# Lecture Notes in Computer Science Edited by G. Goos, J. Hartmanis and J. van Leeuwen

Advisory Board: W. Brauer D. Gries J. Stoer

Timos Sellis (Ed.)

# Rules in Database Systems

Second International Workshop, RIDS '95 Glyfada, Athens, Greece September 25-27, 1995 Proceedings



Series Editors Gerhard Goos, Karlsruhe University, Germany Juris Hartmanis, Cornell University, NY, USA Jan van Leeuwen, Utrecht University, The Netherlands

Volume Editor

Timos Sellis Division of Computer Science, National Technical University of Athens GR-157 73 Zographou, Athens, Greece

Cataloging-in-Publication data applied for

#### Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Rules in database systems : second international workshop ; proceedings / RIDS '95, Glyfada, Athens, Greece, September 1995. Timos Sellis (ed.). - Berlin ; Heidelberg ; New York ; Barcelona ; Budapest ; Hong Kong ; London ; Milan ; Paris ; Tokyo : Springer, 1995 (Lecture notes in computer science ; Vol. 985) ISBN 3-540-60365-4 NE: Sellis, Timos [Hrsg.]: RIDS <2, 1995, Glifada>; GT

CR Subject Classification (1991): H.2

#### ISBN 3-540-60365-4 Springer-Verlag 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 -Verlag. Violations are liable for prosecution under the German Copyright Law.

© Springer-Verlag Berlin Heidelberg 1995 Printed in Germany

Typesetting: Camera-ready by author SPIN 10485600 06/3142 - 5 4 3 2 1 0 Printed on acid-free paper

## Preface

This book is the proceedings of the Second International Workshop on Rules in Database Systems (RIDS '95) held at Athens in September 1995. Rules have been a major focus of research interest in database systems for more than a decade, the initial focus on deductive rules and integrity constraints being augmented by recent research into active rules. The aim of this workshop, which was the second after a very successful first workshop in Edinburgh (Scotland) in September 1993, was to bring together researchers working on both theoretical and practical aspects of rules in database systems, to examine the current state of the art, to explore relationships between different categories of rule systems, and to identify complementary areas for further development, as well as interesting applications.

The workshop was organized by the members of ACT-NET, a "Human Capital and Mobility" network of universities and research institutes funded by the European Union in order to foster collaboration on research in the area of active database systems. The network currently includes Aberdeen, Athens, Darmstadt, Heriot-Watt, Karlsruhe, Linkoping, Pais Vasco, Skovde, Versailles, and Zurich.

In response to the call for papers for RIDS '95, the program committee received 47 submissions indicating strong interest in the area. Each submission was reviewed by 3 members of the program committee, and comments were returned to the authors. After a thorough evaluation, 22 papers were selected for inclusion in the proceedings and presentation in the workshop. These papers covered several aspects, including:

Semantics for active database systems Active behaviour Rule base organization and modeling Rule analysis Deductive databases Implementation and benchmarking of active database systems Cooperative system support.

In addition, there were two panel discussions, one addressing the "The Active Database Management Systems Manifesto", which is an attempt to set the scene on what an active database management system should be, and a second one on implementation and application experiences.

We wish to express our appreciation to all the authors of submitted papers, to the program committee members and their referees, and to the organizers of the panels.

### Acknowledgments

We are indebted to the program committee members for their assistance in evaluating the 47 papers submitted. The committee consisted of:

- M. Bouzeghoub (Univ. de Versailles, France)
- A. Buchmann (TH Darmstadt, Germany)
- G. von Bueltzingsloewen (FZI, Germany)
- S. Chakravarthy (Univ. of Florida, USA)
- O. Diaz (Univ. del Pais Vasco, Spain)
- K.R. Dittrich (Univ. of Zurich, Switzerland)
- P.M.D. Gray (Univ. of Aberdeen, UK)
- H.V. Jagadish (AT&T Bell Laboratories, USA)
- M. Kersten (CWI, The Netherlands)
- M. Koubarakis (UMIST, UK)
- R. Manthey (Univ. of Bonn, Germany)
- N.W. Paton (Univ. of Manchester, UK)
- T. Risch (Linkoping Univ., Sweden)
- T. Sellis (Nat. Tech. Univ. of Athens, Greece)
- E. Simon (INRIA, France)
- J. Widom (Stanford Univ., USA)

We are also grateful to the following who helped with reviews: A. Ait-Braham (UMIST, UK), J. Barros (Univ. de Versailles, France), M. Berndtsson (Univ. of Skovde), B. Boss (FZI, Germany), S. Embury (Univ. of Aberdeen, UK), H. Fritschi (Univ. of Zurich, Switzerland), S. Gatziu (Univ. of Zurich, Switzerland), A. Geppert (Univ. of Zurich, Switzerland), U. Griefahn (Univ. of Bonn, Germany), A. Jaime (Univ. del Pais Vasco, Spain), Z. Kedad (Univ. de Versailles, France), M. Kradolfer (Univ. of Zurich, Switzerland), T. Kudrass (TH Darmstadt, Germany), G. Levreau (Univ. de Versailles, France), E. Metais (Univ. de Versailles, France), B. Rieche (Univ. of Zurich, Switzerland), and D. Tombros (Univ. of Zurich, Switzerland).

Finally, we would like to express our gratitude to the National Technical University of Athens for providing financial support to the workshop.

## Contents

The Active Database Management Systems Manifesto
The Active Database Management System Manifesto: A Rulebase of ADBMS Features
K.R. Dittrich, S. Gatziu and A. Geppert
Semantics for Active Database Systems
Formal Specification of Active Database Functionality: A Survey N.W. Paton, J. Campin, A.A.A. Fernandes, and M.H. Williams
Denotational Semantics for an Active Rule Execution Model T. Coupaye and Ch. Collet
Activity Specification Using Rendezvous Ch. Tawbi, G. Jaber and M. Dalmau51
Active Behaviour
Reactive Behaviour Support: Themes and Variations R. Fernández and O. Díaz69
Reasoning About the Behavior of Active Databases Applications O. Etzion
Extending a Functional DBPL with ECA-Rules S. Reddi, A. Poulovassilis and C. Small101
Rule Base Organization and Modeling
Rule Contexts in Active Databases - A Mechanism for Dynamic Rule Grouping M. Sköld, E. Falkenroth and T. Risch
Temporized and Localized Rule Sets R. Sturm, J.A. Mülle, and P.C. Lockemann
Design and Implementation of an Active Object-Oriented Database Supporting Construction of Database Tools I.S. Thomas and A.C. Jones
Rule Analysis
Improved Rule Analysis by Means of Triggering and Activation Graphs E. Baralis, S. Ceri and S. Paraboschi165
VITAL: A Visual Tool for Analysis of Rules Behaviour in Active Databases E. Benazet, H. Guehl and M. Bouzeghoub

A Visualization and Explanation Tool for Debugging ECA Rules in Active Databases S. Chakravarthy, Z. Tamizuddin and J. Zhou	
Deductive Databases	
Strategies for Parallel Linear Recursive Query Processing T. Zurek and P. Thanisch	213
Planning Complex Updates to Satisfy Constraint Rules Using a Constraint Logic Search Engine S.M. Embury and P.M.D. Gray	2
Constant Propagation Versus Join Reordering in Datalog M.P. Consens, A.O. Mendelzon, D. Vista and P.T. Wood	245
Compilation and Simplification of Temporal Integrity Constraints D. Plexousakis	260
Implementation and Benchmarking of Active Database Systems	
An Active Component for a Parallel Database Kernel <i>M.L. Kersten</i>	277
Using Delta Relations to Optimize Condition Evaluation in Active Databases E. Baralis and J. Widom	292
A Designer's Benchmark for Active Database Management Systems: 007 Meets the BEAST A. Geppert, S. Gatziu and K.R. Dittrich	309
Cooperative System Support	
Realization of Cooperative Agents Using an Active Object-Oriented Database Management System A. Geppert, M. Kradolfer and D. Tombros	377
Active Databases and Agent Systems - A Comparison J. Bailey, M. Georgeff, D.B. Kemp, D. Kinny and K. Ramamohanarao	
Recovering Active Databases O. Zukunft	
Author Index	373