Chapter 12
An Integration Ontology for Components Composition

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ABSTRACT

Software components composition can improve the efficiency of knowledge management by composing individual components together for complex distributed application. There are two main areas of research in knowledge representation for component composition: the syntactic based approach and the semantic-based approach. In this paper, the authors propose an integrated ontology-supported software component composition. The authors' approach provides dual modes to perform component composition. Ontologies are employed to enrich semantics at both components description and composition. The authors demonstrate that their search engine SEC++ fulfills automated component composition, in particular, and knowledge management in general.

1. INTRODUCTION

The development of distributed software based on components composition is becoming increasing important because of its potential to reduce product development cost and time-to-market. The successfulness of the composition is important and depends essentially on two key factors: (1) Knowledge management: components are

knowledge which necessitates a solution for organization, representation and sharing to approve the search and the composition process. This work contributes to the body of knowledge management research by suggesting an ontology-supported and component-oriented approach to organizational knowledge management. We introduce an integrated system for component composition by leveraging the syntactic-based and the semantic-based approaches. The system can support semantic and automated component

composition effectively. (2) QoS-based optimization of component composition: component composition creates new functionalities by aggregating different components. When two or more functional-qualified components are available, they can form different combinations. These combinations deliver the same functionality, but they differ from each other in QoS performance. Obviously, component requesters should be able to select the optimal component set without trying all possible combinations.

Current component-based approaches concentrate mainly on functional properties, and ignore component non-functional ones, which are crucial in many application domains. Few examples of quality parameters are: dependability, reliability, availability. In a component-based approach, it is relatively easy to glue components together to provide the desired system.

This paper is organized as follows: section 2, section 3 and section 4 present respectively the related work, the discovery and the integration ontology and the ontology-supported component composition. We will devote section 5 to describe the shared ontology. Section 6 presents the implementation. In conclusion, we will suggest some openings and prospects related to this study.

2. RELATED WORK

Component composition is to construct higher-level components based on existing multiple individual ones in order to fulfill more sophisticated business requirements. An example of components composition is generating a comprehensive conference travel plan, including conference registration, flight ticket booking, hotel reservation, car rental, map request, and so forth, from existing components. Depending on whether a composition decision is made at design time or at run-time, it falls into either static or dynamic composition, respectively (Cardoso, Busslerand, Shethand, & Fensel, 2002). From a process standpoint, com-

ponent composition can be done horizontally, vertically, or both. The aforementioned example 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. Component composition poses challenges from the following multiple aspects along the composition course (Cardoso et al., 2002): (1) description or representation of components; (2) components discovery; (3) integration of individual components; (4) QoS-based optimization of component composition as well as other issues.

The syntactic-based component composition approach already has been used widely in the industry (Agarwal, Chafle, Mittal, & Srivastava, 2008). Although more vocabularies are added for component description, messaging, those constructs are still concerned mainly with document structure or syntax. The component discovery, matching, and integration utilize keyword searching, which has been usually proved ineffective by information retrieval researchers.

The semantic-based component composition addresses the semantics-absent problem of the syntactic-based approach. In the component composition context, the RDF+OWL technology can help component description, advertisement, discovery, integration, interoperation, invocation, execution, and monitoring, which all converge at component composition (Cardoso et al., 2002). In the context of component composition, ontologies can be employed to distill all concerned concepts in a certain domain as a centralized repository, which shows superiority for on-the-fly component choreography by specifying semantic relationships between component terms.

There are four lines of research that are related to this study. The first one centers on architectures for components description and composition. Some researchers have started incorporating ontologies into conceptual modeling and component architecture (Kim, Sengupta, Fox, & Dalkilic, 2007; Loucopoulos & Zicari, 1992). The second

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