

Chapter 28

Multi-Tier Knowledge-Based System Accessing Learning Object Repository Using Fuzzy XML

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ABSTRACT

Quality of an e-Learning solution depends on its content, services offered by it and technology used. To increase reusability of common learning material which is accessed by multiple applications, there is a need for user-friendly and cost-effective knowledge-based approach. This chapter discusses basic concepts of learning object repositories; presents work done so far and establishes the need of knowledge-based access of the learning repositories to improve cost-benefit ratio of an e-Learning solution. For this purpose, a multi-tier knowledge-based system accessing a fuzzy XML learning object repository is described with architectural framework and detailed methodology. The working of course tier, reusable LO tier, presentation tier, fuzzy interface tier and application tier is discussed in detail with an example to identify learners' level and determine presentation sequence accordingly. The chapter concludes by discussing the advantages and questions related to further enhancement.

INTRODUCTION

Educational technology is now experiencing drastic changes with the advancements of Information and Communication Technology (ICT). Lot of automated learning platforms like instruction material are available in the form of Compact Disks (CD), website or stand alone personal computer system to help large group of learners and instructors. Plat-

form like the Internet provides high accessibility of learning material in reusable fashion. Besides such reusability and high degree of availability of learning material electronically, learners and practitioners of the educational field demand the extended functionalities which helps them in assisting their routine operations.

For any electronically learning support system, it is obvious that there is a need for good content of the domain/area, better services and technological support (Sajja, 2008). All these three aspects, which

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strengthens a learning solution are interrelated and required to be strengthened. Technological support and services achieved for an e-Learning solution has no value without proper content. Rich content embedded with good services increases degree of satisfaction of users and help in improving overall quality of the system.

The typical services which learners need can be summarized as - user friendly access of the material, customized presentation of learning material, practice tutorials and drills, and record keeping. Practitioners need to publish their material, update and access the solved assignments submitted by the learners besides some administrative and monitoring tasks. These services are common to every domain and can be better supported with the technology and tools provided by ICT like Internet and Personal Computers. e-Learning content available on the Internet platform provides access advantages like anytime, anywhere and to anybody. However, there is a lot of redundant instructional material stored in different formats (ontologies); as the services and content are tightly embedded with each other. Even if the content is different, some typical services remain same. This leads to the need of a cost-effective solution, which provides a set of typical services accessing a learning object repository in knowledge-based way. The centrally available learning object repository contains small reusable objects of learning material called learning objects can be used by various applications through a multi tier knowledge-based system. This increases the reusability of the services and content and increase the cost-effectiveness of the e-Learning solution.

Initial session of this chapter describes necessary fundamentals of e-Learning, Learning Objects (LO) and Learning Object Repositories (LOR). Discussion of these topics includes a brief introduction to e-Learning, LO, its characteristics and typical components with learning object schema. This introduction also covers examples and standards of Learning Object Schema. Further the chapter defines LOR and elaborates its need. It

highlights structure of LOR along with interoperability issues. A few commercially used LORs as examples are given here. Another important aspect regarding development life cycle of an LOR is also discussed with necessary diagrams. This initial part of the chapter explains the usefulness of the LOR based approach for e-Learning by introducing forms, technology and existing scenario of the field. The need of accessing LOR in a knowledge-based fashion using a multi-tier framework is justified by presenting work done so far in the field.

Though reusable LORs increase flexibility of usage and cost-effectiveness of an e-Learning solution, still there is a need of technique and services which helps in storage, retrieval and usage of the learning content in effective and user friendly way. Moreover, there are some more demands from learners' perspectives to meet the high quality standards they expect from an ideal e-Learning solution. One of them is the style of presentation and another is the way the system interacts with learners. Customized representation in the media of learner's choice and friendly interaction together plays an important role in increasing scope and usability of the e-Learning solution. This can be achieved if the learning objects are accompanied with some meaningful '*knowledge*' component along with them showing how and when they would be utilized. That is the learning objects contain the instructional material along with a kind of metadata giving additional knowledge about their utility.

Additionally, many different tasks are to be incorporated in an e-Learning solution, which makes the system development easier and friendly. For this purpose, it is needed to combine such tasks into a multi-tier framework, which contains different tiers according to development phases and usage. Every tier can be developed independently. Dividing the development effort into various subtasks like this makes the development less tedious and easier to control. A multi-tier architecture supporting this basic idea with added intelligence is

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