CLAYNET: CONTENT ADAPTATION IN M-LEARNING

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ABSTRACT

M-learning is the natural evolution of e-learning based on the use of mobile devices. Therefore, ClayNet, as an e-learning platform, is performing this step by means of developing a web service which will allow the users of mobile devices to access the resources of the e-learning platform.

KEYWORDS

m-learning, e-learning, ClayNet, lms, web, service.

1. INTRODUCTION

M-learning is the learning methodology which involves the use of small mobile devices, such as mobile phones or PDAs, that is to say, any handheld device with wireless connection. M-learning solutions allow people to access the information technologies whenever and wherever they need, facilitating the possibility of implementing innovative ways of teaching and learning.

The fast improvement of the mobile devices technology, along with the services offered by the mobile phone systems, facilitates the development of more sophisticated mobile software which ends up in a rising demand by the consumers. As a result of the importance which these devices have acquired in our society, formation providing companies have been forced to produce specifically designed contents for mobile devices so as not to ignore this growing market formed by millions of users.

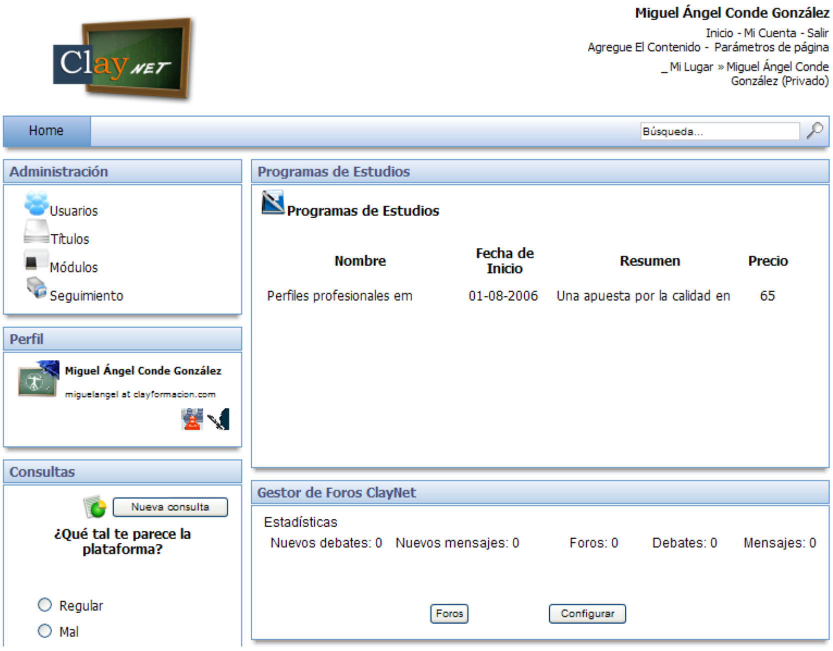
2. ¿WHAT IS CLAYNET?

ClayNet is a learning platform which covers all the process from being a support for in-person education to developing a totally online student-personalized learning method.

ClayNet is structured as a web application based on the idea of a web portal, by means of Java Portlets technology. Portlets are independent small-size web applications which can be grouped and interact in order to build a web portal. Despite being integrated in a web portal, ClayNet is independent of it, which enables it to work isolated or integrated in other platforms.

Portlets’ independence allows them to be developed separately and in a parallel way together with other portlet developments. This feature increases security because one error in a portlet does not propagate to the rest of the application.

The final appearance of the web portal will depend on the portlets it contains because they can be added, removed, maximized or minimized individually and can be ordered easily as well. An example appearance of the portal can be observed on figure 1. ClayNet portlets provide the functionality which any e-learning platform is supposed to have and they can be exported and adapted to other environments or user necessities.


Clay NET
Miguel Ángel Conde González
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Agregue El Contenido - Parámetros de página
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Gestor de Foros ClayNet
Foros
Configurar

Nombre	Fecha de Inicio	Resumen	Precio
Perfiles profesionales em	01-08-2006	Una apuesta por la calidad en	65

¿Qué tal te parece la plataforma?

○ Regular
○ Mal

Estadísticas

Nuevos debates: 0 Nuevos mensajes: 0 Foros: 0 Debates: 0 Mensajes: 0

Figure 1. Appearance of ClayNet.

Portlets technology needs a framework which supports its management and storage. Among the variety of software tools which implement the Portlet Specification JSR 168 (Abdelnur and Hepper, 2003), it has been chosen Liferay (http://www.liferay.com) which is an open source tool for building web portals.

ClayNet portlets also rely on an external data base so as to implement data persistence. The data base management system which has been used is MySQL (http://www.mysql.com/). In order to perform the communication between the portlets classes and the data base, a library of classes has been developed which acts as a wrapper for the data base and abstracts the rest of the application from the data base managing. This also provides a simple interface which automates the data base managing significantly.

2.1 ClayNet and m-learning

The main objective of ClayNet m-learining project is allowing the users to access and interact with the resources of the e-learning platform by means of a mobile device.

A web service based on J2EE (*Java 2 Enterprise Edition*) and a client application based on J2ME (*Java 2 Micro Edition*) are being developed. The client application will be conform to JSR-172 (J2ME Web Services) specification. The communication between both sides will be performed by using SOAP (*Simple Object Access Protocol*) over HTTP (*Hyper Text Transfer Protocol*).

A web service is a set of software applications and technologies with the ability to interoperate in the Web. These applications and technologies exchange data in order to offer some services. Providers offer their services as remote procedures and users request a service by invoking these procedures through the Web. ClayNet’s web service will implement all necessary methods to allow and manage user connections and authentications from mobile devices as well as the access to all available resources, adapting them to the particular technical features of the device used.

The mobile client application will invoke the remote methods in the web service so as to perform many different tasks: authenticating the user in the platform, accessing available resources, receiving all the changes made in the resources after being working offline, etc. In addition, it will show the contents obtained from the platform and allow the user to work with them.

Based on the fact that mobile devices might not have an Internet connection continuously available (in areas without wireless network coverage) and in order to minimize the amount of transferred data (as the current cost of mobile Internet connection is quite high), the user is expected to connect to the platform to obtain the desired resources, download them and disconnect. Then the user will work with those resources offline and, when finished, he will connect with the server again so as to synchronize all the changes (figure 2). A real-life example of this usage might happen when a user is travelling by train or by plain and wants to spend that time working on some resources from the e-learning platform.

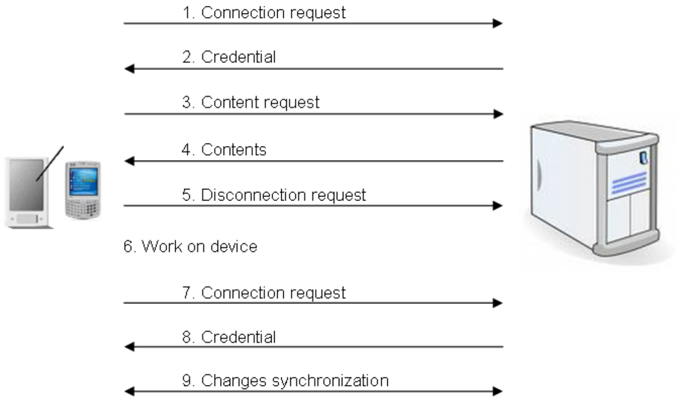

Figure 2. Communication between client and server.

Content adaptation to device's technical features is another important goal related to minimizing the connection time and the data transferred. The client application will send to the web service a list with the technical features of the user's device such as: screen dimensions and number or colours, supported file types (audio/video files, images…), etc. Taking this into account, the server side application will perform a series of actions in order to achieve the adaptation which will depend on the type of the requested resource.

2.2 M-learning in ClayNet now

ClayNet m-learning project is currently under development, with the aim to obtain the first stable version by the end of July 2007. However, most of the methods of the web service and the basic functionality of the mobile client application have been implemented so far.

Authentication service

This service receives a log-in request from the client application which includes the username and password introduced by the user and one object which includes the technical features of the device so as to be associated with the user session. There is also a method for checking whether a session has expired or not and another method to log out.

The server creates a session object with a unique identifier for each user, which will act as a credential, and return it to the client. From that moment on, the client application will have to send that identifier included in every request which it does, in order to identify the user.

Content service

This service contains methods for accessing resources and other methods for navigating through the courses structure. The last ones, which do not involve any adaptation at all, obtain a list of elements which are enclosed in a higher level element. For example, there is a method which returns all the modules of a course, another one which returns all the units of a module, etc. The information of each element includes its identifier and its name.

There are different methods for requesting resources depending on the type of the demanded file. The resources are classified into four types: images, audio files, video files and text files. These methods receive the identifier of the resource and return either the URL of the adapted resource (when dealing with audio and videos files) or an array of bytes which contains the resource's data (for images and text files).

A cache for adapted resources has been designed in order to avoid repeating the adaptation each time a resource is requested. In order to manage all the resource instances created, a XML file is used. Every time a new resource instance is created, a new element is added to the XML tree. This element contains information about the location of the file, its format, and its specific features (width and height in pixels, number of colours, video and audio encodings, etc) which will depend on the type of the resource. Thus, every time the server receives a request for a resource, it checks if an adapted instance of that resource has already been created. Then, it checks if that instance is compatible with the features of the mobile device. The instance will be returned only if it is compatible; otherwise a new adaptation will be performed.

Content adaptation

The first step for all the types of adaptation is checking if the device supports the file type of the original resource. If not, a new copy will be generated, if it is possible, in another file type which the device does support.

In the method which provides images, the first transformation is scaling the dimensions of the original image depending on the screen size of the mobile device. Then a reduction of the image quality is performed by increasing the compression rate, if it is possible, and a reduction on the number of colours used, if necessary. Finally, the new image is rendered to a file which will be transmitted to the client.

When dealing with audio files, the aim is reducing moderately the quality of the file in order to adequate it to the abilities of the device, but always keeping the quality over a minimum level. The transformations which take place are converting the audio track to a monophonic one and reducing the sample rate. Then, the new adapted file is created and its URL returned to the client.

As for video files, the audio track adaptation is similar to the case of audio files and the video image is scaled to fit the screen dimensions of the device. The audio will be encoded in PCM (*Pulse-Code Modulation*) format and the video codec used is H.263.

The adaptation of PDF or HTML files has not been implemented yet. It will work like this: if the user's device cannot show them, the file's textual information will be extracted, if it is possible, and then it will be transmitted as a plain text file to the client application.

Client application

The invocations of the web service's remote methods are executed in separated threads so as to prevent a connection error from blocking the entire application. In addition, since mobile connections are usually quite slow, a wait screen informing that the connection is being established is shown. It makes user's interaction more satisfactory because it continuously informs him about what the application is doing.

The graphical user interface which is being implemented will allow the user to navigate through the courses structure and menu options easily. There will be a multimedia player for playing audio and video files, an image viewer and a text viewer. A high level of optimization of screen rendering will be achieved thanks to content adaptation.

3. CONCLUSION

ClayNet's m-learning project tries to be a referent in the world of e-learning. Synchronization of changes in the contents between client and server, together with content adaptation to device's technical features, are two ambitious goals which might involve an important quality leap within m-learning applications. Another important aim is to obtain a high level of usability, by means of minimizing connection time and providing an attractive and easy-to-use graphical interface. The achievement of all these points will result in a high quality m-learning application.

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