

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Alfred Kobsa

University of California, Irvine, CA, USA

Friedemann Mattern

ETH Zurich, Switzerland

John C. Mitchell

Stanford University, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz

University of Bern, Switzerland

C. Pandu Rangan

Indian Institute of Technology, Madras, India

Bernhard Steffen

University of Dortmund, Germany

Madhu Sudan

Microsoft Research, Cambridge, MA, USA

Demetri Terzopoulos

University of California, Los Angeles, CA, USA

Doug Tygar

University of California, Berkeley, CA, USA

Gerhard Weikum

Max-Planck Institute of Computer Science, Saarbruecken, Germany

Sergio Tessaris Enrico Franconi
Thomas Eiter Claudio Gutierrez
Siegfried Handschuh
Marie-Christine Rousset Renate A. Schmidt (Eds.)

Reasoning Web

Semantic Technologies for Information Systems

5th International Summer School 2009
Brixen-Bressanone, Italy, August 30 – September 4, 2009
Tutorial Lectures

Volume Editors

Sergio Tessaris
Enrico Franconi
Free University of Bozen - Bolzano, Italy
E-mail: {tessaris,franconi}@inf.unibz.it

Thomas Eiter
Technische Universität Wien, Austria
E-mail: eiter@kr.tuwien.ac.at

Claudio Gutierrez
Universidad de Chile, Chile
E-mail: cgutierr@dcc.uchile.cl

Siegfried Handschuh
National University of Ireland, Ireland
E-mail: siegfried.handschuh@deri.org

Marie-Christine Rousset
University of Grenoble, France
E-mail: Marie-Christine.Rousset@imag.fr

Renate A. Schmidt
The University of Manchester, UK
E-mail: schmidt@cs.man.ac.uk

Library of Congress Control Number: 2009932138

CR Subject Classification (1998): H.5, I.2.4, H.3, C.2, I.1, F.3, F.2

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

ISSN 0302-9743
ISBN-10 3-642-03753-4 Springer Berlin Heidelberg New York
ISBN-13 978-3-642-03753-5 Springer Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

springer.com

© Springer-Verlag Berlin Heidelberg 2009
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper SPIN: 12737505 06/3180 5 4 3 2 1 0

Preface

The Semantic Web is one of the major current endeavours of applied computer science. The Semantic Web aims at enriching the existing Web with meta-data and processing methods so as to provide Web-based systems with advanced (so-called intelligent) capabilities, in particular with context-awareness and decision support.

The advanced capabilities required in most Semantic Web application scenarios primarily call for reasoning. Reasoning capabilities are offered by Semantic Web languages that are currently being developed. Most of these languages, however, are developed mainly from functionality-centred perspectives (e.g., ontology reasoning or access validation) or application-centred perspectives (e.g., Web service retrieval and composition). A perspective centred on the reasoning techniques complementing the above-mentioned activities appears desirable for Semantic Web systems and applications. The Summer School is devoted to this perspective. The “Reasoning Web” series of annual Summer Schools was started in 2005 on behalf of the work package “Education and Training (ET)” of the Network of Excellence REWERSE.

This year’s edition focused on the use of semantic technologies to enhance data access on the Web. For this reason, courses presented a range of techniques and formalisms which bridge semantic-based and data-intensive systems.

The school introduced Semantic Web foundations with a strong perspective on data management as well as applications of scalable semantic-based techniques for data querying. Topics of the lectures were design and analysis of reasoning procedures for Description Logics; Answer Set Programming basics, its modelling methodology and its principal extensions tailored for Semantic Web applications; languages for constraining and querying XML data; RDF databases theory and efficient and scalable support for RDF/OWL data storage, loading, inferencing and querying; tractable Description Logics and their use for Ontology-Based Data Access; the Social Semantic Desktop, which defines a user’s personal information environment as a source and end-point of the Semantic Web.

We are grateful to all the lecturers and their co-authors for their excellent contributions, to the Reasoning Web School Board, and the organisations that supported this event: the Free University of Bozen–Bolzano and STI2 International.

August 2009

Thomas Eiter
Enrico Franconi
Claudio Gutierrez
Siegfried Handschuh
Marie-Christine Rousset
Renate Schmidt
Sergio Tessaris

School Organisation

Programme Chairs

Sergio Tessaris	Free University of Bozen-Bolzano, Italy
Enrico Franconi	Free University of Bozen-Bolzano, Italy

Programme Committee

Thomas Eiter	Vienna Technical University, Austria
Claudio Gutierrez	Universidad de Chile, Chile
Siegfried Handschuh	DERI Galway, Ireland
Marie-Christine Rousset	University of Grenoble, France
Renate Schmidt	University of Manchester, UK

Local Organisation

Stefano David	Università Politecnica delle Marche, Italy
Enrico Franconi	Free University of Bozen-Bolzano, Italy
Sergio Tessaris	Free University of Bozen-Bolzano, Italy

Sponsoring Institutions



FREE UNIVERSITÄT BOZEN
LIBERA UNIVERSITÀ DI BOLZANO
FREE UNIVERSITY OF BOZEN - BOLZANO

Free University of Bozen-Bolzano
<http://www.unibz.it>



STI · INTERNATIONAL

STI International
<http://www.sti2.org>



REVERSE
<http://reverse.net>

External Reviewers

Pablo Barcelo	Universidad de Chile, Chile
Thomas Krennwallner	Vienna Technical University, Austria
Mantas Simkus	Vienna Technical University, Austria

Table of Contents

Description Logics	1
<i>Franz Baader</i>	
Answer Set Programming: A Primer	40
<i>Thomas Eiter, Giovambattista Ianni, and Thomas Krennwallner</i>	
Logical Foundations of XML and XQuery	111
<i>Maarten Marx</i>	
Foundations of RDF Databases	158
<i>Marcelo Arenas, Claudio Gutierrez, and Jorge Pérez</i>	
Database Technologies for RDF	205
<i>Souripriya Das and Jagannathan Srinivasan</i>	
Technologies for the Social Semantic Desktop	222
<i>Michael Sintek, Siegfried Handschuh, Simon Scerri, and Ludger van Elst</i>	
Ontologies and Databases: The <i>DL-Lite</i> Approach	255
<i>Diego Calvanese, Giuseppe De Giacomo, Domenico Lembo, Maurizio Lenzerini, Antonella Poggi, Mariano Rodriguez-Muro, and Riccardo Rosati</i>	
Author Index	357