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Chapter XIV

Using a Semiotic Framework for a Comparative Study of Ontology Languages and Tools

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ABSTRACT

In this chapter, we survey and compare different ontology languages and tools with the aid of an evaluation framework. An ontology must be of high quality to enable actors to reach a common understanding of the domain at hand. The notion of "quality" in the context of ontology is discussed, and means to achieve high-quality ontologies are listed. The different quality aspects and means to improve them formulate the template for the comparisons of ontology languages and tools, which are two of the major factors that affect the quality of ontologies. The evaluation is based on both practical experiences and evaluations of existing ontology languages and tools. The authors believe that the discussions and understanding of the quality aspect of ontology will assist in developing high-quality ontologies in various application domains.

INTRODUCTION

Ontology attracts much attention in today's computer science, largely due to the vision of the "Semantic Web" (Berners-Lee, 2001), where the real ''semantic'' of the Web lies in the ontologies being used. Its importance is being recognized in diverse research fields, such as knowledge management, intelligent information integration, e-commerce, cooperative information systems, and database integration. The major reason of the popularity lies in its ability to provide a shared and common understanding of a domain, which can facilitate sharing of information therein and enable the construction of intelligent or semantic-aware applications.

Ontology as a branch of philosophy is the science of "what is" — that is, the kinds and structures of objects, properties, events, processes, and relations in every area of reality. Philosophical ontology seeks a classification that is exhaustive in the sense that all types of entities are included in the classification (Smith, 2003). In information systems, a more pragmatic view to ontology is taken, where ontology is considered as a kind of agreement on a domain representation. As such, an engineering viewpoint of ontology is often taken in information systems, as reflected in a commonly cited definition: "Ontology is an explicit account or representation of a conceptualization" (Uschold & Gruninger, 1996). This conceptualization includes a set of concepts, their definitions, and their inter-relationships. Preferably this conceptualization is shared or agreed. The IS community has dealt with meta-level constructs such as the Bunge-Wand-Weber model (Wand & Weber, 1993). Compared to the current de facto definition, which ranges from simple taxonomy to full-fledged logical theory, the Bunge-Wand-Weber model is more strict and closer related to the philosophical origin.

For practical reasons, ontologies are designed and constructed in information systems. The design of an ontology experiences the same problems as any other design, e.g., multiple stakeholders, varying viewpoints, different needs, etc. In addition, ontologies are used in different contexts, such as development time vs. run time (Guarino, 1998). Despite the different usage of ontologies, constructing ontologies of high quality is of common interest. The available languages and tools to aid this work are many. In this chapter we will survey and compare a selection of languages and tools by the aid of an evaluation framework. The evaluation framework has been developed in the research area of information systems (Lindland, Sindre, & Sølvberg, 1994; Krogstie, Lindland, & Sindre, 1995). We have adapted it in order to understand the quality of ontology and discuss the means to achieve high-quality ontologies. The different quality aspects and means to improve them formulate the template for the comparisons of ontology languages and tools, which are the basis for creating ontologies of high quality. The evaluation is based on both practical experiences and evaluations of different ontology languages and tools. We believe that the discussions