

Editor-in-Chief

A. Joe Turner, Seneca, SC, USA

Editorial Board

Foundations of Computer Science

Mike Hinchey, Lero, Limerick, Ireland

Software: Theory and Practice

Bertrand Meyer, ETH Zurich, Switzerland

Education

Bernard Cornu, CNED-EIFAD, Poitiers, France

Information Technology Applications

Ronald Waxman, EDA Standards Consulting, Beachwood, OH, USA

Communication Systems

Guy Leduc, Université de Liège, Belgium

System Modeling and Optimization

Jacques Henry, Université de Bordeaux, France

Information Systems

Barbara Pernici, Politecnico di Milano, Italy

Relationship between Computers and Society

Chrisanthi Avgerou, London School of Economics, UK

Computer Systems Technology

Paolo Prinetto, Politecnico di Torino, Italy

Security and Privacy Protection in Information Processing Systems

Kai Rannenberg, Goethe University Frankfurt, Germany

Artificial Intelligence

Max A. Bramer, University of Portsmouth, UK

Human-Computer Interaction

Annelise Mark Pejtersen, Center of Cognitive Systems Engineering, Denmark

Entertainment Computing

Ryohei Nakatsu, National University of Singapore

IFIP – The International Federation for Information Processing

IFIP was founded in 1960 under the auspices of UNESCO, following the First World Computer Congress held in Paris the previous year. An umbrella organization for societies working in information processing, IFIP's aim is two-fold: to support information processing within its member countries and to encourage technology transfer to developing nations. As its mission statement clearly states,

IFIP's mission is to be the leading, truly international, apolitical organization which encourages and assists in the development, exploitation and application of information technology for the benefit of all people.

IFIP is a non-profitmaking organization, run almost solely by 2500 volunteers. It operates through a number of technical committees, which organize events and publications. IFIP's events range from an international congress to local seminars, but the most important are:

- The IFIP World Computer Congress, held every second year;
- Open conferences;
- Working conferences.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is small and by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is less rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

Any national society whose primary activity is in information may apply to become a full member of IFIP, although full membership is restricted to one society per country. Full members are entitled to vote at the annual General Assembly, National societies preferring a less committed involvement may apply for associate or corresponding membership. Associate members enjoy the same benefits as full members, but without voting rights. Corresponding members are not represented in IFIP bodies. Affiliated membership is open to non-national societies, and individual and honorary membership schemes are also offered.

Peter Bernus Guy Doumeingts Mark Fox (Eds.)

Enterprise Architecture, Integration and Interoperability

IFIP TC 5 International Conference, EAI2N 2010
Held as Part of WCC 2010
Brisbane, Australia, September 20-23, 2010
Proceedings



Springer

Volume Editors

Peter Bernus
Griffith University
Nathan, QLD 4111, Australia
E-mail: p.bernum@griffith.edu.au

Guy Doumeingts
University of Bordeaux 1, LAPS
33405 Talence, France
and INTEROP-VLab, Belgium
E-mail: gdoumeingts@gfi.fr

Mark Fox
Novator Systems Ltd.
Toronto, ON M5V 3P8, Canada
E-mail: mfox@novator.com

Library of Congress Control Number: 2010933124

CR Subject Classification (1998): C.2, H.3, H.4, H.2.8, H.2, D.2

ISSN 1868-4238
ISBN-10 3-642-15508-1 Springer Berlin Heidelberg New York
ISBN-13 978-3-642-15508-6 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

© IFIP International Federation for Information Processing 2010
Printed in Germany

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

IFIP World Computer Congress 2010

(WCC 2010)

Message from the Chairs

Every two years, the International Federation for Information Processing (IFIP) hosts a major event which showcases the scientific endeavors of its over one hundred technical committees and working groups. On the occasion of IFIP's 50th anniversary, 2010 saw the 21st IFIP World Computer Congress (WCC 2010) take place in Australia for the third time, at the Brisbane Convention and Exhibition Centre, Brisbane, Queensland, September 20–23, 2010.

The congress was hosted by the Australian Computer Society, ACS. It was run as a federation of co-located conferences offered by the different IFIP technical committees, working groups and special interest groups, under the coordination of the International Program Committee.

The event was larger than ever before, consisting of 17 parallel conferences, focusing on topics ranging from artificial intelligence to entertainment computing, human choice and computers, security, networks of the future and theoretical computer science. The conference History of Computing was a valuable contribution to IFIPs 50th anniversary, as it specifically addressed IT developments during those years. The conference e-Health was organized jointly with the International Medical Informatics Association (IMIA), which evolved from IFIP Technical Committee TC-4 "Medical Informatics".

Some of these were established conferences that run at regular intervals, e.g., annually, and some represented new, groundbreaking areas of computing. Each conference had a call for papers, an International Program Committee of experts and a thorough peer reviewing process of full papers. The congress received 642 papers for the 17 conferences, and selected 319 from those, representing an acceptance rate of 49.69% (averaged over all conferences). To support interoperation between events, conferences were grouped into 8 areas: Deliver IT, Govern IT, Learn IT, Play IT, Sustain IT, Treat IT, Trust IT, and Value IT.

This volume is one of 13 volumes associated with the 17 scientific conferences. Each volume covers a specific topic and separately or together they form a valuable record of the state of computing research in the world in 2010. Each volume was prepared for publication in the Springer IFIP Advances in Information and Communication Technology series by the conference's volume editors. The overall Publications Chair for all volumes published for this congress is Mike Hinchey.

For full details of the World Computer Congress, please refer to the webpage at <http://www.ifip.org>.

June 2010 Augusto Casaca, Portugal, Chair, International Program Committee
Phillip Nyssen, Australia, Co-chair, International Program Committee
 Nick Tate, Australia, Chair, Organizing Committee
 Mike Hinchey, Ireland, Publications Chair
 Klaus Brunnstein, Germany, General Congress Chair

Preface

Enterprise Architecture, Integration, and Interoperability and the Networked enterprise have become the theme of many conferences in the past few years. These conferences were organised by IFIP TC5 with the support of its two working groups: WG 5.12 (Architectures for Enterprise Integration) and WG 5.8 (Enterprise Interoperability), both concerned with aspects of the topic: how is it possible to architect and implement businesses that are flexible and able to change, to interact, and use one another's services in a dynamic manner for the purpose of (joint) value creation. The original question of enterprise integration in the 1980s was: how can we achieve and integrate information and material flow in the enterprise? Various methods and reference models were developed or proposed – ranging from tightly integrated monolithic system architectures, through cell-based manufacturing to on-demand interconnection of businesses to form virtual enterprises in response to market opportunities.

Two camps have emerged in the endeavour to achieve the same goal, namely, to achieve interoperability between businesses (whereupon interoperability is the ability to exchange information in order to use one another's services or to jointly implement a service).

One school of researchers addresses the technical aspects of creating dynamic (and static) interconnections between disparate businesses (or parts thereof). Techniques and underlying theories include the use of information and process modelling, artificial intelligence methods, such as semantic modelling (ontological theories, Semantic Web technologies), intelligent agents for implementing service brokering, Web service technologies to create (supposedly) simple ways of exposing and using services, but also low-level implementation standards (such as XML as a standard syntax for data exchange), etc.

While the above techniques have been maturing, it has also been realised that the solution to the dynamic creation of businesses needs more than just technical elements, and this realisation created another school of thought. Technology provides the opportunity for businesses to work together and to produce value in ways not previously possible, but another necessary condition of success is the creation of economic environments that foster the development of the readiness in enterprises to cooperate and collaborate. These non-technical requirements range from the necessity to develop legislations, industry policies and standards, the creation of an organisational backdrop, such as inclusive industry groups that can help companies to engage with the opportunities brought about by technology. Furthermore, it is not obvious how the interest of the economy as a whole and the interest of powerful companies can be reconciled in this respect. The requirement to create an economic environment that fosters cooperative and collaborative enterprising is most acute in the realm of small and medium-sized enterprises.

Another view of the split in viewpoints and approaches is as follows:

1. Systems that are highly integrated where one can take a holistic approach to system design, e.g., manufacturing and supply chain, where EA methods can be more readily applied, and systems where the holistic approach cannot be applied, e.g., where the motivation to be tightly integrated does not exist.

2. Systems where sharing of data is very important, hence the adoption of interoperability standards is necessitated in order to survive—probably true of many aspects of engineering: CAD, CAE, etc., versus other domains where standards, e.g., ontologies, have not adopted and there is no catalyst to do so, e.g., eCommerce.

While these two major thrusts of interoperability research developed, Enterprise Architecture (EA), which can be considered an applied systems engineering field where the enterprise (or a network of enterprises) is the ‘system,’ developed methods to address the complexity of enterprise engineering. These methods, however, are usually only used by large companies and government agencies, and in addition have only been utilised extensively in two areas: the creation of manufacturing enterprises (but much less frequently for the dynamic creation of virtual manufacturing enterprises), and for the creation (or change) of the IT architecture that supports conventional enterprises (in private business and in government).

Possibly, treating enterprises as being at one end or the other of a spectrum between self-designing and self-evolving systems (from deliberate to spontaneous) is a way to reconcile (and combine) the methods developed by various segments of this research community.

Furthermore, while the practice of EA has become commonplace in the portfolio of IT management, and in some industrial cultures in the portfolio of manufacturing management, EA practice has not spread much to other portfolios, nor has it been extended to higher levels of management, such as to the CEO or the Board.

Today, there is a growing feeling among EA researchers and practitioners that EA methods would be able to close the still existing gap between strategy making and the implementation of the strategy, and that the next generation of EA methods and tools should ensure that they are well understood by top-level management as well as are demonstrably able to respond to their concerns. The problem is similar to the one faced by interoperability researchers: there are technical as well as cultural barriers to overcome.

In conclusion of this debate we underline the philosophy of the Network of Excellence, INTEROP-NoE (Interoperability Research for Networked Enterprise Applications and Software, a Network of Excellence supported by European Commission 2004-2007, FP6 508011, 42 months, 50 partners, 6,5 M€ EC funds), INTEROP NoE try to reconcile the two previous schools by defining interoperability as the ability of an Enterprise to interact with other Enterprises not only from an information technology point of view but also from an organisational and semantic point of view. This interaction must be flexible and developed at an acceptably low cost. Interoperability is considered as significant if the interactions can take place at least on four different levels: Data, Services, Processes and Systems, with a semantics defined in a given business context.

Papers in this volume address several of the problems listed above and have been organised into two parts: papers in Part 1 are about the future of enterprise architecture and papers in Part 2 address questions of interoperability.

Papers were double blind refereed by members of the International Program Committee and we are grateful for all who helped in this process.

July 2010

Peter Bernus
Guy Doumeingts
Mark Fox

Organization

Program Committee Chairs

Asia-Pacific

Peter Bernus Griffith University, Australia

Europe

Americas

Mark Fox University of Toronto, Canada

International Steering Committee

Peter Bernus	Griffith University, Australia
Guy Doumeingts	INTEROP-VLab, B and University of Bordeaux, France
Yves Ducq	University of Bordeaux France
Nenad Filipovic	IEDC, SI
Mark Fox	Novator and University of Toronto, Canada
Ted Goranson	Earl Research, USA
John Gotze	CPH Bus School, Demark
Michael Gruninger	University Toronto, Canada
Roland Jochem	IIS, University of Kassel, Germany
Pontus Johnson	KTH, S
Brane Kalpic	ATK and IEDC, SI
Stephan Kassel	University of Zwickau, Germany
Bernhard Katzy Cetim	University Munich, Germany
Kurt Kosanke	CIMOSA, Germany
Gyorgy Kovacs Sztaki	Hungary
Lea Kutvonen	University of Helsinki, Finland
Richard Martin	Tinwistle, USA
Kai Mertins	IPK, Germany
Arturo Molina	TEC Monterrey, Mexico
Laszlo Nemes	Nemes Cons, Australia
Ovidiu Noran	Griffith University, Australia
Hervé Panetto	University of Nancy, France
David Romero	Tec Monterrey, Mexico

XII Organization

Pallab Saha	NUS, Singapore
Gunter Schmidt	University Saarland, Germany
Pat Turner	ASPL, Australia
Marten van Sinderen	University of Twente, The Netherlands
Francois Vernadat	ECA, EU (LX)
Jakob Vlietsra	USA
Georg Weichhart	University of Linz, Austria
Robert Weisman	Buildthevision, Canada
Richard Weston	Loughborough University, UK
Xu Xiaofei	HIT, PRC
Djamal Zeghlache	Telecom SudParis, France
Martin Zelm	CIMOSA, Germany

Local Organizing Committee

Peter Bernus	Griffith University, Australia
Patrick Turner	ASPL, Australia (Chair)
Ovidiu Noran	Griffith University, Australia
Mark Hudson	CITEC, Australia
Jane Baldock	QLD Health, Australia

Program Committee Members

(Members of IFIP WG5.12 and 5.8)

P. Assogna, Italy	G. Doumeingts, France
A. D'Atri, Italy	N. Dowler, UK
M. Avram, Romania	Y. Ducq, France
S. Banerjee, UK	J. Edwards, UK
S. Bansal, SG	F.G. Fadel, Canada
L. Basanez, Spain	I. Fan, UK
P. Bernus, Australia	F. Farinha, Portugal
J. Brosvic, USA	J. Favrel, France
J. Browne, Ireland	L. Fernandez, Spain
C.J. Bussler, USA	C. Fichtenbauer, Austria
R. Chalmeta, Spain	F. Filip, Romania
V. Chapurlat, France	T. Fischer, Germany
Y. Chen, China	M. Fox, Canada
D. Chen, France	Y. Fukuda, Japan
I. Cruz, USA	M. Garetti, Italy
P. Davidsson, Sweden	P. Ghodous, France
P. De Sabbata, Italy	R. Goncalves , Portugal
Z. Deng, Norway	T. Goranson, USA
T. Dimitrakos, UK	M. Gruninger, USA
A. Dolgui, France	B. Guthridge, USA

- G. Haidegger, Hungary
K. Halpin, Ireland
Z. Han, China
P. Heymans, Belgium
R. Hutter, Germany
J. Huysentruyt, Belgium
A. Inamoto, Japan
M. Jarke, Germany
M. Jeusfeld, The Netherlands
R. Jochem, Germany
P. Johnson, S
J. José Pinto Ferreira, Portugal
L. Kalinichenko, Russia
B. Kalpic, SI
S. Kassel, Germany
A. Kokossis, UK
P. Kopacek, Austria
K. Kosanke, Germany
I. Kotsopoulos, Greece
G.L. Kovacs, Hungary
L. Kutvonen, Finland
U. Lechner, Germany
C. Leong Ang, SG
H. Li, USA
R. Meersman, Belgium
K. Mertins, Germany
A. Molina, Mexico
A. Molina Gutierrez, Mexico
H.J. Molstand, Denmark
J. Müller, Germany
J. Mylopoulos, Canada
K. Naujok, Germany
L. Nemes, Australia
C. Nikolaou, Greece
R. Nikolov, Belgium
L. Obrst, USA
- A. Opdahl, Norway
A. Ortiz, Spain
P. Oude Luttighuis, The Netherlands
A. Pardasani, Canada
J. Paulo Almeida, The Netherlands
H. Pingaud, France
R. Poler, Spain
S. Psonis, Greece
D. McRandall, UK
S. Rehm, Germany
C. Rolland, France
N. Rozsenich, Austria
K. Sandkuhl, Sweden
G. Schmidt, Germany
P. Schobbens, Belgium
Y. Shibata, Japan
D. Shorter, UK
R. Sommar, Sweden
T. Tan, China
X. Tang, China
B. Vallespir, France
M. van Sinderen, The Netherlands
F. Vernadat, France
J. Vesterager, Denmark
C. di Vittorio, Italy
L. Vlacic, Australia
J. Vlietstra, USA
G. Weichhart, Austria
R.H. Weston, UK
T.J. Williams, USA
N. Wognum, The Netherlands
B. Wood, UK
H. Wortmann, The Netherlands
X. Xu, PRC
C. Zhao, China
I. Zugasti, Spain

Table of Contents

Architecting the Firm – Coherency and Consistency in Managing the Enterprise..... <i>Patrick Turner, John Götze, and Peter Bernus</i>	1
Defining Leadership as Process Reference Model: Translating Organizational Goals into Practice Using a Structured Leadership Approach	11
<i>David Tuffley</i>	
Valuation of Procurement Flexibility in the Machinery and Equipment Industry Using the Real Option Approach	21
<i>Alexander Kleinert and Volker Stich</i>	
Business Capabilities Centric Enterprise Architecture	32
<i>Thiago Barroero, Gianmario Motta, and Giovanni Pignatelli</i>	
An Enterprise Architecture Approach towards Environmental Management	44
<i>Ovidiu Noran</i>	
A Metamodel for Enterprise Architecture	56
<i>Peter Bernus and Ovidiu Noran</i>	
Communication as a Crucial Element for Enterprise Architecture Management in Virtual Organization	66
<i>Taivo Kangilaski</i>	
Semantic Harmonization for Seamless Networked Supply Chain Planning in the Future of Internet	78
<i>Ricardo Jardim-Goncalves, Joao Sarraipa, and Adolfo Steiger-Garcia</i>	
Learning Interoperability in Emerging Supply Networks.....	90
<i>Georg Weichhart, Matthias Neubauer, and Christian Stary</i>	
Research on Quality of Transaction Standards: The Maturity of a Research Topic	101
<i>Erwin Folmer, Wouter Berends, Paul Oude Luttighuis, Jos van Hillegersberg, and Rutger Lammers</i>	
Digital Business Ecosystem Tools as Interoperability Drivers	116
<i>Miklós Herdon, Mária Raffai, Ádám Péntek, and Tünde Rózsa</i>	
XML in Enterprise Systems: Its Roles and Benefits	128
<i>Jaroslav Pokorný</i>	

XVI Table of Contents

Software Interoperability Tools: Standardized Capability-Profilng Methodology ISO16100	140
<i>Michiko Matsuda and Qian Wang</i>	
Value Added by Interoperable Information Systems in Spread Production Networks	152
<i>Dirk Oedekoven, Volker Stich, and Bojan Stah</i>	
Pragmatic Interoperability: A Systematic Review of Published Definitions	164
<i>Camlon H. Asuncion and Marten J. van Sinderen</i>	
Author Index	177