

Editor-in-Chief

A. Joe Turner, Seneca, SC, USA

Editorial Board

Foundations of Computer Science

Mike Hinchey, Lero, Limerick, Ireland

Software: Theory and Practice

Michael Goedicke, University of Duisburg-Essen, Germany

Education

Arthur Tatnall, Victoria University, Melbourne, Australia

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

Jan Pries-Heje, Roskilde University, Denmark

ICT and Society

Jackie Phahlamohlaka, CSIR, Pretoria, South Africa

Computer Systems Technology

Paolo Prinetto, Politecnico di Torino, Italy

Security and Privacy Protection in Information Processing Systems

Kai Rannenber, Goethe University Frankfurt, Germany

Artificial Intelligence

Tharam Dillon, Curtin University, Bentley, Australia

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 also 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 about information processing 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.

Louis Rivest Abdelaziz Bouras
Borhen Louhichi (Eds.)

Product Lifecycle Management

Towards Knowledge-Rich Enterprises

IFIP WG 5.1 International Conference, PLM 2012
Montreal, QC, Canada, July 9-11, 2012
Revised Selected Papers



Springer

Volume Editors

Louis Rivest
Borhen Louhichi
École de Technologie Supérieure
Department of Automated Production Engineering
1100 Notre-Dame West, Montreal, QC H3C 1K3, Canada
E-mail: {louis.rivest, borhen.louhichi}@etsmtl.ca

Abdelaziz Bouras
Université Lumière Lyon 2
Laboratoire DISP, IUT Lumière
160 Boulevard de l'Université, 69676 Bron, France
E-mail: abdelaziz.bouras@univ-lyon2.fr

ISSN 1868-4238
ISBN 978-3-642-35757-2
DOI 10.1007/978-3-642-35758-9
Springer Heidelberg Dordrecht London New York

e-ISSN 1868-422X
e-ISBN 978-3-642-35758-9

Library of Congress Control Number: 2012954263

CR Subject Classification (1998): K.6.1, K.4.3, J.7, H.4.1, I.2.4, I.2.6,
D.2.1-2, H.5.3

© IFIP International Federation for Information Processing 2012

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.

The use of general descriptive names, registered names, trademarks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

These proceedings are the result of the efforts of all contributors to the 9th International Conference on Product Lifecycle Management (PLM'12), held at Ecole de technologie supérieure (ETS), of the University of Quebec, in Montreal, Canada, during July 9–11, 2012.

From its first edition in 2003, the PLM conference has been bringing together both researchers and practitioners involved in product development for the whole lifecycle, to share their viewpoints on product innovation, lifecycle management, as well as supply and service chains, hoping to shape the future by advancing the science and practice of enterprise development.

In 2010, the PLM International Conference was endorsed as the official conference for Working Group 5.1 (WG5.1) of the International Federation for Information Processing (IFIP), dedicated to Global product development for the whole life-cycle.

PLM'12 offered a forum where ideas were shared and exchanged through two days of scientific sessions and one industrial-focused day. The conference also included keynote speeches by international academic and industrial PLM leaders. Fifty-nine scientific papers were accepted after review by the PLM'12 International Scientific Committee, and presented at PLM'12 by participants from 22 countries. PLM'12 also saw PhD students gather at the conference's first doctoral workshop to exchange and discuss their research projects, while benefiting from the supervision of experienced researchers.

Papers presented at the conference covered topics such as collaboration in PLM, tools and methodologies for PLM, modeling for PLM and PLM implementation issues. We observed strong interest for knowledge management, sharing and reuse. It has become clear to both researchers and industry representatives that knowledge-related issues, such as the ability to locate knowledge within large organizations, to capture knowledge from retiring workers, or to structure knowledge so as to be able to share and capitalize on past experiences is key to an organization's survival, and that PLM is an enabler and an excellent solution.

On behalf of the conference organization, we wish to thank all authors for submitting, revising, and expanding on their original papers, members of the various conference committees for their highly valuable help and support, and we also wish to thank the conference sponsors for making PLM'12 a great success.

October 2012

Louis Rivest
Abdelaziz Bouras
Borhen Louhichi

Organization

Conference Chairs

Bouras, Abdelaziz	University Lumière of Lyon, France
Rivest, Louis	Ecole de technologie supérieure, University of Quebec, Canada

Steering Committee

Bernard, Alain	Ecole Centrale de Nantes, France
Dutta, Deba	University of Illinois, USA
Garetti, Marco	Politecnico di Milano, Italy
Gurumoorthy, Balan	Indian Institute of Science, India
McMahon, Chris	University of Bath, UK

Program Chairs

Pels, Henk Jan	Eindhoven University of Technology, The Netherlands
Rivest, Louis	Ecole de technologie supérieure, University of Quebec, Canada

Technical Organization

Louhichi, Borhen	Ecole de technologie supérieure, University of Quebec, Canada
Rivest, Louis	Ecole de technologie supérieure, University of Quebec, Canada

International Scientific Committee

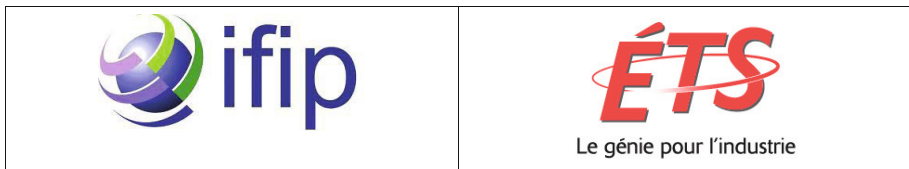
Bandinelli, Romeo	University of Florence, Italy
Bernard, Alain	École Centrale de Nantes, France
Bilalis, Nikolaos	Technical University of Crete, Greece
Bouras, Abdelaziz	University Lumière of Lyon, France
Bronsvooort, Wim	Delft University of Technology, The Netherlands
Corney, Jonathan	University of Strathclyde, UK
Cugini, Umberto	Politecnico di Milano, Italy

VIII Organization

Cuilliere, Jean-Christophe	UQTR, Canada
Culley, Steve	Bath University, UK
Demoly, Frédéric	Université de Technologie de Belfort-Montbéliard, France
Do, Namchul	Gyeongs National University, South Korea
Do, Noh Sang	Sungkyunkwan University, South Korea
El-Ouafi, Abderrazak	UQAR, Canada
Eynard, Benoît	Université de Technologie de Compiègne, France
ElMaraghy, Waguih	University of Windsor, Canada
Gakwaya, Augustin	Université Laval, Canada
Gardoni, Mickael	École de technologie supérieure, Canada
Garetti, Marco	Politecnico di Milano, Italy
Ghie, Walid	UQAT, Canada
Hong, Paul	University of Toledo, USA
Huet, Greg	Bombardier Aerospace, Canada
Jamshidi, Jafar	Bath University, UK
Jiping, Li	Dalian Polytechnic University, P.R. China
Kärkkäinen, Hannu	Technical University of Tampere, Finland
Keraron, Yves	KERARON Recherche, Conseil et Formation, France
Lampela, Hannele	Lappeenranta University of Technology, Finland
Lee, Sang Hun	Kookmin University, South Korea
Lim, Jong Gyun	Samsung Electronics, Korea
Malmqvist, Johan	Chalmers University of Technology, Sweden
Malak, Richard	Texas A&M University, USA
Maranzana, Nicolas	Arts et Métiers ParisTech, France
McKay, Alison	University of Leeds, UK
McMahon, Chris	University of Bath, UK
Miller, Craig L.	Purdue University, USA
Nassehi, Aydin	Bath University, UK
Noël, Frédéric	Université de Grenoble, France
Ouertani, Mohamed Zied	University of Cambridge, UK
Pellerin, Robert	École Polytechnique de Montréal, Canada
Pels, Henk Jan	Technische Universiteit Eindhoven, The Netherlands
Roucoules, Lionel	ENSAM Aix En Provence, France
Salim, Shawkat	United International University, Bangladesh
Song, Bin	Singapore Institute of Manufacturing Technology, Singapore
Srinivasan, Vijay	NIST, USA
Sudarsan, Rachuri	NIST, USA

Terzi, Sergio	University of Bergamo, Italy
Thoben, Klaus-Dieter	Universität Bremen, Germany
Thomson, Vince	McGill University, Canada
Tiwari, Ashutosh	Cranfield University, UK
Witherell, Paul	NIST, USA
Young, Robert	Loughborough University, UK
Zeng, Yong	Concordia University, Canada
Zhang, Linda	IESEG School of Management, France
Zhang, Yufeng	University of Cambridge, UK

Organizers



Sponsors



Table of Contents

Knowledge Management

Semantic Relationship Based Knowledge Management and Reuse in Collaborative Product Development	1
<i>Ibrahim Assouroko, Guillaume Ducellier, Benoît Eynard, and Philippe Boutinaud</i>	
Several Aspects of Information Flows in PLM	14
<i>Hong-Bae Jun and Dimitris Kiritsis</i>	
Managing Knowledge Needs during New Product Lifecycle Design on Quick-term Project Development QPD: Case Study of 24 Hours of Innovation – ETS Montreal	25
<i>Luz-Maria Jiménez-Narvaez, Kimiz Dalkir, and Mickaël Gardoni</i>	
Functional Architecture and Specifications for Tolerancing Data and Knowledge Management	35
<i>Farouk Belkadi, Magali Bosch-Mauchand, Yannick Kibamba, Julien Le Duigou, and Benoît Eynard</i>	
The Role of Internal and External Sources of Knowledge in the Product Lifecycle in Biotechnology Sector	46
<i>Elham Tayaran and Andrea Schiffauerova</i>	
Towards the Definition of Domain Concepts and Knowledge through the Application of the User Story Mapping Method	58
<i>Ana Milicic, Apostolos Perdikakis, Soumaya El Kadiri, Dimitris Kiritsis, and Petko Ivanov</i>	
Mereotopological Description of Product-Process Information and Knowledge for PLM	70
<i>Frédéric Demoly, Aristeidis Matsokis, Dimitris Kiritsis, and Samuel Gomes</i>	
The Need for Improved Integration between PLM and KM: A PLM Services Provider Point of View	85
<i>Berit Folkard, Yves Keraron, Damien Mantoulan, and Roger Dubois</i>	
ECO-Boat MOL Capturing Data from Real Use of the Product	99
<i>Carl Christian Røstad and Bjørnar Henriksen</i>	

PLM Ecosystem

Shift from PLM to SLM: A Method to Support Business Requirements Elicitation for Service Innovation.....	111
<i>Margherita Peruzzini, Michele Germani, and Claudio Favi</i>	
Life-Cycle Oriented Requirement Formalization and Traceability	124
<i>Robert Orawski, Clemens Hepperle, Sebastian Schenkl, Markus Mörtl, and Udo Lindemann</i>	
PLM (Product Lifecycle Management) Model for Supply Chain Optimization	134
<i>Imane Bouhaddou, Abdellatif Benabdelhafid, Latifa Ouzizi, and Youssef Benghabrit</i>	
PLM Interoperability with Information Systems.....	147
<i>Aurélie Bissay and Kamal Cheballah</i>	
Manufacturing Process Planning in Set-Based Concurrent Engineering Paradigm	158
<i>Endris Kerga, Marco Taisch, and Sergio Terzi</i>	
PLM-Based Service Data Management in Steam Turbine Business	170
<i>Patrick Müller, Michael Muschiol, and Rainer Stark</i>	
Verification of Item Usage Rules in Product Configuration	182
<i>Alexey Voronov, Anna Tidstam, Knut Åkesson, and Johan Malmqvist</i>	
DMU Maturity Management as an Extension of the Core Product Model	192
<i>Guillaume Herlem, Pierre-Antoine Adragna, Guillaume Ducellier, and Alexandre Durupt</i>	
Design and Implementation of a PLM System for Sustainable Manufacturing	202
<i>Wen-Bin Zhao, Yang Ho Park, Hye Yun Lee, Chan Mo Jun, and Sang Do Noh</i>	
Visual and Interactive Tool for Product Development Process Enhancement: Towards Intuitive Support of Co-located Project Review	213
<i>Samira Sadeghi, Cédric Masclat, and Frédéric Noël</i>	
Virtually Indistinguishable: Systems Engineering and PLM	226
<i>Michael W. Grieves</i>	

Tools and Methodologies

Product Data Reuse in Product Development: A Practitioner's Perspective.....	243
<i>M.A. El Hani, Louis Rivest, and Roland Maranzana</i>	
Operational Framework Based on Modeling Languages to Support Product Repository Implementation	257
<i>Muriel Pinel, Christian Braesch, Laurent Tabourot, and Aline Berger</i>	
Adapting Product and Development Process for Risk Reduction in New Product Development	267
<i>Marc Neumann, Tim Sadek, and Patrick Labenda</i>	
Product Life Cycle Oriented Representation of Uncertainty.....	277
<i>André Sprenger and Reiner Anderl</i>	
Learning Methodologies to Diffuse Lean Product Development to Industries	287
<i>Monica Rossi, Endris Kerga, Marco Taisch, and Sergio Terzi</i>	
Set-Based Prototyping with Digital Mock-Up Technologies	299
<i>Boris Toche, Robert Pellerin, Clément Fortin, and Greg Huet</i>	
Improved Span Time Performance in NPD Using Better Coordination	310
<i>Samuel Suss and Vince Thomson</i>	
The Role of Product Lifecycle Management Systems in Organizational Innovation	322
<i>Hamzeh K. Bani Milhim, Xiaoguang Deng, Andrea Schifffauerova, and Yong Zeng</i>	
Creative Tools and Processes to Remain Competitive in the Twenty-First Century	332
<i>Mario Dubois, Loic Hamel, and Mickaël Gardoni</i>	
Towards PLM for Mechatronics System Design Using Concurrent Software Versioning Principles	339
<i>Matthieu Bricogne, Louis Rivest, Nadège Troussier, and Benoît Eynard</i>	
Lifecycle Oriented Planning of Mechatronic Products and Corresponding Services	349
<i>Konstantin Kernschmidt, Clemens Hepperle, Markus Mörtl, and Birgit Vogel-Heuser</i>	
Design System Assessment Tool.....	359
<i>S. Gendron, J. Brousseau, A. Elouafi, and B. Urli</i>	

Software Management in Product Structure	369
<i>Gülden Şenaltun and Can Cangelir</i>	
PLMXQuery: Towards a Standard PLM Querying Approach	379
<i>Mohamed-Foued Sriti and Philippe Boutinaud</i>	

Collaboration

Study on Collaborative Product Development and Digital Engineering Tools	389
<i>Patrick Müller, Florian Pasch, Roland Drewinski, Heinz Bedenbender, Haygazun Hayka, and Rainer Stark</i>	
Can a Product Have a Facebook? A New Perspective on Product Avatars in Product Lifecycle Management.....	400
<i>Thorsten Wuest, Karl Hribernik, and Klaus-Dieter Thoben</i>	
Management of Associations within Digital Mock-Ups for Improved Collaboration.....	411
<i>Borhen Louhichi and Louis Rivest</i>	
A Framework for Evaluating Collaborative Product Representations in Product Lifecycle Workflows	424
<i>Nathan Hartman, Phil Rosche, and Kevin Fischer</i>	
Future Product Lifecycle Management (PLM) – A Consideration of Informal Communication as a Key Enabler for Future Product Development	435
<i>Andrea Denger and Wolfgang Unzeitig</i>	

Modelling for PLM

Integration of Explicit Geometric Constraints in the Comparison of 3D CAD Models for Part Design Reuse	445
<i>Antoine Brière-Côté, Louis Rivest, and Roland Maranzana</i>	
From Functional Analysis to CAD Modelling Based on Knowledge Transformation Driven by the Design Process.....	458
<i>Mehdi Iraqi and Lionel Roucoules</i>	
A BREP Model and Mesh Errors Detecting Tool: TopoVisu	468
<i>François Petit and François Guibault</i>	
A Modeling Language for 3D Process Plant Layout Representation, Exchange and Visualization	478
<i>Thomas Paviot, Virginie Fortineau, Samir Lamouri, and Ludovic Louis-Sidney</i>	

PLM as Support for Global Design Reuse – Long Term Benefits and Immediate Drawbacks	488
<i>Christoffer Levandowski, Mattias Bokinge, Johan Malmqvist, and Hans Johannesson</i>	

Implementation

PLM Impact Analysis Model – PIA	501
<i>Simo-Pekka Leino, Juha-Pekka Anttila, Juhamatti Heikkilä, Joonas Aaltonen, and Kaj Helin</i>	

A Method to Identify Risks Associated with a PLM Solution	512
<i>Mattias Bokinge, Christoffer Levandowski, Johan Malmqvist, and Hans Johannesson</i>	

PLM Reference Model: A Preliminary Proposal for Reference Model Evolution	525
<i>Eduardo Zancul</i>	

Decision Support Framework for PLM Harmonization Projects within Industrial Companies	535
<i>Michael Abramovici and Jens Christian Göbel</i>	

Collaborative Design Tools: A Comparison between Free Software and PLM Solutions in Engineering Education	547
<i>Nicolas Maranzana, Frédéric Segonds, Frédéric Lesage, and Julien Nelson</i>	

Web, Semantics and Ontologies for PLM

A Holistic Approach for the Architecture and Design of an Ontology-Based Data Integration Capability in Product Master Data Management	559
<i>Daniel Fitzpatrick, François Coallier, and Sylvie Ratté</i>	

Dynamic Customization and Validation of Product Data Models Using Semantic Web Tools	569
<i>Sylvere Krima, Allison Barnard Feeney, and Sebti Foufou</i>	

Toward an Automatic Reduction of Non-added Values Tasks in the Project-Product-Process Domain	578
<i>Jeremy Boxberger, Mathieu Lebouteiller, Toufik Boudouh, and Samuel Gomes</i>	

SWRL as a Rule Language for Ontology-Based Models in Power Plant Design	588
<i>Virginie Fortineau, Thomas Paviot, Ludovic Louis-Sidney, and Samir Lamouri</i>	

Formalization for PLM

Visual Product Architecture Modelling for Structuring Data in a PLM System	598
<i>Hans Peter Lomholt Bruun and Niels Henrik Mortensen</i>	
Towards Model-Based System Engineering for Simulation-Based Design in Product Data Management Systems	612
<i>Thomas Vosgien, Thomas Nguyen Van, Marija Jankovic, Benoît Eynard, and Jean-Claude Bocquet</i>	
Defining the Customer Dimension of PLM Maturity	623
<i>Hannu Kärkkäinen, Henk Jan Pels, and Anneli Silventoinen</i>	
Maturity Model for Improving Virtual Engineering in Small and Medium-Sized Enterprises	635
<i>Tobias Bensiek and Arno Kuehn</i>	
Approach on Lifecycles on Research Environment and Analysis Based on Systems Engineering (SE)	646
<i>Marja Lintala, Jivka Ovtcharova, and Pierre Bonnal</i>	
Author Index	657