

Chapter 16

Design and Development of a Multi-Agent E-Learning System

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ABSTRACT

In this paper the authors present the design and software development of an E-learning system based on a multi-agent (MAS) architecture. The multi-agent architecture is established on the client-server model. The MAS architecture is combined with the Dynamic Content Manager (DCM) model of E-learning developed at Bergen University College, Norway. The authors first present the quality requirements of the system before they describe the architectural decisions taken. They then evaluate and discuss the benefits of using a multi-agent architecture. Finally, the MAS architecture is compared with a pure service-oriented architecture (SOA) to observe that a MAS architecture has a lot of the same qualities as this architecture, in addition to some new ones.

1. INTRODUCTION

E-learning has become an important part of our educational life. Web-based learning systems have developed into many different fields to support the learners in the learning process (Shank, 2012). Previous learning methods were restricted to access and assimilate knowledge. A web-based system is a valuable addition to face-to-face communication (Tavangarian, et al., 2004). The art of designing good e-learning systems is difficult and is a great challenge to the human mind. The way this is done is also dependent on the culture of the actual country. The main issues are to facilitate new learning modalities for the younger generation, as a self-learning process where previous goals undergo continuous change (Vygotsky, 1978). Traditional classroom learning is mostly based on behavioural learning theories where the learner is the object of assessment. The teacher initiates the learning process and the learner responds. Another learning approach, constructivism, focuses on the learner's abilities to develop her own mental models and learning concepts (Hay, Kinchi, 2000, p.167-182), (Kinchi, 2000, p.41-46),

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(Kinchi, et al., 2000, p.42-57), (Novak, Canãs, 2006/2008). This approach has more and more become accepted as a more relevant method to promote learning, even at the university level. We believe that the system described in this paper will promote such a learning mode.

1.1. Asynchronous and Synchronous E-Learning

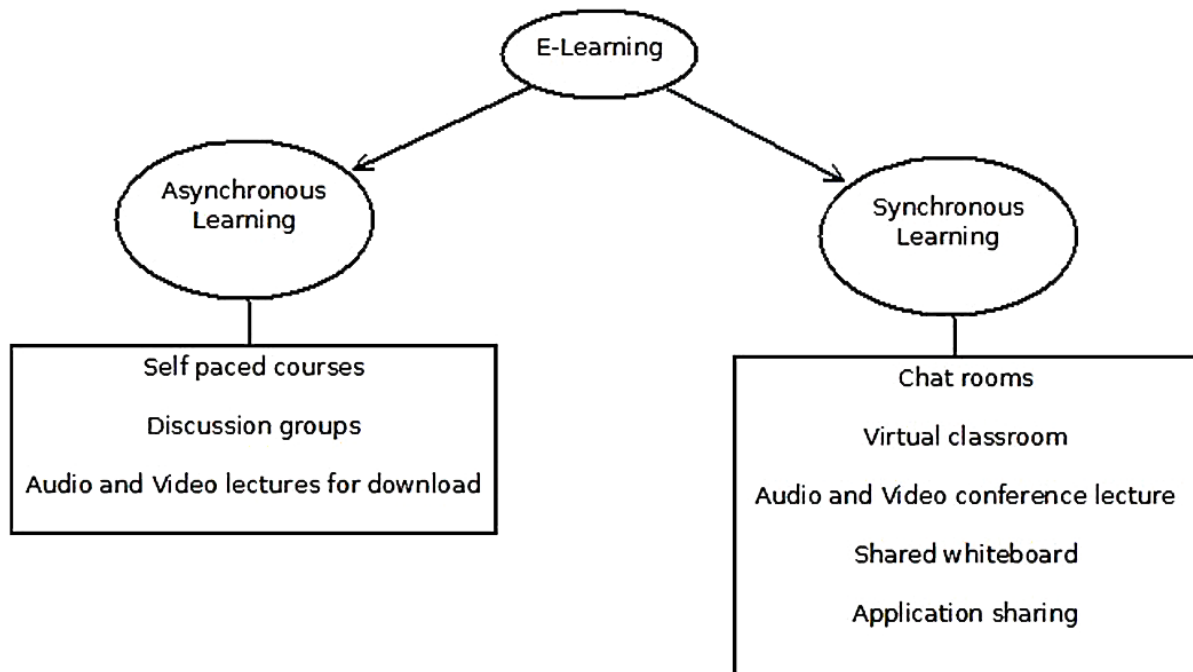
E-Learning may be categorized into two different classes, *asynchronous* or *synchronous* learning (Graziadei, et al., 1997), as seen in Figure 1. The classical classroom learning is an example of synchronous learning. The student has to stay in the classroom when the lecture is given, synchronized with the tutor and the class. If the students are not in the classroom at the same time as the lecture is given, they will miss the lecture.

Synchronous E-Learning may take place, for instance, in chat rooms, virtual classrooms, shared white board, etc. By using a shared whiteboard a tutor may draw and explain the topic to the students who are distributed across the Internet. Control of the whiteboard may also be given to a student, when the tutor wants to check if the student has understood a concept or wants to demonstrate how to solve a certain problem. The students and the tutor maybe participating in the learning process from anywhere in the world. However, they all have to participate at the same time.

1.2. “Learn from Anywhere at Anytime”

With this heading in mind, we understand that the phrase does not include synchronous learning. However, it includes asynchronous learning. In this case we mean that the student does not have to be

Figure 1. E-learning categories



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