DISTRIBUTED ENVIRONMENT OF LEARNING SUITABLE FOR TELEPHONY AND MOBILE COMPUTING

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ABSTRACT

A training platform online is an environment that affords the conduct of long distance teaching. It's an online training environment that is made of tools to facilitate the use of the system various functional devices. It also allows to simplify long distance consultation of teaching contents, the tailoring of the apprenceship and the service protector. It as well allows to implement flexible solutions that can fit all types of profile in accordance with their roles, with actors such as learners, trainers or teaching ideas men. A platform gets notably a long distance access to the teaching resources that allows in that way to solve the constraint of physical presence in a classroom, the management and the individual organization of the timetable. The environment can offer to each and every one of the learners to take care of himself; and handles his progression and with his rhythm interacts with the trainers or collaborates with the other learners. Considering their growing evolution, the telephony and the mobile computing constitute now means of communication widely used in all circles; they form helpful means to have access to information because they use easily transportable equipment and very suitable for mobile users. Besides the implementations are relatively easy to use thanks to the wireless application protocol (WAP), the mobile terminals have access to data processing programs in the network. In this way, the use of mobile computers, small ones and mobile phones which have various degrees functionality as apprenticeship support can help to spread out geographically the area of coverage for the long distance teaching. Yet the mobile terminals present, particularly for the most current mobile phones, limitations that are often link to their restricted random access memory (RAM); their small data storage, the reduce size of the screen, the lack of color of certain devices and mostly the lack of possibility to be online to the internet network. Despite all the conjured up constraints, the telephony and the small size computers use in an asset for the spreading of the pedagogical contents of the apprenticeship and the access to the online laboratories. In this communication, we are going to present our process that has led to the online apprenticeship environment setting up that has fitted the mobile phone and small computers. This virtual teaching environment and of online apprenticeship named E-mobile learning (E-ML) take into account the specific limitations of mobile terminals. The results allow to the learners to get the content of courses at real time and at every time without any constraint of place, space and bandwidth limitation. This solution will afford students to follow their courses on a mobile phone screen on a small computer named Personal Digital Assistant.

Keywords: *WAP, Mobile, Telephony, E-Learning*

1. INTRODUCTION

The training has become a basic element as regards perfecting and innovation. It gives the possibility to adapt oneself to different economic, social and cultural contents. During the last years, the training has stopped being episodic as in the past, splitted up and non-interactive; it has become continuous, systematic and well organized. And mostly with multimedia new technologies in particular the internet; apprenticeship has got rid of space and time constraint, by giving way to a dialogue without any constraint of constant exchanges, decentralized and personalized that foreshadows new forms of communication, apprenticeship and teaching. Teaching or long distance training is an educational situation in which knowledge transference and apprenticeship activities stand outside the direct relation, i.e face to face with the different actors: trainer and learner. Knowledge acquisition has become possible without any matter, without moving in a classroom, and without the physical presence of a teacher. The

objective is to conceive an online teaching environment suitable for the mobile devices.

In this article, we are going to show how we've conceived and set up an environment that is essentially based on distance apprenticeship and on mobile network.

This communication plan is composed with two parts. In the first part we are going first of all to speak about online teaching basic concepts, afterwards the mobile network and finish with the WAP protocol and the Wireless Markup Language. In the second part, we are going to make an analysis of the solutions and we'll finish by presenting E-ML platform.

2   ONLINE APPRENTICESHIP PLATFORM

A platform used for an online training (Learning Management System, LMS) is a software package gathered in a common environment that facilitate the conduct of the online training activities. This platform put together the necessary tools for the system users, i.e: the administrator, the learner or the student and the protector or the teacher. In this system, the teacher creates adapted and typical pedagogical routes for his teaching, incorporates multimedia pedagogical resources and carries out the follow up of the students activities. These ones consult online or download the teaching contents as they please. For the evolution of their work, they do exercises, evaluate themselves and pass their works on to receive the appropriate feedbacks. Teacher and students communicate individually or in a group, create discussion themes and collaborate through common documents. The administrator sets up and assures the system maintenance, manage the access and the rights of the system users. He creates links with the eternal information systems (schooling, catalogues, pedagogical resources, etc). Administrator means, a specific role in the platform and not a regular role of the establishment. Around main users categories can be added other roles. The main roles can also be modulated. These softwares can have many components that have different types of use: (i) the document server that facilitates pages consultation and browsing the "electronic books" to publish or consult information, or courses; (ii) tools of interaction or corporative apprenticeship; (iii) the electronic mail server or e-mail, interchange of messages by way of electronic mail service; (iv) the chat is a synchronous conversation which, an exchange of message in real time via a specific software; (v) the online forum is a non-synchronous conversation which is animated

by a trainer or a protector. It functions by writing messages. It exists other tools like the electronic organizer, which is a planner that informs of the working programs; the timetables and the availability of the actors interested by an activity. The valuation tools consist often of tests and self-assessment. These valuations are accompanied by model answers to help students to move through the apprenticeship activities. The cooperative and communication working tools in synchronous mode give way to the actors to profit by different form of work in common or to be shared. The platform structure is based in the roles and functionality group that assure the management of one of its aspect (communication, marking, etc). A role is a whole functionality that an individual has access. This functionality will be different according to the participants on the platform: then a course creator could alter the teaching documents; what could be forbidden to the student. [3], [20], [15]

3   MOBILE NETWORK EVOLUTION

GMS networks (Global system for mobile communication) offer a data transmission service with a limited throughput of 9.6 Kbits/s. GSM networks are based on circuit switching. A communication channel is held on by a user during a connection. This transmission mode is fitted to voice transport. GSM future passes now through an offer of data service of best quality, more competitive in order to come up to users expectations. That is why ETSI (European Telecommunications Standards Institute) recommends the integration of "by packet" transmission technology called GPRS in GSM networks. The GPRS allows to internet services with a throughput that can reach 115kbits/s; thanks to the multiple use of radio channels that are assigned to one use or share by many other users.

With the GPRS, radio resources are dynamically allocated and the speed of transmission varies with more important flexibility and more important adaptability of the packet mode with regard to the circuit mode. GPRS uses the state multiplexing, the internet mobile services or intranet available by GPRS display are the mobile bureau (remote access or long distance connection in one's enterprise network); the e-mail, the internet access, the telemarketing, localized information services and the telemetry. Actually, GPRS is particularly effective for discontinuous data transmission or data small volume frequent transmission. Yet, it works also for data big volume punctual transmission. Media applications in GPRS afford

quick access to directory services such as a yellow pages, the online downloading "audio file" etc. [10]

ETSI means by UMTS (Universal Mobile Telecommunications system) the third generation mobile communication system capable of giving new type multimedia wireless services that goes beyond the second generation system current possibilities like the GSM that combine the use of land elements and satellites. The UMTS shows in European community must be compatible with the concept of third generation mobile system IMT-2000 (International Mobile telecommunication-2000) which has been worked out by UIT worldwide on the basis of 2/2 revolution. [12]

4   THE WAP PROTOCOL FUNCTIONAL ARCHITECTURE

The temptation was really big to connect the mobile telephony network and the internet one. That's what WAP puts into effect. Its objective is to supply internet access to terminals such as mobile phones but also to digital personal assistant like the Palm Pilots or Windows Pocket CE. It is very important to clarify that the WAP does not give direct access to internet but only to adapted sites and conceive with WML (Wireless Markup Language) it uses. [14]. (See FIGURE 1)

The WAP functional architecture is inspired by the logic model client-server. This architecture is the one used by internet world. The client (the terminal browser) by means of query interrogates the server and the client is the shave of a coding norm of the information (queries and answers). The wireless application environment uses architecture very close to that of the internet. The WAP functional architecture lean on three major components; presented in figure 2: one WEB server, one WAP Gateway and a WAP client [14]. (See FIGURE 2)

The WAP client "user agent" is an application that sends out queries to the server and displays the server answer. It exists two categories; the first is to process data presented in Wireless Markup Language (WML) and the second is to interpret Wireless Markup Language Scripts (WML Script).

The WAP Gateway questions the Web server with HTTP standard queries; the servers don't have to get fitted for the WAP client. The goal is to have standard servers on internet. The adaptation to the radio interface and to a small size screen rest with the WAP Gateway which is going to compress data and adjusts them before their transmission to the terminal. This compression is necessary to reduce

data volume exchange on radio interface and the required calculation power for its processing on the terminal. The WAP Gateway functionalities can be installed whether on dedicated equipment or on a server designed to host WAP pages. The gateway interprets demands of the client and affords him to browse on the server pages. The Web server is the source data base. The WAP functional model derives from that of the internet with server Proxy. The dialogue between a terminal and a Gateway is always done with the help of WSP protocol (Wireless Session Protocol) and no matter how the protocol supports the dialogue between the Gateway and the server source of the consulted pages. The URL used by the terminal determines the protocol used by the browser of the caller to attain the Gateway. Figure 3 shows the WAP Gateway translator role. [14]. (See FIGURE 3)

The WAP Gateway translates a WAP query into an HTTP query and vice versa. By another hand, the Gateway adapts as well the contents to his interlocutor capacities. The micro browser specifications for the WAP terminals that control the user interface, define the terminal functionalities. As far as possible, the WAP is in keeping with the technologies or validate programming languages. The WML and the script WML are defined for small screen. An application permits to the user to interact with a series of documents. The WML language offers a set of adapted labels to the mobile terminals that don't exist in HTML. The WAP Gateway is the element that makes the difference between the WAP and the Web. It assures two principle functions; conversion of the data format between computer network and wireless network telephony; queries and answers coding and decoding between mobile terminal and Web server. This second functionality is specific to the WAP. In order to reduce the size of the transmitted data, the queries and the answers are encoded in a compact binary format. The files in WAP format are compiled by the Gateway before being sent towards the terminal. The terminal decodes and interprets them. Some constructors also incorporate a server in the Gateway so as to offer additional services. In this case, we talk about WAP server and it is able to produce itself documents that are transmitted to the mobile phone. Some Gateways carry out for example services or interpret script language so as to produce dynamically pages in compatible WAP.

WAP standard is made up for a scale of services and protocols that work in superposed layers called

WAP protocol pile. The following board shows the protocol six layers.

***Tab 1**: WAP protocol pile layers*

Application layer or WAE
Session layer or WSP
Transaction layer or WTP
Security layer or WTLS
Transport layer or WDP
Bearer network layer (GSM, GPRS, UMTS…)

The WAP uses the mobile network as bearer network. There is of course the GSM norm but also the other data transmission network like CSD (Circuit Switched Data), SMS (Short Message Service) or CDMA (Code division Multiple Access) are compatible. The transport layer takes upon itself the communication (the transport) between the Gateway and the WAP terminal. The protocol used in this case is the wireless Datagram Protocol (WDP). The security layer (optional) assures transmitted data integrity, authenticity and data privacy thanks to the wireless transaction protocol or WTP guarantees a good conclusion of the transactions in the form of queries-answers. Above, we find the session layer assured by the wireless session protocol or WSP. Finally, the WAE defines the WAP environment which the files format is in WML, the images and executables format as WML script or others.

5   WML LANGUAGE

Like the web that uses the HTML language, the WAP uses the WML for the wireless Markup language. The WML is also an embedded language "markup" but here stops the similarity with HTML for WML is in fact derived from XML from which it retakes rules and syntax. The WML is managed by the WAP forum, open group where it gathered more than ninety companies including Ericsson, Motorola, and Nokia. The WAP forum has the objective to elaborate standards for WAP technology and its language the WML. WAP forum works in a way as the World Wide Web Consortium (W3C) for the Web. The W3C, aware of the difficulty that HTML language get to satisfy the internet needs has set the language of the future on the Web, i.e, the Extensible Markup Language (XML). XML is what we call a metalanguage as a set of rules and prescriptions to invent new languages (see the upgradable) with its embedded

visible commands. The WML used as WAP language is one of the WML heirs. [14]. (See FIGURE 4)

WML allows to describe some users interfaces, some contents and interactions for the peripherals with weak passers-by tape by mobile phones, or pagers. During its designs; constraints due to weak passers-by tape have been omnipresent. The mobile terminal screens are of small size and their resolution is weak. The mobile phone possesses only few lines that can go over height to twelve characters. The peripherals offer possibilities of very limited users capture. A telephone allows only to seize easily figures; not easily characters and possibly other few specialized function keys. The peripherals possess very poor throughput and generally very weak RAM too. The mobile networks interconnecting these peripherals have a very weak passer-by tape of about 300 bps to 10kbps; with a latency period between 5 and 10 seconds. WML completely assumes the legacy of the World Wide Web architecture in general and of HTML in particular. In this way, it uses URLs to locate documents or applications. It also uses HTTP protocol as transport protocol. URLs are used in WML as well for browsing or pointing out an external resource (scripts, images etc). A WAP page conception is enough different from the classical Web page. Actually, the Web page which is displayed corresponds to the complete content of a HTML file. On the basis of the reduce screen size of the mobile terminals, we could not display the complete content of a WML file; only a small snatch of information could be displayed. By another hand, it is not conceivable to engage a telephone connection for every small snatch. Then the process adopted by the WAP will be to charge a set of snatch that will be stored in a terminal memory. The different snatches will be called during the consultation. The entire snatches correspond to a file of expansion WML document which is "DECK" or "PACKET of CARDS". The different snatches are called "CARDS". [14]

The WML script was made to supply "scripting" functionalities to the WAP. It is used to enrich the WML of functionalities it is short of, like for instance: check of the users capture; validity control etc. The WML script is based on the ECMA Script international standard which is also on the basis of Java Script that is conceived to take into account of the constraints link to the peripherals of weak passer-by tape and also to CPU weak capacity and on board memory. In this way, all the complex mechanism; that consume passer-by tape, in CPU

time and/or memory have been isolated from WML script so as to optimize this language. Another considerable advantage of WML script rests in its relationship with Java script. Actually, being derived from the ECMAScript norm, WML script allows to contents and services providers to capitalize in external resources, without reinvesting in human resources, in training, in software tools, in a new language. This established fact permits very quickly to bring a service or an application HTML/existing Java script towards WML peripheral/WML script while conserving the same developing teams and/or in affecting new resources knowing the couple HTML/Java script.

6   PRESENTATION OF E–MOBILE LEARNING PLATFORM

E-Mobile learning (E-ML) is an adapted environment for online teaching on mobiles mechanism. [16]. It is composed of many normalized components for e-learning.

The identification organization and the platform users: This section allows the user management system, namely the creation of accounts. (See FIGURE 5)

A course registrations management: To take a course, the learner must first register in the course. (See FIGURE 6)

The courses management: The E-ML Learning Environment has a manager to facilitate ongoing monitoring of the course. (See FIGURE 7)

For a given course, it is possible to have direct access to the user personal space. The course home page gives access to the tools below: he assures description, organizer, announcements, exercises, works and forums. (See FIGURE 8)

To better understand the stakes of the course and its conception, the protector and the course teacher prepare a file of description that comprises the following information: the course detailed description, competences and objective, content, planned apprenticeship, links with other courses, with the web to get the or all the used supports of the courses, valuation procedures and possibly few additional information.

The announcement tool: This module has a purely informative vocation, but must be regularly consulted. It affords teachers to send messages to the whole registered for the courses. (See FIGURE 9)

The forum tool: The forums of discussion constitute the cooperative and interactive course part. (See FIGURE 10)

The exercises management tool: This tool allows to protectors and teachers check the knowledges acquisition and to put right to certain shortcomings or difficulties of understand. It also permits the learners valuation. (See FIGURE 11)

7   CONCLUSION

One of the main objectives of e-learning is very clearly the solutions conception and experimentation that are adapted to the new situations of apprenticeship developed by the technology. This requirement results in the necessity to supply flexible solution that are fitted to the various profiles of the learners and the teachers including notably geographic mobility, the time organization, self-sufficiency and the cooperative work. It is in this sense of evolution that "E-ML" platform has been developed. This solution that consists of adapting the online teaching to the mobile terminals seems to deserve an interest in the way to contribute to the apprenticeship process even if certain constraints due to the technology of these tools and their specific mode of use that reduce the application field. Even if third generation networks help added to mobile terminals new ranges have offered new prospects such as graphics; lively images and the video certain constraints always remain. For example, it is impossible to read documents in Word, Excel, Pdf format, etc because of the smallness and the weak resolution of the mobile terminals but also their memory poor capacity. It's the reason why "E-ML" platform has not included "Espace documents" tool where we can download or store files related to the courses. To lessen the impact of this constraint, we suggest to spread "E-ML" platform with a server or a Web site use dedicated exclusively to the storage and downloading of the documents. In this way, the students will not confine themselves only to the course description done by the teachers within the application but they can also have access to the course sources, exercises. "E-ML" mobile platform use within Institute offers to it the opportunity not only to integrate the online teaching in its system but to have it adapted to the telephony and mobile computer. Yet our work as any other work is far from being over because all the tools related to online laboratory in the platform would be a significant asset for the leaner and effective means to help emerging countries to use the devices offered by the information and communication new technologies. Besides "E-ML" platform could be improved with the use in the mobile terminals of more adapted technologies such as Java J2ME.

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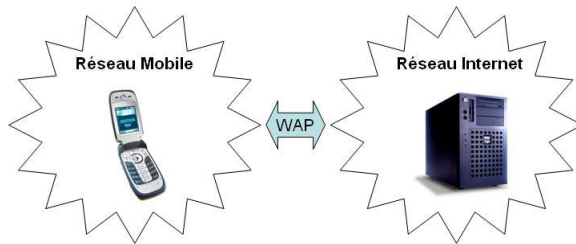
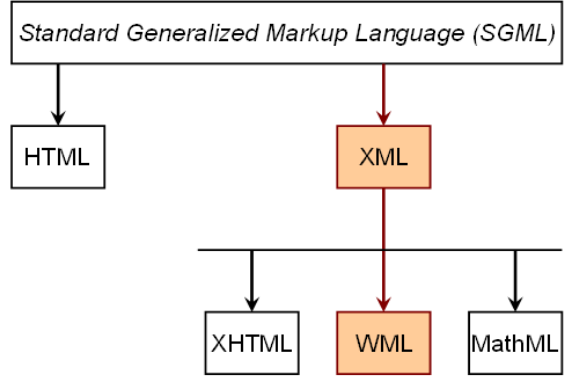*FIGURE 1*: *WAP ROLE* [14]

FIGURE 4: *DIRECTORY STRUCTURE OF THE SGML*

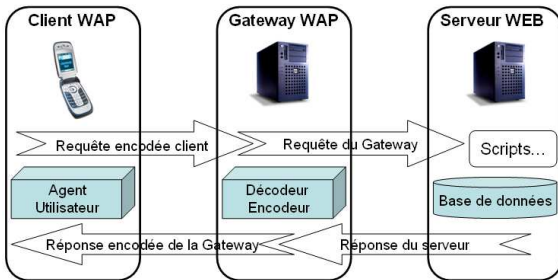*FIGURE 2*: *THE WAP FUNCTIONAL ARCHITECTURE* [14]
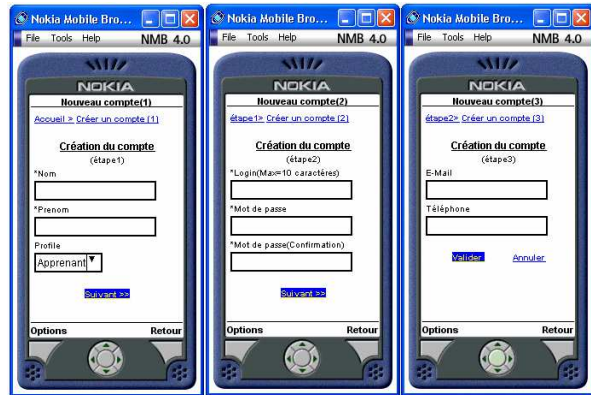

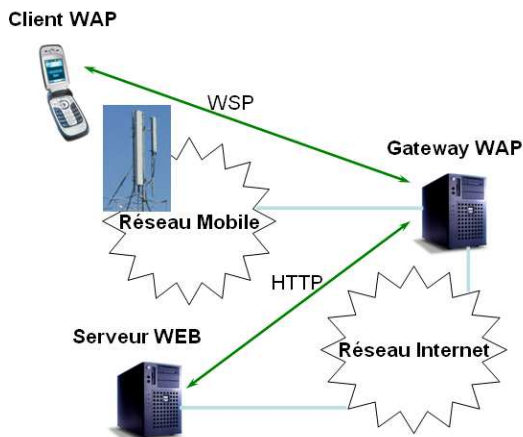*FIGURE 5*: *IDENTIFICATION AND USERS MANAGEMENT*

FIGURE 3: *THE WAP FUNCTIONAL ARCHITECTURE* [14]
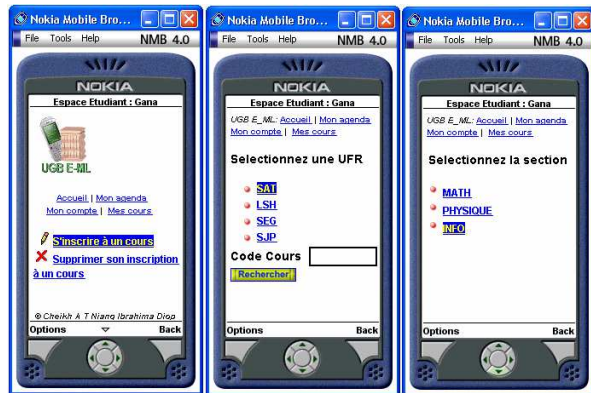

FIGURE 6: *A COURSE REGISTRATION MANAGEMENT*
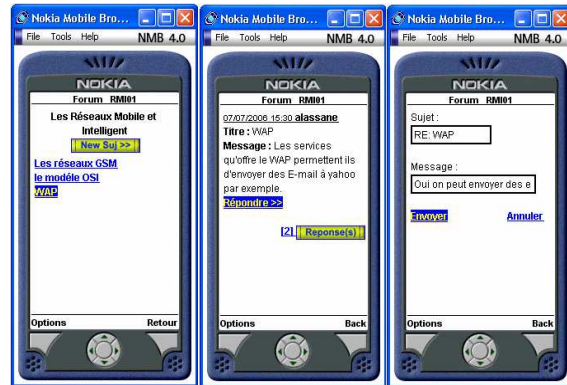
FIGURE 7: COURSES MANAGEMENT

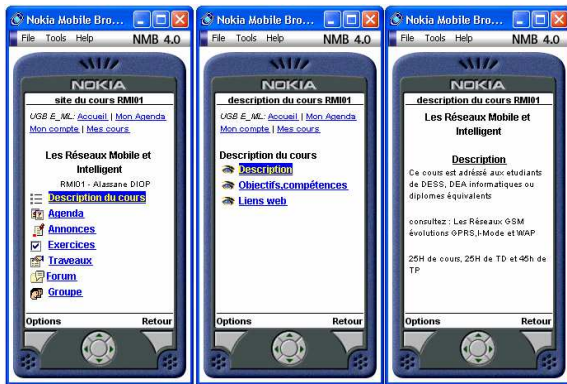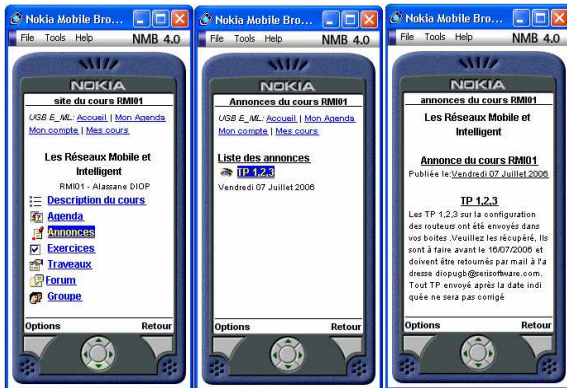

FIGURE 10: THE FORUM TOOL

FIGURE 8: A COURSE TOOLS

FIGURE 11: THE EXERCISES MANAGEMENT TOOL

FIGURE 9: ANNOUNCEMENTS TOOL