
Chapter III

A Model-Driven Approach for Synchronous Dynamic Collaborative E-Learning

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ABSTRACT

This chapter describes a recent experience in the development of a model-driven approach. We present architecture foundations, model features, implementation characteristics and assessment scenarios.

A graph-based collaboration model has been proposed to represent the structure of synchronous groups, with their dynamic evolving. The model is used to define an advanced and distributed e-learning scenario involving three types of users: teachers, students and coordinators. Work of the synchronous group is supported by the PLATINE software platform composed of a multipoint videoconference, an application-sharing tool, a shared whiteboard and a session manager, developed in JAVA. The high-level scenario has been instantiated and tested in relation with two experiments: the first one related to a Cyberlicence training, the second to professional training.

INTRODUCTION

Rapid changes of the technological systems with the faster progression of the scientific domains require more frequent training periods during the professional career. These training periods are compulsory to bring up-to-date the knowledge required for working, interleaved with more operational work phases. In our opinion, adapted digital interactive and virtual campuses are a good solution to anticipate such particular training needs (Multimedia Technologies Portal for French Education, 2002).

E-learning systems, with integration of information and communication technologies, support training accesses in space (near or distant rooms from the trainer intervention site) but also in time (during the time periods chosen by the student and compatible with his other activities). Such systems must be able to organize consortium-based campus to strengthen information quality and quantity of the presented knowledge, as well as the services proposed to the students. The focus is made on training individualization and direct communication with personal relationships between trainer and trainees through adequate tools as discussion forums, chats, audio or videoconferences, usable according to the available resources. This augments student autonomy and increases their responsibility because each one manages himself his progress with flexible evaluation choice, either autonomously (self-evaluation) or with help (trainer evaluation). Finally, e-learning systems must facilitate access to complex knowledge such as business process experiments through web-based simulations, available locally or remotely with university distant servers.

During requirements analysis, the end-users, represented by different representatives of distance learning from French Centre National de la Recherche Scientifique and University institutes, stress the importance of a particular coordination function that manages data sharing and tools distribution between the involved participants during synchronous collaborative e-learning sessions. Managing these dependencies can be efficiently and correctly automated by using a formal model we introduce in this chapter, namely, the collaboration graphs. The defined model allows evolution of collaboration structures as required by the Distance Learning collaboration scenarios.

Most online environments that attempt to use collaboration as a learning strategy incorporate a set of communication technologies that are not structured according to theories and results published in social and cognitive sciences research fields concerning collaborative learning (South et al., 2000). Furthermore, the applications included in these systems (such as email, discussions forum, teleconferencing, etc.) don't generally take into account pedagogical aspects of communication between students and between students and learners. The paradigms that scaffold these systems are relied to classical applications paradigms. Miao et al. (1999) said "... Specifically, the weakness of these approaches is their primary reliance on a document-based paradigm, (...) conferencing-based paradigm (...), or room-based paradigm (...)." We postulate that these environments must, in addition, support cognitive and pedagogical rule-based collaboration. Indeed, the cognitive and social approaches will be helpful to capture complex collaboration scenarios, realizing the link and translation between user needs and processable models.

This chapter introduces first a model-driven approach for a synchronous collaborative e-learning environment. The model proposes a multi-tier architecture that is used to manage both communication channels and the collaboration space. These two

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