

*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*

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

*Massachusetts Institute of Technology, MA, USA*

Demetri Terzopoulos

*University of California, Los Angeles, CA, USA*

Doug Tygar

*University of California, Berkeley, CA, USA*

Moshe Y. Vardi

*Rice University, Houston, TX, USA*

Gerhard Weikum

*Max-Planck Institute of Computer Science, Saarbruecken, Germany*

Stefano Spaccapietra (Ed.)

# Journal on Data Semantics VII



Springer

Volume Editor

Stefano Spaccapietra  
Database Laboratory, EPFL  
1015 Lausanne, Switzerland  
E-mail: stefano.spaccapietra@epfl.ch

Library of Congress Control Number: 2006935770

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

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

ISSN	1861-2032
ISBN-10	3-540-46329-1 Springer Berlin Heidelberg New York
ISBN-13	978-3-540-46329-0 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 is a part of Springer Science+Business Media

springer.com

© Springer-Verlag Berlin Heidelberg 2006  
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India  
Printed on acid-free paper SPIN: 11890591 06/3142 5 4 3 2 1 0

# The LNCS Journal on Data Semantics

Computerized information handling has changed its focus from centralized data management systems to decentralized data exchange facilities. Modern distribution channels, such as high-speed Internet networks and wireless communication infrastructure, provide reliable technical support for data distribution and data access, materializing the new, popular idea that data may be available to anybody, anywhere, anytime. However, providing huge amounts of data on request often turns into a counterproductive service, making the data useless because of poor relevance or inappropriate level of detail. Semantic knowledge is the essential missing piece that allows the delivery of information that matches user requirements. Semantic agreement, in particular, is essential to meaningful data exchange.

Semantic issues have long been open issues in data and knowledge management. However, the boom in semantically poor technologies, such as the Web and XML, has boosted renewed interest in semantics. Conferences on the Semantic Web, for instance, attract crowds of participants, while ontologies on their own have become a hot and popular topic in the database and artificial intelligence communities.

Springer's *LNCS Journal on Data Semantics* aims at providing a highly visible dissemination channel for most remarkable work that in one way or another addresses research and development on issues related to the semantics of data. The target domain ranges from theories supporting the formal definition of semantic content to innovative domain-specific application of semantic knowledge. This publication channel should be of the highest interest to researchers and advanced practitioners working on the Semantic Web, interoperability, mobile information services, data warehousing, knowledge representation and reasoning, conceptual database modeling, ontologies, and artificial intelligence.

Topics of relevance to this journal include:

- Semantic interoperability, semantic mediators
- Ontologies
- Ontology, schema and data integration, reconciliation and alignment
- Multiple representations, alternative representations
- Knowledge representation and reasoning
- Conceptualization and representation
- Multi-model and multi-paradigm approaches
- Mappings, transformations, reverse engineering
- Metadata
- Conceptual data modeling
- Integrity description and handling
- Evolution and change
- Web semantics and semi-structured data
- Semantic caching

- Data warehousing and semantic data mining
- Spatial, temporal, multimedia and multimodal semantics
- Semantics in data visualization
- Semantic services for mobile users
- Supporting tools
- Applications of semantic-driven approaches

These topics are to be understood as specifically related to semantic issues. Contributions submitted to the journal and dealing with semantics of data will be considered even if they are not within the topics in the list.

While the physical appearance of the journal issues looks like the books from the well-known Springer LNCS series, the mode of operation is that of a journal. Contributions can be freely submitted by authors and are reviewed by the Editorial Board. Contributions may also be invited, and nevertheless carefully reviewed, as in the case for issues that contain extended versions of best papers from major conferences addressing data semantics issues. Special issues, focusing on a specific topic, are coordinated by guest editors once the proposal for a special issue is accepted by the Editorial Board. Finally, it is also possible that a journal issue be devoted to a single text.

The journal published its first volume in 2003 (LNCS 2800). That initial volume, as well as volumes II (LNCS 3360), III (LNCS 3534), V (LNCS 3870), and coming volume VIII represent the annual occurrence of a special issue devoted to publication of selected extended versions of best conference papers from previous year conferences. Volumes III and VI are annual special issues on a dedicated topic. Volume III, coordinated by guest editor Esteban Zimányi, addressed Semantic-based Geographical Information Systems, while volume VI, coordinated by guest editors Karl Aberer and Philippe Cudre-Mauroux, addressed Emergent Semantics. The fourth volume was the first "normal" volume, built from spontaneous submissions on any of the topics of interest to the Journal. This volume VII is the second of this type.

The Editorial Board comprises one Editor-in-Chief (with overall responsibility), a co-editor-in-chief, and several members. The Editor-in-Chief has a four-year mandate. Members of the board have a three-year mandate. Mandates are renewable. New members may be elected anytime.

We are happy to welcome you to our readership and authorship, and hope we will share this privileged contact for a long time.

Stefano Spaccapietra  
Editor-in-Chief  
<http://lbdwww.epfl.ch/e/Springer/>

## **JoDS Volume VII – Preface**

This JoDS volume results from a rigorous selection among 35 abstract/paper submissions received in response to a call for contributions issued July 2005.

After two rounds of reviews, nine papers, spanning a wide variety of topics, were eventually accepted for publication. They are listed in the table of contents herein.

We would like to thank authors of all submitted papers as well as all reviewers who contributed to improving the papers through their detailed comments.

Forthcoming volume VIII will contain extended versions of best papers from 2005 conferences covering semantics aspects. Its publication is expected towards the end of 2006.

We hope you'll enjoy reading this volume.

Stefano Spaccapietra  
Editor-in-Chief

## Reviewers

We are very grateful to the external reviewers listed below who helped the editorial board in the reviewing task:

Daniele Barone, Università Milano Bicocca, Italy  
Stefano Borgo, Laboratory for Applied Ontology (ISTC-CNR), Italy  
Federico Cabitza, Università Milano Bicocca, Italy  
Flavio De Paoli, Università Milano Bicocca, Italy  
Denise de Vries, Flinders University, Australia  
Ying Ding, University of Innsbruck, Austria  
Gillian Dobbie, University of Auckland, New Zealand  
Fabrice Estiévenart, University of Namur, Belgium  
Silvia Gabrielli, Università di Roma 1 “La Sapienza,” Italy  
Birte Glimm, The University of Manchester, UK  
Giancarlo Guizzardi, Laboratory for Applied Ontology (ISTC-CNR), Italy  
Benjamin Habegger, Università di Roma 1 “La Sapienza,” Italy  
Markus Kirchberg, Massey University, New Zealand  
Jacek Kopecký, DERI Innsbruck, Austria  
Changqing Li, National University of Singapore, Singapore  
Sebastian Link, Massey University, New Zealand  
Andrea Maurino, Università Milano Bicocca, Italy  
Jean-Roch Meurisse, University of Namur, Belgium  
Diego Milano, Università di Roma 1 “La Sapienza,” Italy  
Wei Nei, National University of Singapore, Singapore  
Fabio Porto, EPFL, Switzerland  
Saurav Sahay, Georgia Institute of Technology, USA  
Christelle Vangenot, EPFL, Switzerland  
Evgeny Zolin, The University of Manchester, UK

## JoDS Editorial Board

Editor-in-chief	Stefano Spaccapietra, EPFL, Switzerland
Co-editor-in-chief	Lois Delcambre, Portland State University, USA

### Members of the Board

Carlo Batini, Università di Milano Bicocca, Italy  
Alex Borgida, Rutgers University, USA  
Shawn Bowers, University of California Davis, USA  
Tiziana Catarci, Università di Roma “La Sapienza,” Italy  
David W. Embley, Brigham Young University, USA  
Jerome Euzenat, INRIA Alpes, France  
Dieter Fensel, University of Innsbruck, Austria  
Nicola Guarino, National Research Council, Italy  
Jean-Luc Hainaut, FUNDP Namur, Belgium  
Ian Horrocks, University of Manchester, UK  
Arantza Illarramendi, Universidad del País Vasco, Spain  
Larry Kerschberg, George Mason University, USA  
Michael Kifer, State University of New York at Stony Brook, USA  
Tok Wang Ling, National University of Singapore, Singapore  
Shamkant B. Navathe, Georgia Institute of Technology, USA  
Antoni Olivé, Universitat Politècnica de Catalunya, Spain  
José Palazzo M. de Oliveira, Universidade Federal do Rio Grande do Sul, Brazil  
Christine Parent, Université de Lausanne, Switzerland  
John Roddick, Flinders University, Australia  
Klaus-Dieter Schewe, Massey University, New Zealand  
Heiner Stuckenschmidt, University of Mannheim, Germany  
Katsumi Tanaka, University of Kyoto, Japan  
Yair Wand, University of British Columbia, Canada  
Eric Yu, University of Toronto, Canada  
Esteban Zimányi, Université Libre de Bruxelles (ULB), Belgium

### Previous EB members who contributed reviews for this JoDS volume VII:

Maurizio Lenzerini, Università di Roma “La Sapienza,” Italy  
Salvatore T. March, Vanderbilt University, USA  
John Mylopoulos, University of Toronto, Canada



# Table of Contents

Discovering the Semantics of Relational Tables Through Mappings . . . . .	1
<i>Yuan An, Alex Borgida, John Mylopoulos</i>	
Specifying the Semantics of Operation Contracts in Conceptual Modeling . . . . .	33
<i>Anna Queralt, Ernest Teniente</i>	
Model-Driven Ontology Engineering . . . . .	57
<i>Yue Pan, Guotong Xie, Li Ma, Yang Yang, ZhaoMing Qiu, Juhnyoung Lee</i>	
Inheritance in Rule-Based Frame Systems: Semantics and Inference . . . .	79
<i>Guizhen Yang, Michael Kifer</i>	
Unsupervised Duplicate Detection Using Sample Non-duplicates . . . . .	136
<i>Patrick Lehti, Peter Fankhauser</i>	
Towards Algebraic Query Optimisation for XQuery . . . . .	165
<i>Markus Kirchberg, Faizal Riaz-ud-Din, Klaus-Dieter Schewe, Alexei Tretiakov</i>	
Automatic Image Description Based on Textual Data . . . . .	196
<i>Youakim Badr, Richard Chbeir</i>	
Reasoning About ORA-SS Data Models Using the Semantic Web . . . . .	219
<i>Yuan Fang Li, Jing Sun, Gillian Dobbie, Hai H. Wang, Jun Sun</i>	
A Pragmatic Approach to Model and Exploit the Semantics of Product Information . . . . .	242
<i>Taehee Lee, Junho Shim, Hyunja Lee, Sang-goo Lee</i>	
<b>Author Index . . . . .</b>	<b>267</b>