

Chapter 2.40

Conceptual Framework and Architecture for Agent–Oriented Knowledge Management Supported E–Learning Systems

H. K. Yau

The Hong Kong Polytechnic University, China

E. W. T. Ngai

The Hong Kong Polytechnic University, China

T. C. E. Cheng

The Hong Kong Polytechnic University, China

ABSTRACT

In this era of information, traditional practices, technologies, skills, and knowledge are becoming obsolete at a much faster pace than ever before. This makes lifelong learning a necessity for everyone. An e-learning system is a promising solution to the demand for a flexible means of delivering knowledge to educate a large number of people over a vast area. Knowledge management systems (KMSs) are a fast growing area of research on the creation and sharing of knowledge. Agent-oriented software engineering is opening up a new horizon for the analysis and development

of systems in an open, complex, and distributed environment. This article proposes a conceptual framework and architecture for the development of an agent-oriented e-learning system supported by knowledge management to provide a flexible, self-paced, and collaborative learning environment with the least constraints. The framework is based on the technologies of e-learning systems, multi-agent systems (MASs), and KMSs. The proposed system architecture consists of three levels: user level, domain level, and Web level. The system will provide all of the basic teaching- and learning-related support facilities, plus some enhanced features that are provided by the agents

within the system. The system will also provide the facilities for capturing and sharing the knowledge created during utilization of the system. Finally, conclusions and the potential theoretical and practical implications of the proposed system are presented.

INTRODUCTION

There is no universal definition of e-learning. Broadly speaking, e-learning can be defined as learning activities performed over electronic device(s). Terms such as technology-based learning, computer-based learning, computer-based education, and Web-based training can be classified under the banner of e-learning. E-learning systems embrace a wide collection of applications and processes such as Web-based, computer-based, or digital collaboration. E-learning and distance learning are commonly considered interchangeable (Usnews, 2003). In this study, we define e-learning as credit-granting education or training courses delivered to remote (off-campus) location(s) via audio, video, or computer technologies such as the Internet, including both synchronous and asynchronous instruction (Ozdemir et al., 2000). An e-learning system is well suited for mass education and training. The cost and difficulty of accessing information on the Web are continuously decreasing, given the support of an increasing plethora of portable or hand-held computing devices such as sub-notebooks, palm devices, pocket computers, and WAP phones. E-learning has the potential to become a cost-effective tool for mass education, one of the key applications in e-commerce and the largest information industry in the near future (Cisco, 2004; White, 2003).

Multi-agent systems (MASs) have been given a more general meaning. The term is now used to refer to all types of systems composed of multiple autonomous components that behave like agents (Flores-Mendez, 2001). Wooldridge

(1997) stated that the technologies of agents and MASs have brought a new way of visualizing and implementing open, complex, and distributed systems. Different kinds of agents are applied in a wide variety of disciplines (Giraffa et al., 1998; Jennings et al., 1998; Nwana, 1996). With the gradual maturity of agent-developing techniques, people are beginning to apply them in fields other than e-commerce (Guttman et al., 1988; Liang et al., 2000), manufacturing (Lee et al., 1999; Zhang et al., 1995), or multiple-scheduling under a distributed environment (Glezer et al., 1999; Sen, 1997).

Applying agents to increase or enhance the system's features is not new. Researchers or developers have always named their agents in line with the nature of the job or the applied areas of the agents, or even according to the name of the research project. Some typical examples within the field of education are pedagogical agent, tutor, mentor, and assistance (Giraffa et al., 1998). Examples in other fields are information agents, webot, softbot (BotSpot, 2003), personal agents, digital butlers, and virtual secretaries (Vise, 2004). The redesign and modification of the e-learning system utilizing the techniques of agents likely will introduce extra helpful features and can improve the efficiency of the e-learning system. Ritter (1997) highlighted the use of different tools to communicate with an agent tutor in a target learning environment. Lester et al. (1997) reported a simple constraint agent that could enhance learning. Ganeshan et al. (2000) reported the use of pedagogical agents in tutoring on the subject of medical diagnosis.

Knowledge is a justified belief that can increase an entity's capacity for effective action (Huber, 1991; Nokaka, 1994). Commercial KMSs are gaining the attention of users due to their ease of use, functional diversity, and wide availability. They provide functions that support the repository of knowledge — something current e-learning systems lack (Serban et al., 2002). We believe that our proposed framework essentially integrates

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