Chapter 16

A Study of Ontology Construction:
The Case of a Compliance Management Ontology

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ABSTRACT

Ontology has been recognized, and prominently used, as tool to facilitate shared understanding (and knowledge sharing) in a particular domain. Ensuring that such an ontology is relevant to a particular domain, however, remains a challenging task to the ontology developer. Motivated by the lack of consistent holistic guidelines to assist development of ontologies that are industry-relevant, the goal of this chapter is to present such an approach. The presented approach is based on the synthesis of existing approaches and varied sources of academic and industry input. The approach follows a typical ontology development cycle and consists of incremental steps that need to be taken to assure industry-relevance of the ontology. To provide a thorough discussion of the approach, the authors utilize a previously completed ontology development project that followed the developed approach. The project was specifically aimed at developing an industry-relevant ontology for the compliance management domain and was based on three main inputs, namely, scholarly articles, industry expert/practitioner input and industry reports. Their experience indicates that the use of the ontology development approach promotes an ontology that is closely aligned with the needs of industry.

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INTRODUCTION

Ontology is defined as a set of representational primitives with which to model a domain of knowledge or discourse (Gruber, 2009). According to Gruniger and Lee (2002), the use of an ontology benefits an organization in three ways. First, it serves as a communication medium between computational systems and humans. Second, it is useful as a computational reference. Third, it facilitates the reuse of knowledge for structuring or organizing libraries or repositories of plans. Given such benefits, ontology is well-researched by academia, has been widely used to represent many real world cases (Blomqvist & Öhgren, 2008; Moreira, Andréia, Martimiano, Brandão, & Bernardes, 2008), and is utilized by industry.

The maturity of ontology research is evidenced by the existence of several methodologies for ontology development (e.g. Knight & Luk, 1994; Grüniger & Fox, 1995; Fernández, et al., 1997). However, developing an ontology is a complicated and time-intensive process (Navigli & Velardi, 2004). Although there are a number of methodologies available, many researchers tend to only loosely couple their ontology development with these methodologies. The ontology development process is considered to be a craft, rather than an engineering activity, and each development team usually follows its own set of principles, design criteria and phases in the development process (Fernández-López & Gómez-Pérez, 2002). Initiating ontology development requires the developer to have the necessary domain expertise to ensure that ontology elements, as relationships between them, are precisely defined and capable of being mapped to an end user’s needs (Nawoj & Goniak, 2004). In other words, accurate selection of inputs for the development process increases the chances of the developed ontology accurately representing the target domain. Therefore, the development of an industry-relevant ontology requires a holistic approach; one that is able to guide the ontology developer in selecting relevant inputs, synthesizing them, building the ontology and documenting it.

In this chapter, we present an approach for ontology construction based on our experience with developing an ontology for the compliance management domain. The remainder of the chapter is organized as follows. The following section reviews existing methodologies for ontology development. We then briefly present what motivated us to focus on the compliance management domain. In the following section, we describe the details of our ontology construction approach. Finally, we conclude with a discussion of future work and conclusions.

ONTOLOGY ENGINEERING

A review of methods and techniques for ontology development indicates that several methodologies are available. The methodologies include Cyc (Knight & Luk, 1994), TOVE (Grüniger & Fox, 1995), ENTERPRISE (Uschold, 1996; Uschold & King, 1995), METHONTOLOGY (Fernández, et al., 1997), ontology integration methodology (Pinto & Martins, 2001), OntoClean (Guarino & Welty, 2009), and semantic interoperability methodology (Paredes-Moreno, et al., 2010), to name a few.

Several researchers have studied the features and applicability of various ontology development methodologies. Fernández-López and Gómez-Pérez (2002), for instance, discuss ontology development methodologies by classifying them into three different development approaches viz. ontology building from scratch, ontology re-engineering, and cooperative ontology construction. They examine eight methodologies, viz. Cyc (Knight & Luk, 1994), ENTERPRISE (Uschold, 1996; Uschold & King, 1995), TOVE (Grüniger & Fox, 1995), KACTUS (Schreiber, Wielinga, Jansweijer, Anjewierden, & Harmelen,