Multi-Agent Paradigm for Semantic Web Service in E-learning System

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ABSTRACT

E-learning has become an alternative solution for the traditional learning. There is a need to manage the learning materials in e-learning environments in order to deliver it to learners according to their requirements. Semantic Web Services (SWS) aim at developing a machine understandable and common conceptual framework which share and accumulate concepts from different web service resources to meet a particular objective in question. Different SWS composition methods have been developed for different purposes and objectives. In this paper we have developed an Agent-based SWS composition method using two sets of agents i.e. Service Requester Agent (SRA) and Service Provider Agent (SPA) to represent the user’s side and the solution side respectively for the problem of a course composition in e-learning systems. The SRA corresponds to requirements of different ebook/chapter and the SPA corresponds to books containing the relevant and required chapters in courseware. The course composition is primarily based on the important and relevant prime keywords in a courseware. Learning materials and other actors are described semantically in form of ontologies. Also, we present the use of reasoning rule to infer different relations between Agents, ebook/chapter and other actors in the proposed model.

Keywords: E-Learning, Multi Agent System, Ontology, Semantic Web Rule Language (SWRL), Semantic Web Services (SWS), Service Provider Agent (SPA), Service Requester Agent (SRA)

1. INTRODUCTION

E-learning has become an alternative solution for the traditional learning. It has shifted the focus of learning process from the teacher-centered to learner-centered. From learner perspective this shift will give the learners more control to choose their learning materials and construct personal learning process (Saye, 1997). In this context the learners in e-learning system can select/access appropriate learning materials based on his/her demand. But most of the E-learning systems have limited possibilities because they display their contents statically (Vargas-Vera & Lytras, 2008). On the other hand, due to the big size of the web and lack of semantic of HTML pages (Paolucci et al., 2008), the search for learning materials has become a time/effort-consuming process. One of the aims of e-learning is to make its

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contents broadly accessible, searchable and reusable (Parrish, 2004). This content needs to store along with semantic description to move from human accessible to machine accessible (Emina, 2009). Moreover, the content needs to be searched and queried them semantically to improve the search results and facilitate the growth of web technologies. Managing a large quantity of documents involves administration efforts and certain strategies to arrange and order the contents (Mitschick, Pietschmann, & Meißner, 2010). Semantic web offers a promising approach to e-learning environment which ensures machine-process ability and interchangeability. Semantic web aims at introducing metadata to describe meaning of web resources in order to create environments that are capable of advanced automatic processing of the web content by both human and software agents (Berners-Lee, Hendler, & Lassila, 2001).

Ontology, defined as a representation of a shared conceptualization of particular domain, is the backbone of semantic web. Ontology typically consists of description of concepts relevant for particular domain, their relations and axioms about these concepts and relationships. Ontology may include relations of taxonomy among classes; data type properties and descriptions of class element attributes; object properties and descriptions of relations among class elements; class instances; and property instances. The data type properties and object properties are, collectively, the properties of a class. Ontology can be expressed in Description Logic such as Web Ontology Language-Description Logic OWL-DL (D. L. McGuinness & Van Harmelen, 2004).

On the other hand, Web services can accomplish a loose coupling of process across organizational boundaries. It supports interoperability among client agents and services with a minimum interference of human agent in order to fulfill a particular task. Web services offer the potential to allow the organization to create content-based logic driven information and knowledge-value chain in digital economy (Singh, Iyer, & Salam, 2005). The system that consists of a group of agents that can potentially interact with each other is called Multi-agent system MAS (Gladun et al., 2009). The MAS model has been used for further enhancing in different areas such as e-commerce e-government. Bireshwar and Mishra (Mazumdar & Mishra, 2010) discussed the selection of seller agent based on competitive negotiation factor in B2C e-commerce. Arora and Devi (2011) have presented the model of funds allocation in education institute and monitoring the utilities of funds using MAS. Zouhair et al. (2013) have used the MAS and dynamic case based reasoning to improve the learning process by retrieve the past experience that are similar to learners’ trace.

Many researchers are actively engaged in the direction of addressing the problem of search of and access to the learning materials recourses on the web. Emina (2009) presents certain facts that need to be considered in the process of generating consistent metadata for learning materials. Ontology has been used to construct the learning materials in e-learning systems to generate the learning path (Chen, Peng, & Shiue, 2008; Kontopoulos, Vrakas, Kokkoras, Bassiliades, & Vlahavas, 2008). Gladum et al. (2009) presents a Semantic web-oriented MAS prototype for e-learning system to control the students’ acquired knowledge. LT4EL project provides a semantic search for the learning content in the domain ontology (Lemnitzer, Mossel, Simov, Osenova, & Monachesi, 2008). Pandey et al. (2013) have used different intelligent agents in e-learning system to gather the requirements from the students and fulfill them. In this work we will present an e-learning system that takes the advantage of Semantic Web Services, Semantic rule language and multi agent system to allow learners to choose appropriate learning materials from different resources.

The rest of the paper is organized as follows. In section 2 we give a description for the problem. The Multi agent paradigm is presented in section 3. The computational models for our proposed method are presented in section 4. Section 5 describes the details of the proposed Ontology framework and reasoning. Learners’
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