Using IMS LD Specification for e-Learning in the Cloud Computing

S. Ouahabi, A. Eddaoui, H. Labriji, E. Benlahmar, and K. El Guemmat

***Abstract*—E-learning takes advantage of the use of information and communication technology. Its objectives can be defined as self-learning, distance learning, individualizing learning paths and the development of online teaching relationships.**

Keeping interoperability between e-learning content in a universities cloud is not always easy, diffusion of training modules on the cloud by various institutions causes heterogeneous e-learning systems which affect the educational quality offered by university to teachers and learners, from this reason, comes the idea of modeling and synchronizing content between the different parts included in the learning task.

Our contribution result a model aims to ensure the interoperability in distributed architectures of large sizes using the IMS-LD specification to facilitate the task of identification, reuse, sharing, adapting teaching and learning resources in the Cloud.

***Index Terms*—Cloud, e-learning, IMS-LD, interoperability.**

I. Introduction

There are many definitions of adaptation in e-learning systems [1].

E-learning has recently become a promising alternative to the traditional classroom learning, helping society move toward a vision of lifelong and on-demand learning [2]. It has become one of the fastest-moving trends [3] and aims to provide a configurable infrastructure that integrates learning material, tools, and services into a single solution to create and deliver training or educational content quickly, effectively and economically [4].

Create a learning experience to the student, but also to the tutor, based on the configuration of a set of elements in a specific period is not always easy especially if we add the aspect of cloud computing in universities.

Using Cloud for e-learning offers several advantages to overcome the constraints of e-learning systems especially at the technical level [5], but diffusion of training modules on the cloud by various institutions causes heterogeneous e-learning systems which affects the educational quality offered by university to teachers and learners.

In this sense we will propose a new adaptive model that aims to adopt e-learning in the cloud according to student profile based on IMS-LD specification, the model keep the interoperability to facilitate the task of identifying, reusing, sharing and adaptation of learning and teaching resources in the cloud.

This paper is organized as follows. Section II describes the challenges of implementation cloud computing in universities, the Section III describes the challenges of educational modeling and the relationship between it and the Cloud. Section IV presents the interoperability model in cloud. Section V ends this paper with conclusion and perspectives.

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II. Cloud Computing in Higher Education

Cloud computing is a new emerging technology that is expected to significantly change the field of IT in the next few years. Cloud computing [6] is the use of computing resources (hardware and software) that are delivered as a service over a network (typically the Internet).It entrusts remote services with a user's data, software and computation.

Numerous services and applications can be provided in the Cloud due to its many interesting and promising characteristics. Cloud computing [7] is a computing model based on networks, which task is to ensure that users can simply use the computing resources on demand and pay money according to their usage by a metering pattern similar to water and electricity consumption.

In other side, the Academic researchers have expressed a need for access to massively scaled computing infrastructures that allow them to complete projects and research activities that have been difficult or impossible previously due to the amount of data involved [8]. Moreover today's cloud computing providers are offering higher education the opportunity to substitute a presence in "the cloud" for universities' existing data centers, servers, and applications, replacing these machines' traditional "physical" presence on campus [8].

The cloud computing application can be of great help when a large university is considered [9] for example, Oxford University (England), Berkeley University (U.S.A.) and North Carolina State University (U.S.A.).

The University of California (UC) at Berkeley, found cloud computing to be attractive to be used in one of the courses which was focused exclusively on developing and deploying Software as a Service (SaaS) applications. By a donation from Amazon Web Services (AWS), UC was able to move its course from locally owned infrastructure to the Cloud [10]. In some cases, a large university might become a provider of cloud services. More often, individual campuses will obtain services from the cloud. The trend toward greater

use of mobile devices also supports cloud computing because it provides access to applications, storage, and other resources to users from nearly any device [8].

Using cloud computing for e-learning solutions of universities simplifies the complexity of the device and influences the way the e-learning software projects are managed.

There are specific tasks for different types of actors and to better understand the contribution of cloud computing it seems essential to us to describe the system of distance education in all its complexity (learners, tutors, training, educational resources, trading tools, platforms ...) and combined with the cloud.

We have several models to manage this complexity, in [8] offer Massive Centralized Cloud Computing (MCCC) scenario for educational institutions and our previous Educational cloud model [5] cf.figure1, that is useful for reducing limits of e-learning systems factors by offering the educational cloud model that combines the different tasks of the actors in the institutions and within the cloud computing.

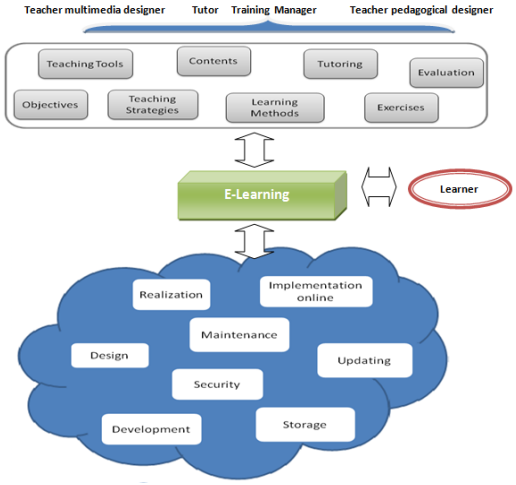

Fig. 1. Educational cloud model.

Some of the clear benefits that the cloud computing fetches to overcome the constraints of e-learning systems is given below:

1) Pooling: Pooling aims to align resources (equipment, expertise, best practices, applications, educational content and infrastructure) facilitate the support, to avoid incompatibility issues or difficult integration between different tools and systems to ensure that each institution no develops and not unnecessarily acquire existing resources elsewhere , Pooling (pooling and exchange) educational quality content promises to erase pedagogical inequality, fight against the phenomenon of "poor" schools
2) Discount: The Cloud can better cope with the evolution of increasingly rapid information technology, it also offers the possibility to update centralized and systematic manner of all documents (work, homework, collaborative exercises, projects ...) and fit coherently into a single central point. This helps to ensure their adequacy and relevance, as well as information which are identical for all users.
3) Elasticity : One of the characteristics of IT and learning resources "in the cloud" is the flexible adaptation of resources and means available (servers, storage space, computing power, application instances, content), with the elasticity of infrastructure and ease to seek resources needed.
4) Economies: A reduction in the size and complexity of machinery and software to be installed at each institution and avoid costly local infrastructure, not exploited to their full potential, and consequently the burden of licensing and Maintenance.

III. Educational Adapting and Modeling

A. Adaptive e-Learning

Adaptive e-learning as a method to create a learning experience to the student, but also to the tutor, based on the configuration of a set of elements in a specific period aiming to increase of the performance of a pre-defined criteria [11]. These criteria could be educational, economic, time-based, user satisfaction-based or any other involved in e-learning. Elements to modify/adapt could be based on content, time, order, assessment, interface and etcetera.

In modern learning theory there are four main approaches to adaptive learning [12], [13]:

- Macro-adaptive, selecting a few components that define the general guidelines for the eLearning process, such as learning goals or levels of detail and mainly based on the student's profile;
- Aptitude-treatment interaction, proposing different types of instructions and/or different types of media for different students;
- Micro-adaptive, monitoring the learning behavior of the student while running specific tasks and adapting the instructional design afterwards, based on quantitative information;
- Constructivist-collaborative, focused on how the student actually learns while sharing knowledge and activities with others.

A modern system based on adaptation should consider all of them to provide a wide range of possibilities on eLearning.

Among the most powerful languages of modeling we found IMS-LD, we investigated the possibility of its adaptation in the Section IV.

B. IMS-Learning Design

The description schemes were considered as descriptive languages for digital education resources; allows indexing very quickly the education resources to accelerate the task of information retrieval.

There are several standards of description schemes among others there is the LOM (Learning Object Model), which is a metadata model developed in 2002 by the IEEE consortium for the description of resources for educational purposes. It ensures the processing, evaluation, sharing, exchange and reusing of digital learning resources.

Another standard is SCORM (Sharable Content Object Reference Model) designed to create structured learning objects and to achieve accessibility requirements, adaptability, sustainability, interoperability and reusability.

Another specification to create structured learning objects

is IMS-LD that completes very well the LOM and is a supplement of SCORM; it defines the learning design as well-defined scenarios for learners to achieve their goals.

IMS-LD provides an Educational Modelling Language (EML) developed by the Open University of the Netherlands OUNL that enables the formal description of teaching-learning processes for a wide range of pedagogies in online learning, including collaborative learning [14].

The IMS-LD objective is to provide appropriate models for instructional design of diverse learning situations. This model of learning design focuses on three entities: roles, activities and environment. The activity is placed at the center of the process cf.Figure2; it is defined as a task with a specific learning objective; it is done by a number of persons which take different roles (teachers, tutors, etc..) in a certain environment and based on a number of digital resources or not, including the learning objects, resource materials, simulations [15].

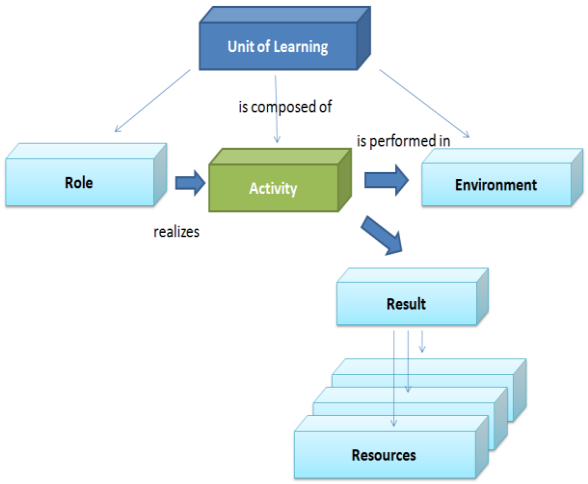

Fig. 2. Model of IMS LD.

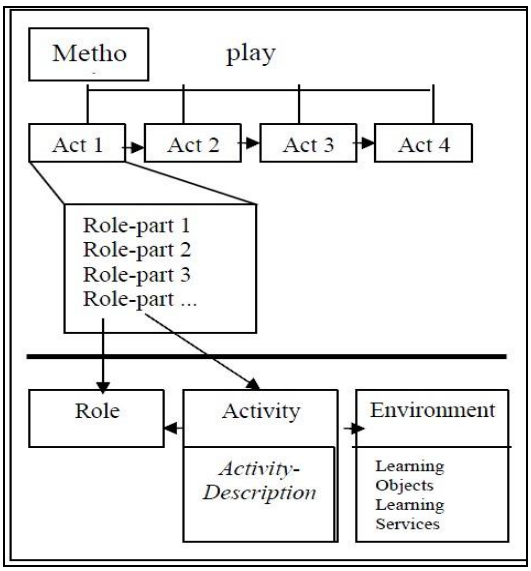

Fig. 3. The dynamics in learning design.

The overall scenario or design is described within the method element, which contains play, act, and role-parts elements, and is analogous to a theatrical play cf. Fig. 3 [16]. A learning design may be based around the achievement of specified learning objectives by learners; it may also define prerequisites. As well as allowing an entire design to be shared or reused, IMS Learning Design allows these elements to be reused in other learning designs [17].

C. Distributed Architectures and Educational Modeling

After a thorough study, we found several studies concerned with modeling Subject Teaching (online courses, course materials, etc...) In distributed architectures whose warehouse distributed based on the description of LOs by metadata LOM [18] which aims to make the LO easily accessible, usable and reusable.

The authors proposed a distributed architecture that put in place a system that will enable:

- Capitalize at each university, all relevant LOs produced.
- Annotate each LO to make it accessible and re-usable. This annotation is based on a description by LOM metadata and semantic annotations.
- Create an educational metadata warehouse which will be powered by all descriptors warehouses universities. Each resource can be shared between universities, and will be accessed remotely (while respecting gathered in one place).

Another work that deals with concerning of modeling large warehouses LOs through DBpedia categories to automate the classification of LOs [19] The aim is to link the text fields based on the IEEE LOM that describe subjects of the LO, which are contained in the Universia [20] digital library with a set of semantic categories described in DBpedia.

IV. Interoperability Model in the Cloud

From the research we do in this field, we deem that the implementation of e-learning systems in the cloud computing do not address the educational adapting and modeling. Our study involves in this field in order to analyze the contribution of modeling in cloud computing based on a distributed architecture rich in terms of teaching and learning resources.

A. Our Educational Model in the Cloud

Suppose there are several universities in the cloud [21], our question is how we can benefit from these resources and maintain interoperability between them to adapt the training according to needs of students and facilitate the identification task, reuse, sharing and adaptation of teaching and learning resources in the cloud.

Each student belongs to a university Cloud; he followed a modeled IMS-LD course. The student can access similar content offered by other universities to complete and enrich their knowledge.

We aim to develop the language modeling IMS-LD already explained in Chapter 3 to adapt training according to the needs of learners, to support, and at the same time teachers can work together to improve the quality of training provided to learners, so there are benefits for teachers and learners.

Our model uses various entities that are listed in Fig. 2.

- Roles: As a learner and facilitator in the Cloud (teacher, tutor, and facilitator) are played by people described by their properties.

- Activities: We have invested in Activities to ensure the desired interoperability between different Roles.
- Activity can be used several times by different roles in different environments.
- You find examples of modeling in section "benefits of our Educational model In the Cloud"
- Environments: Includes all types of Learning Objects (LO) or services used by the roles in the activities and the results produced by the roles in the activities.

B. Benefits of Our Educational Model in the Cloud

Our model has advantages for different roles in the cloud.

For Learners, they get more advantages through educational cloud using IMS-LD, They can take online courses from their university and they can have similar proposals of contained and support courses of other universities to complete and enrich their knowledge of. Fig. 4.

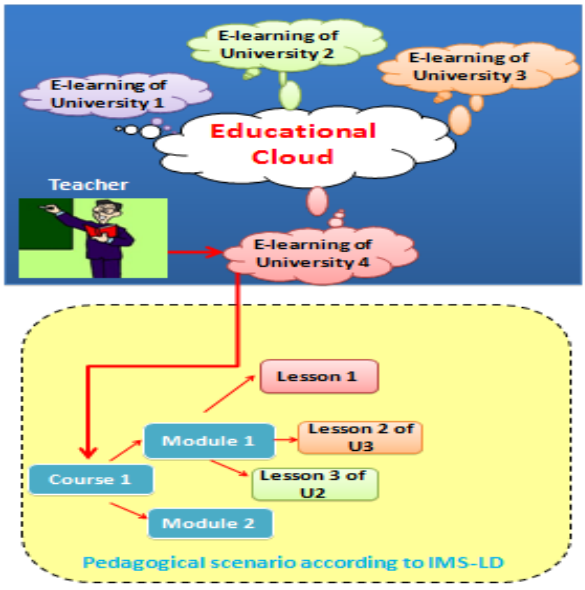

Fig. 4. Pedagogical scenario according to IMS-LD 'support case'.

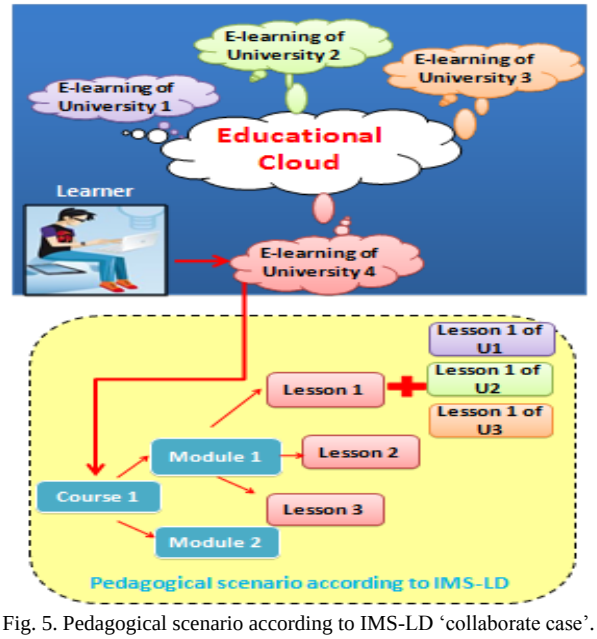

Fig. 5. Pedagogical scenario according to IMS-LD 'collaborate case'.

For Teachers, they also get numerous benefits over cloud; they deal and create better content resources for students when they collaborate with other teachers and they can also use courses of others teachers from cloud as it is said "Knowledge which is shared is better" in Fig. 5.

Using IMS LD Specification for E-learning in the Cloud Computing offer several advantages for various roles in the learning situation:

- The identification and reutilization of Learning objects by the teachers of various universities in cloud thereby reducing the efforts provided by the teachers and save time.
- Sharing Learning Objects between learners allowing enhances student satisfaction with the learning experience, promotes a positive attitude toward the subject matter, clarify ideas and allows the teacher to have an idea about the other courses in cloud for improve the quality of their scenario
- Adapting teaching and learning resources according to the profile of students that will be the goal of future work

V. Conclusion and Perspectives

In many countries, e-learning has become a key of bringing knowledge and the quality of education has increasingly becomes in great demand.

As we have shown Cloud computing offers several advantages for e-learning Systems, in this article, we define the advantages and the general context of adapting distance learning in the cloud according to IMS LD specification, it remains to find the ideal solution to suit IMS-LD to cloud so that we can generate each time a student profile in a distributed and heterogeneous platform.

In a future work, we would implement and validate our proposition by Operating of particular scenario related to IMS-LD in cloud computing and exploit a suitable learning model.

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