



2008

Optimizing Service Oriented Architecture to Support e-Learning with Adaptive and Intelligent Features Ph.D. Proposal

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2008

Abstract

Service Oriented Architecture (SOA) is a design pattern that presents systems as collection of reusable services that can be exposed and consumed on the Internet with standard interfaces. SOA utilization advantages are many and can be achieved on technical, managerial, and implementation aspects. e-Learning can make use of SOA in integrating University Management Information Systems (UMISs) and Learning Management Systems (LMSs).

Both UMISs and LMSs can make use of adaptive and intelligent features presented during long time of research. Intelligent features are many, and they can be utilized in new systems. Presenting intelligent features as services with standard interfaces will allow different e-learning systems to integrate them, so they will be reusable and newly built systems do not have to redo the intelligence again, besides wrapping intelligent features with standard interfaces will present a separation of interest that will help intelligent features workers to focus more. The capability to wrap intelligent software components in a standard interface; that is Web services and exposing them so they can be consumed by different e-learning system is one of the research goals of this dissertation. Other goals include the attempt to present adaptive and intelligent features that can serve e-Learning.

1. Introduction

1.1 e-Learning

e-Learning is defined as the learning process created by interaction with digitally delivered content, service, and support [1-3]. e-Learning involves intensive usage of Information and Communication Technology (ICT) to serve, facilitate, and revolutionize learning process [4-8].

e-learning has been defined as the use of new multimedia technologies and the internet to improve the quality of learning. E-learning is based on a reliable technology but is pedagogy oriented [9]. It was identified that an one-to-one teaching or small group tutoring is more efficient than the teaching in a class with the size of 25 to 30 students. Bloom, 1984 showed that the academic performance difference between the two groups corresponded to 2 standard deviation (2 sigma: 2 SD) value through the real field stud. The meaning of 2SD is that a goup whose average class academic performance was 50% can improve to an average 98% range in academic performance, if they are taught in one-to-one or small group tutoring [10].

1.2 Adaptive Features

Adaptive behavior is a type of behavior that is used to adapt to another type of behavior or situation. Adaptive Learning refer to technologies that can dynamically recognize the role and profile of each learner, and respond accordingly. For example, when a learner logs on, a learner-centric system can immediately identify that person and "understand" whether they are an employee, a partner or a customer, and deliver content accordingly [11]. Another adaptivity feature is the adaptive questions [12]. IMS QTI defines adaptive questions (items) as:

"An adaptive item is an item that adapts its appearance, its scoring (Response Processing) or both in response to each of the candidate's attempts. For example, an adaptive item may start by prompting the candidate with a box for free-text entry but, on receiving an unsatisfactory answer, present a simple choice interaction instead and award fewer marks for subsequently identifying the correct response. Adaptivity allows authors to create items for use in formative situations which both help to guide candidates through a given task while also providing an outcome that takes into consideration their path."

In [13] an adaptive and intelligent web based educational system that uses AI techniques for personalized assessment of the learners is presented. Intelligent Tutoring Systems (ITSs) are systems used for personalized learning and were usually developed as stand-alone systems. However, the emergence of the WWW gave rise to a number of Web-based ITSs, a type of Web-Based Intelligent Educational Systems (WBIESs). Adaptive Educational Hypermedia Systems (AEHSs) are also systems that offer personalized education. They are specifically developed for hypertext environments such as the WWW. Enhancing AEHSs with aspects and techniques from ITSs creates a type of adaptive and Intelligent Educational Systems (AIESs).

Adaptive features in learning are many and they are evolving. Attempting to present adaptive features in e-Learning as standalone services with standard interface to be reused is one of this dissertation research goals.

1.3 Intelligent Features

ITSs form an advanced generation of Computer-Aided Instruction (CAI) systems with key feature is their ability to provide a user-adapted presentation of the teaching material. ITSs have been developed and evaluated for many years in the field of artificial intelligence in education. The emergence of the World Wide Web increased the usefulness of such systems. Web-based learning/training systems should be more intelligent through the adoption of artificial intelligence techniques [8].

The objective of intelligent e-learning systems, as it is typically conceived, is to provide highly structured lessons that are to a large extent under automated control. Within this framework, the intelligence of the system often appears in the form of adaptive sequencing or personalization of the course material, adaptive guidance for navigation, or interactive problem solving support. The most interesting opportunities to develop intelligent functionality are related to facilitating collaboration rather than adapting the learning material [14].

Intelligent e-learning systems include utilizing artificial intelligence techniques such as decision making, machine learning, planning, scheduling, and cognitive science in e-learning platforms [15].

2. Aim of Study

Exposing intelligent features as services will allow different e-learning systems to integrate them, so they will be reusable. The capability to wrap intelligent software components in a standard interface; that is Web services and exposing them so they can be consumed by different e-learning systems is one of the research goals of this dissertation.

Adaptive and intelligent e-learning systems are interdisciplinary in nature, related closely to such fields as artificial intelligence (decision making, machine learning, planning, and scheduling), cognitive science, software engineering, web based information systems, and education. On the other hand, with the increasing popularity of e-learning systems, the proliferation of interoperability e-learning specifications raises the need to extend existing e-learning platforms so that they can be used efficiently in a distributed environment where material producers, service providers, and users (either learners or teachers) exchange information using standard models.

Adaptive and Intelligent features in e-Learning when combined with SOA presents an important trend and an updated topic. Google Trends analyzes a portion of Google web searches to compute how many searches have been done for the terms of interest, relative to the total number of searches done on Google over time.

Figure 1 depicts the interest in Intelligent, adaptive, SOA, and e-Learning within the last 12 months. Graph shows the interest in e-Learning, the interest in e-Learning and intelligent features, and the interest in e-Learning, Intelligent features, and SOA, and the interest in e-Learning, intelligent features, adaptive features, and SOA as obtained from Google Trends. Graph shows that Intelligent and Adaptive features in e-Learning combined with SOA are highly points of interest in the recent 12 months.

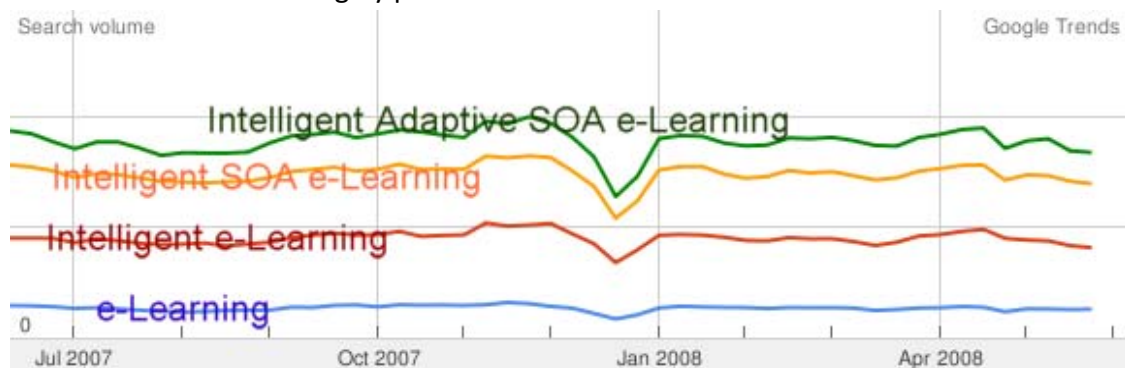


Figure 1: Combining Intelligent, adaptive, e-Learning, and SOA together is the highest interest
(Obtained from: Google Trends, 8/6/2008)

<http://trends.google.com>

3. Research Activities

Proposed dissertation research activities and work plan include the following activities

- Surveying e-Learning; including e-Learning requirements, software and information systems specifications
- Surveying currently available intelligent and adaptive features presented to e-Learning
- Working on making use, modifying, and enhancing current adaptive and intelligent features of e-Learning systems
- Surveying SOA and its related technologies highlighting implementation, technical, and organizational advantages gained by organizations from adopting SOA
- Working on presenting modified and enhanced features in a standard interface services to make them reusable in many aspects
- Evaluating proposed adaptive and intelligent features regarding different evaluation aspects to determine the efficiency and effectiveness of proposed features
- Working on providing real world scenarios, solutions, and reusable components to real world institutions and organizations

4. Proposed Chapters

Dissertation will consist of five chapters not including abstract and a list of references / bibliography as follows

Chapter One: Introduction

This chapter is an introduction to the dissertation illustrating the conducted survey of e-Learning, e-Learning information systems, e-Learning challenges, and intelligent and adaptive features currently available to e-Learning. This chapter will also highlight SOA, SOA technologies, concepts like Service Oriented Analysis and Design (SOAD), and SOA best practices and how to apply SOA in e-Learning.

Chapter Two: Proposed Adaptive and Intelligent Features

This chapter will start presenting proposed modified and/or new adaptive and intelligent features will be added to e-Learning systems. Adaptive and intelligent features will be based on chapter one survey.

Chapter Three: Utilizing SOA to present Adaptive and Intelligent Features

This chapter will present utilizing SOA to present intelligent and adaptive features presented in chapter three including technical and implementation details.

Chapter Four: Evaluation of Proposed Work

This chapter will present an evaluation of proposed/implemented features. Evaluation of information systems is itself a research topic and evaluating proposed adaptive and intelligent features shall consider many features, like pedagogical, managerial, and architectural aspects of the information systems.

Chapter Five: Conclusion

This chapter concludes research activities and results presented through the research and presenting future work can be conducted by collaborative researchers.

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