Chapter 5
Recent Contributions to a Generic Architecture Design that Supports Learning Objects Interoperability

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ABSTRACT
Adaptation and personalization services in e-learning environments are considered the turning point of recent research efforts, as the "one-size-fits-all" approach has some important drawbacks, from the educational point of view. Adaptive Educational Hypermedia Systems in World Wide Web became a very active research field and the need of standardization arose, as the continually augmenting research efforts lacked interoperability capabilities. This article concentrates and classifies recent research work and notices important points that can lead to an open, modular and generic architecture of a Learning Management System based on widely accepted standards.

INTRODUCTION
As the Internet and World Wide Web are rapidly developed, the technologies that support the educational processes come closer to the traditional educational systems. More and more teachers provide their teaching material to their students through simple or more sophisticated electronic means and experts in various fields continually provide knowledge to the public, usually in the form of web pages. A recent research by Liaw, Huang, & Chen (2007) demonstrated that instructors have very positive perceptions toward using e-learning as a teaching assisted tool. Regarding to learners’
attitudes, self-paced, teacher-led, and multimedia instruction are major factors one expects to affect learners’ attitudes toward e-learning. According to Brusilovsky and Miller (2001), Adaptive and Intelligent Web-Based Educational Systems provide an alternative to the traditional ‘just-put-it-on-the-Web’ approach in the development of Web-based educational courseware. In their work Brusilovsky and Pyelo, (2003) mention that Adaptive and Intelligent Web-Based Educational Systems attempt to be more adaptive by building a model of the goals, preferences and knowledge of each individual student and using this model throughout the interaction with the system in order to be more intelligent by incorporating and performing some activities traditionally executed by a human teacher – such as coaching students or diagnosing misconceptions.

According to Brusilovsky and Pyelo, (2003) existing Adaptive and Intelligent Web-Based Educational Systems are very diverse. They offer various kinds of support for both students and teachers involved in the process of Web-enhanced education. In their introductory article they address several technologies appeared (until 2003) in Adaptive and Intelligent Web-Based Educational Systems and provide a catalog of sample systems that provide these technologies.

Also Brown et al (2005) mention that the ultimate objective of Adaptive Educational Hypermedia is to create the ‘perfect’ online lesson for every learner – utilizing a common set of learning resources. The ‘rules’ that are used to describe the creation of such a system are not yet standardized, and the criteria that need to be used pedagogically effective rule-sets (i.e. adaptation parameters) are, as yet, poorly mentioned. Many experimental Adaptive Educational Hypermedia Systems have been created – each to their own unique specifications. As yet, however, no combined effort has been made to extract the common design paradigms from these systems.

The scope of this article is to provide a starting point for the development of a generic, open and modular architecture for the retrieval of learning objects from disperse learning objects’ repositories (LORs) to an e-learning environment. Rehak and Mason (2003) consider learning object as a digitized entity which can be used, reused or referenced during technology supported learning. Practically, LOs acquisition is achieved by querying LORs distributed over the internet. This LO “journey” must comply with widely accepted standards. A brief description of research work is also presented. This description classified according to the adaptivity strategy published by several authors aiming to underline the need of unification. Properly modified techniques and methods from the referenced work are suggested for application to the architecture’s foundation to provide an open, modular and distributed solution, closely coupled to given standardizations.

The rest of the article is structured as follows. In chapter 2 there is a brief description of the different areas of e-learning systems’ adaptive behavior, namely adaptive navigation, presentation and content retrieval. In chapter 3 the most commonly cited adaptivity parameters are classified and several research efforts are mentioned in order to justify the connection of each parameter with the e-learning procedure. An overview of the most commonly accepted standards for e-learning is given in chapter 4. In chapter 5 we provide a review table of the research efforts that connect adaptivity behaviors with some adaptivity parameters and standards. Following, a first attempt for the design of a generic, open and modular architecture for LOs retrieval from LORs is described and the relations of the proposed architecture with other ones found in literature are given. Chapter 7 consists of the properly modified methods and techniques found in literature which could be applied in the modules and become the foundations of the proposed architecture. This article closes with some conclusions and an overview of our planned future work.