Ontology Management for Large-Scale Enterprise Systems

Juhnyoung Lee, IBM T.J. Watson Research Center, USA
Richard Goodwin, IBM T.J. Watson Research Center, USA
Rama Akkiraju, IBM T.J. Watson Research Center, USA

Abstract

Semantic markup languages such as RDF (Resource Description Framework) (RDF, 1999) and OWL (Web Ontology Language) (OWL, 2004) are increasingly being used to externalize metadata or ontologies about data, software and services in a declarative form. Such externalized descriptions in ontological format are used for purposes ranging from search and retrieval to information integration and to service composition (RDF Projects, 2004; OWL Tools, 2004). Ontologies could significantly reduce the costs of deploying, integrating, and maintaining enterprise systems. The barrier to more widespread use of ontologies for such applications is the lack of support in the currently available middleware stacks used in enterprise computing. This chapter presents our work on developing an
enterprise-scale ontology management system that will provide APIs and query languages, and scalability and performance that enterprise applications demand. We describe the design and implementation of the management system that programmatically supports the ontology needs of enterprise applications in a similar way to a database management system supporting the data needs of applications. In addition, we present a novel approach to representing ontologies in relational database tables to address the scalability and performance issues. The state of the art ontology management systems are either memory-based or use ad-hoc solutions for persisting data, and so provide limited scalability.

Introduction

In recent years, there has been a surge of interest in using ontological information for communicating knowledge among software systems. Particularly, the effort has been lead by the Semantic Web initiative by W3C (Semantic Web, 2001). As a result, an increasing range of software systems need to engage in a variety of ontology management tasks, including the creation, storage, search, query, reuse, maintenance, and integration of ontological information. Recently, there have been efforts to externalize such ontology management burden from individual software systems and put them together in middleware known as an ontology management system. An ontology management system provides a mechanism to deal with ontological information at an appropriate level of abstraction. By using programming interfaces and query languages the ontology management system provides, application programs can manipulate and query ontologies without the need to know their details or to reimplement the semantics of standard ontology languages. Such a setting is analogous to the way a database management system allows applications to deal with data as tables and provides a query engine that can understand and optimize SQL queries.

In this chapter, we describe the design and implementation of the SnoBase ontology management system (SnoBase, 2003), which is being developed at IBM T.J. Watson Research Center. While there are a number of projects for building ontology support tools (Chaudhri et al., 1989; Das et al., 2004; Missikoff, 2003; Oberle et al., 2004; Jena, 2003; pOWL, 2004; Protégé, 2005), the SnoBase project is different from others in its objective of developing an industry-strength ontology management system. The design of the SnoBase system focuses on providing reliability, scalability, and performance for enterprise computing, and also providing functionality robust and sufficient for different levels of practitioners of ontological information.
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