ICEIS 2007

NINTH INTERNATIONAL CONFERENCE ON ENTERPRISE INFORMATION SYSTEMS

Proceedings

Databases and Information Systems Integration

FUNCHAL, PORTUGAL, June 12-16, 2007

SPONSORED BY

FCT - Fundação para a Ciência e Tecnologia

ORGANIZED BY

INSTICC

CO-ORGANIZED BY

University of Madeira

IN COOPERATION WITH

ACM/SIGMIS and AAAI

ICEIS 2007

Proceedings of the
Ninth International Conference on
Enterprise Information Systems

Volume DISI

Funchal, Madeira, Portugal

June 12 – 16, 2007

Co-organized by
INSTICC – Institute for Systems and Technologies of Information, Control and Communication
and
Universidade da Madeira

Sponsored by
FCT – Fundação para a Ciência e Tecnologia

In Cooperation with
ACM SIGMIS – Special Interest Group on Management Information Systems
AAAI – Association for the Advancement of Artificial Intelligence

Copyright © 2007 INSTICC – Institute for Systems and Technologies of Information, Control and Communication
All rights reserved

Edited by Jorge Cardoso, José Cordeiro and Joaquim Filipe

Printed in Portugal

ISBN: 978-972-8865-88-7

Depósito Legal: 258799/07

http://www.iceis.org

secretariat@iceis.org

BRIEF CONTENTS

INVITED SPEAKERS IV

SPECIAL SESSION CHAIRS V

ORGANIZING AND STEERING COMMITTEES VI

SENIOR PROGRAM COMMITTEE VII

PROGRAM COMMITTEE VIII

AUXILIARY REVIEWERS XII

SELECTED PAPERS BOOK XIV

SPONSOR XIV

FOREWORD XV

CONTENTS XVII

INVITED SPEAKERS

Amit Sheth

Kno.e.sis Center, Wright State University

USA

Wil van der Aalst

Eindhoven University of Technology

The Netherlands

Kurt Sandkuhl

Jönköping University

Sweden

Christoph Bussler

BEA Systems, Inc.

USA

Martin Curley

Intel Corporation

USA

K. Venkatesh Prasad

Ford Motor

USA

Larry Constantine

University of Madeira, Portugal and

Constantine & Lockwood Ltd., USA

SPECIAL SESSION CHAIRS

SPECIAL SESSION ON BUSINESS INTELLIGENCE, KNOWLEDGE MANAGEMENT AND KNOWLEDGE MANAGEMENT SYSTEMS

Aurora Vizcaíno, Escuela Superior de Informática Universidad de Castilla-La Mancha, Spain

Juan Pablo Soto, Escuela Superior de Informática Universidad de Castilla-La Mancha, Spain

Ezendu Ariwa, London Metropolitan University, U.K.

SPECIAL SESSION ON COMPUTER SUPPORTED COLLABORATIVE EDITING

Claudia Ignat, LORIA-INRIA Lorraine, France

Pascal Molli, LORIA- INRIA Lorraine, University Henri Poincaré, France

Hala Skaf-Molli, LORIA- INRIA Lorraine, University Henri Poincaré, France

SPECIAL SESSION ON APPLICATIONS IN A REAL WORLD

Wita Wojtkowski, Boise State University, USA

SPECIAL SESSION ON NEW INFORMATION SYSTEM AND APPROACHES FOR PRODUCT MAINTENANCE

Stéphanie Minel, LIPSI-ESTIA Biarritz, LAPS-Bordeaux University, France

Jérémy Legardeur, LIPSI-ESTIA Biarritz, LAPS-Bordeaux University, France

SPECIAL SESSION ON COMPARATIVE EVALUATION OF SEMANTIC WEB SERVICE FRAMEWORKS

Tiziana Margaria, Institute for Computer Science, University Potsdam, Germany

Ulrich Küster, Institute for Computer Science, Friedrich-Schiller-University Jena, Germany

ORGANIZING AND STEERING COMMITTEES

CONFERENCE CHAIR

Joaquim Filipe, Polytechnic Institute of Setúbal / INSTICC, Portugal

PROGRAM CO-CHAIRS

Jorge Cardoso, Universidade da Madeira, Madeira, Portugal

José Cordeiro, Polytechnic Institute of Setúbal / INSTICC, Portugal

LOCAL ARRANGEMENTS

Mónica Saramago, INSTICC, Portugal

PROCEEDINGS PRODUCTION

Andreia Costa, INSTICC, Portugal

Vítor Duarte, INSTICC, Portugal

Bruno Encarnação, INSTICC, Portugal

Luís Marques, INSTICC, Portugal

Vitor Pedrosa, INSTICC, Portugal

CD-ROM PRODUCTION

Paulo Brito, INSTICC, Portugal

WEBDESIGNER

Marina Carvalho, INSTICC, Portugal

GRAPHICS PRODUCTION

Helder Coelhas, INSTICC, Portugal

SECRETARIAT AND WEBMASTER

Vitor Pedrosa, INSTICC, Portugal

SENIOR PROGRAM COMMITTEE

Luís Amaral, University of Minho, Portugal

Peter Bøgh Andersen, University of Aarhus, Denmark

Senén Barro, University of Santiago de Compostela, Spain

Jean Bézivin, ATLAS Group (INRIA & IRIN), University of Nantes, France

Enrique Bonsón, University of Huelva, Spain

João Alvaro Carvalho, University of Minho, Portugal

Albert Cheng, University of Houston, USA

Bernard Coulette, University of Toulouse 2, France

Andrea De Lucia, Università di Salerno, Italy

Jan Dietz, Delft University of Technology, The Netherlands

Virginia Dignum, Utrecht University, The Netherlands

Schahram Dustdar, Technical University of Vienna, Austria

António Figueiredo, University of Coimbra, Portugal

Ulrich Frank, ICB - University of Essen, Germany

Nuno Guimarães, University of Lisbon, Portugal

Jatinder Gupta, The University of Alabama in Huntsville, USA

Erik Hollnagel, École des Mines de Paris, France

Dimitris Karagiannis, University of Vienna, Austria

Maurizio Lenzerini, University of Rome La Sapienza, Italy

Michel Leonard, University of Geneva, Switzerland

Kecheng Liu, The University of Reading, UK

Pericles Loucopoulos, The University of Manchester, UK

Paul Luker, Higher Education Academy, UK

Kalle Lyytinen, Case Western Reserve University, USA

Yannis Manolopoulos, Aristotle University of Thessaloniki, Greece

José Legatheaux Martins, Faculty of Sciences and Technology, New University of Lisbon, Portugal

Masao Johannes Matsumoto, Kyushu Sangyo University, Japan

Carmel McNaught, The Chinese University of Hong Kong, China

Luís Moniz Pereira, Universidade Nova de Lisboa, Portugal

George Papadopoulos, University of Cyprus, Cyprus

Marcin Paprzycki, SWPS and IBS PAN, USA

Alain Pirotte, University of Louvain, Belgium

Klaus Pohl, University of Duisburg-Essen, Germany and Lero, The Irish software Engineering Centre, Ireland/Germany

Matthias Rauterberg, Technical University Eindhoven, The Netherlands

Colette Rolland, University of PARIS-1, France

Narcyz Roztocki, State University of New York (SUNY) at New Paltz, USA

Abdel-Badeeh Salem, Ain Shams University, Egypt

Bernadette Sharp, Staffordshire University, UK

Timothy K. Shih, Tamkang University, Taiwan

Alexander Smirnov, St. Petersburg Institute for Informatics and Automation of Russian Academy of Sciences - SPIIRAS, Russia

Ronald Stamper, Staffordshire University, UK and University of Twente, NL, UK/The Netherlands

David Taniar, Monash University, Australia

Miguel Toro, University of Seville, Spain

Antonio Vallecillo, Universidad de Málaga, Spain

Michalis Vazirgiannis, Athens University of Economics & Business, Greece

François Vernadat, European Commission, Luxembourg

Ioannis Vlahavas, Aristotle University of Thessaloniki, Greece

Frank Wang, Cambridge-Cranfield High Performance Computing Facilities, UK

Merrill Warkentin, Mississippi State University, USA

Hans Weigand, Tilburg University, The Netherlands

Yoneo Yano, The University of Tokushima, Japan

Mohd Syazwan Abdullah, Universiti Utara Malaysia, Malaysia

PROGRAM COMMITTEE

Rama Akkiraju, IBM Research, USA

Patrick Albers, ESEO - Ecole Superieure d'Electronique de l'Ouest, France

Salah Al-Sharhan, Gulf University for Science and Technology, Kuwait

Andreas Andreou, University of Cyprus, Cyprus

Pedro Antunes, Faculty of Sciences, University of Lisboa, Portugal

Ezendu Ariwa, London Metropolitan University, UK

Juan Carlos Augusto, University of Ulster at Jordanstown, UK

Bart Baesens, University of Southampton, UK

Cecilia Baranauskas, UNICAMP - Universidade Estadual de Campinas, Brazil

Steve Barker, King's College London University, UK

Balbir Barn, Thames Valley University, UK

Daniela Barreiro Claro, Universidade Federal da Bahia, Brazil

Nick Bassiliades, Aristotle University of Thessaloniki, Greece

Remi Bastide, LIIHS-IRIT, France

Nadia Bellalem, University NANCY 2, France

Orlando Belo, University of Minho, Portugal

Hatem Ben Sta, Tunisia University, Tunisia

Sadok Ben Yahia, Faculty of Sciences of Tunis, Tunisia

Peter Bertok, RMIT University, Australia

Robert Biddle, Carleton University, Canada

Oliver Bittel, HTWG Konstanz - University of Applied Sciences, Germany

Luis Borges Gouveia, University Fernando Pessoa, Portugal

Djamel Bouchaffra, Oakland University, Michigan, USA

Danielle Boulanger, University of Lyon, France

Jean-Louis Boulanger, University of Technologie of Compiegne, France

José Ângelo Braga de Vasconcelos, Universidade Fernando Pessoa, Portugal

Sjaak Brinkkemper, Utrecht University, The Netherlands

Miguel Calejo, Declarativa, Portugal

Coral Calero, University of Castilla-La Mancha, Spain

Luis M. Camarinha-Matos, New University of Lisbon / Uninova, Portugal

Olivier Camp, Ecole Supérieure d'Electronique de l'Ouest, France

Fernando Carvalho, Universidade Federal do Ceará, Brazil

Malu Castellanos, HP Laboratories, USA

Jose Jesus Castro-Schez, Universidad de Castilla-La Mancha, Spain

Luca Cernuzzi, Universidad Católica, Paraguay

Maria Filomena Cerqueira de Castro Lopes, Universidade Portucalense Infante D. Henrique, Portugal

Laurent Chapelier, Fortis Banque Luxembourg, France

William Cheng-Chung Chu, TungHai University, Taiwan

Chrisment Claude, IRIT/SIG, France

Francesco Colace, Università degli Studi di Salerno, Italy

Cesar Collazos, Universidad del Cauca, Colombia

Jose Eduardo Corcoles, LoUISE Research Group Castilla-La Mancha University, Spain

Antonio Corral, University of Almeria, Spain

Julie Cowie, University of Stirling, UK

Sharon Cox, University of Central England, UK

Alfredo Cuzzocrea, University of Calabria, Italy

Mohamed Dahchour, Institut National des Postes et Télécommunications (INPT), Morocco

Sergio de Cesare, Brunel University, UK

Nuno de Magalhães Ribeiro, Centro de Estudos e Recursos Multimediáticos (CEREM), UFP, Portugal

Suash Deb, National Institute of Science & Technology, India

Vincenzo Deufemia, University of Salermo, Italy

PROGRAM COMMITTEE (CONT.)

Rajiv Dharaskar, Nagpur University, MIET, CSI, India

José Javier Dolado, University of the Basque Country, Spain

Alan Eardley, Staffordshire University, UK

Hans-Dieter Ehrich, Technische Universitaet Braunschweig, Germany

David Emery, Staffordshire University, UK

Jean-Max Estay, Université Catholique de l'Ouest, France

Yaniv Eytani, University of Illinois at Urbana-Champaign, USA

Antonio Fariña, University of A Coruña, Spain

Antonio Fernández-Caballero, Universidad de Castilla-La Mancha, Spain

Eduardo Fernández-Medina, University of Castilla-La Mancha, Spain

Edilson Ferneda, Universidade Católica de Brasília, Brazil

Paulo Ferreira, INESC-ID/IST - Tecnhical University of Lisbon, Portugal

Filomena Ferrucci, University of Salerno, Italy

Andre Flory, INSA, France

Donal Flynn, University of Manchester, UK

Ana Fred, IT - IST - Technical University of Lisbon, Portugal

Lixin Fu, University of Carolina, USA

Jose A. Gallud, University of Castilla-La Mancha, Spain

Juan Garbajosa, Universidad Politécnica de Madrid (UPM) - Technical University of Madrid, Spain

Aristogiannis Garmpis, Technological Educational Institution of Messolonghi, Greece

Leonardo Garrido, Monterrey Institute of Technology / Center for Intelligent Systems, Mexico

Marcela Genero, University of Castilla-La Mancha, Spain

Joseph Giampapa, Carnegie Mellon University, USA

Paolo Giorgini, University of Trento, Italy

Raúl Giráldez, Pablo de Olavide University of Seville, Spain

Pascual González, Universidad de Castilla-La Mancha, Spain

Gustavo Gonzalez-Sanchez, University of Girona, Spain

Robert Goodwin, Flinders University of South Australia, Australia

Jaap Gordijn, Vrije Universiteit Amsterdam, The Netherlands

Silvia Gordillo, LIFIA-UNLP, Argentina

Feliz Gouveia, University Fernando Pessoa / CEREM, Portugal

Virginie Govaere, INRS, France

Sven Groppe, University of Innsbruck, Austria

Rune Gustavsson, Blekinge Institute of Technology, Sweden

Sissel Guttormsen Schär, University of Bern, Switzerland

Beda Christoph Hammerschmidt, Oracle Corporation, USA

Thorsten Hampel, University of Paderborn, Germany

Christian Heinlein, University of Ulm, Germany

Ajantha Herath, Richard Stockton College of New Jersey, USA

Suvineetha Herath, Richard Stockton College of New Jersey, USA

Francisco Herrera, University of Granada, Spain

Colin Higgins, University of Nottingham, UK

Peter Higgins, Swinburne University of Technology, Australia

Jun Hong, Queen's University Belfast, UK

Nguyen Hong Quang, Institut de la Francophonie pour l'Informatique (IFI), Viet Nam

Jiankun Hu, RMIT University, Australia

Kaiyin Huang, South China Normal University, China

Patrick C. K. Hung, University of Ontario Institute of Technology (UOIT), Canada

Joshua Ignatius, Intelligent Insights International, Malaysia

Hamid Jahankhani, University of East London, UK

PROGRAM COMMITTEE (CONT.)

Arturo Jaime, Universidad del Pais Vasco, Spain

Ivan Jelinek, Czech Technical University in Prague, Czech Republic

Luis Jiménez Linares, UCLM, Spain

Paul Johannesson, Royal Institute of Technology, Sweden

Luis Joyanes, Universidad Pontificia de Salamanca, Spain

Nikos Karacapilidis, University of Patras, Greece

Nikitas Karanikolas, Technological Educational Institute of Athens (TEI-A), Greece

Stamatis Karnouskos, SAP Research, Germany

Hiroyuki Kawano, Nanzan University, Japan

Nicolas Kemper Valverde, Universidad Nacional Autónoma de México, Mexico

A. Rahman Khan, Intel Corporation, USA

John Krogstie, IDI, NTNU and SINTEF, Norway

Stan Kurkovsky, Central Connecticut State University, USA

Joaquín Lasheras, University of Murcia, Spain

James P. Lawler, Pace University, USA

Chul-Hwan Lee, University of Pittsburgh, USA

Alain Leger, France Telecom R&D, France

Carlos León de Mora, University of Sevilla, Spain

Joerg Leukel, University of Hohenheim, Germany

Hareton Leung, Hong Kong Polytechnic University, China

Therese Libourel, LIRMM, France

John Lim, National University of Singapore, Singapore

Selma Limam Mansar, Zayed University, UAE

ZongKai Lin, Chinese Academy of Sciences, China

Matti Linna, University of Vaasa, Finland

Jan Ljungberg, Gothenburg University, Sweden

Stephane Loiseau, LERIA, France

João Correia Lopes, University of Porto, Portugal

Víctor López-Jaquero, LoUISE Group, University of Castilla-La Mancha, Spain

María Dolores Lozano, University of Castilla-La Mancha, Spain

Miguel R. Luaces, Universidade da Coruña, Spain

Christopher Lueg, University of Tasmania, Australia

Mark Lycett, Brunel University, UK

Edmundo Madeira, UNICAMP - Universidade Estadual de Campinas, Brazil

Laurent Magnin, University of Montreal, Canada

Sam Makki, University of Toledo, USA

Mirko Malekovic, FOI - Zagreb University, Croatia

Nuno Mamede, IST / L2F of INESC-ID Lisboa, Portugal

João Bosco Mangueira Sobral, UFSC / CPGCC - Computer Science Pos-Graduate, Brazil

Esperanza Marcos, Universidad Rey Juan Carlos, Spain

Farhi Marir, London Metropolitan University, UK

Maria João Marques Martins, IST - Technical University of Lisbon, Portugal

Herve Martin, LSR-IMAG, France

Miguel Angel Martinez, University of Murcia, Spain

Johannes Mayer, University of Ulm, Germany

Andreas Meier, University of Fribourg, Switzerland

Emilia Mendes, The University of Auckland, New Zealand

Engelbert Mephu Nguifo, Université d'Artois - IUT de Lens, CRIL-CNRS, France

John Miller, University of Georgia, USA

Subhas Misra, Carleton University, Canada

Sudip Misra, Cornell University, USA

Michele Missikoff, IASI-CNR, Italy

Ghodrat Moghadampour, Vaasa University of Applied Sciences, Finland

Pascal Molli, LORIA, Université Henri Poincaré, Nancy 1, France

Francisco Montero, LoUISE Research Group. University of Castilla-La Mancha, Spain

Paula Morais, Universidade Portucalense, Portugal

Fernando Moreira, Universidade Portucalense, Portugal

PROGRAM COMMITTEE (CONT.)

Gianluca Moro, DEIS, University of Bologna, Italy

Haralambos Mouratidis, University of East London, UK

Nathalie Nathalie, Universidad de Málaga, Spain

Ana Neves, knowman - Consultadoria em Gestão, Lda, Portugal

Jose Angel Olivas, University of Castilla-La Mancha, Spain

Luis Olsina Santos, Universidad Nacional de La Pampa, Argentina

Peter Oriogun, London Metropolitan University, UK

José R. Paramá, University of A Coruña, Spain

João Pascoal Faria, FEUP - Faculty of Engineering of University of Porto, Portugal

Vicente Pelechano, Universidad Politécnica de Valencia, Spain

Maria Carmen Penadés Gramaje, Technical University of Valencia, Spain

Gabriel Pereira Lopes, Universidade Nova de Lisboa, Portugal

Laurent Péridy, IMA-UCO, France

Dana Petcu, Western University of Timisoara, Romania

Steef Peters, Vrije Universiteit Amsterdam, The Netherlands

Paolo Petta, Medical University of Vienna, Austrian Research Institute for Artificial Intelligence, Austria

José Pires, Escola Superior de Tecnologia e Gestão / IPB, Portugal

Geert Poels, Ghent University, Belgium

Abdul Razak Rahmat, University Utara Malaysia, Malaysia

Jolita Ralyte, University of Geneva, Switzerland

Pedro Ramos, ISCTE, Portugal

Hajo A. Reijers, Eindhoven University of Technology, The Netherlands

Ulrich Reimer, University of Applied Sciences St. Gallen, Switzerland

Marinette Revenu, Greyc Ensicaen, France

Yacine Rezgui, University of Salford, UK

Simon Richir, Presence & Innovation Lab. ENSAM Laval, France

Maria Rigou, University of Patras, Greece

Roland Ritsch, University of Applied Sciences St. Gallen, Switzerland

David Rivreau, Université Catholique de l'Ouest, France

Daniel Rodriguez, University of Alcalá, Spain

Pilar Rodriguez, Universidade Autónoma de Madrid, Spain

Jimena Rodriguez Arrieta, University of the Basque Country, Spain

Oscar M. Rodriguez-Elias, Universidad Autónoma de Baja California (UABC), Mexico

Jose Raul Romero, University of Cordoba, Spain

Agostinho Rosa, IST - Technical University of Lisbon, Portugal

Gustavo Rossi, LIFIA-UNLP, Argentina

Francisco Ruiz, University of Castilla-La Mancha, Spain

Roberto Ruiz, Pablo de Olavide University, Spain

Ángeles S. Places, University of A Coruña, Spain

Manuel Santos, Universidade do Minho, Portugal

Daniel Schang, ESEO, France

Mareike Schoop, University of Hohenheim, Germany

Isabel Seruca, Universidade Portucalense, Portugal

Hanifa Shah, Staffordshire University, UK

Jianhua Shao, Cardiff University, UK

Alberto Silva, INESC/IST - Technical University of Lisbon, Portugal

Maria João Silva Costa Ferreira, Universidade Portucalense, Portugal

Janice Sipior, Villanova University, USA

Spiros Sirmakessis, Technological Educational Institution of Messolongi, Greece

Hala Skaf-Molli, INRIA Lorraine - University Henri Ponicaré, France

Chantal Soule-Dupuy, University of Toulouse 1 - IRIT, France

Chris Stary, University of Linz, Austria

PROGRAM COMMITTEE (CONT.)

Janis Stirna, Jönköping University, Sweden

Vijayan Sugumaran, Oakland University, USA

Lily Sun, The University of Reading, UK

Ramayah T., Universiti Sains Malaysia, Malaysia

Sotirios Terzis, University of Strathclyde, UK

Philippe Thiran, University of Namur, Belgium

Claudine Toffolon, Université du Maine - LIUM, France

Robert Tolksdorf, Freie Universität Berlin, Germany

Ambrosio Toval, University of Murcia, Spain

Grigorios Tsoumakas, Aristotle University of Thessaloniki, Greece

Theodoros Tzouramanis, University of the Aegean, Greece

Gulden Uchyigit, Imperial College, UK

Athina Vakali, Aristotle University of Thessaloniki, Greece

Michael Vassilakopoulos, Technological Educational Institute of Thessaloniki, Greece

Christine Verdier, University Joseph Fourier Grenoble, France

Maria-Amparo Vila, University of Granada, Spain

Tuong Vinh Ho, Institut de la Francophonie pour l'Informatique (IFI), Viet Nam

Aurora Vizcaino, Escuela Superior de Informática, Spain

Bing Wang, University of Hull, UK

Hans Weghorn, University of Cooperative Education, Stuttgart, Germany

Gerhard Weiss, SCCH, Austria

Graham Winstanley, University of Brighton, UK

Claus Witfelt, ITU, Denmark

Wita Wojtkowski, Boise State University, USA

Robert Wrembel, Poznan University of Technology, Poland

Baowen Xu, Southeast University, China

Haiping Xu, University of Massachusetts Dartmouth, USA

Hongji Yang, De Montfort University, UK

Jasmine Yeap, Intelligent Insights International, Malaysia

Kokou Yetongnon, University of Bourgogne, France

Jun Zhang, SUN Yat-sen University, China

Liping Zhao, The University of Manchester, UK

Shuigeng Zhou, Fudan University, China

Ester Zumpano, University of Calabria, Italy

AUXILIARY REVIEWERS

Cesar Javier Acuña, Universidad Rey Juan Carlos, Spain

Pedro P. Alarcón, UPM, Madrid, Spain

Grigoris Antoniou, University of Crete, Greece

Jose Mª Cavero Barca, Universidad Rey Juan Carlos, Spain

Manuel Bollaín, UPM, Madrid, Spain

M. Boughanem, IRIT/SIG, France

João Paulo Caldeira, ISR/Politechnic Institute of Setubal, Portugal

Angélica Caro, University of Bio-Bio, Chile

Mª Valeria de Castro, Universidad Rey Juan Carlos, Spain

Isabel Nepomuceno Chamorro, University of Seville, Spain

Evandro de Barros Costa, UFAL, Brazil

Guillermo Covella, GIDIS_Web / Universidad Nacional de La Pampa, Argentina

David Benavides Cuevas, Universidad de Sevilla, Spain

Yuhui Deng, Cranfield University, UK

Vincenzo Deufemia, University of Salerno, Italy

AUXILIARY REVIEWERS (CONT.)

Norberto Diaz Diaz, University of Seville, Spain

Angelina Espinoza, UPM, Madrid, Spain

Jian Feng, QilinSoft (China) Ltd, China

Carlos Fernandes, IRS/Technical University of Lisbon, Portugal

Óscar Pedreira Fernández, University of A Coruña, Spain

Rita Francese, University of Salerno, Italy

Vittorio Fuccella, University of Salerno, Italy

Arantza Irastorza Goñi, Universidad del Pais Vasco, Spain

Carmine Gravino, University of Salerno, Italy

Na Helian, London Metropolitan University, UK

Mohamed Said El Hmam, LGI2A / University of Artois, France

Kaidong Huang, Century Securities, China

Geert Jonker, Utrecht University, The Netherlands

Ioannis Katakis, Aristotle University of Thessaloniki, Greece

Dimitrios Katsaros, University of Thessaly, Greece

Vasiliki Koutsonikola, Aristotle University, Greece

Marcelo Ladeira, UnB, Brazil

Elie Abiu Lahoud, University of Borgogne, France

Oriana Licchelli, ESEO, France

Mondher Maddouri, URPAH-INSAT, Tunis, Tunisia

Francisco Javier Lucas Martinez, University of Murcia, Spain

Sergio di Martino, University of Salerno, Italy

José P. Molina Massó, University of Castilla-La Mancha, Spain

Juan Manuel Vara Mesa, Universidad Rey Juan Carlos, Spain

Gabriele Monti, University of Bologna, DEIS Cesena, Italy

Mª Ángeles Moraga, University of Castilla-La Mancha, Spain

Diego Seco Naveiras, University of A Coruña, Spain

Antonio De Nicola, IASI-CNR, Italy

Joaquin Nicolas, University of Murcia, Spain

Germana Menezes da Nóbrega, UCB, Brazil

George Pallis, Aristotle University, Greece

Efi Papatheocharous, University of Cyprus, Cyprus

Ignazio Passero, University of Salerno, Italy

Hércules Antonio do Prado, Embrapa, Brazil

Ajith Ranabahu, University of Georgia, USA

Michele Risi, University of Salerno, Italy

Ilias Sakellariou, City College, Thessaloniki, Greece

Ivo José Garcia dos Santos, UNICAMP - University of Campinas, Brazil

K. Sauvagnat, IRIT/SIG, France

Giuseppe Scanniello, University of Basilicata, Italy

Joaquin Peña Siles, Universidad de Sevilla, Spain

Mehdi Snene, University of Geneva, Switzerland

Konstantinos Stamos, Aristotle University, Greece

Francesco Taglino, IASI-CNR, Italy

Guilaine Talens, University of Lyon, France

Rui Tavares, ISR/University of Evora, Portugal

Olivier Teste, IRIT/SIG, France

Jean-Marc Thevenin, University of Toulouse 1 and IRIT, France

Norbert Tsopze, CRIL / University of Artois, France

Sining Wu, Cranfield University, UK

Agustín Yagüe, UPM, Madrid, Spain

SELECTED PAPERS BOOK

A number of selected papers presented at ICEIS 2007 will be published by Springer, in a book entitled Enterprise Information Systems IX. This selection will be done by the conference Chair and program co-chairs, among the papers actually presented at the conference, based on a rigorous review by the ICEIS 2007 program committee members.

SPONSOR

FOREWORD

This volume contains the proceedings of the Ninth International Conference on Enterprise Information Systems (ICEIS 2007) organized by the Institute for Systems and Technologies of Information Control and Communication (INSTICC) and the University of Madeira, in collaboration with ACM/SIGMIS and AAAI. Furthermore, the conference was sponsored by the Portuguese Foundation for Science and Technology (FCT).

ICEIS has become a major point of contact between research scientists, engineers and practitioners in the area of business applications of information systems. This year, five simultaneous tracks were held, covering different aspects related to enterprise computing, including: "Databases and Information Systems Integration", "Artificial Intelligence and Decision Support Systems", "Information Systems Analysis and Specification", "Software Agents and Internet Computing" and "Human-Computer Interaction". All tracks describe research work that is often oriented towards real world applications and highlight the benefits of Information Systems and Technology for industry and services, thus making a bridge between the Academia and the Enterprise worlds.

Following the success of 2006, ICEIS 2007 also had a number of satellite workshops, related to the field of the conference. This year we collaborated in the organization of the following ten international workshops: 7th International Workshop on Pattern Recognition in Information Systems; 1st International Joint Workshop on Wireless Ubiquitous Computing; 5th International Workshop on Modelling, Simulation, Verification and Validation of Enterprise Information Systems; 5th International Workshop on Security In Information Systems; 4th International Workshop on Natural Language Processing and Cognitive Science; 4th International Workshop on Computer Supported Activity Coordination; 3rd International Workshop on Model-Driven Enterprise Information Systems; 1st International Joint Workshop on Technologies for Collaborative Business Processes and Management of Enterprise Information Systems; 1st International Workshop on RFID Technology - Concepts, Applications, Challenges and 1st International Workshop on Human Resource Information Systems.

This year, ICEIS 2007 received 644 paper submissions from more than 40 countries in all continents. 72 papers were published and presented as full papers, i.e. completed work (8 pages/30' oral presentation), 198 papers reflecting work-in-progress or position papers were accepted for short presentation, and another 131 contributions were scheduled for poster presentation.

These numbers, leading to a "full-paper" acceptance ratio below 12%, and a total acceptance ratio below 65%, show the intention of preserving a high quality forum for the next editions of this conference. Additionally, as usual in the ICEIS conference series, a number of invited talks, presented by internationally recognized specialists in different areas, have positively contributed to reinforce the overall quality of the Conference and to provide a deeper understanding of the Enterprise Information Systems field.

A book of Selected Papers will be published, following the conference, by Springer in the newly created series "Lecture Notes in Business Information Processing" (LNBIP). This series brings the

successful LNCS approach to areas such as business information systems, e-business, B2B integration, Enterprise applications and industrial software development.

The program for this conference required the dedicated effort of many people. Firstly, we must thank the authors, whose research and development efforts are recorded here. Secondly, we thank the members of the program committee and the additional reviewers for their diligence and expert reviewing. Thirdly, we thank the invited speakers for their invaluable contribution and for taking the time to synthesise and prepare their talks. Fourthly, we thank the workshop chairs and the special session chairs whose collaboration with ICEIS was much appreciated. Finally, special thanks to all the members of the local organising committee, especially Jorge Cardoso, whose collaboration was fundamental for the success of this conference.

This year, the organization will distribute two awards to papers presented at the conference: the best paper award and the best student paper award, mainly based on the classifications provided by the Program Committee members.

We wish you all an exciting conference and an unforgettable stay in the lovely island of Madeira. We hope to meet you again next year for the 10th ICEIS, to be held in Barcelona - Spain, details of which are available at http://www.iceis.org.

Joaquim Filipe

I.P.Setúbal/ INSTICC, Portugal

José Cordeiro

I.P.Setúbal/INSTICC, Portugal

Jorge Cardoso

Universidade da Madeira, Portugal

CONTENTS

INVITED SPEAKERS

KEYNOTE LECTURES

THE 4 X 4 SEMANTIC MODEL - Exploiting Data, Functional, Non-functional and Execution Semantics Across Business Process, Workflow, Partner Services and Middleware Services Tiers IS-5
Amit P. Sheth and Karthik Gomadam

TRENDS IN BUSINESS PROCESS ANALYSIS - From Verification to Process Mining IS-13
Wil M. P. van der Aalst

INFORMATION LOGISTICS IN NETWORKED ORGANISATIONS - Issues, Concepts and Applications IS-23
Kurt Sandkuhl

SERVICE-ORIENTED ARCHITECTURE - One Size Fits Nobody IS-31
Christoph Bussler

INTRODUCING AN IT CAPABILITY MATURITY FRAMEWORK IS-35
Martin Curley

DRIVING AHEAD: JOINT ENTERPRISE-EMBEDDED COMPUTING IN SMART CLOUDS, SMART DUST AND INTELLIGENT AUTOMOBILES IS-49
K. Venkatesh Prasad

ENTERPRISE INFORMATION SYSTEMS FOR USE: FROM BUSINESS PROCESSES TO HUMAN ACTIVITY IS-51
Larry Constantine

DATABASES AND INFORMATION SYSTEMS INTEGRATION

FULL PAPERS

STATISTICS API: DBMS-INDEPENDENT ACCESS AND MANAGEMENT OF DBMS STATISTICS IN HETEROGENEOUS ENVIRONMENTS
Tobias Kraft and Bernhard Mitschang 5

USING AN INDEX OF PRECOMPUTED JOINS IN ORDER TO SPEED UP SPARQL PROCESSING
Sven Groppe, Jinghua Groppe and Volker Linnemann 13

ONE-TO-MANY DATA TRANSFORMATION OPERATIONS - Optimization and Execution on an RDBMS
Paulo Carreira, Helena Galhardas, João Pereira and Andrzej Wichert 21

MONITORING WEB DATA SOURCES USING TEMPORAL PROPERTIES AS AN EXTERNAL RESOURCES OF A DATA WAREHOUSE
Francisco Araque, Alberto Salguero and Cecilia Delgado 28

TRANSFORMATION OF LEGACY BUSINESS SOFTWARE INTO CLIENT-SERVER ARCHITECTURES
Thomas Rauber and Gudula Rünger 36

A NEW ALGORITHM FOR TWIG PATTERN MATCHING
Yangjun Chen 44

XML SCHEMA STRUCTURAL EQUIVALENCE
Angela C. Duta, Ken Barker and Reda Alhajj 52

MODELING DIMENSIONS IN THE XDW MODEL - A LVM-Driven Approach
R. Rajugan, Elizabeth Chang and Tharam S. Dillon 60

INFORMATION SYSTEMS INTEGRATION DURING MERGERS - Integration Modes Typology and Integration Paths
Gérald Brunetto 71

A VIRTUALIZATION APPROACH FOR REUSING MIDDLEWARE ADAPTERS
Ralf Wagner and Bernhard Mitschang 78

XML INDEX COMPRESSION BY DTD SUBTRACTION
Stefan Böttcher, Rita Steinmetz and Niklas Klein 86

DYNAMIC COMMIT TREE MANAGEMENT FOR SERVICE ORIENTED ARCHITECTURES
Stefan Böttcher and Sebastian Obermeier 95

DETERMINING THE COSTS OF ERP IMPLEMENTATION
Rob J. Kusters, Fred J. Heemstra and Arjan Jonker 102

SHORT PAPERS

STAH-TREE: Hybrid Index for Spatio Temporal Aggregation
Marcin Gorawski and Michał Faruga 113

PREFERENCE RULES IN DATABASE QUERYING
Sergio Greco, Cristian Molinaro and Francesco Parisi 119

SIMPLIFIED QUERY CONSTRUCTION - Queries Made as Easy as Possible
Brad Arshinoff, Damon Ratcliffe, Martin Saetre, Reda Alhajj and Tansel Özyer 125

DISTRIBUTED APPROACH OF CONTINUOUS QUERIES WITH KNN JOIN PROCESSING IN SPATIAL DATA WAREHOUSE
Marcin Gorawski and Wojciech Gębczyk 131

ACTIVITY WAREHOUSE: DATA MANAGEMENT FOR BUSINESS ACTIVITY MONITORING
Oscar Mangisengi, Mario Pichler, Dagmar Auer, Dirk Draheim and Hildegard Rumetshofer 137

UNASSSUMING VIEW-SIZE ESTIMATION TECHNIQUES IN OLAP - An Experimental Comparison
Kamel Aouiche and Daniel Lemire 145

OLAP AGGREGATION FUNCTION FOR TEXTUAL DATA WAREHOUSE
Franck Ravat, Olivier Teste and Ronan Tournier 151

REVISITING THE OLAP INTERACTION TO COPE WITH SPATIAL DATA AND SPATIAL DATA ANALYSIS
Rosa Matias and João Moura-Pires 157

USING FUZZY DATACUBES IN THE STUDY OF TRADING STRATEGIES
M. Delgado Calvo-Flores, J. F. Nuñez Negrillo, E. Gibaja Galindo and C. Molina Fernández 164

PIN: A PARTITIONING & INDEXING OPTIMIZATION METHOD FOR OLAP
Ricardo Jorge Santos and Jorge Bernardino 170

FROM DATABASE TO DATAWAREHOUSE: A Design Quality Evaluation
Maurizio Pighin and Lucio Ieronutti 178

IMPLEMENTING SPATIAL DATAWAREHOUSE HIERARCHIES IN OBJECT-RELATIONAL DBMSs
Elzbieta Malinowski and Esteban Zimányi 186

A DOCUMENT REPOSITORY ARCHITECTURE FOR HETEROGENEOUS BUSINESS INFORMATION MANAGEMENT
Mohamed Mbarki, Chantal Soulé-Dupuy and Nathalie Vallès-Parlangeau 192

EXTRACTION AND TRANSFORMATION OF DATA FROM SEMI-STRUCTURED TEXT FILES USING A DECLARATIVE APPROACH
R. Raminhos and J. Moura-Pires 199

DIMENSION HIERARCHIES UPDATES IN DATA WAREHOUSES - A User-driven Approach
Cécile Favre, Fadila Bentayeb and Omar Boussaid 206

SECURE KNOWLEDGE EXCHANGE BY POLICY ALGEBRA AND ERML
Steve Barker and Paul Douglas 212

EXPOSING WORKFLOWS TO LOAD BURSTS
Dmytro Dyachuk and Ralph Deters 218

USING SEMANTIC WEB AND SERVICE ORIENTED TECHNOLOGIES TO BUILD LOOSELY COUPLED SYSTEMS: SWOAT – A Service and Semantic Web Oriented Architecture Technology
Bruno Caires and Jorge Cardoso 226

THE CONCEPTUAL FRAMEWORK FOR BUSINESS PROCESS INNOVATION: Towards a Research Program on Global Supply Chain Intelligence
Charles Møller 233

TRANSACTION SERVICE COMPOSITION - A Study of Compatibility Related Issues
Anna-Brith Arntsen and Randi Karlsen 239

MEDIATION FRAMEWORK FOR ENTERPRISE INFORMATION SYSTEM INFRASTRUCTURES: Application-driven Approach
Leonid Kalinichenko, Dmitry Briukhov, Dmitry Martynov, Nikolay Skvortsov and Sergey Stupnikov 246

A FRAMEWORK FOR SUPPORTING KNOWLEDGE WORK PROCESSES
Weidong Pan, Igor Hawryszkiewycz and Donghei Xue 252

A METHOD FOR EARLY CORRESPONDENCE DISCOVERY USING INSTANCE DATA
Indrakshi Ray and C. J. Michael Geisterfer 258

PROBLEMS WITH NON-OPEN DATA STANDARDS IN SWEDISH MUNICIPALS - When Integrating and Adopting Systems
Benneth Christiansson and Fredrik Svensson 264

CHANGE MANAGEMENT IN DATA INTEGRATION SYSTEMS
Rahee Ghurbhurn, Philippe Beaune and Hugues Solignac 268

RELEVANT VALUES: NEW METADATA TO PROVIDE INSIGHT ON ATTRIBUTE VALUES AT SCHEMA LEVEL
Sonia Bergamaschi, Mirko Orsini, Francesco Guerra and Claudio Sartori 274

LEGACY SYSTEM EVOLUTION – A Comparative Study of Modernisation and Replacement Initiation Factors
Irja Kankaanpää, Päivi Tühonen, Jarmo J. Ahonen, Jussi Koskinen, Tero Tilus and Henna Sivula 280

A XML-BASED QUALITY MODEL FOR WEB SERVICES CERTIFICATION
J. Jorge Dias Jr., J. Adson O. G. da Cunha, Alexandre Álvaro, Roberto S. M. de Barros and Sílvio Meira 288

AN INSERTION STRATEGY FOR A TWO-DIMENSIONAL SPATIAL ACCESS METHOD
Wendy Osborn and Ken Barker 295

PTSM: A PORTLET SELECTION MODEL
Mª Ángeles Moraga, Coral Calero, Mario Piattini and Oscar Díaz 301

KNOWLEDGE-MASHUPS AS NEXT GENERATION WEBBASED SYSTEMS - Converging Systems via Self-explaining Services
Thomas Bopp, Birger Kühnel, Thorsten Hampel, Christian Prpitsch and Frank Lützenkirchen 307

ON CORRECTNESS CRITERIA FOR WORKFLOW
Belinda M. Carter and Maria E. Orlowska 315

ENABLING CSCW SYSTEMS TO AUTOMATICALLY BIND EXTERNAL KNOWLEDGE BASES
Thomas Bopp, Jonas Schulte and Thorsten Hampel 323

WFESelector - A Tool for Comparing and Selecting Workflow Engines
Karim Baïna 330

INTEGRATING IDENTIFICATION CONSTRAINTS IN WEB ONTOLOGY
Thi Dieu Thu Nguyen and Nhan Le-Thanh 338

EXTENSIBLE METADATA REPOSITORY FOR INFORMATION SYSTEMS AND ENTERPRISE APPLICATIONS
Ricardo Ferreira and João Moura-Pires 344

AN EXTENSIBLE RULE TRANSFORMATION MODEL FOR XQUERY OPTIMIZATION - Rules Pattern for XQuery Tree Graph View
Nicolas Travers and Tuyêt Trâm Dang Ngoc 351

DQXSD: AN XML SCHEMA FOR DATA QUALITY - An XSD for Supporting Data Quality in XML
Eugenio Verbo, Ismael Caballero and Mario Piattini 359

ENTERPRISE INFORMATION SEARCH SYSTEMS FOR HETEROGENEOUS CONTENT REPOSITORIES
Trieu C. Chieu, Shyh-Kwei Chen and Shiwa S. Fu 365

EVIE - AN EVENT BROKERING LANGUAGE FOR THE COMPOSITION OF COLLABORATIVE BUSINESS PROCESSES
Tony O'Hagan, Shazia Sadiq and Wasim Sadiq 372

SEMANTIC ORCHESTRATION MERGING - Towards Composition of Overlapping Orchestrations
Clementine Nemo, Mireille Blay-Fornarino, Michel Riveill and Günter Kniesel 378

MAINTENANCE COST OF A SOFTWARE DESIGN: A Value-Based Approach
Daniel Cabrero, Javier Garzás and Mario Piattini 384

AN INFORMATION SYSTEMS AUDITOR'S PROFILE
Mariana Carroll and Alta van der Merwe 390

SOFTWARE COST ESTIMATION USING ARTIFICIAL NEURAL NETWORKS WITH INPUTS SELECTION
Efi Papatheocharous and Andreas Andreou 398

DOING THINGS RIGHT OR DOING THE RIGHT THINGS? Proposing a Documentation Scheme for Small to Medium Enterprises
Josephine Antoniou, Panagiotis Germanakos and Andreas S. Andreou 408

THE CHALLENGES FACING GLOBAL ERP SYSTEMS IMPLEMENTATIONS
Paul Hawking, Andrew Stein and Susan Foster 415

OOPUS - A Production Planning Information System to Assure High Delivery Reliability under Short-term Demand Changes and Production Disturbances
Wilhelm Dangelmaier, Tobias Rust, Thomas Hermanowski, Daniel Brüggemann, Daniel Kaschula, Andre Döring and Thorsten Timm 423

POSTERS

MODEL-DRIVEN DEVELOPMENT USING STANDARD TOOLS
Julián Garrido, Mª Ángeles Martos and Fernando Berzal 433

DEVELOPMENT OF AN ACCOUNTING SYSTEM - Applying the Incrementally Modular Abstraction Hierarchy to a Complex System
Kenji Ohmori and Tosiyasu L. Kunii 437

AN ORDER ALLOCATION MODEL IN VIRTUAL ENTERPRISES BASED ON INDUSTRIAL CLUSTERS
Fangqi Cheng, Feifan Ye and Jianguo Yang 445

A WEB TOOL FOR WEB DOCUMENT AND DATA SOURCE SELECTION WITH SQLFI
Marlene Goncalves and Leonid Tineo 449

A DATABASE INTEGRATION SYSTEM BASED ON GLOBAL VIEW GENERATION
Uchang Park and Ramon Lawrence 453

A KOREAN SEARCH PATTERN IN THE LIKE OPERATION
Sung Chul Park, Eun Hyang Lo, Jong Chul Park and Young Chul Park 457

ON THE SEMI-AUTOMATIC VALIDATION AND DECOMPOSITION OF TERNARY RELATIONSHIPS WITH OPTIONAL ELEMENTS
Ignacio-J. Santos, Paloma Martínez Fernandez and Dolores Cuadra 465

INDUCTION OF DATA QUALITY PROTOCOLS INTO BUSINESS PROCESS MANAGEMENT
Shazia Sadiq, Maria Orlowska and Wasim Sadiq 473

MODELING OF AN ANALYTICAL DATABASE SYSTEM
Alex Sandro Romeu de Souza Poletto and Jorge Rady Almeida Junior 477

USABILITY ISSUES IN SERVICE-ORIENTED ARCHITECTURE
Jaroslav Král and Michal Zemlicka 482

MULTIDIMENSIONAL VECTOR ROUTING IN A P2P NETWORK
Laurent Yeh, Georges Gardarin and Florin Dragan 486

THE HAV DATA INTEGRATION APPROACH: The Mapping in HAV
Fatima Boulçane 490

TIMING BEHAVIOR ANOMALY DETECTION IN ENTERPRISE INFORMATION SYSTEMS
Matthias Rohr, Simon Giesecke and Wilhelm Hasselbring 494

UNDERSTANDING THE DYNAMICS OF INFORMATION SYSTEMS
Abdelwahab Hamou-Lhadj 498

ONE-TO-MANY DATA TRANSFORMATIONS - As Relational Operations
Paulo Carreira 503

AN EXECUTIVE INFORMATION SYSTEM FOR SECURITIES BROKER'S RISK MANAGEMENT WITH DATA WAREHOUSING AND OLAP
Yung-Hsin Wang, Shing-Han Li and Kuo-Lung Sun 508

STRATEGIC FRAMEWORK TO IMPLEMENT A TELECOMMUNICATIONS BUSINESS INTELLIGENCE SOLUTION IN A DEVELOPING COUNTRY
D. P. du Plessis and T. McDonald 512

TOWARDS INDUSTRIAL SERVICE BUSINESS: Challenges in Designing ICT Support for the Networks of Companies
Sauli Hiippavuori, Markus Hänninen, Samuli Pekkola and Kari Luostarinen 516

MANAGING COMPLEX INFORMATION IN REACTIVE APPLICATIONS USING AN ACTIVE TEMPORAL XML DATABASE APPROACH
Essam Mansour, Kudakwashe Dube and Bing Wu 520

ORGANIZATIONAL ISSUES ON COOPETITIVE FEDERATED INFORMATION SYSTEMS
Mirko Cesarini and Mario Mezzanzanica 524

A DATABASE MANAGEMENT SYSTEM KERNEL FOR IMAGE COLLECTIONS
Liana Stanescu, Dumitru Burdescu, Cosmin Stoica and Marius Brezovan 530

INTEGRATING ENTERPRISE DATA FOR DECISION SUPPORT IN CONSTRUCTION ORGANISATIONS
Tanko Ishaya, James Chadband and Lucy Grierson 534

A NEW LOOK INTO DATA WAREHOUSE MODELLING
Nikolay Nikolov 540

A MULTI-VIEWS REPOSITORY FOR MULTI-STRUCTURED DOCUMENTS
Karim Djemal 544

INCENTIVES AND OBSTACLES IN IMPLEMENTING INTER-ORGANISATIONAL INTEROPERABILITY
Raija Halonen and Veikko Halonen 549

A FRAMEWORK FOR MODEL-DRIVEN PATTERN MATCHING
Ignacio García-Rodríguez de Guzmán, Macario Polo and Mario Piattini 553

A METRICS PROPOSAL TO EVALUATE SOFTWARE INTERNAL QUALITY WITH SCENARIOS
Anna Grimán, María Pérez, Maryoly Ortega and Luis Mendoza 558

A METHOD PROPOSAL FOR ARCHITECTURAL RELIABILITY EVALUATION
Anna Grimán, María Pérez, Luis E. Mendoza and Edumilis Méndez 564

TOURISM INFORMATION AGGREGATION USING AN ONTOLOGY BASED APPROACH
Miguel Gouveia and Jorge Cardoso 569

AN OVERVIEW OF THE OBJECT-ORIENTED DATABASE PROGRAMMING LANGUAGE DBPQL
Markus Kirchberg 573

A DATA WAREHOUSE ARCHITECTURE FOR INTEGRATING FIELD-BASED DATA
Alberto Salguero, Francisco Araque and Ramón Carrasco 577

TEXT ANALYTICS AND DATA ACCESS AS SERVICES - A Case Study in Transforming a Legacy Client-server Text Analytics Workbench and Framework to SOA
E. Michael Maximilien, Ying Chen, Ana Lelescu, James Rhodes, Jeffrey Kreulen and Scott Spangler 581

A CONTINUOUS DATA INTEGRATION METHODOLOGY FOR SUPPORTING REAL-TIME DATA WAREHOUSING
Ricardo Jorge Santos and Jorge Bernardino 589

SPECIAL SESSION ON NEW INFORMATION SYSTEM AND APPROACHES FOR PRODUCT MAINTENANCE

LOGISTICS TRACEABILITY FOR SUPPLY CHAIN IMPROVEMENT - Case Study of SMMART Project
Paulina Blaszkowska, Jana Pieriegud and Michal Wolanski 599

A POLICY-BASED PRIVACY STORAGE APPROACH
Julien Nowalczyk and Frédérique Tastet-Cherel 605

SUPPLY CHAIN IMPROVEMENT - Assessing Readiness for Change trough Collaboration Evaluation
Olivier Zephir, Emilie Chapotot, Stéphanie Minel and Benoît Roussel 609

ACTIVITY THEORY MODEL - Application in the Automotive Industry
Jon Aldazabal, Gaizka Ballesteros and Juan Antonio Martín 615

AUTHOR INDEX 621

A FRAMEWORK FOR MODEL-DRIVEN PATTERN MATCHING

Ignacio García-Rodríguez de Guzmán, Macario Polo and Mario Piattini
ALARCOS Research Group
Information Systems and Technologies Department
UCLM-Soluziona Research and Development Institute
University of Castilla-La Mancha
Paseo de la Universidad, 4 – 13071 Ciudad Real, Spain
{Ignacio.GRodriguez, Macario.Polo, Mario.Piattini}@uclm.es

Keywords: MDA, pattern-matching, QVT, transformation.

Abstract: Today, software technology is evolving to model engineering. Standards such as MOF and MDA and languages such as QVT and ATL are emerging to support this evolution from object paradigm to model engineering. At times, these standards and languages give rules and advices at a high level of abstraction, and concrete solutions and implementations are difficult to perform. As a consequence of this technological immaturity and the lack of documentation, many capabilities in this new field are not exploited. To this end, the authors in this paper propose a first step of providing a framework for performing *Model-Driven Pattern Matching* operations. Pattern matching based on models is an evolution of a traditional concept adapted to the model realm. In this respect, this kind of pattern matching seems to be promising not only for finding occurrences of given models in others, but also for giving meaning or sense to these patterns in order to undertake actions over the resulting matchings.

1 INTRODUCTION

Today, software engineering is going through a change of paradigm from object orientation to model driven development (Bézivin, 2006). Perhaps one of the reasons for this evolution is the growth of current platform complexities, which has evolved faster than the ability of general-purpose language to face it (Schmidt, 2006).

MDE brings many other standards such as MDA (OMG, 2003a), QVT (OMG, 2005a), UML2 (OMG, 2005b) among others.

One of the most ambitious bets is QVT, a model transformation language. QVT makes it possible to perform different kinds of operations over models such as query, transformation and views generation.

This paper focuses on QVT capabilities for performing pattern matching. QVT uses pattern matching to carry out most operations. Since both the pattern and the data are models, this pattern matching technique can be seen as a *Model-Driven Pattern Matching* (MDPEM from now on) process.

MDPEM has been conceived as an important element inside an MDA process intended to infer and to extract services from relational databases (García-Rodríguez de Guzmán et al., 2006a). In this process, MDPEM is also used to perform additional tasks over matchings.

This paper is organized as follows: Section 2 depicts the recent history of QVT; Section 3 describes the proposed framework using a working example; after the introduction of the approach, Section 4 outlines a possible use for matchings; Section 5 provides some conclusions and introduces future lines of work in this field.

2 STATE OF THE ART

Perhaps the soundest MDE-related technology is MDA (OMG, 2003a). Model transformation is an important part of MDA, and OMG proposes QVT to perform this operation.

OMG published the QVT RFP in 2002. In March 2003, the QVT-Partners published the "Initial submission for MOF 2.0 Query/Views/Transformations RFP" (OMG, 2003b).

In November 2003, QVT-Partners published the "Revised submission for MOF 2.0 Query / Views / Transformations RFP" (OMG, 2003c) (showing a more complete specification along with the declarative and imperative QVT´s languages). In November 2005, OMG published the "MOF QVT Final Adopted Specification" (OMG, 2005a).

On the other hand, up to now there is no available any QVT engine implementing the declarative QVT language. In order to solve this problem, some projects in the academic world (Queralt et al., 2006) are now underway.

3 MDPEM FRAMEWORK

3.1 An Overview to the Framework

This framework is used to provide information about: (1) where the patterns can be located in the MOF architecture; (2) how these patterns are represented; (3) the target model against which patterns are matched and (4) what the resulting matchings are and where they are located.

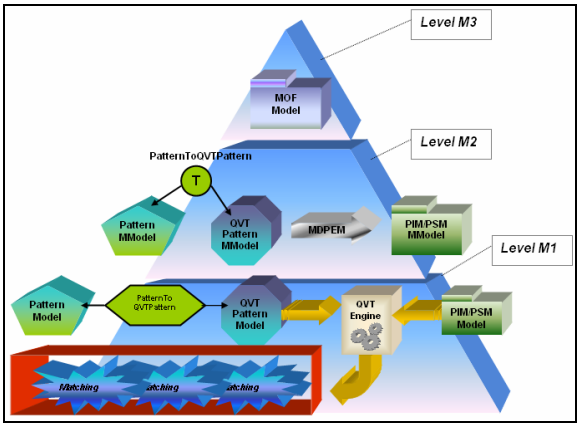

Figure 1: Generic framework for MDPEM.

Both patterns and models (against which patterns are matched) have their own metamodel. Thus *Level M2* (*MetaModel Level*) represents all these metamodels, as well as transformations among them to perform the MDPEM process.

Patterns, models and matchings make up a particular metamodel (from level 2). So *Level M1* level (*Model Level*) represents all the models involved in the MDPEM process.

3.2 Elements Involved in the Process

In order to make the framework clear, a description of all the elements is given:

- *Pattern MModel*: To generate valid patterns to do the MDPEM against a target model, a pattern metamodel is given together with the target metamodel. *Pattern Model* is the model actually describes the pattern to be found in the target model
- *QVT Pattern MModel*: QVT provides a metamodel (OMG, 2005a) to express any searching pattern (*template* in QVT terminology). The *QVT Pattern Model* is obtained applying the *PatternToQVTPattern* transformation over the *Pattern Model*.
- *PIM/PSM MModel*: This metamodel is used to represent the target model. *PIM/PSM Model* is actually the target model.
- *PatternToQVTPattern*: Because a *QVT Template* is required to perform the MDPEM process, a transformation between the pattern metamodel and the QVT template should be given for each pair <*pattern metamodel*, *QVT template*>. The transformation is defined in a metamodel level, but applied to models.
- *MDPEM*: represents that the QVT template metamodel is the basis to perform the MDPEM over the instance of the target model metamodel. The matching process is executed by a *QVT Engine*.
- *Matching*: Represents the result (if any) from the MDPEM execution using the specified *QVT template* over the given *target model*. These matchings are also models from the *target model*.

3.3 MDPEM Process

The MDPEM process is divided in the following steps:

1. Pattern model and target model are given.
2. QVT Template instance is obtained from Pattern Model.
3. MDPEM is carried out.
4. Matchings (sub-models) are returned to the invoker

According to (QVTP, 2003), "*The essential idea behind pattern matching is to allow the succinct*

expression of complex constraints on an input data type; data which matches the pattern is then picked out and returned to the invoker". In our context, the *pattern model specifies the complex constraints*, and the *target model* represents *the data*.

In addition to these elements (and according to the framework shown in Figure 1), another element is required to perform the MDPEM process: the transformation between the *pattern model* and the *QVT template*.

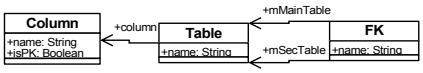

Figure 2: Very simple metamodel.

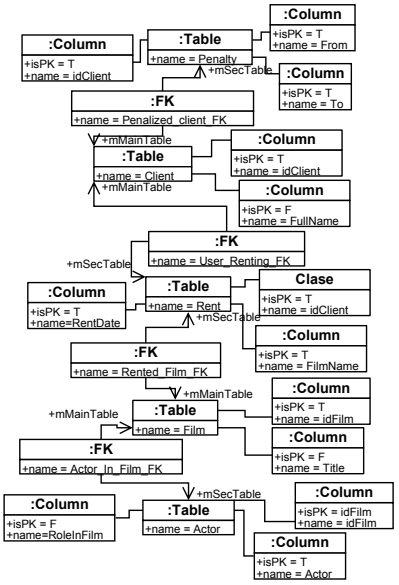

Figure 3: Working example.

As noted above, any model representing a searching pattern must be compatible in the context of the target model. Therefore, to specify a pattern, it may be useful to use the target model metamodel. Consequently, any pattern will be compatible with the target model and thus, MDPEM applicable. In this section, the process depicted in Section 3.3 will be explained using the working example of Figure 3. Both target model and pattern will conform to the metamodel in Figure 2.

3.3.1 Pattern Model and Target Model

As a first step in the MDPEM process, the definition of both the target model and the pattern is mandatory. Figure 3 contains the target model. This example represents a (very simple) database for a video store. This database keeps information about clients, films, rents, penalties and actors. This model conforms to the metamodel in Figure 2.

Once we have the target model, the pattern must be specified. Because the example in Figure 3 is a simple database, the pattern must specify the constraints in terms of tables, foreign keys, columns and so on. Figure 4 (a) represents the double foreign key pattern (DFK) (García-Rodríguez de Guzmán et al., 2006b). The DFK pattern relates three tables (*a*, *b* and M) by means of two foreign keys (fk_1 and fk_2). Figure 4 (b) represents the DFK pattern according to the metamodel in Figure 2.

3.3.2 QVT Template Generation for MDPEM Application

According to Figure 1, the pattern expressed in terms of the PIM/PSM metamodel is not the same as that used to perform the MDPEM. To this end, a *QVT Template* is obtained from the proposed pattern (Figure 4 (b)).

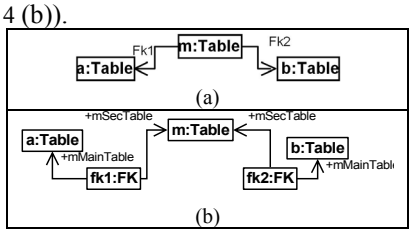

Figure 4: (a) DFK pattern and (b) Figure 2 metamodel-like representation.

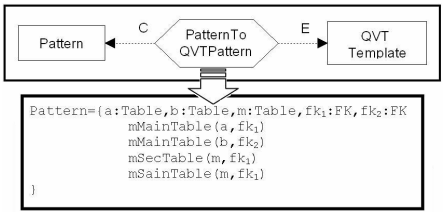

Figure 5: QVT template creation.

There are two ways to obtain a *QVT Template*: (1) manually or (2) automatically. The first may be complex depending largely on the complexity of the pattern metamodel and the size of the pattern. The second can be carried out implementing a suitable transformation to obtain *QVT Template* from the source pattern (see Figure 5).

Due to the lack of space, the *PatternToQVTPattern* transformation for a working example is not shown, but rather the *QVT Template* textual representation. Once the *PatternToQVTPattern* transformation is written, any

pattern conforming to the pattern metamodel can be transformed into the *QVT Template*.

This textual *QVT template* representation can be understood in the following way: "return all the matchings composed by three tables (*a*, *b* and *m*) and two foreign keys (fk_1 and fk_2). Those elements must hold the following conditions: *a* is related to fk_1, *b* is related to fk_2, *m* is related to fk_1 and *m* is related to fk_2".

In this pattern, the criteria to process the search are only based on the structure of the elements composing the pattern. In another situation, it may be useful to establish another kind of conditions.

3.3.3 MDPEM Application

Given the *QVT template* (representing the pattern) and the *target model* (Figure 3), the QVT engine looks for all the occurrences (matchings) of the template that exist in the model.

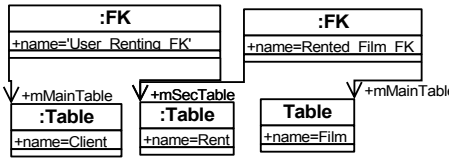

Figure 6: Matching obtained from the working example.

As a result, a set of sub-models from the target model, holding the constraints set by the pattern, are returned to the invoker.

Because all the matchings are "fragments" of the target model, all of them belong to the same level of the target model (Figure 1).

The only obtained matching (Figure 6) consists of a set of classes that hold the *a, b* and *c* tables and the foreign keys fk_1 and fk_2

4 PURPOSE OF MATCHINGS

Matchings may be useful when a particular purpose is bound to patterns. For example, a pattern such as DFK could be accompanied by abstract operations. Each *abstract operation* involves those tables included in the pattern, so, when a matching is found, this *abstract operation* can be applied to a real set of tables. The real result of this matching is a set of operations associated with the pattern.

The DFK pattern can be accompanied by the following operations: *getA_ForAGiven_B* (having B, obtain the associated A) and *getB_ForAGiven_A* (the opposite). The combination "*pattern+actions*" can be a powerful tool to deal with complex systems. Another possible use for MDPEM could also be the design pattern detection in large software systems, such as other authors do (Zhang et al., 2004).

5 CONCLUSIONS AND FUTURE WORK

In this paper, a framework for *Model-Driven Pattern Matching* has been presented. To perform MDPEM, both the pattern and target models must be known. To ensure compatibility among these models we propose using the metamodel of the target model (or at least a subset) to build the pattern. Thus any given pattern can be used to find matchings in a given target model.

Because each pattern must be translated into a *QVT Template*, a suitable transformation must be developed. An excerpt of a transformation to obtain *QVT Templates* from our patterns is presented.

ACKNOWLEDGEMENTS

This work has been partially supported by the ENIGMAS Project (PIB-05-058), the FAMOSO Project (2006: FIT-340000-2006-67); and the MECENAS project (PBI06-0024).

REFERENCES

Bézivin, J. (2006). Introduction to Model Engineering, ATLAS Group (INRIA & LINA), Nantes.

García-Rodríguez de Guzmán, I., M. Polo and M. Piattini (2006a). A Methodology for Database Reengineering to Web Services. European Conference on Model Driven Architecture - Foundations and Applications, Bilbao (Spain), Springer-Verlag Berlin Heidelberg.

García-Rodríguez de Guzmán, I., M. Polo and M. Piattini (2006b). Un primer paso para la obtención de servicios en bases de datos relacionales mediante patrones y MDA. ZOCO: Desarrollo y Mantenimiento Ágil de Aplicaciones Basadas en Servicios Web, Sitges (Barcelona).

OMG (2003a). MDA Guide Version 1.0.1., Object Management Group**:** 62.

OMG (2003b). QVT-Partners initial submission to qvt-rfp, Object Management Group.

OMG (2003c). Revised submission for MOF 2.0 Query/Views/Transformations RFP, Object Management Group.

OMG (2005a). MOF QVT Final Adopted Specification, Object Management Group.

OMG (2005b). Unified Modeling Language: Superstructure. Versión 2.0.

Queralt, P., L. Hoyos, A. Boronat, J. Á. Carsí and I. Ramos (2006). Un Motor de Transformación de Modelos con soporte para el Lenguaje QVT Relations. Desarrollo del Software Dirigida por Modelos y Aplicaciones 2006 (DSDM´06), Sitges, Barcelona (Spain).

QVTP (2003). Revised submission for MOF 2.0 Query / Views /Transformations RFP (Version 1.1), QVT-Partners (http://qvtp.org/).

Schmidt, D. C. (2006). "Model-Driven Engineering." IEEE Computer 39(2): 25-31.

Zhang, Z. and Q. Li (2004). Automated Detection of Design Patterns. Grid and Cooperative Computing, Springer Berlin / Heidelberg**:** pp 694-697.

Proceedings of the
9th International Conference on Enterprise Information Systems - ICEIS 2007
ISBN: 978-972-8865-88-7
http://www.iceis.org