

Complex Systems Design & Management

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Editors

Complex Systems Design & Management

Proceedings of the Sixth International
Conference on Complex Systems Design
& Management, CSD&M 2015

 Springer

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ISBN 978-3-319-26107-2

ISBN 978-3-319-26109-6 (eBook)

DOI 10.1007/978-3-319-26109-6

Library of Congress Control Number: 2015953795

Springer Cham Heidelberg New York Dordrecht London

  Springer International Publishing Switzerland 2016

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Printed on acid-free paper

Springer International Publishing AG Switzerland is part of Springer Science+Business Media
(www.springer.com)

Preface

Introduction

This volume contains the proceedings of the Sixth International Conference on “Complex Systems Design & Management Paris” (CSD&M Paris 2015; see the conference Web-site: <http://www.csdm2015.csdm.fr> for more details).

The CSD&M Paris 2015 conference was organized on November 23–25, 2015, at the EDF Lab at Clamart (France) under the High Patronage of the French Ministry of Economy, Industry and Digital. The two following founding partners are given below:

1. The non-profit organization C.E.S.A.M.E.S. (Center of Excellence on Systems Architecture, Management, Economy and Strategy),
2. The Ecole Polytechnique—ENSTA ParisTech—Télécom ParisTech—Dassault Aviation—DCNS—DGA—Thales “Engineering of Complex Systems” chair.

The conference benefited of the permanent support of many academic organizations such as Ecole Polytechnique, CentraleSupélec, ENSTA ParisTech and Télécom ParisTech which were deeply involved in its organization.

We also would like to thank the conference partners: Airbus Group, CEA LIST, Dassault Aviation, Dassault Systemes, DCNS, Digiteo Labs, Direction Générale de l’Armement (DGA), Faurecia, l’IRT SystemX, MEGA International, Obeo, PPI, and Thales which were the main industrial and institutional sponsors of the conference. The generous specific support of Airbus Group and Dassault Systemes shall be especially pointed out here.

We are also grateful to several non-profit organizations such as Association Française d’Ingénierie Système (AFIS), International Council on Systems Engineering (INCOSE) and Systematic Paris Region Systems & ICT Cluster which strongly supported our communication effort.

Finally, our special thanks go to EDF which offers us to welcome the CSD&M Paris 2015 conference at EDF Lab, in Clamart.

Why a CSD&M Conference?

Mastering complex systems requires an integrated understanding of industrial practices as well as sophisticated theoretical techniques and tools. This explains the creation of an annual *go-between* forum at European level (which did not exist yet) dedicated both to academic researchers and to industrial actors working on complex industrial systems architecture and engineering. Facilitating their *meeting* was actually for us a *sine qua non* condition in order to nurture and develop in Europe the science of systems which is currently emerging.

The purpose of the “Complex Systems Design & Management” Paris (CSD&M Paris) conference is exactly to be such a forum, in order to become, in time, *the* European academic-industrial conference of reference in the field of complex industrial systems architecture and engineering, which is a quite ambitious objective. The last five CSD&M Paris 2010, CSD&M Paris 2011, CSD&M Paris 2012, CSD&M Paris 2013, and CSD&M Paris 2014 conferences—which were held in the end of October 2010, December 2011, December 2012, December 2013, and November 2014 in Paris—were the first steps in this direction. In 2014, there were almost 300 participants who came from 20 different countries, which measures the growing success of the CSD&M Paris conference.

Our Core Academic—Industrial Dimension

To make the CSD&M Paris conference this convergence point of the academic and industrial communities in complex industrial systems, we based our organization on a principle of *complete parity* between academics and industrialists (see the conference organization sections in the next pages). This principle was first implemented as follows:

- the Program Committee consisted of 50 % academics and 50 % industrialists,
- the Invited Speakers came in a balanced way from numerous professional environments.

The set of activities of the conference followed the same principle. They indeed consist of a mix of research seminars and experience sharing, academic articles and industrial presentations, software and training offers presentations, etc. The conference topics cover in the same way the most recent trends in the emerging field of complex systems sciences and practices from an industrial and academic perspective, including the main industrial domains (aeronautic and aerospace, transportation and systems, defense and security, electronics and robotics, energy and environment, healthcare and welfare services, media and communications, software and e-services), scientific and technical topics (systems fundamentals, systems architecture and engineering, systems metrics and quality, systemic tools), and system types (transportation systems, embedded systems, software and information systems, systems of systems, artificial ecosystems).

The 2015 Edition

The CSD&M Paris 2015 Edition received 75 submitted papers, out of which the Program Committee selected 20 regular papers to be published in the conference proceedings. A 27 % acceptance ratio has been reached and guarantees the high quality of the presentations. The Program Committee also selected 20 papers for a collective presentation during the poster workshop of the conference.

Each submission was assigned to at least two Program Committee members, who carefully reviewed the papers, in many cases with the help of external referees. These reviews were discussed by the Program Committee during a physical meeting held in C.E.S.A.M.E.S. office in Paris by the May 29, 2015, and via the EasyChair conference management system.

We also chose 12 outstanding speakers with various industrial and scientific expertises who gave a series of invited talks covering all the spectrum of the conference, mainly during the two first days of CSD&M Paris 2015. The first and second days of the conference were especially organized around a common topic—Smart Cities: Systems Issues—that provided consistency to all invited talks. The last day was finally dedicated to a special “thematic session,” followed by a “à la carte” program: the presentations of the 20 accepted papers, the conference partners’ workshops, an IBM workshop, and an IEEE Chapter workshop. Furthermore, we had a poster workshop for encouraging presentations and discussions on interesting but “not-yet-polished” ideas. CSDM Paris 2015 also offered a Systems Architecture & Engineering Tools Session in order to provide each participant a good vision of the last engineering and technological news.

Paris
November 2015

Gérard Auvray
Jean-Claude Bocquet
Eric Bonjour
Daniel Krob

Conference Organization

Conference Chairs

- **General Chair**
 - Daniel Krob, Incose Fellow, C.E.S.A.M.E.S. & Ecole Polytechnique, France
- **Organizing Committee Chair**
 - Jean-Claude Bocquet, CentraleSupélec, France
- **Program Committee Chairs**
 - Gérard Auvray, Airbus Defense and Space, France
 - Eric Bonjour, Ensgsi Université De Lorraine, France

Program Committee

The Program Committee consists of 32 members (17 academic and 15 industrial) of high international visibility. Their spectrum of expertise covers all of the conference topics.

Academic Members

- *Co-chair*
 - Eric Bonjour, Ensgsi Université De Lorraine, France
- *Other Members*
 - Vincent Chapurlat, Ecole des Mines d'Alès, France
 - Eric Coatanea, Aalto University, Finland
 - Olivier De Weck, MIT, USA
 - Timothy Ferris, Unisa, Australia

- Alfredo Garro, University of Calabria, Italy
- Nil Handen Ergin, Penn State University, USA
- Michael Henshaw, Loughborough University Leicestershire, Great Britain
- Paulien Herder, University of Delft, Netherlands
- Claude Y. Laporte, École de Technologie Supérieure, Canada
- Jörg Lalk, University of Pretoria, South Africa
- Eric Levrat, Université de Lorraine/Cran, France
- Maik Mauer, Technische Universität München, Germany
- Patrick Millot, Université Valenciennes, France
- Chris Paredis, Georgia Institute of Technology, USA
- Brian Sauser, University of North Texas, USA
- Dinesh Verma, Stevens Institute of Technology, USA

Industrial Members

- *Co-chair*
 - Gérard Auvray, Airbus Defense and Space, France
- *Other Members*
 - Henrik Balslev, Systems Engineering Denmark Aps, Denmark
 - Richard Beasley, Rolls Royce, United Kingdom
 - Jean-Pierre Daniel, Areva, France
 - Alain Dauron, Renault, France
 - Gauthier Fanmuy, Dassault Systemes, France
 - Sanford Friedenthal, Lockheed-Martin, USA
 - Mike Johnson, Ruag, Switzerland
 - Juan Llorens, The Reuse Company, Spain
 - David Long, Vitech, Canada
 - Clotilde Marchal, Airbus Group, France
 - Garry Roedler, Lockheed-Martin, USA
 - Jean-Claude Roussel, Airbus Group Innovation, France
 - Sven-Olaf Schulze, LINITY AG, Germany
 - Robert Swarz, MITRE, USA

Organizing Committee

The Organizing Committee consists of 18 members (academic and industrial) of high international visibility. The Organizing Committee is in charge of defining the agenda/program of the conference, identifying keynote speakers and has to ensure the functioning of the event (sponsoring, communication...). Its spectrum of expertise covers all of the conference topics.

Organizing Committee

- *Chair*
 - Jean-Claude Bocquet, CentraleSupélec, France
- *Other Members*
 - Marc Aiguier, Ecole Centrale de Paris, France
 - Anas Alfaris, CCES & MIT, Saudi Arabia
 - Emmanuel Arbaretier, APSYS, Airbus Group, France
 - Frédéric Boulanger, CentraleSupélec, France
 - Guy Boy, Florida Institute of Technology, USA
 - Cihan Dagli, Missouri University of Science and Technology, USA
 - John Fitzgerald, Newcastle University, United Kingdom
 - Pascal Foix, Thales, France
 - Eric Goubault, CEA LIST, France
 - Chahinez Hamlaoui, Systematic Paris Region Systems & ICT Cluster, France
 - Paul Labrogere, IRT SystemX, France
 - Frédéric Magoules, Ecole Centrale Paris, France
 - Garry Roedler, Lockheed Martin Corporate Engineering, USA
 - François Stephan, IRT SystemX, France
 - Nicolas Trêves, CNAM, France
 - Jon Wade, Stevens Institute of Technology, USA
 - David Walden, Sysnovation & INCOSE, USA

Invited Speakers

Grand Challenges—Society

- Serge Salat, President, Urban Morphology and Complex Systems Institute, Paris, France
- Daniel Kaplan, President, The Next-Generation Internet Foundation, Europe
- Carlos Moreno, COFELY INEO, Professor, President Scientific Advisor, FSIM COFELY Department (INEO, AXIMA, ENDEL) the Energy Services business line, GDF Suez, France

Grand Challenges—Industry

- Pascal Terrien, Director, Sustainable Cities Program, EDF R&D, France & Singapore
- Pierre Guehenneux, Digital Transformation Director, Vinci Construction, France

Scientific State of the Art

- Eric Goubault, Institute Professor and Director of the “Complex Systems Engineering” Chair, Ecole Polytechnique, France
- Joseph Sifakis, Professor, Ecole Polytechnique Fédérale de Lausanne, Switzerland
- Sébastien Tremblay, Scientific Director of UMR in Urban Scholars of Laval University, Canada

Methodological State of the Art

- Laurent Schmitt, Vice-President Innovation and Strategy, Alstom Grid, France
- Michel-Alexandre Cardin, Professor, National University of Singapore, Singapore
- Jakob Puchinger, Head of the business unit dynamic transportation systems, Austrian Institute of Technology, Austria

Acknowledgments

We would like to thank all members of the Program and Organizing Committees for their time, effort, and contributions to make CSD&M Paris 2015 a top-quality conference. A special thank is addressed to the C.E.S.A.M.E.S. non-profit organization team which managed permanently with an huge efficiency all the administration, logistics, and communication of the CSD&M Paris 2015 conference (see <http://www.cesames.net>).

The organizers of the conference are also greatly grateful to the following sponsors and partners without whom the CSD&M Paris 2015 event would not exist:

- **Founding Partners**

- C.E.S.A.M.E.S.—Center of Excellence on Systems Architecture, Management, Economy and Strategy,
- Ecole Polytechnique—ENSTA ParisTech—Télécom ParisTech—Dassault Aviation—DCNS—DGA—Thales “Engineering of Complex Systems” Chair.

- **Academic Sponsors**

- CEA LIST,
- CNAM—Conservatoire National des Arts et Métiers,
- Ecole Polytechnique,
- CentraleSupélec,
- ENSTA ParisTech,
- Télécom ParisTech.

- **Industrial and Institutional Sponsors**

- Airbus Group,
- Dassault Aviation,

- Dassault Systemes,
 - DCNS,
 - Direction Générale de l’Armement (DGA),
 - EDF,
 - Faurecia,
 - MEGA International,
 - Obeo,
 - PPI,
 - Thales.
- **Institutional Sponsors**
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 - IRT SystemX,
 - French Ministry of Economy, Industry and Digital.
- **Supporting Partners**
 - Association Française d’Ingénierie Système (AFIS),
 - International Council on Systems Engineering (INCOSE),
 - Systematic Paris Region Systems & ICT Cluster.
- **Participating Partners**
 - Ellidiss,
 - Esterel Technologies,
 - IBM Analytics,
 - IEEE Chapter,
 - Knowledge Inside,
 - No Magic Europe MBSE,
 - Pragmadev,
 - PTC,
 - Squoring Technologies,
 - The CoSMo Company,
 - The MathWorks.

At the publishing moment, new partners could join CSDM Paris 2015; you can find them on the conference Web-site.

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