Ontologies for Model-Driven Business Transformation

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ABSTRACT

Semantic markup languages such as RDF (resource description framework) and OWL (Web ontology language) are increasingly used to externalize metadata or ontology about business data, software, and services in a declarative form. Such externalized descriptions in ontological format are utilized for purposes ranging from search and retrieval to information integration and to business transformation. Ontology can significantly reduce the costs and improve the qualities of deploying, querying, integrating, and transforming enterprise systems. This chapter presents an innovative application of ontology to a model-driven approach to business analysis and transformation. The approach employs a daisy chain of business models for causality analyses. It links, by using semantic models, business processes and business components to IT solutions and capabilities at different phases of business transformation. The semantic models help infer causality of any business pain points and recommend appropriate solutions to fix business or IT shortfalls associated with the pain points in the process of business transformation. In addition, this chapter presents an enterprise-scale ontology management system which provides functionality, scalability, and performance demanded by enterprise applications such as the proposed model-driven business transformation. It describes the design and implementation of the management system which programmatically supports the ontology needs of business applications in a similar to that in which a database management system supports their data needs.

INTRODUCTION

Ontology is similar to a dictionary, taxonomy, or glossary, but with structure and formalism that enables computers to process its content. It consists of a set of concepts, axioms, and relations, and represents an area of knowledge. Unlike taxonomy or glossary, ontology allows to model arbitrary relations among concepts,
also model logical properties and semantics of the relations such as symmetricity, transitivity, and inverse, and logically reason about the relations. Ontology is specified in a declarative form by using semantic markup languages such as RDF (W3C, 1999) and OWL (W3C, 2004). It provides a number of potential benefits in processing knowledge, including the separation of domain knowledge from operational knowledge, sharing of common understanding of subjects among humans and also among computer programs, and the reuse of domain knowledge. In general, ontology can be beneficial to any enterprise system dealing with multiple domain concepts that are interrelated and needs to use the concepts to describe the behavior or capabilities of its programs. Business application examples of ontology include business process integration by using Web services composition, information retrieval, and search systems for semantic-based search capabilities, video retrieval systems to annotate media with metadata, and business collaboration management using corporate social network to provide a common understanding to collaboration contexts and annotate them, to name a few.

Among the enterprise applications of ontology, this chapter focuses on its use in business transformation processes. Business transformation is a key executive management initiative that attempts to align the technology initiatives of a company closely with its business strategy and vision, and is achieved through efforts from both the business and IT sides of the company. However, the technology side of the company often emphasizes functions and capabilities, while the business side focuses on business impact and value. Because of this “business-IT gap” (McDavid, 2004), business transformation processes for IT and services are lengthy and costly. To address this problem, this chapter presents an innovative application of ontology to a model-driven approach to business analysis and transformation. This approach innovatively extends the model-driven business transformation (IBM, 2004; Lee, 2005) and utilizes semantic models that link business performance measures, business processes, and components with key IT enablers all the way down to the IT infrastructure. The ontological model is used to infer both direct and indirect causalities of any business pain points and recommend appropriate solutions to fix the business or IT shortfalls associated with the business pain points.

In the second part of this chapter, we present an enterprise-scale ontology management system which provides functionality, scalability, and performance that enterprise applications such as the proposed model-driven business transformation would demand. In recent years, there has been a surge of interest in using ontological information for communicating knowledge among software systems. 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 re-implement 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. This chapter describes the design and implementation of the SnoBase ontology management system (Lee & Goodwin, 2006), which was developed at the IBM T.J. Watson Research Center.

The rest of this chapter is structured as follows: We introduce the model-driven business transformation and briefly describe how ontologies and semantic technologies can facilitate the business transformation process. Next, we present a semantic model for the proposed business transformation approach and then explain several qualitative business analyses helping business transformation. We then provide a schematic overview of the SnoBase ontology management system.