

## Preface

**Ontological Engineering** refers to the set of activities that concern the ontology development process, the ontology life cycle, the methods and methodologies for building ontologies, and the tool suites and languages that support them.

During the last decade, increasing attention has been focused on ontologies and Ontological Engineering. Ontologies are now widely used in Knowledge Engineering, Artificial Intelligence and Computer Science; in applications related to knowledge management, natural language processing, e-commerce, intelligent integration information, information retrieval, integration of databases, bio-informatics, and education; and in new emerging fields like the Semantic Web.

Primary goals of this book are to acquaint students, researchers and developers of information systems with the basic concepts and major issues of Ontological Engineering, as well as to make ontologies more understandable to those computer science engineers that integrate ontologies into their information systems. We have paid special attention to the influence that ontologies have on the Semantic Web. Pointers to the Semantic Web appear in all the chapters, but specially in the chapter on ontology languages and tools.

Many different methods, tools and languages, as well as the most outstanding ontologies, are presented to illustrate a diversity of approaches, but no single technique receives special attention. Each individual may choose to emphasize particular techniques depending on his/her own circumstances and interests. So, the book is designed to operate at two levels. First, as a simple introduction to the major areas of Ontological Engineering, and second, as a reference book. The emerging areas and the most up-to-date standards have also been considered.

The layout of the text is divided into five chapters: theoretical foundations, the most outstanding ontologies, methodologies, languages, and tools for developing ontologies. In every chapter (except the chapter that describes the most outstanding ontologies) we have used examples taken from the traveling domain. This provides a focal point for the book and allows readers to practise and compare different modeling techniques, different and similar methods and methodologies for building ontologies, and learn about ontology languages and different types of tools. We also

include comparative studies of methodologies, tools and languages to advise ontologists on their use.

The first chapter contains the **theoretical foundations** of the ontology field. Here we explain what an ontology is, the main types of ontologies, the main modeling components of ontologies based on frames or description logic, the design criteria for building ontologies as well as the relationships with other modeling techniques that are widely used on software engineering and databases.

Chapter 2 is devoted to **the most outstanding ontologies**. We present different types of ontologies: knowledge representation ontologies of traditional (i.e., Ontolingua and OKBC) and ontology mark-up languages (i.e., RDF(S), OIL, DAML+OIL, and OWL), top level ontologies, linguistic ontologies, and domain ontologies in the areas of e-commerce, medicine, engineering, enterprise, chemistry and knowledge management.

In Chapter 3 we explore different **methods and methodologies for ontology construction**. We present in detail the ontology development process and the methods and methodologies that support the ontology construction from scratch. We also discuss particular methods that allow specific activities. Special attention is given to the ontology learning methods that reduce the effort during the knowledge acquisition process; the merging of ontologies that generates a unique ontology from several ontologies; the ontology alignment that establishes different types of mapping between ontologies (hence preserving the original ones); and the ontology evaluation for evaluating the ontology content. For each methodology and method, we give an example taken from the traveling domain.

Chapter 4 deals with the process of selecting the **ontology language** (or set of languages) in which the ontology will be implemented. We describe how to implement ontologies in classical languages (Ontolingua, KIF, OCML and FLogic), the OKBC protocol, and web-based ontology languages (SHOE, XOL, RDF(S), OIL, DAML+OIL and OWL) that have laid the foundations of the Semantic Web. Some of them, like RDF(S) and OWL, are still in a development phase. As we have implemented an ontology of the traveling domain in all these languages, we compare their expressiveness and the reasoning mechanisms of each language.

Finally, Chapter 5 is concerned with several types of the **tools** and platforms used to build ontologies and tools that allow the use of ontologies for the Semantic Web. As in the previous chapters, we provide examples of ontologies with the tools of the traveling domain.

We hope that in the near future we will be able to support this text with a web site and give updates and slides for undergraduate and PhD courses.

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