Chapter 7.11
Ontology–Supported Web Service Composition:
An Approach to Service–Oriented Knowledge Management in Corporate Financial Services

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ABSTRACT

Web service composition can enhance the efficiency and agility of knowledge management by composing individual Web services together for complex business requirements. There are two main research streams in knowledge representation for Web service composition: syntactic-based and semantic-based approaches. Despite the promises brought by each approach, the two streams are largely separated from each other. In this paper, we propose an integrated ontology-supported Web service composition framework, which provides a novel solution to organizational knowledge management. By synergistically leveraging both syntactic-based and semantic-based approaches, this framework provides dual modes to perform service composition. Ontologies are employed to enrich semantics at both service description and composition levels. The proposed conceptual framework has been implemented in the corporate financial services domain. It is demonstrated that the shared ontology helps fulfill automated and on-the-fly service composition in particular and knowledge management in general.

INTRODUCTION

The competition in today's business world requires significant involvement of organizations' intangible assets. Innovative approaches to knowledge management can provide competitive advantages to organizations. Although a variety of information technologies for knowledge management, such as information retrieval, databases, data mining, and knowledge representation, have considerably advanced, organizations are still facing challenges in automated and dynamic knowledge discovery, sharing, reuse, and consumption.

A Web Service is a software system designed to support interoperable machine-to-machine interaction over a network (W3C, 2003), which emphasizes such essences as: (1) componentization guarantees platform- and programming language-independency; (2) interoperability benefits communication and collaboration; (3) the architecture involves three basic roles: service provider, service broker, and service consumer; and (4) fundamental technologies include WSDL, SOAP, UDDI, and so on (Zhang, 2005). The latest Web services standards and technologies make it a reality to compose individual Web services into more complex services for e-businesses. Unfortunately, current approaches to service composition are rigid, time- and resource-consuming, ad hoc, and error-prone (Cardoso, Bussler, Sheth, & Fensel, 2002; Medjahed, Bouguettaya, & Elmagarmid, 2003; Papazoglou & Georgakopoulos, 2003).

This research contributes to the body of knowledge management research by proposing an ontology-supported and service-oriented approach to organizational knowledge management. We introduce an integrated framework for Web service composition by synergistically leveraging both syntactic-based and semantic-based approaches. It takes advantage of the Semantic Web technology to enrich semantic representation of domain knowledge and complements traditional syntactic service composition methods. We have applied the proposed conceptual framework to a corporate financial service application. The prototype shows that the framework can support semantic, dynamic, and automated Web service composition effectively.

The rest of the paper is organized as follows. First, we briefly introduce the concept of Web service composition and syntactic-based and semantic-based approaches. Then, an ontology-based integrated conceptual framework for Web service composition is presented. Next, we illustrate the proposed framework with a prototype system, followed by the discussion of implications of our research. Finally, we conclude the paper with future work.

WEB SERVICE COMPOSITION AND RELATED WORK

Web service composition (WSC), namely choreography of Web services, is to construct higher level services based on existing multiple individual services in order to fulfill more sophisticated business requirements (W3C, 2002). It is viewed as a step-stone through which to reach the Mecca of Web services, and even the vision of the Semantic Web (Berners-Lee, Hendler, & Lassila, 2001; Medjahed et al., 2003). A typical example of Web service composition is to generate a comprehensive conference travel plan, including conference registration, flight ticket booking, hotel reservation, car rental, map request, and so on, from existing services. Depending on whether a composition decision is made at design time or run time, it falls into either static or dynamic composition, respectively (Cardoso et al., 2002). From a process standpoint, service composition can be done horizontally, vertically, or both. The aforementioned example involving flight and lodging reservations belongs to vertical composition, because hotel booking cannot be carried out until the flight ticket is issued. However, car rental and map request can be performed simultaneously in a horizontal way.

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