Journal of Zhejiang University-SCIENCE C (Computers & Electronics)
ISSN 1869-1951 (Print); ISSN 1869-196X (Online)
www.zju.edu.cn/jzus; www.springerlink.com
E-mail: jzus@zju.edu.cn

Report:

Enterprise applications of semantic technologies for business process management

Ralf MUELLER
Oracle BPM Product Development, Redwood City, CA, USA
E-mail: ralf.mueller@oracle.com

doi:10.1631/jzus.C1101011

1 Introduction

Today's business process management (BPM) systems have evolved to provide rich and sophisticated tooling and runtime support for subject domain experts, business analysts, development, and information technology (IT). However, the evolution of BPM systems led to a jungle of different representation formats for the various artifacts in such systems. These include models for value chains, strategies, goals, and objectives on the analysis side, business process models, organizational data and service models, and finally models for the implementation of a BPM system to a runtime infrastructure. In many systems, the complex relationships between the entities of a BPM system are vaguely documented, let alone be formalized in a machine readable way. This is where semantic technologies kick in: to provide the foundation for formalizing the complex relationships of a business in a common model using Web Ontology Language (OWL) ontologies. This avoids information silos and enables a holistic view to a BPM system using SPARQL.

We would like to give a short perspective on how BPM can benefit from the technical advances in semantic technologies over the last 10 years. BPM spans a wide range of concepts, technologies, and personas. From a top-down perspective, a BPM project typically starts with the definition of the company value chains, the strategies and goals that should be achieved, and the key performance indicators (KPIs) that are used to measure the success or failure of well-defined objectives. The value chains are further decomposed into supporting business processes (typically modeled in BPMN 2.0 (Silver, 2009)), applications, and services. An implementation of those artifacts is then performed using the tenets of a Service-Oriented Architecture (SOA). We are considering the use of semantic technologies invaluable in formalizing the complex relationships between the involved entities of a BPM system and providing a unified method for query and business rules. Understanding the exact semantics of a BPM system will foster agility and reduce proliferation of services and processes in an enterprise.

2 An ontology for BPM and SOA

We started looking into the core of a modern BPM system and identified the most important concepts and their relationships (Fig. 1).

Based on this, we developed three ontologies considering the various levels of abstraction in a BPM

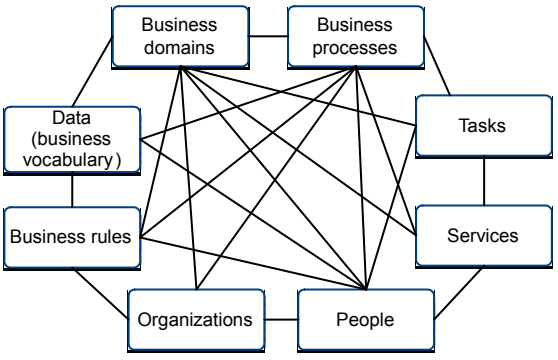

Fig. 1 Major entities in a business process management (BPM) system and their relationships

system:

1. Oracle BPM ontology. This ontology creates a composite model by establishing relationships between the OWL classes of the BPMN 2.0 ontology and the OWL classes of the Service Component Architecture (SCA, http://www.osoa.org) runtime ontology.

2. Ontology for BPMN 2.0. This ontology comprises classes and properties that cover the entire semantic model specified by the BPMN 2.0 OMG standard.

3. Ontology for SCA, which is a representation of the SCA assembly model. This ontology is at the lowest level of the BPM system and covers service definitions specified by Web Service Definition Language (WSDL) as well as data definitions specified by an eXtensible Markup Language (XML) schema.

The project is a work-in-progress, partially motivated by a customer and as a learning environment for ontology engineering within Oracle BPM development.

3 Applications

In modern enterprises, business processes are continuously refined and optimized for better business performance and to adapt to market changes. Reading from the bottom, the diagram in Fig. 2 visualizes this refinement and optimization loop.

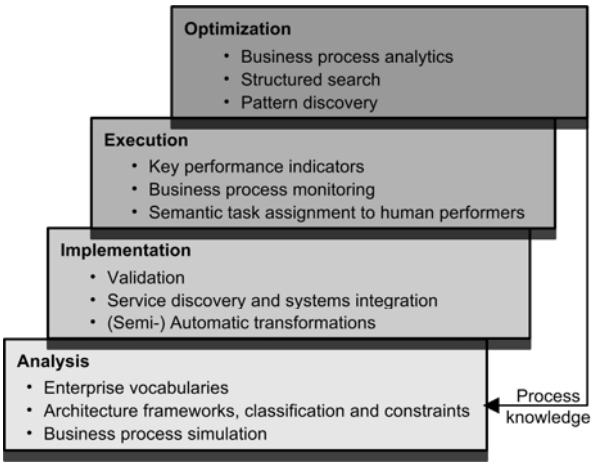

Fig. 2 Applications of business process management (BPM) ontology

Some of the key applications of the ontologies include:

1. Process analysis: The process modeling toolset can be constrained depending on a chosen architecture framework, and the ontology associates custom classification models, thesauri, and people's skill sets with process models, tasks, etc.

2. Implementation: An important aspect of implementing a business process for execution is validating the correctness of the process relative to the process blueprint and associated value chain and strategy models.

3. Execution: Events generated by the process engine can be investigated in the broader context by relating relevant information about strategies and service level agreements. A more precise identification of a human performer for a task in the process can be achieved by considering the performer skill sets and contribution to earlier, similar situations.

4. Optimization: The ontology for BPM can be referenced for semantically enabled searches that provide a more complete perspective of the involved artifacts and to discover patterns in a business process to reduce redundant work and identify bottlenecks.

Fensel (2001) and Wood (2010) provided many other use cases in the domain of enterprise applications and electronic commerce.

4 Challenges

With all the euphoria about the use of semantic technologies in the context of a BPM system, we do not want to conceal some of the challenges we have faced during our journey so far:

1. Ontology engineering: There exist hundreds of books on Unified Modeling Language (UML), but little has been said on best practices for ontology modeling (Antoniou and van Harmelen, 2004; Allemang and Hendler, 2011). We consider this key for a successful introduction of semantic technologies.

2. Inference: Diverse mechanisms and products exist for inferencing; however, which methodology is right for the job?

3. Non-technical challenges: There are still a lot of myths about semantic technologies and concerns in using the technology for enterprise applications.

5 Conclusions

Our experiments with semantic technologies including OWL and SPARQL in the context of BPM are very promising and also demonstrate that the use of this technology is valuable for domains that do not expose itself to the Web.

References

Allemang, D., Hendler, J., 2011. Semantic Web for the Working Ontologist (2nd Ed.). Morgan Kaufmann.

Antoniou, G., van Harmelen, F., 2004. A Semantic Web Primer. MIT Press.

Fensel, D., 2001. Ontologies: a Silver Bullet for Knowledge Management and Electronic Commerce. Springer.

Silver, B., 2009. BPMN Method & Style. Cody-Cassidy Press.

Wood, D., 2010. Linking Enterprise Data. Springer. [doi:10.1007/978-1-4419-7665-9]

Recommended reading

Yu, L.Y., 2011. A Developer's Guide to the Semantic Web. Springer. [doi:10.1007/978-3-642-15970-1]

Shapiro, R., White, S., Palmer, N., zur Muehlen, M., Allweyer, T., Gagné, D., 2011. BPMN 2.0 Handbook. Available from http://www.bpm-guide.de/wp-content/uploads/2011/09/BPMN-2.0-Handbook-Camunda.pdf

Mueller, R., Chow, L., Prater, J., 2011. Business Driven Architecture: Combining BPMN 2.0 and Semantic Technologies, Delivering BPM Excellence, Business Process Management in Practice. Future Strategies Inc.

Obrst, L., Janssen, T., Ceusters, W. (Eds.), 2010. Ontologies and Semantic Technologies for Intelligence. IOS Press.

Kiefer, C., Bernstein, A., 2011. Application and evaluation of inductive reasoning methods for the semantic Web and software analysis. *LNCS*, **6848**:460-503. [doi:10.1007/978-3-642-23032-5_10]