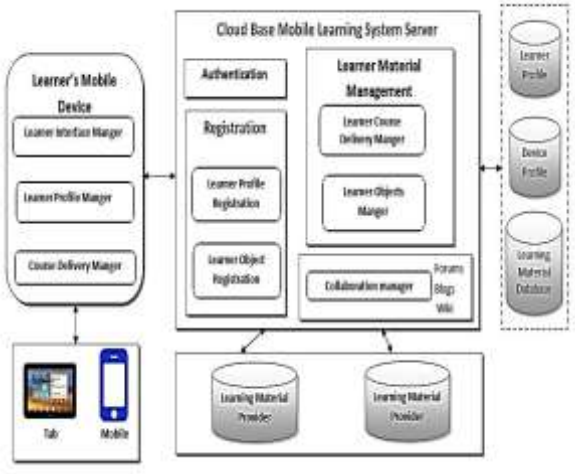
• Course Delivery Manager courses and teaching strategies:

o Providing an interface for defining learning objects and courses knowledge (study guide and study plan).

o Receiving service requests from devices and giving access to courses material.

o Generating the course study guide and study plan based on the user profile and the teaching strategy.

o Packaging the course teaching material according to the user profile and device profile.



The back-end databases of the framework include:

• Learners' Profile : for each learner the system maintains a profile that has two components, the learner's model and the learner preferences regarding the learning style,

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interfaces and content display.

• Devices' Profiles: contains for each device a description of its features and capabilities that are useful for the learning service provision (screen size, bandwidth limit, colors, resolution, etc.). Some features that can be automatically detected by the system (Operating System, Browser, Plug-ins) are not stored in the repository but integrated to the profile when initializing the Learner Tutoring Interface Manager.

• Learning Material Database: contains the learning material defined as learning objects. For each unit of the learning material the system maintains its study guide and its study plan structures.

IV. ADAPTIVE MOBILE LEARNING SERVICES

Learner Object' s (LO's) metadata requires a process for adapting the learning content, built from various in-house and imported LOs, to the learner's profile and device profile. The framework uses a common metadata model to describe LOs. This process, depicted in figure 2, involves two steps:

Step 1: metadata adapters are used to translate imported LOs metadata models used by third parties LO repositories to that common metadata model.

Step 2: The metadata of imported LOs, described using the common model of the framework, and the learner's profile and the device profile are the input of the adaptation (transformation) service, which generates content adapted to the learner's device. Open source software tools for developing mobile applications such as PhoneGap and Apache Cordova allow generating native apps for different kind of platforms (Android, iOS, etc.) and various kinds of devices. The adaptation service may use this kind of tools for generating adapted content to the learner's device.

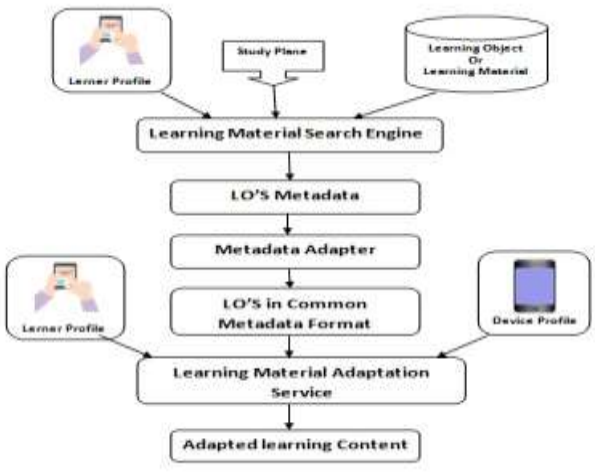

Figure 2: LOs metadata adaptation process.

V. CONCLUSIONS

Training organizations, which offer mobile-learning, face the following challenges: support and adaptation of learning content to multiple devices, adaptation of the learning material to the mobile learner profile and preferences, and the ability to integrate learning content from external training providers and open repositories with in-house learning content.

In this paper, we have described our proposed cloud-based framework for adaptive mobile learning. We described the components of the framework at the cloud service of the educational institution and the components to deploy on the device of the mobile learner. The proposed solution takes advantage of the benefits procured by the cloud regarding elasticity of resources and scalability by supporting a large number of mobile learners. It permits to adapt both the course content and the mobile learner interface dynamically. We have also described the process of importing learning objects from third party learning providers and their integration with in-house learning objects, which allows building and adapting the study plan and the learning material to the mobile learner profile.

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