Editorial

Vocabularies, ontologies, and rules for enterprise and business process modeling and management

1. Introduction

Vocabularies, ontologies, and business rules are key components of a model-driven approach to enterprise computing in a networked economy. Enterprise vocabularies, ontologies, and business rules do not exist in isolation but serve to support business processes. While many have recognized the importance of vocabularies, ontologies, and business rules in business process modeling and management, there are many open research challenges to be addressed. These challenges can be approached from different perspectives. Fundamental research explores theoretical foundations for enterprise and business process modeling by applying techniques developed in disciplines such as formal ontology, cognitive science, linguistics, and logics. It also covers ontological evaluation of enterprise systems and their interoperability, and ontological analysis and (re)design of business process modeling languages and methods. Applied research looks into enhancing business rule engines and business process management systems by ontologies. Business process modeling research aims to define how process modeling and execution languages, such as Business Process Modeling Notation and Business Process Execution Language, relate to business ontologies and rules. Enterprise integration and collaboration research address ontology-based service description technologies for inter-enterprise collaboration.

2. Special issue scope and selection process

Trying to reflect on the current state of research on vocabularies, ontologies and rules in business process management and modeling, this special issue presents a collection papers covering the following topics:

- Conceptual modeling
  - Ontological foundations for enterprise and business process modeling
  - Languages and methods for business vocabularies, terminologies, and taxonomies
- Modeling of enterprise information integration and interoperability
- Languages for conceptual modeling (for example, OWL and UML)
- Agent-oriented conceptual modeling
- Business rule and business process modeling
  - Analysis of and experiences with OMG’s Semantics of Business Vocabularies and Rules (SBVR)
  - Rule modeling and rule markup
  - Rule-based approaches to Web service policies and choreographies
  - Agent-based business rule and process management
  - Integrating business rules with business process modeling and execution languages (for example, BPMN and BPML)
- Ontologies for enterprise systems
  - Ontological approaches to content and knowledge management
  - Ontologies for e-business registries/repositories
  - Web service ontologies
  - Ontological evaluation of enterprise systems
  - Ontology-based enterprise architectures
  - Ontology-based software engineering for enterprise solutions
- Model-driven engineering approaches in enterprise systems
  - Modeling and architecture frameworks
  - Domain engineering
  - Domain-specific business information and system engineering
  - Model transformations in enterprise and business process modeling

The special issue is a follow-up of the 3rd International Workshop on Vocabularies, Ontologies, and Rules in the Enterprise (VORTE 2007), which was co-located with the 11th IEEE International EDOC Conference (EDOC 2007) in Annapolis, Maryland, USA in October 2007. From the pool of the featured 12 peer-reviewed papers selected out of 24 submissions, we invited two best papers for publication in
this special issue. Both papers were substantially extended, after which they went through another round of the peer-review process. In addition, we invited the keynote speaker of VORTE 2007 to submit his paper based on the keynote. His paper was then peer-reviewed by following the standard policy of the journal. In addition to the three papers originating from VORTE 2007, we also published an open call for papers, which attracted 34 submissions in May 2008. By following a rigorous peer-review process, we eventually selected six papers for this special issue. This results in the acceptance rate of the special issue 17.65% (6/34).

3. Selected papers

3.1. Papers selected from VORTE 2007

The special issue starts with the two best papers selected from VORTE 2007. They are followed by the paper based on the VORTE 2007 keynote.

Modeling business processes and business rules are complementary activities in business process management. Currently, there are many different languages and systems that support both process- and rule-based approaches. However, there is still a remaining research question—what is an optimal balance between rule and process modeling. Michael zur Muehlen and Marta Indulska, in their paper “Modeling languages for business processes and business rules: a representational analysis,” which was selected as one of two VORTE 2007 best papers, consider the expressivity of rule and process modeling languages by making use of the well-known BWW model. After introducing metrics for estimating the expressivity of modeling languages, they apply those metrics to a set of well-known process and modeling languages. Their main finding is that no analyzed language fully covers the BWW model. Another important finding is that a combination of the Simple Rule Markup Language and Business Process Modeling Notation offers a better representational foundation than any single language currently available.

Many assume that ontologies as finished products are readily available to be used in business process modeling. However, the quality of ontologies is very important if one wants to achieve best effects in real business process-oriented applications. Investigating the quality of ontologies, Joerg Evermann and Jennifer Fang look at another measure—cognitive quality of ontologies—in their paper entitled “Evaluating ontologies: towards a cognitive measure of quality.” This paper was also selected as one of two VORTE 2007 best papers. The proposed measurement approach is to estimate the relationship between a mental model created through the perceptual and cognitive process used in domain analysis and the formal specification of the mental model obtained in domain analysis. Building on the principles of cognitive psychology, the authors propose an experimental method to measure this newly-introduced quality relationship, and demonstrate how their proposed method is applied to the BWW SUMO upper-level ontologies and the WordNet lexical ontology. The presented experimental results obtained by applying the proposed method indicate some weaknesses in all of the three studied ontologies.

The research subject of the VORTE 2007 keynote was related to reporting. Reporting is today a critical activity in business process management. Reporting needs to strictly follow the policies and standards, which are typically defined by different authorities such as governments or international standardization bodies. Marcus Spies in his paper “An ontology modeling perspective on business reporting” discusses how the use of ontologies can improve the reporting process. The rationale for the presented research is that ontologies have a greater potential for integrating different analytics applications. Ontologies can allow for using different structured and unstructured data sources and for interoperating different data analysis methods. The author’s proposal is an ontology, which is built on top of the eXtensible business reporting language and which makes use of the best practices and standards of ontology and model-driven software engineering.

3.2. Papers selected from the open call

The six papers selected from the 34 open-call submissions reflect on the current research in the following areas: efforts aiming to improve communication of business logics between business experts and business modelers as well as efforts aiming to develop better means for reconciliation of individual goals and organizational processes; empirical studies of the current practices in the use of vocabularies for labeling business process activities; and efforts in semantic business process management, modeling of performance indicators, and copyrights in business value chains.

Better capturing of a business domain is of great importance for a successful use of business rules in business process management. This has recently been recognized by the research community, which tries to improve the communication of business knowledge between developers and business experts in the development process. The key challenge lies in the fact that business experts do typically not understand well modeling languages for business processes and rules. To address this gap, the Object Management Group adopted the Semantics for Business Vocabulary and Rules (SBVR) specification. However, to have the real value for SBVR, one needs to connect it with modeling languages used in business process management. Jordi Cabot, Raquel Pau, and Ruth Raventós in their paper “From UML/OCL to SBVR specifications: a challenging transformation,” present their experience in developing a transformation from UML into SBVR. In their work they consider that business rules are typically represented as associated OCL statements while UML is used for modeling. The authors enabled the developers to transform their UML/OCL models into the so-called structured English natural language, understandable for business experts. The transformation is implemented in the ATL modeling language and tested with the tools developed for the Eclipse platform.

Each organization consists of individuals and teams who might have different perspectives to the overall
organizational processes. It is therefore important to consider those individual perspectives in enterprise modeling, so that one can provide more precise relations between organizational processes and individual goals. This is especially important in today's organizations where the social constructivism paradigm is becoming a prevailing approach in organizational knowledge construction and evolution. M. Zacarias, H.S. Pinto, R. Magalhães, and J. Tribolet, in their paper “A 'context-aware' and agent-centric perspective for the alignment between individuals and organizations,” propose an approach that is built on agent-oriented principles (to represent human perspectives) and ontological engineering (to represent shared conceptualization).

Business process modeling languages are typically formally-defined languages encapsulating the key conceptualization, and principles and best practices for process modeling. However, every time such a modeling language is applied, business process modelers need to make use of a natural language to name (i.e., label) the modeling elements employed. Such labels carry semantics and conceptualization of concrete processes at hand. This an obvious reason why it is very important to assure high quality of business processes, as this inevitably leads to better quality process models. As Jan Mendling, Hajo A. Reijers, and Jan Recker clearly recognize, there have not been so much empirical insights exploring the quality of labeling in process modeling. In their paper entitled “Activity labeling in process modeling: empirical insights and recommendations,” the authors report on an empirical study, which examines the types of styles typically used in process models (e.g., SAP Reference model). They used a questionnaire as an instrument to get some qualitative feedback from business modelers about perceived usefulness of the activity labeling styles identified. Based on a detailed statistical analysis of the collected data, the authors draw important conclusions and define recommendations relevant for both research and practice of business process modeling.

Today, we are witnessing growing needs for creating business chaining allowing for flexible business process changes, needs for introduction of different collaborating parties, and frequent changes in business polices. A very important aspect is copyrights management where one can clearly trace and specify copyrights across different value chains of business processes. While we can find many licensing mechanisms successfully used on the Web (e.g., Creative Commons), we can not find effective formal models representing and regulating copyrights in a form lending itself to computational processing. This is why Roberto García and Rosa Gil propose the usage of ontologies and reasoning based on description logic for modeling copyrights. In their paper “Content value chains modeling using a copyright ontology,” they introduce a novel copyright ontology, and demonstrate how this ontology is applied for modeling value changes. The ontology itself is suitable for defining static value chains; dynamic ones call for hybrid approaches. In their paper, the authors propose the usage of rules. In their experiments they made use of a query language (SPARQL) for implementing such rules. Their observation is that a more declarative rule-based approach is needed to enable better maintenance and reusability of such rules.

With the development of the Semantic Web technologies, the semantic business process area emerged. Semantically-enriched business process models grounded in formal ontologies are expected to be used at initial stages of the development. Such an ontological foundation allows for the use of advanced reasoning techniques in various engineering and reengineering tasks. Once such semantic process models have been developed, they need to be deployed and executed on executable process languages such as BPEL. In this step of transferring from semantic to executable process models, Violeta Damjanovic recognizes a gap caused by the fact that executable languages such as BPEL do not have formal semantics. Hence, there is a need to use an intermediary language preserving the originally intended semantics, which can also be executed. To address this research challenge, the author in her paper entitled “Semantic reengineering of business processes,” proposes the usage of Pi-Calculus, a well-known process algebraic formalism, as a solution. The author defines a set of mapping rules from ontology-based (semantic) business processes into Pi-Calculus, and then another set of mappings rules from Pi-Calculus into the BPEL language.

For every organization, it is very important to measure the performance of their business processes. For doing that, it is very important to identify relevant performance indicators, integrate those indicators into an overall enterprise modeling framework, and formalize the representations of those indicators. Viara Popova and Alexei Sharponslykh propose a framework for modeling performance indicators in the paper entitled “Modeling organizational performance indicators.” Their framework is based on the integration of temporal trace logic into a general enterprise modeling framework. The authors present some promising results in modeling of performance indicator structures, soft aspects of the organizational performance, and relations to other organizational concepts.

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