

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Alfred Kobsa

University of California, Irvine, CA, USA

Friedemann Mattern

ETH Zurich, Switzerland

John C. Mitchell

Stanford University, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz

University of Bern, Switzerland

C. Pandu Rangan

Indian Institute of Technology, Madras, India

Bernhard Steffen

TU Dortmund University, Germany

Madhu Sudan

Microsoft Research, Cambridge, MA, USA

Demetri Terzopoulos

University of California, Los Angeles, CA, USA

Doug Tygar

University of California, Berkeley, CA, USA

Gerhard Weikum

Max Planck Institute for Informatics, Saarbruecken, Germany

Fernando A. Kuipers Poul E. Heegaard (Eds.)

Self-Organizing Systems

6th IFIP TC 6 International Workshop, IWSOS 2012
Delft, The Netherlands, March 15-16, 2012
Proceedings

Volume Editors

Fernando A. Kuipers
Delft University of Technology
Faculty of Electrical Engineering, Mathematics and Computer Science
P.O. Box 5031, 2600 GA Delft, The Netherlands
E-mail: f.a.kuipers@tudelft.nl

Poul E. Heegaard
Norwegian University of Science and Technology
Department of Telematics
O.S. Bragstads plass 2B, 7491 Trondheim, Norway
E-mail: poul.heegaard@item.ntnu.no

ISSN 0302-9743 e-ISSN 1611-3349
ISBN 978-3-642-28582-0 e-ISBN 978-3-642-28583-7
DOI 10.1007/978-3-642-28583-7
Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2012932131

CR Subject Classification (1998): C.2, D.4.4, C.2.4, C.4, H.3, H.2.8, I.2.11

LNCS Sublibrary: SL 5 – Computer Communication Networks and Telecommunications

© 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

This book contains research articles from the IFIP International Workshop on Self-Organizing Systems (IWSOS), held in Delft, The Netherlands, in March 2012.

This was the sixth workshop in a series of multidisciplinary events dedicated to self-organization in networked systems with the main focus on communication and computer networks. The concept of self-organization is becoming increasingly popular in various branches of technology. A self-organizing system may be characterized by global, coordinated activity arising spontaneously from local interactions between the system's components. This activity is distributed over all components, without a central controller supervising or directing the behavior. Self-organization relates the behavior of the individual components (the microscopic level) to the resulting structure and functionality of the overall system (the macroscopic level). Simple interactions at the microscopic level may give rise to complex, adaptive, and robust behavior at the macroscopic level.

The necessity of self-organization in technological networks is caused by the growing scale, complexity, and dynamics of future networked systems. This is because traditional methods tend to be reductionistic, i.e., they neglect the effect of interactions between components. However, in complex networked systems, interactions cannot be ignored, since they are relevant for the future state of the system. In this sense, self-organization becomes a useful approach for dealing with the complexity inherent in networked systems. Since self-organization principles do not only apply to the Internet, but also to a variety of other complex networks, like transportation networks, telephony networks, smart electricity grids, smart cities, financial networks, social networks, and biological networks, IFIP IWSOS 2012 also invited articles on "Network Science" and "Complex Networks Theory" that focus on self-organizing systems.

The IFIP IWSOS 2012 committee received 28 submissions from 16 countries. Three papers were immediately rejected due to wrong scope or non-conformance with the template. Each of the remaining 25 submissions found to be eligible was in general reviewed by three members (papers with only two reviews had consistent reviews) of the Technical Program Committee. In total, 65 reviews were performed. Based on these reviews, ten papers were accepted. Five full papers were accepted out of the 20 full papers submitted, i.e., 25% acceptance rate. In addition, five short papers were accepted, which included three out of the eight short paper submissions, plus two full papers that were accepted as short papers. Two additional publications were invited for the workshop. The authors of the papers are from Italy, The Netherlands, Czech Republic, Germany, UK, South Korea, USA, Israel, Austria, and Norway.

The following key IWSOS topics were addressed:

- Design and analysis of self-organizing and self-managing systems
- Inspiring models of self-organization in nature and society
- Structure, characteristics and dynamics of self-organizing networks
- Techniques and tools for modeling self-organizing systems
- Robustness and adaptation in self-organizing systems
- Self-organization in complex networks like peer-to-peer, sensor, ad-hoc, vehicular and social networks
- Control of self-organizing systems
- Decentralized power management in the smart grid
- Self-organizing group and pattern formation
- Self-organizing mechanisms for task allocation, coordination and resource allocation
- Self-organizing information dissemination and content search
- Risks and limits of self-organization

The IWSOS series brings together leading international researchers to create a visionary forum for discussing the future of self-organization. It addresses theoretical aspects of self-organization as well as applications in communication and computer networks and complex networks.

IFIP IWSOS 2012 was technically sponsored by IFIP—the International Federation for Information Processing—and cosponsored by the European Network of Excellence Euro-NF.

The IFIP IWSOS 2012 workshop featured two keynote talks given by Shlomo Havlin, Bar-Ilan University, Israel, and Karl Aberer, EPFL, Switzerland. In addition, two panel sessions were organized: (1) Self-Organizing Smart Grids, and (2) Self-Organized Resilience, as well as a poster session with a student research competition.

January 2012

Fernando A. Kuipers
Poul E. Heegaard

Technical Program Committee

Ozalp Babaoglu	University of Bologna, Italy
Yuriy Brun	University of Washington, USA
Christian Doerr	Delft University of Technology, The Netherlands
Raissa D'Souza	University of California, Davis, USA
Falko Dressler	University of Innsbruck, Austria
Stefan Dulman	Delft University of Technology, The Netherlands
Schahram Dustdar	Vienna University of Technology, Austria
Wilfried Elmenreich	University of Klagenfurt, Austria
Alois Ferscha	University of Linz, Austria
Kurt Geihs	University of Kassel, Germany
Carlos Gershenson	Universidad Nacional Autónoma de México, Mexico
Salima Hassas	University of Lyon, France
Boudewijn Haverkort	University of Twente, The Netherlands
Bjarne Helvik	Norwegian University of Science and Technology, Norway
Tom Holvoet	Katholieke Universiteit Leuven, Belgium
Guy Leduc	University of Liège, Belgium
Hein Meling	University of Stavanger, Norway
Juval Portugali	Tel Aviv University, Israel
Christian Prehofer	Fraunhofer ESK, Germany
Andreas Riener	Johannes Kepler Universität Linz, Austria
Hiroki Sayama	Binghamton University, USA
Marcus Schöller	NEC Europe Ltd., Germany
Caterina Scoglio	Kansas State University, USA
Paul Smith	Lancaster University, UK
Ioannis Stavrakakis	National and Kapodistrian University of Athens, Greece
Maarten van Steen	VU University Amsterdam, The Netherlands
Bosiljka Tadic	Jozef Stefan Institute, Slovenia
Marc Timme	Max Planck Institute for Dynamics and Self-Organization, Germany
Vito Trianni	National Research Council - CNR, Italy
Huijuan Wang	Delft University of Technology, The Netherlands

Reviewers

Ozalp Babaoglu	University of Bologna, Italy
Yuriy Brun	University of Washington, USA
Christian Doerr	Delft University of Technology, The Netherlands

Falko Dressler	University of Innsbruck, Austria
Schahram Dustdar	Vienna University of Technology, Austria
Wilfried Elmenreich	University of Klagenfurt, Austria
Rinde van Lon	Katholieke Universiteit Leuven, Belgium
Kurt Geihs	University of Kassel, Germany
Carlos Gershenson	Universidad Nacional Autónoma de México, Mexico
Shaza Hanif	Katholieke Universiteit Leuven, Belgium
Boudewijn Haverkort	University of Twente, The Netherlands
Patrick Heinrich	Fraunhofer ESK, Germany
Bjarne Helvik	Norwegian University of Science and Technology, Norway
Tom Holvoet	Katholieke Universiteit Leuven, Belgium
Guy Leduc	University of Liège, Belgium
Hein Meling	University of Stavanger, Norway
Ebisa Negeri	Delft University of Technology, The Netherlands
Christian Prehofer	Fraunhofer ESK, Germany
Andreas Riener	Johannes Kepler Universität Linz, Austria
Hiroki Sayama	Binghamton University, USA
Marcus Schöller	NEC Europe Ltd., Germany
Paul Smith	Lancaster University, UK
Ioannis Stavrakakis	National and Kapodistrian University of Athens, Greece
Maarten van Steen	VU University Amsterdam, The Netherlands
Bosiljka Tadic	Jozef Stefan Institute, Slovenia
Vito Trianni	National Research Council - CNR, Italy
Stijn Vandael	Katholieke Universiteit Leuven, Belgium
Constantinos Vassilakis	Greek Research and Technology Network (GRNET), Greece
Huijuan Wang	Delft University of Technology, The Netherlands
Kashif Zia	University of Linz, Austria

Table of Contents

Invited Papers

Distributed Storage Management Using Dynamic Pricing in a Self-Organized Energy Community	1
<i>Ebisa Negeri and Nico Baken</i>	

Ant-Based Systems for Wireless Networks: Retrospect and Prospects ...	13
<i>Laurent Paquereau and Bjarne E. Helvik</i>	

Full Papers

Triadic Motifs and Dyadic Self-Organization in the World Trade Network	24
<i>Tiziano Squartini and Diego Garlaschelli</i>	

On Measurement of Internal Variables of Complex Self-Organized Systems and Their Relation to Multifractal Spectra	36
<i>Dalibor Štys, Petr Jizba, Štěpán Papáček, Tomáš Náhlík, and Petr Císarř</i>	

Self-Organised Routing for Road Networks	48
<i>Holger Prothmann, Sven Tomforde, Johannes Lyda, Jürgen Branke, Jörg Hähner, Christian Müller-Schloer, and Hartmut Schmeck</i>	

P2P and Cloud: A Marriage of Convenience for Replica Management ...	60
<i>Hanna Kavalionak and Alberto Montresor</i>	

Self-Organizing Spatio-temporal Pattern Formation in Two-Dimensional Daisyworld	72
<i>Dharani Punithan and R.I. (Bob) McKay</i>	

Short Papers

Heuristic Resource Search in a Self-Organised Distributed Multi Agent System	84
<i>Muntasir Al-Asfoor, Brendan Neville, and Maria Fasli</i>	

A Quantitative Measure, Mechanism and Attractor for Self-Organization in Networked Complex Systems	90
<i>Georgi Yordanov Georgiev</i>	

MetroNet: A Metropolitan Simulation Model Based on Commuting Processes	96
<i>Efrat Blumenfeld-Lieberthal and Juval Portugali</i>	

Robustness of Self-Organizing Consensus Algorithms: Initial Results from a Simulation-Based Study	104
<i>Alexander Gogolev and Christian Bettstetter</i>	
Initial Experiments in Using Communication Swarms to Improve the Performance of Swarm Systems	109
<i>Stephen M. Majercik</i>	
Author Index	115