Preface

There are increasing opportunities to consider the application of semantic technologies for business information systems. Semantic technologies are expected to improve business processes and information systems, and lead to savings in cost and time as well as improved efficiency. However, the degree of automation in enacting business processes and monitoring information systems and value chains is still unsatisfying. Current problems are representational heterogeneities between the various modeling notations used, the various (subjective) perspectives of the modelers on the application domains, or the different stages in the life-cycles of business processes. Interoperability and integration of advanced business information systems is concerned with the application of semantic technologies. These technologies allow for annotating meaning to business concepts and processes, and allow for automatically monitoring business systems and processes without human interactions. The book at hand explores the potential of semantic technologies for business and information systems engineering and provides an overview of applying semantic technologies for business and information systems engineering.

The first section, Models and Methods, covers fundamental aspects of creating and applying knowledge structures. At first, methodologies are compared by Daniela Lucas da Silva, Renato Rocha Souza, and Mauricio Barcellos Almeida. The authors conduct an analytical study compiled by the analysis of literature about methodologies for building ontologies and controlled vocabularies as well as by the analysis of international standards for software engineering. The application of an ontology-based method is then described by José González and Mathias Uslar. The authors develop an approach for constructing a domain specific reference model catalogue for the energy sector. In doing so, the authors consider both modeling requirements in the fields of ontology and reference model design. In the last chapter of this section, Peter Fettke and Peter Loos illustrate the use of ontology to evaluate Scheer’s reference model for production planning and control systems. The authors use ontology as a tool or theory and thus complement the dominating view on ontologies as design artifacts by a view on ontology in line with the philosophical discipline.

The second section provides an overview of the plethora of applications of semantic technologies in the field of Data and Knowledge Management. A fundamental problem in this area is how to process data originating from heterogeneous data sources and in diverse data formats such as text, numerical data, multimedia and others. Farid Bourennani and Shahryar Rahnamayan propose a unified approach for representing and processing data of heterogeneous types which ultimately should augment the interpretation of qualitative and quantitative data with use cases in business and financial sectors. Further, Liane Haak presents new ways for the integration of structured and unstructured data focusing on the application to data warehousing and knowledge management. The chapter introduces a solution for
generating an ontology from a data warehouse system and integrating it with a knowledge management systems ontology. The integrated ontologies are subsequently used for semantic navigation.

The last chapter of this section, by Alexey Alishvevik and Tatiana Emshanova, demonstrates how personal knowledge management can be improved by semantic desktop technologies. It describes theoretical aspects as well as the implementation of a supportive technology and framework integrating several aspects such as content aggregation, search, natural language processing, metadata management, and tagging. The synthesis of these different techniques aims at augmenting the experience of knowledge workers when working with digital information assets.

The third section, **Semantic Technologies in Conceptual Modeling**, focuses on applying semantic technologies to support conceptual modeling. The improved construction and analysis of semi-formal models on a general level is targeted by an approach for conceptual model analysis contributed by Patrick Delfmann, Sebastian Herwig, Łukasz Lis, and Jörg Becker. The approach integrates semantic standardization and structural pattern matching, hence enabling an unambiguous analysis of the models’ contents. It is intended for a number of purposes such as revealing syntactical errors, model comparison, model integration or the identification of business process improvement potentials.

Regarding the semantic verification of business process models, an ontology-based approach making use of background knowledge encoded in formal ontologies and rules is proposed by Michael Fellmann, Frank Hogrebe, and Oliver Thomas. The authors develop a model for the ontology-based representation of process models which is used in conjunction with machine reasoning for process model verification. The approach is demonstrated using real-life administrative process models taken from a capital city.

Whereas the two previous approaches aim at improvements regarding the construction and validation or verification of conceptual models and hence stick to more traditional ways of conceptual modeling, a more fundamental shift in the way of modeling is accompanied by the idea of a fully automated model construction. In the domain of process modeling, first results are shown by Bernd Heinrich, Mathias Klier, and Steffen Zimmermann, who present an algorithm and accompanying method for the automated planning of process models.

At the end of this section, the use of semantic technologies from a practical perspective is reported by Hans-Georg Fill and Ilona Reischl. Their chapter describes how semantic technologies can be combined with conceptual models to support management executives in the distribution of knowledge and the analysis of compliance. The approach is based on a stepwise semantic enrichment of conceptual models with formal semantic schemata and has been implemented on the ADONIS meta-modeling platform in the context of a real-life project with the Austrian competent authority in regard to safety in healthcare.

The fourth section of the book, **Semantic Process Description**, is dedicated specifically to the semantically enhanced representation and annotation of semi-formal process models. A detailed model how to annotate semi-formal process models both with lexical and semantic labels bridges the gap between human understandability and machine interpretability. This is introduced by Andreas Bögl, Michael Karlinger, Michael Schrefl, and Gustav Pomberger. Amongst other purposes, it can be applied for the automated refactoring of model elements and automated semantic annotation. The latter is also addressed by Yun Lin and Darijus Strasunskas, albeit they suggest annotating processes on a more coarse-grained level of process model templates. The annotation consists of the three basic parts: meta-model, domain, and goal annotation. It may be used to facilitate the retrieval and reuse of process knowledge.

In the last chapter of this section, the semantically enhanced business process modeling notation is introduced by Witold Abramowicz, Agata Filipowska, Monika Kaczmarek and Tomasz Kaczmarek. This “ontologized” version of the Business Process Modeling Notation is formalized in the sBPMN
ontology, which is consequently suggested as a serialization format for BPMN modeling tools. In such a way, annotations can be created invisible to the users and directly embedded into the models leading to advanced machine interpretability which facilitates and mechanizes the task of transforming semi-formal process models into executable workflows.

The last section of the book provides insights on how to use semantic technologies to support Services and Workflows. The first contribution in this part by Tariq Mahmoud, Jorge Marx Gómez and Timo von der Dovenmühle offers a Semantic Web services based reference model. This model relies on the idea of applying lightweight semantics to web services targeted at improved service advertisement, service composition, and service validation. While this chapter mainly focuses on the description and composition of services, the check whether such processes comply with regulations or policies is the main concern of the contribution by Rainer Telesko and Simon Nikles. They describe a concept for the semantics-based configuration of service packages with respect to service level agreements thereby capitalizing on the principles and use cases of the EU-project plugIT and additionally reporting on the economic benefits. With similar intentions, semantic policies for modeling regulatory process compliance are envisioned by Marwane El Kharbili and Elke Pulvermueller. They also motivate the need for automation in compliance management and propose the use of policies as a modeling concept for regulations. The authors introduce the CASE model and the corresponding policy modeling ontology. Both are used to support automated compliance checking of enterprise processes to regulations. The utilization of the CASE method as well as the policy ontology is showcased using an example of resource access control in business processes.

In the last chapter of the book, Barbara Thönssen and Daniela Wolff take a broader view on context models with the intent to support business process agility. They present dimensions of change concentrating on a specific ability of an enterprise to deal with change and propose a semantically enriched context model based on a well-known enterprise architecture. Finally, a context aware workflow engine is presented which leverages these concepts and rules which trigger process adaptations during run time.

We hope that this book will receive widespread recognition both from practitioners and the scientific community.

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