

A distributed platform of training of data-processing networks based on the web

Souleymane Oumtana^{*,1}, **L. Jimmy Kouraogo**²

^{1,2}LABTIC –INPHB, Abidjan, 08 BP 475 Abidjan 08, Ivory Coast

¹oumtana@nic.ci, ²jkouraogo@yahoo.fr.

The present feature shows the concepts and the design of a distributed framework for networking learning relying on Internet technology. We studied first some ways of teaching networking. After then, we proposed one model already tested through teaching experience. It helped us build a framework using object oriented approach and ITS.

Keywords Communication network; intelligent tutorial system; Model object, pedagogy; UML

1. Introduction

With the advent of the Internet, the platforms of remote teaching are increasingly numerous. They are developed by private companies or resulting from the world of research. Comparative studies have been realized on platforms of remote teaching; among them, those of Ovaep [11] and Préau [12] PRE 2000]. These platform's editors worry more technical aspects consisting in looking for solutions allowing integrating the greatest number of standard of documents available on the market. The educational aspects are often absent or relieved in the background. The activities of learning are mostly reduced to consultations of course or to answers to questionnaires. The activities requiring the manipulation of real object or the practical works are not envisaged, making of these platforms of the tools of transmission of knowledge. It would however be necessary to notice that these platforms allow the student to manage his course of training by consulting a sight on its own course in the form of indicator on its progress report. It's the case of (ClassLear, LearningSpace, TopClass, VirtualU and WebCT [11] [13].

So, most of the platforms often emphasize the addition of the features of communication to make the students cooperate, by considering that the integration of communication's tools between peers will be sufficient so that there is really cooperation. The communication's tools are mostly asynchronous and do not benefit from tools specifically conceived for the remote tutelage.

The development of accessible trainings via Web notably supposes the mutualization and the re-use of educational resources. The particular question of the description of the educational resources for Web took place because of the processes of current normalization.

Of this report was born our motivation to conceive a distributed platform training making it possible to integrate knowledge in communication network. The implied expertise can effectively cooperate only if the concepts relative to every expertise are separated from the know-how which manipulates them.

We start from a formal modelling of the network's concepts. This work has ends in a knowledge representation model which we present in the first part. In the second part, we validate this model by applying it to the computer networks within the framework of our educations. The third part is the description of the remote networks education platform .

2. Some platforms of remote teaching

2.1 State of the art

* e-mail: oumtana@nic.ci, Phone: +225 07900231

In this part we evoke the essential elements constituting the distance teaching platforms, and then we will be delayed on the modelling of the contents. The web site thot.cursus.edu proposes more than 224 sites of remote teaching. It isn't realistic to make a qualitative and quantitative comparison of these various tools. Some studies were undertaken in this direction [2] [11]. An open and remote platform is software which assists the control of courses. This gives the essential tools to the teaching contents use and exploitation to teachers, students and administrators.

In this system, the teacher creates a standard of courses or teaching models, integrates multimedia educational resources and makes a follow-up of student's activities.

The student consults courses contents on-line, organizes an evolutive sight of its work, makes exercises and complete home works.

Teachers and students communicate, discuss on different subjects, and work on the same documents.

The administrator ensures the maintenance of the system, manages the access and the rights of.

With these various points quoted above, can be added other functionalities and other roles, the role of educational objects for example. The platforms will be able to use media and more diversified communication modes and to enrich the data exchange procedures.

Claroline [15] is a simple platform giving an easily access to completely classic functions. There isn't a course model in Claroline. His seizure of courses is made by using either forms, or text editors whom the teacher can post. The educational service is little developed.

While Ganesha [16] gives to trainers and auditors some teaching modules equipped with supports of course and collaborative tools.

ACOLAD (Remote Collaborative learning) [17] is a teaching platform which is based on the internet technologies, and whose graphic interface is founded on a space metaphor

2.2 Critics

The major inconveniences of these tools of assistance live in the level of [9]:

- User interfaces and their ergonomics: The system adaptability to the user is rarely taken into account [8];
- Their structure: These systems are generally structured in terms of logic of functioning rather than in terms of logic of use;
 - The computer networks constitute a complex domain especially since they combine two disciplines: networks and telecommunications. The currently existing educational systems have for objective to simulate the execution of the concepts about this domain.
 - The produced courses contain stiff structures [8] in which the pedagogy (good or bad) is incorporated and cannot be modified to adapt it to the various contexts. Production of multimedia artifices can mask a lack of pedagogy and lead to ineffective courses.
 - The quality of the courses diffused by Internet takes on a particular importance because no means is available to verify or improve their pedagogy organization[8]

3. Informal description of the model representation

3.1 Representation and knowledge organization

The course is structured in Teaching Objects (TO). For every educational object, we have textual description (Textual TD). A textual description is a text with information under other formats (pictures, animations etc). A teaching object can be illustrated by examples. An example is a textual description illustrating the TO. An example defines a model of what one can find in the domain. For example the 'Token Ring' network is an example of local area network. The TCP/IP protocol is an example of communication protocol. It should be noted that Token Ring can also be described by a teaching object if a part of the course relates to this subject.

We defined relations between teaching objects, texts and examples which is necessary to structure the course. These relations also supply a means of navigation between the concepts of course [1] [3]. We classified them in structuring units: TO, text, example, and specimen. For each relation, we specify the name, the associated structuring unit, synonyms and the sense of the relation. We indicate the relations in their major sense, but they are bidirectional (the opposite relation is implicit). For example, a TO is defined by a text (defined relation) and a text can be the definition of a TO (implicit relation).

Table 1 Teaching object

relation name	associated unit	Sense
<i>Is_a</i>	<i>TO</i>	<i>Classification</i>
<i>Is_defined_by</i>	<i>Text</i>	<i>Definition</i>
<i>Is_composed_of, contain, Is consist_of</i>	<i>OP</i>	<i>Composition</i>
<i>Is_characterized_by</i>	<i>Text</i>	<i>Description point of detail</i>
<i>Consist_in</i>	<i>Text</i>	<i>Technical description ,how</i>
<i>Allow_to</i>	<i>Text</i>	<i>Functionality role</i>
<i>Is_said</i>	<i>Text</i>	<i>Qualifying</i>
<i>Is_illustrated_by</i>	<i>Example</i>	<i>Illustration</i>
<i>Related_notion</i>	<i>TO</i>	<i>TO of close sense</i>
<i>Tech_Rep</i>	<i>Tech model</i>	<i>Technical representation</i>
<i>Is_composed</i>	<i>TO</i>	<i>Important concepts</i>

3 .2 Model of representation of the domain with UML

The modelling UML resumes the informal description using the UML concepts as to represent the concepts and their relations. We use the class diagram notation. The elements of the domain representation model are defined by classes. The course can be seen like a teaching object. The classes resume TO concepts, text, example, specimen, technical models. Some are declined in particular form by the relation of specialization. Thus a complex TO is a TO constituted by components.

A class is a general TO which is declined in several TO. For example a network is composed of supports of transmission. All the relations indicated above are represented in the diagram. The relations *Is_defined_by*, *Is_characterized_by*, *permit_to* and *consist_in*, are represented by associations with navigation indicating that we sails of the TO towards the text. Conversely, in the association keywords, we leave the text, arranging at least a keyword. The signe '< ', '>' give the direction of association reading.

In order to validate the model, we applied it to the low layers of OSI model (Open system Interconnexion)

The teaching object is here the local area network constituted by two essential components: a material aspect and a software aspect. As shows in Fig. 2

We use the relations “*is characterized by*”, “*is composed of*” drawn from the model. All the teaching objects are expressed according to this model. The following chapter will consist in integrating the results of this model in the DPTDN environment.

4. General description of the learning environment.

4.1 Material architecture

The installation of such a platform based on the existence of two models of teaching resources centres: a main resources centre which organizes, manages and distributes the training, and a training centre which gives to users all the technical and human means for the training. The production of teaching services by the teaching staff can be made as well at the level of the teaching server as in the training centre. However it is advisable to notice that the purpose of the production in the server centre aim to the implementation of the teaching objects for their distribution in the training centres.

The production in a training centre begins with the downloading of objects created in the server centre. Also, the production services allow each learning centre teacher to adapt common resources and to edit them, for their integration in a particular teaching strategy in order to better meet the needs emanating for learning themselves.

4.2 Software architecture

The software environment architecture bases on a set of elements which interacts with the system. With the aim to conceive a generic system, we had defined an architecture allowing each user to integrate his own base.

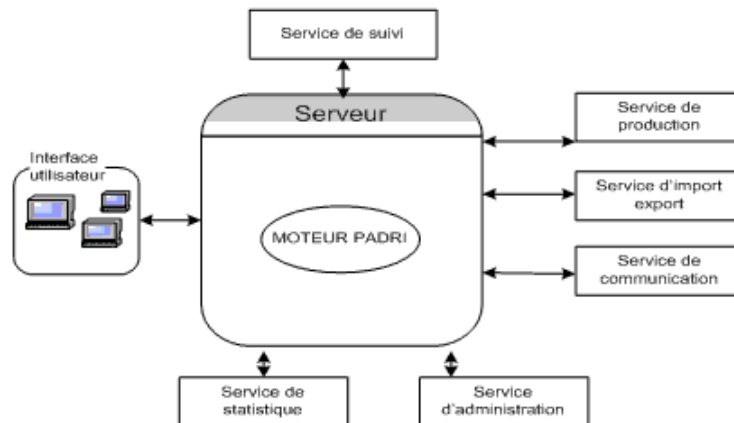


Fig. 2 The interactions between the various modules of the system

- **Import / export service SCORM**

This service allows to:

- Import and export contents with the SCORM 1.2 standard [2]
- Import and export contents with XML format [3] [5]
- Export contents with HTML format for offline consultation or on a web site.

With this module, the contents are reusable and inter operable.

- **Production service**

The service of production gives teachers tools to build teaching resources. The courses are defined according to the model of knowledge. With an intuitive and very structured teaching architecture, the producer easily builds his contents which are automatically put on page.

- **Service of follow-up**

The teacher has the possibility of following his students. At any time, he can show the courses which were studied, the achieved exercises, and other activities. The objective of the teaching service is to manage the access to the blocks of construction (reusable objects). These blocks are functional entities which can be downloaded and integrated into a particular strategy (for a session of formation).

- **Communication service**

These services allow the various users to interact. It manages for example the co production of the teaching blocks of construction between the various teachers, as well in the principal centre of resources as in each centre of training. The communication is synchronous (chat) and asynchronous (forum and e-mail). The proximity between learning and the tutor allow an easy collaborative work.

- **Administration service**

The creation and the management of learning profiles, tutors, producers, and the training are very easy with this module.

- **Statistical service**

This module gives the retrieval of the data in various formats (EXCEL, CSV, html, xml) in order to facilitate their use. It is then possible to:

1. Follow the learning and the tutor's activities (learning or tutors choice, of one or more one, an order of sorting).
2. Examine the learning time.

In our tool, the control is the capacity to observe the student who solves an exercise in a particular domain via an interface, to understand the suggested solution.

5. Conclusion

The object of the presented platform is the maintenance of the technological teaching in a computer-network context. This training can be made locally or remotely within the remote learning framework. It is especially to students of second and third year of engineering schools and to teachers wishing to create and diffuse their courses in learning centres. This work represents an effort of training optimization (flexible, targeted, adapted etc).

The information system developed in this paper starting from the oriented approach object, gave rise to a very advantageous model: this model could be validated with specialists in networks. We were able to study all the possible and existing cases of network configurations and this, by a simple approach, realistic and without heavy explanation of technical terms. This model gives answers to all the structural and relational problems. Indeed, it could be extended to any type of network system. The platform has a double objective:

- 1- Give to the student flexible training services, adapted and available in training centres in order to meet the specific needs for training (knowledge acquisition and know-how on the networks concepts, the communication protocols, etc.)
- 2- Give to teachers the necessary means (tools, teaching resources, etc.) of teaching resources production; or create their own resources with the classes or re-use existing resources (created by others).

References

- [1] André Pascal Attiogbe Christian, Souleymane Oumtanaga, IRIN Nantes research report August 2002
- [2] AGADIO remote training by open intelligent Agents, University of Montréal 1999
- [3] William J. PARDI XML in Microsoft Press Action Editions 1999
- [4] Stephen Spainbour Robert Eckstein Webmaster in aNutshell edition o'reilly 2000
- [5] Diaz M.: "The data-processing network research ", Revue TSI. Paris 1990.
- [6] ADL (Advance Distributed Learning SCORM Overview <http://www.adlnet.org/> 2002

- [7] Joyce, B., Calhoun, E. Models of teaching, 6th edition. Boston: Allyn 2000
- [8] Frasson C., Intelligent Tutoring Systems: status and prospects in North America, Educational Genius, May 1991.
- [9] Hochon J.C., A model of systems of intelligent assistance for a data-processing environment, Acts of the First African Conference on research in Data processing CARI'92, Yaoundé, Cameroun, October 1992.
- [10] ISO/IEC DIS 10165 "Information technology-Open Systems Interconnection-Management Information service-Structure of management information".
- [11] OVAREP Technical and Teaching Comparative study of Platforms for the Open and remote training, updated in november 2000. <http://www.algora.org/kiosque/publicat/doc/pdf/pf2000.pdf>
- [12] [Oumtanaga, 93] Oumtanaga S.: "Using computer assisted teaching network", International conference of Teleteaching 93, Trondheim, Norway, Août 1993, Norvège.
- [13] Paquette, G. (2000) *Construction of gates of tele-training - Explor@: A diversity of teaching models. Educational science and Technology*, 7 (1), 207-226.
<http://www.licef.teluq.quebec.ca/gp/doc/publi/campus/steexplora.doc> 2000
- [14] McLean, N. *Interoperability convergence of online learning and information environments*. The New Review or Information Networking, 7. Cambridge: Taylor Graham Publishing.
http://www.colis.mq.edu.au/news_archives/convergence.pdf 2001
- [15] Claroline <http://www.claroline.net> (2001)
- [16] Ganesha <http://www.ganesha.org> (2002)
- [17] Acolade <http://acolad-gpl.u-strasbg.fr/> (2005)