

A Mobile Learning Application to Access Learning Objects

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ABSTRACT

The concept of learning object appears as a mean to improve the reuse of educational resources in digital format. The Sharable Content Object Reference Model (SCORM) is a common model for learning objects that makes easy the reutilization of educational contents between different systems. The objective of this paper is to show how an educational content in form of learning object packaged under the SCORM model can be viewed and accessed from a mobile device. This is very useful from the point of view of mobile learning (m-learning), where it is common that the materials created are very specific to a particular learning environment and it is unable to reuse them in other platforms different than those for which they were created. The application which implements these results is nowadays being used in a real environment by several e-learning companies.

General Terms

Mobile Learning

Keywords

Learning Object, SCORM, M-learning, Reusing.

1. INTRODUCTION

In order to improve the reuse of educational resources in digital format appears the concept of learning object [15.] A learning object includes not only educational content, but also metadata descriptions that describe the own object and make easier its use and location in other contexts.

Sharable Content Object Reference Model (SCORM) is a common model for learning objects. Its main advantage is to make easy the reuse of educational contents between different systems (learning object repositories and e-learning platforms, for example).

Nowadays SCORM is a 'de facto' standard supported by major manufacturers and consumers of e-learning and is supported by the leading learning platforms.

Learning objects and their associated standards like SCORM allow e-learning to achieve a common methodology to ensure the accessibility, interoperability, durability and reutilization of materials in digital format.

Nowadays e-learning is evolving to new platforms where it is possible to learn using the Communication and Information Technologies (TIC), but not only from personal computers, but also from mobile devices. The result is called m-learning.

The m-learning can be considered as an evolution of e-learning that allows the user to take advantage of mobile technologies to support the learning process.

Mobile phone is today a very usual device, and it does not need a permanent Internet connection to work. For all these reasons the mobile device is an ideal tool to be used at any time and for any activitie (including learning).

In this paper the two concepts, SCORM model and mobile learning, will be put on relation, to promote the use and reuse of educational contents through mobile devices.

Nowadays contents in m-learning are tailored and most of them do not reuse the educational resources that already exist. This paper tries to give a solution to this problem.

In the first section it will be contextualized the problem studying on one hand the main trends in m-learning research. On the other hand the fundamentals of the SCORM model. In the third section it will be described the SCORMmobile project which is the case study that uses the SCORM model in m-learning context. The paper finishes with the conclusions and future work.

2. STATE OF THE ART

In this paper we link two concepts, m-learning and the SCORM model for learning objects. Therefore we are going to explore both subjects.

In this section we will see the current trends in m-learning and the foundations of the Sharable Content Object Reference Model.

2.1 Research trends in m-learning

The m-learning as a teaching platform is increasing their users and utilities. There are different lines of advanced research trends in this area. It will be discussed the most interesting. In one of them could frame the SCORMmobile project.

One of the research lines focuses on the analysis of issues involving education and teaching methods through mobile environments. A project which aims to develop innovative teaching methods using the mobile can be found in the [6] e-book.

Other line is the adaptation of contents in order these contents to be accessible from mobile devices due to the limitations and special features that have these devices. The idea is to use "converters" of multimedia content, images, web... to a format that can be viewed in the mobile device. There already exist some applications in the market that allow different types of format conversion.

Another trend is to integrate mobility systems in Learning Management Systems (LMS). This line is mainly oriented to include mobility features in online learning platforms. One of the most extended platforms of learning is Moodle. There are several studies of this type with Moodle but most of them are in process or are not released. MLE [9] is one of them. Apart from this, there exist some applications for Moodle on the mobile but natives, that is, only for a specific mobile platform. For example for iPhone are mTouch [12], mPage [11], Moodle4iPhone [7] or ILite [5]. Also there exist specific implementations of Moodle for Android like MOMO [13], MBot [8] or Moodbile [10]. However, as we have just mentioned, these adaptations are always partial and specific of a particular learning platform. In addition, most of them are not operative or are not accessible.

Finally, another important line of research, that would fit the main objective of this paper, is oriented to allow viewing from a mobile device learning contents that follow e-learning standards. This is a potential development line in the future.

By the moment the most important initiative in this area is Pocket SCORM Runtime Environment [14] that allows tailored the SCORM contents to mobile. However, the functionality of this project in reference to the SCORM standard has become somewhat outdated and limited, and does not supported sequencing and timing characteristic of the new version of the standard.

In the same line other authors propose to use an intermediate layer (framework) to adapt the SCORM object to use it in mobile devices like in [3]. The best would be not to need any change over the SCORM object to be visualized in the mobile.

Our research also aims to achieve display the contents of a SCORM object in a mobile phone. This research line is the least explored.

2.2 SCORM: Sharable Content Object Reference Model

SCORM model is a 'de facto' standard in e-learning. SCORM is a specification of the ADL (Advanced Distributed Learning)

[1] [2]. The main objective is to share an educational content between different systems to facilitate the reuse of this content.

SCORM is composed by three models:

- *Aggregation model (CAM)* which defines how the educational content may be packaged in a .zip file. In this way the content will be able to be transferred between different systems.
- *Run Time Environment (RTE)* which defines the communication between the e-learning platform (LMS - Learning Management Systems) and the host where the educational content is stored.
- *Sequencing and Navigation model (SCORM SN):* This model is very important in the new 2004 version [1]. It consists in a set of rules that specifies the order in which learner should acquire the content.

In the project which is proposed in this paper it is necessary to study the *Aggregation model* in detail.

From this model point of view the content is packaged in a .zip file. This file contains a special file. This file is a XML file which contains the information about the structure (organizations) of the object and their resources. Apart from this, the object and their items could also contain metadata about themselves. These metadata are described using another e-learning standard called LOM (Learning Object Model) [4].

LOM defines nine categories to describe a Learning Object. These categories describe for example, general information about the object, technical requirements, copyrights or pedagogical characteristics to use it.

The LMS who wants to use the SCORM object will have to interpret the content and structure of the XML file associated to the SCORM object.

3. CASE STUDY: ACCESS SCORM OBJECTS FROM MOBILE DEVICES

3.1 Context of the problem

Nowadays most of the educational contents for mobile learning are made for a specific purpose or situation. In this context, on one hand it will not be possible to reuse educational contents that already exist. On the other hand educational contents specially designed for m-learning will not be able to be used in others environments, may not be reused.

There are many educational contents in different Learning Object Repositories (LOR) or in Learning Management Systems (LMS). SCORM enables content sharing across platforms. If one content is packaged using the SCORM model, this content

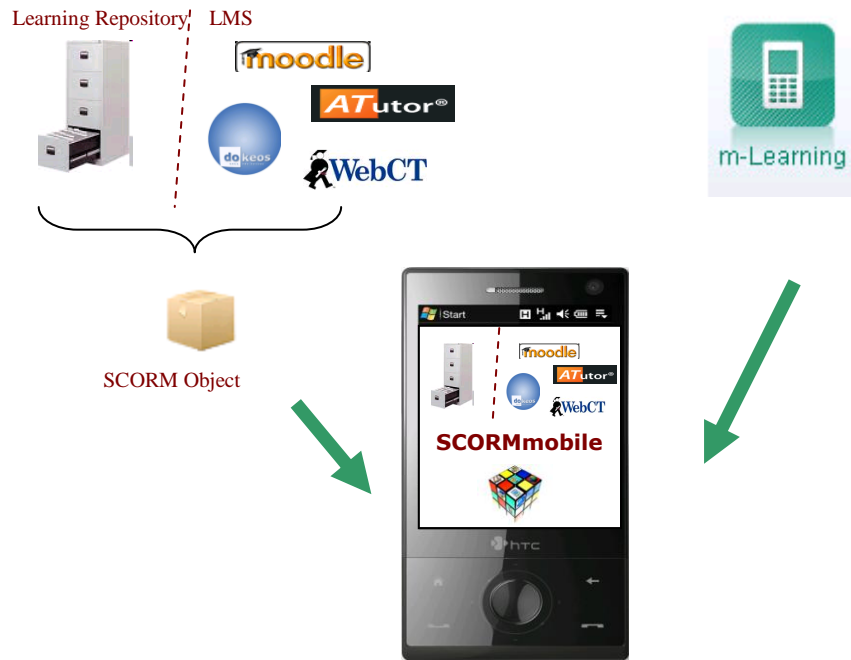


Fig 1: Objective of SCORMmobile project

could be interpreted an accessed from all the LMS and LORS that support this model.

Therefore, if it was possible to interpret a SCORM object from a mobile phone, all the contents packaged with SCORM could be accessible from mobile and could be used like resources for m-learning.

SCORMmobile [16] is the application which gives the answer to this question. Figure 1 shows how SCORMmobile enables educational contents in digital format that could come from different platforms could be accessed from the mobile.

The objective of this project is to view and access from a mobile device an educational content in form of learning object packaged under the SCORM model. This would be very useful from the point of view of m-learning, where it is common that the created materials are very specific to a particular technology and unable to be reused in other environments different than those for which they were created.

3.2 Methodology to solve the problem

SCORMmobile shows the content of a SCORM object in a mobile phone. To achieve this it is necessary not only obtaining the resources of the educational content, but also finding out the structure and organization of these contents.

Once the user has the SCORM object that he wants to access on his mobile, the application will show the structure and organization of the object on the device screen. From this moment the user will only have to select the SCORM object resource which wishes to visualize on his mobile.

To reach this objective the software application has to carry out several steps, once the user already has the SCORM object stored in his mobile phone. For each of these steps there is a software component which implements the task of this step.

1. Unpacking the SCORM Object

The SCORM object appears as a packed file in zip format. Therefore the first activity will be to unpacked this zip file. After this operation all the resources (files) associated to the SCORM object will be stored in the mobile phone. The software component which realizes this operation is called *Unpacking component*.

2. Finding out the structure of the SCORM object

When the SCORM object is unpacked, it is also obtained a special XML file, called "imsmanifest.xml", in addition to some special files, XMLSchemas files (.xsd) associated to the "imsmanifest.xml" which helps to interpret its content. This XML file contains the information about the organization and

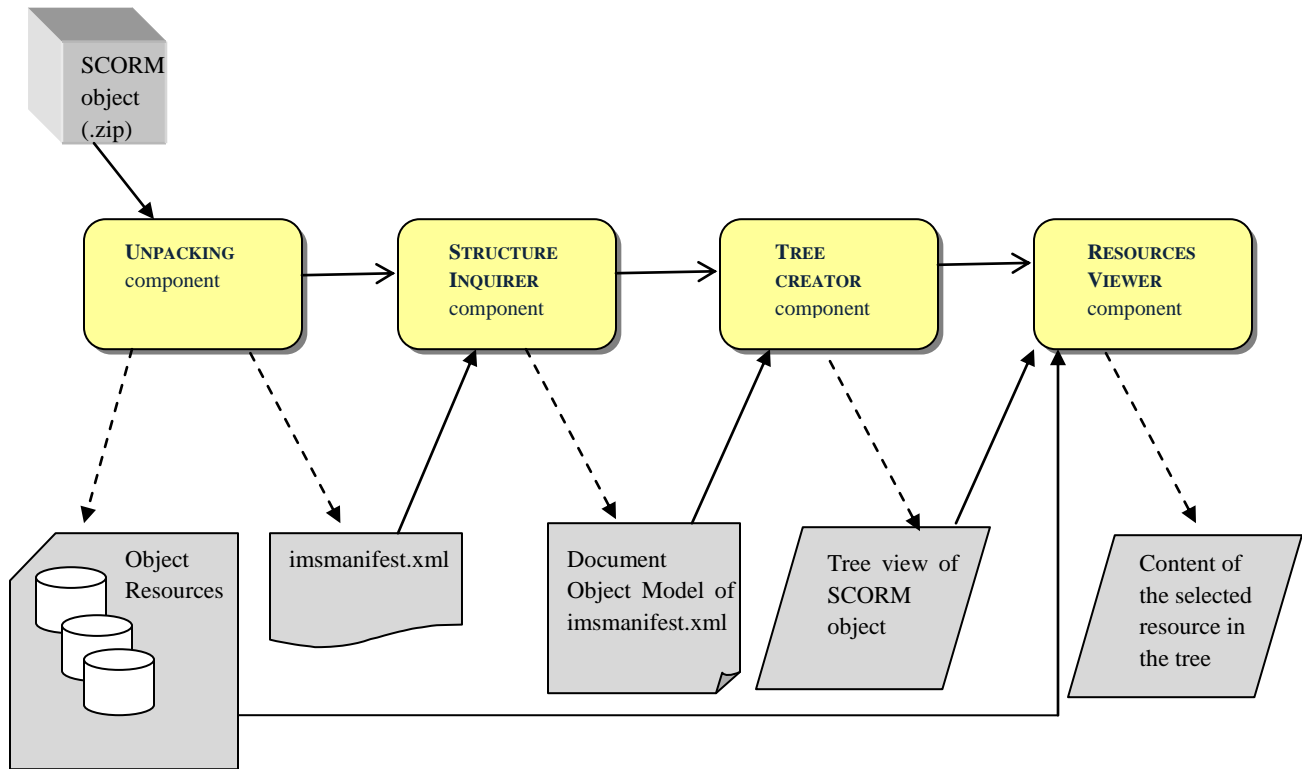


Fig 2: Software architecture of SCORMmobile application

resources of the object. Therefore, it is necessary to explore this file in order to find the structure of the object.

The content of the object can be organized in different ways from a pedagogical point of view. Therefore, the same object could have many organizations in order to view its educational resources.

Each organization can have several items. Each item can have other items, other *manifest* or a resource associated. So the XML file is represented like a tree, which is a recursive data structure.

Analyzing the “imsmanifest.xml” using the Document Object Model (DOM) [17], it will be possible to find out all the information about the structure and contents of the learning object (organizations, items, resources, others nested SCORM objects,...). The software component which realizes this operation is called *Structure inquirer component*.

3. Creating and visualizing the structure of the SCORM object on the mobile screen.

From the information extracted from the object in the previous phase, the application will represent on the mobile screen the structure of the object: organizations and items of each organization. For each item it will be shown its content: that is, other items, other SCORM object or the resource associated to this item.

All this information will be presented to the user in a tree format. Choosing a tree view is not random because this is the way in which it is displayed the structure and content of a SCORM object in any LMS that supports SCORM management. The software component which realizes this operation is called *Tree creator component*.

4. Selecting, opening and visualizing on the mobile screen a content of the SCORM object

If the user wants to see a content of the SCORM object on the mobile screen, he will have to select from the SCORM tree view the item of the organization which he wants to display. Once the user selects in the tree an item and only if this item has associated a resource, the content of this resource will be displayed on the screen of the mobile.

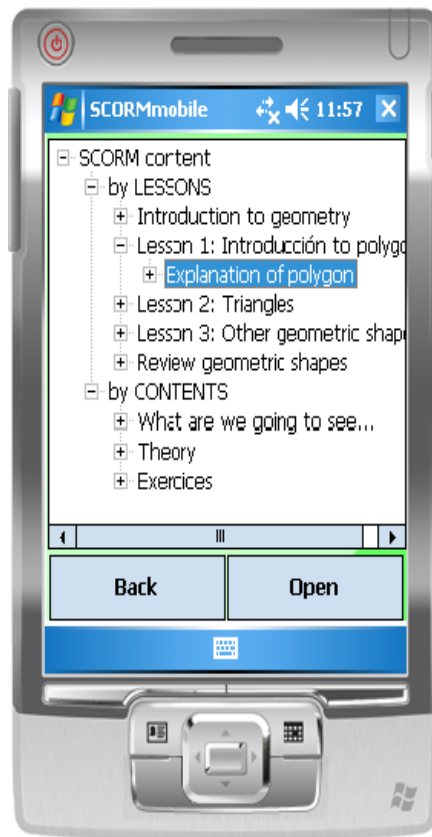


Fig 3: Structure of a SCORM object in a mobile phone

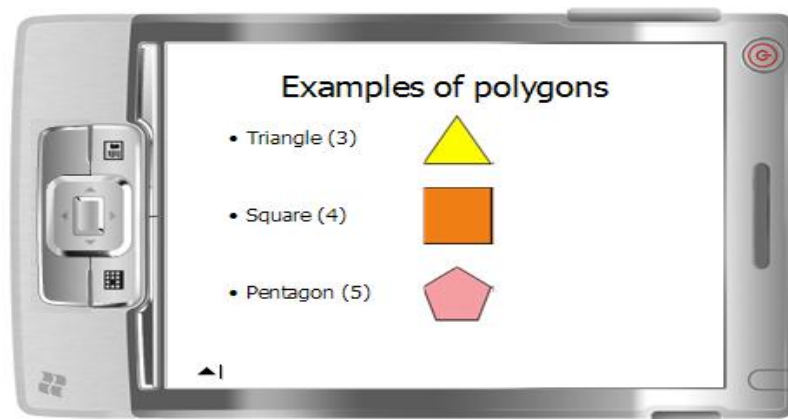


Figure 4. Content of a resource of a SCORM object

In order to open a resource, it will be necessary to find out the type of the resource. It is possible that certain types of contents could not be displayed directly in some mobiles phones. This depends mainly on the mobile platform or operating system the user is working with. In its first version SCORMmobile is implemented only for Windows mobiles and allows visualizing the most common types of contents supported by SCORM objects: office documents (.doc, .xsl or .ppt files), web contents (.html files) or PDF contents, for example.

The software component which realizes this operation is called *Resources viewer component*.

After the explanation of how the SCORMmobile applications works, Figure 2 shows a schema with the software components of the application, associated to the process needed to access a SCORM object from a mobile phone described in this section.

3.3 Results

Nowadays SCORMmobile project is being used in real environments for several training companies that already use e-learning in their teaching and learning process.

SCORMmobile has been licensed as a software application and some companies involved in training and located in different parts of Spain (Madrid, Sevilla and Barcelona mainly) have purchased this product. These companies already had some of its training contents organized in SCORM format. Nowadays, with the new product these contents can also be imparted to the students of the companies through mobile devices. That has allowed these companies to enter in the market of m-learning. As a result, they are getting good results and increase the number of their students.

As an example of the functionality an appearance of the application, Figure 3 shows the tree associated to a learning object packaged in SCORM. In this example, the SCORM object represents a simple course of geometry to learn the basic foundations of polygons and their main types.

In this case, the tree which presents the structure of the object shows that the object has two organizations. The learning content can be organized “*by lessons*” or “*by content*”, which are the names of the two organizations of the object. Inside each organization there are displayed the resources of the object. The user has only to select the resource who wants to open and then its content will be shown.

In our case the user has selected the content (item) “*Explanation of Polygon*”. Figure 4 shows the content of the resource of the SCORM object selected in Figure 3, which is a simple presentation, in Power Point format, about some types of polygons.

The tree interface implemented in SCORMmobile used to process a SCORM object is very similar to the opening of a SCORM object in a LMS like Moodle or any other.

4. CONCLUSIONS

The implemented mobile application allows visualizing any educational contents packaged in SCORM format. In this way any learning object packed in SCORM would be accessible from a mobile device. Learning platforms allow importing SCORM resources to visualize them. Learning repositories allow importing and exporting SCORM objects. Therefore, the resources in SCORM format stored in learning platforms or learning repositories will be accessible from mobile with the SCORMmobile application. In this way we can access from the mobile for multiple educational contents that already exist.

Nowadays the application is being used in a real environment by several training companies. SCORMmobile allows these companies also teach now through mobile devices.

In its current version, the application works in mobiles with Windows Mobile operating system. As future work, we will implement the application for other mobile platforms like Android. We are working now in this new project.

Another application of SCORMmobile could be using it to access learning objects in an LMS when this LMS works in a mobile platform. For example, we have just mentioned in this paper some efforts to use Moodle in the mobile. It could be useful to add SCORMmobile to these implementations in order to manage a SCORM object from Moodle even when Moodle is working in a mobile device.

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