Chapter X
E–Learning Systems Re–Engineering:
Functional Specifications and Component–Based Architecture

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ABSTRACT

In this chapter, we propose functional specifications and a component-based architecture for designing e-learning platforms. An important feature is that the proposed specifications and architecture are based on the experience gained in an e-learning company and result from a re-engineering process. To guide the re-engineering process, we used two reference models, which are the e-learning global process and the e-learning global cycle. The functional specifications are described according to the e-learning global cycle phases and they are used to propose a software component-based architecture. The proposed kernel of components was completed with services to allow interoperability and standard compliance between several e-learning platforms. We hope that this case study exemplifies e-learning platform suppliers' needs and available pragmatic solutions. We conclude on foreseeable evolutions of e-learning actors' needs and practices and on new platform features for fulfilling such needs.

INTRODUCTION

The deployment of online training services generally relies on a software platform offering a variety of services. These platforms should be designed for fast, multiple evolutions because of new needs emergence for the actors and because of the advent of more powerful technological solutions.

Software engineering provides models, methods and tools for designing and implementing flexible software applications where requirements changes are systematically converted into code generation. The process works well for new applications. However, even if some free and open-source e-learning platforms are widely used, most systems are commercially developed. The platforms suppliers can make their offer evolve only from the existing one. In this context, general frameworks are missing for enabling designers to conceive new solutions from existing ones and to propose new services with an approach oriented towards interoperable and evolving components.

The proposals of this chapter are based on the experience gained when working within an e-learning company; they result from a re-engineering process and they aim at providing solutions that do not imply a design from scratch. We examined real users' needs as they were encountered in a company selling customized platforms and training solutions. Then, a re-engineering process conducted on the e-learning software provided by the company to its customers resulted in functional specification production according to a global formation view. Then, according to the identified functions, we organize existing components into a kernel of components, which implement the functions. Finally, based on the component kernel, we show how we implemented new services required by customers to allow interoperability between several platforms.

The chapter is structured as follows: In the next section, we briefly review some models which have been proposed in the e-learning domain and we present two models on which we have based our re-engineering work, which are the e-learning global process and the e-learning global cycle. In section three, we describe the functional specifications according to the e-learning global cycle phases. In section four, we detail a component-based kernel architecture elaborated from the functionalities specified in section three. Section five is devoted to describing the implementation of two services,

thus showing how it is possible to exploit the functional components defined in our kernel. We conclude by comparing these re-engineering achievements with other on-going approaches such as pattern languages, model-driven design, Web-services-based architectures and new needs emerging from new practices.

REFERENCE MODELS FOR E-LEARNING PLATFORMS DESIGN

As far as e-learning platforms architectures are concerned, we are interested in models that could act as a basis for design. Such models may belong either to software development models or to e-learning design models. In this paragraph we focus only on e-learning reference models. In this category, the processes that e-learning platforms should support are getting more and more complex, so this complex reality can only be represented through several viewpoints. Therefore, most of the existing models represent a partial view of the activity or are focused on a given category of actors. However, our goal is to rely on a model, which takes into account the whole life cycle of the production process from a small and medium enterprise (SME) perspective.

We first analyze as examples some proposed models, then we describe the two models on which we have based our re-engineering process.

Examples of Existing Models

Firstly, we briefly present one of the most complete sets of models that have been produced so far, the MISA Instructional Engineering Method for Learning Design by Paquette and his colleagues at LICEF (Paquette, 2004). Then, as increasing interoperability is crucial in the field, through agreement on standards, we describe the learning technology system architecture (LTSA) from (IEEE-LTSC, 2007) that has been discussed since the end of the 90s with a perspective of moving it

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