A Hybrid Model for Service Selection in Semantic Web Service Composition

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ABSTRACT

One of the most important aspects of semantic web service composition process is the selection of most appropriate semantic web service. The Quality of Service (QoS) and cognitive parameters can be a good basis for this selection process. In this paper, we have presented a hybrid selection model for the selection of semantic web services based on their QoS and cognitive parameters. The presented model provides a new approach of measuring the QoS parameters in an accurate way and provides a completely novel and formalized measurement of different cognitive parameters.

Keywords: cognitive parameters; composition; quality of service; Semantic Web

INTRODUCTION

Selecting the most appropriate semantic web service is one of the important components of the semantic web service composition process. Most aspects of the Semantic Web Service (SWS) composition process such as automatic discovery, selection, and composition are tightly related to the quality of semantic web services (QoS). QoS can be defined as a part of service description and is an especially important factor for service composition (Zeng et al., 2004). In addition to the QoS, the cognitive parameters of service providers can also prove to be the deciding factors in semantic web service selection and composition. They can be used to decide on a particular SWS to invoke by the user among the numerous services discovered. Various cognitive parameters such as capability, desire, intention, commitment, trust, reputation etc. and a number of QoS parameters such as cost, response time, reliability, accuracy, security feature, execution time, exception handling
feature, penalty on breaking service contract etc., have to be considered in service selection. To our knowledge, the issue of service selection based on QoS and cognitive parameters has not been thoroughly addressed in the literature till now. This is primarily due to the complexity of QoS metrics and a lack of formal measurement of cognitive parameters. The work by Ermolayev et al. (2004) has presented a method for selection of service provider agents based on some cognitive parameters. But the agent selection model only considers capability and credibility assessment as the base for agent selection and then performs negotiation with each of the capable agent. But assessing these parameters alone may not result in the selection of the best performing agent.

The proposed Hybrid Selection Model (HSM) for service selection can be easily integrated with Multi-Agent based SWS composition process. HSM performs rating of the agents based on their cognitive as well as QoS parameters. Some of the novel features in the model are: providing the formalization and new normalization procedure for QoS parameters, providing the formalization of cognitive parameters, providing a method for measuring the reputation of agent, and providing a dynamic feedback system affecting the reputation of the selected service provider based on the quality of its present service. In support of this work, an evaluation and experimentation is also presented.

The remainder of the paper is organized as follows. Following the introduction section, section 2 provides a description of the hybrid selection model and the details of QoS and cognitive parameters based rating is provided in section 3 and 4 respectively. Section 5 discusses the evaluation of the presented model and some comparison with existing work. Section 6 provides the conclusion and future work.

**HYBRID SELECTION MODEL**

The success of semantic web based system in satisfying a user’s request depends highly upon the selection of the most appropriate SWSs. Use of agent based technology in semantic web based systems is one of the emerging and important areas of research. Even in the manifesto by Berners-Lee et al. (2001), the use of software agents in semantic web based systems has been discussed. This approach considers the SWS composition system as a multi-agent system (MAS), in which each component service is considered as an agent capability. Though multi-agent technology has been explored for use in web based systems, little work (Ermolayev et al. 2004; Kungas & Matskin, 2006) has been reported in the literature which directly addresses the agent-based approach inform the semantic web perspective. In MAS based SWS composition systems, the selection of most appropriate SWS seems to be more reliable, because the agents can be characterized by various social, cognitive, and QoS parameters. However, the issue of service selection and composition has been highly discussed in the literature, but the selection of intelligent software agent based on its cognitive and QoS parameters for a MAS based SWS composition system has not been thoroughly addressed in the literature till now. Ermolayev et al. (2004) have briefly discussed agent selection in SWS composition based on cognitive parameters alone (credibility and capability assessment), where as Wang et al. (2006) have presented a model for the selection of SWSs based on QoS alone. To our knowledge, no work has been reported in the literature, which provides a model for selection of agents acting as SWS providers based on both cognitive and QoS parameters, as well as a formalized method of measuring the various parameters. The model presented in this paper deals with these issues.

HSM calculates an index called Index of Selection (IoS) for the agent based on its cognitive and QoS parameters. The IoS value is then used as the basis for the selection of the best provider agent. HSM can be used by the service requester agent (SRA) for the selection of best performing service provider agent (SPA). A requester agent is any agent that needs services from another agent, called the provider agent. As IoS represents the overall rating of agent based on its cognitive parameters based
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