Lecture Notes in Computer Science 6325

Commenced Publication in 1973
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Uwe Aßmann Andreas Bartho
Christian Wende (Eds.)

Reasoning Web

Semantic Technologies for Software Engineering

6th International Summer School 2010
Dresden, Germany, August 30 - September 3, 2010
Tutorial Lectures

Springer

Volume Editors

Uwe Aßmann
Technische Universität Dresden, Fakultät Informatik
Institut für Software- und Multimediatechnik
Lehrstuhl Softwaretechnologie
01062 Dresden, Germany
E-mail: uwe.assmann@tu-dresden.de

Andreas Bartho
Technische Universität Dresden, Fakultät Informatik
Institut für Software- und Multimediatechnik
Lehrstuhl Softwaretechnologie
01062 Dresden, Germany
E-mail: andreas.bartho@tu-dresden.de

Christian Wende
Technische Universität Dresden, Fakultät Informatik
Institut für Software- und Multimediatechnik
Lehrstuhl Softwaretechnologie
01062 Dresden, Germany
E-mail: c.wende@tu-dresden.de

Library of Congress Control Number: 2010933248

CR Subject Classification (1998): H.4, H.3, I.2, H.5, C.2, D.2

LNCS Sublibrary: SL 3 – Information Systems and Application, incl. Internet/Web and HCI

ISSN 0302-9743
ISBN-10 3-642-15542-1 Springer Berlin Heidelberg New York
ISBN-13 978-3-642-15542-0 Springer Berlin Heidelberg New York

springer.com

Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper 06/3180

Preface

Welcome to the proceedings of Reasoning Web 2010 which was held in Dresden.

Reasoning Web is a summer school series on theoretical foundations, contemporary approaches, and practical solutions for reasoning in a Web of Semantics. It has established itself as a meeting point for experts from research institutes and industry, as well as students undertaking their PhDs in related fields. This volume contains tutorial notes of the sixth school in the series, held from August 30 to September 3, 2010.

This year, the school focused on applications of semantic technologies in software engineering and the reasoning technologies appropriate for such an endeavor. As it turns out, semantic technologies in software engineering are not so easily applied, and several issues must be resolved before software modeling can benefit from reasoning. First, reasoning has to be fast and scalable, since models and programs can be quite large and voluminous. Since many reasoning languages are exponential or NP-complete, approximation, incrementalization, and other optimization techniques are extremely important. Second, software engineering needs to model software systems, in contrast to modeling domains of the world. Thus, the modeling techniques are prescriptive rather than descriptive [1], which influences the way models are reasoned about. When a software system is modeled, its behavior is *prescribed* by the model, that is, "the truth is in the model" [2]; when a domain of the world is described, its behavior cannot be *prescribed*, only *described* by the model ("the truth is in the world"). Therefore, reasoning has to distinguish between prescriptiveness and descriptiveness, leading to different assumptions about the closeness or openness of the world (closed-world assumption, CWA vs. open-world assumption, OWA). Third, while software modeling languages usually conform to a 4-level metalevel hierarchy (with objects on level M0, models on M1, metamodels on M2, metalanguages on M3), ontology languages usually only distinguish TBox and ABox. Different metalanguages are used, different repositories, and different strategies for integration with application code. Basically, ontology and software modeling worlds are two technological spaces [3], and these spaces have to be bridged on each of the M0-M3 levels. Since bridging often requires transformations of models to ontologies and ontologies to models, flexible glue technologies are looked for that hide the transformations from software developers.

These three requirements form only the top of the iceberg. There are many more problems below the surface, and the lecturers of the school attempt to provide answers for at least the following questions:

- How can we limit the complexity of reasoning to polynomial time? For this purpose, *expressive description logics* have been developed and transfered to OWL-EL, a profile for OWL ensuring polynomial complexity. Many of these contributions were achieved here in Dresden, and Anni-Yasmin Turhan from the Description Logic group presented them in the tutorial "Reasoning and Explanation in $\mathcal{EL}$ and in Expressive Description Logics."

- How can we reason with both rules and ontologies (hybrid reasoning)? Are we able to reason in an integrated fashion about domain models (which can easily be described by ontologies), requirements specifications (which talk about issues like business rules), and architecture specifications (which talk about rules for architectural styles)? What happens if a business rule from the requirement specification accesses the domain ontology? These fundamental questions of hybrid reasoning were taken up in the lecture on "Hybrid Reasoning with Non-Monotonic Rules" by Włodzimierz Drabent from the Polish Academy of Sciences and Linköping University.
- How can ontologies be embedded into the model-driven software development process (MDSD)? How can software models be checked on additional constraints? Can we model in an integrated fashion, that is, model in software languages while adding constraints from an ontology language? Which bridging technologies exist? These questions were discussed in the tutorial "Model-Driven Engineering with Ontology Technologies" by Steffen Staab, Tobias Walter, Gerd Gröner, and Fernando Silva Parreiras from the University of Koblenz-Landau.
- Can we use other techniques to speed up reasoning, such as approximation, incrementalization, or database optimization technology? How do we integrate requirements ontologies (which talk about the domains of the world with OWA) with system architecture specifications (which talk about systems with CWA)? Jeff Z. Pan from the University of Aberdeen discussed these issues in his talk "Scalable DL Reasoning" [4].
- Not only data definitions and their languages, but also query languages have to be bridged. Problems like OWA/CWA need to be taken into account while querying syntactic (model) data and semantic data. An example for a bridging technology for two leading query languages from the ontology and modeling worlds (SPARQL and GReQL) was presented in the tutorial "Bridging Query Languages in Semantic and Graph Technologies" by Hannes Schwarz and Jürgen Ebert from the University of Koblenz-Landau.

Apart from these more conceptual tutorials, the school featured a strong discussion of application areas in software engineering.

- Jens Lemcke, Tirdad Rahmani, and Andreas Friesen from SAP Research Karlsruhe reported on an application of ontologies in "Semantic Business Process Engineering." SAP has developed a reasoning-based refinement method for business process specifications, in which a concrete, executable workflow can be shown to be a behavioral refinement of an abstract business process. This method is very useful for enterprise process modeling, which is a focus area of SAP.
- Krzysztof Miksa, Pawel Sabina, and Marek Kasztelnik from Comarch (Krakow) showed how ontologies can be applied for the checking of constraints in domain-specific models in network device configuration ("Combining Ontologies with Domain Specific Languages: A Case Study from Network Configuration Software"). Comarch is one of the leading providers for telecommunication network software and needs to control huge domain models.
- Michael Schroeder from Technische Universität Dresden presented "Semantic Search Engines." Transinsight, his start-up company, has successfully built

several semantic search machines for different biomedical applications, for instance, GoWeb [5].
- There were two smaller tutorials on "Semantic Service Engineering in the TEXO and Aletheia Projects" (SAP Dresden, Ralf Ackermann) and "Semantic Wikis" (Sören Auer, Leipzig University).

We believe that the application of reasoning technologies in software engineering will be a fruitful field in the future. The summer school clearly showed that a number of challenges exist, but also that they can be overcome with an appropriate bridging technology.

We would like to thank all lecturers of the Reasoning Web Summer School 2010 for their interesting and inspiring tutorials. We also thank the Program Committee members for executing their reviewing duties, in particular under the given time constraints in spring 2010. Many thanks go to Christiane Wagner and Gundula Gelfert from CMD Dresden for the organization of the school. Thanks also to Steffen Hölldobler and the summer school "Computational Logic," running in parallel with Reasoning Web this year [6], for their openness to share social activities. Finally, we also thank our funding agencies: this volume has been supported by the European Commission and by the Swiss Federal Office for Education and Science within the 7th Framework Programme project MOST number 216691.

September 2010

Uwe Aßmann
Andreas Bartho
Christan Wende

1. Ed Seidewitz, "What Models Mean", IEEE Software, September 2003
2. Jean-Marie Favre, Foundations of Model (Driven) (Reverse) Engineering: Models - Episode I, Stories of the Fidus Papyrus and of the Solarus. Dagstuhl Seminar 04101 on "Language Engineering for Model-Driven Software Development", Dagstuhl, Germany, February 29-March 5, 2004, Appeared in DROPS 04101, ISSN 1862-4405, IBFI. `http://megaplanet.org/jean-marie-favre`
3. Ivan Kurtev, Jean Bezivin, Mehmet Aksit, Technological Spaces: an Initial Appraisal, CoopIS, DOA'2002 Federated Conferences, Industrial track, Irvine, 2002
4. Yuan Ren, Jeff Z. Pan and Yuting Zhao. Soundness Preserving Approximation for TBox Reasoning. In Proc. of the 25th AAAI Conference Conference (AAAI2010). 2010. `http://www.abdn.ac.uk/~csc280/pub/RPZ2010.pdf`
5. Heiko Dietze and Michael Schroeder. GoWeb: a semantic search engine for the life science web. Biotechnology Center (BIOTEC), Technische Universität Dresden, 01062, Dresden, Germany. BMC Bioinformatics 2009, vol. 10(Suppl 10):S7, `http://www.biomedcentral.com/1471-2105/10/S10/S7`
6. Summer School Computational Logic 2010. `http://www.computational-logic.org`

Organization

Program Committee

José Júlio Alferes	University of Lisbon (Portugal)
Michael Altenhofen	SAP Research CEC Karlsruhe (Germany)
Uwe Aßmann	Technische Universität Dresden (Germany)
Colin Atkinson	University of Mannheim (Germany)
François Bry	Ludwig-Maximilians-Universität München (Germany)
Diego Calvanese	Free University of Bozen (Italy)
Carlos Damásio	University of Lisbon (Portugal)
Thomas Eiter	Vienna University of Technology (Austria)
Andreas Friesen	SAP Research CEC Karlsruhe (Germany)
Dragan Gašević	Athabasca University (Canada)
Jakob Henriksson	Intelligent Automation, Inc. (USA)
Carsten Lutz	University of Bremen (Germany)
Jan Małuszyński	University of Linköping (Sweden)
Daniel Oberle	SAP Research CEC Karlsruhe (Germany)
Jeff Z. Pan	University of Aberdeen (UK)
Renate Schmidt	University of Manchester (UK)
Michael Sintek	DFKI GmbH, Kaiserslautern (Germany)

Local Organization

Andreas Bartho	Technische Universität Dresden (Germany)
Christian Wende	Technische Universität Dresden (Germany)
Christiane Wagner	Technische Universität Dresden (Germany)
Gundula Gelfert	CMD Congress Management GmbH, Dresden (Germany)

Proceedings Chair

Uwe Aßmann	Technische Universität Dresden (Germany)

Sponsoring Institutions

TECHNISCHE UNIVERSITÄT DRESDEN

MOSTPROJECT http://most-project.eu

REWERSE reasoning on the web

Table of Contents