

*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*

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*

Moshe Y. Vardi

*Rice University, Houston, TX, USA*

Gerhard Weikum

*Max Planck Institute for Informatics, Saarbruecken, Germany*

Kurt Jensen Wil M.P. van der Aalst  
Marco Ajmone Marsan  
Giuliana Franceschinis Jetty Kleijn  
Lars Michael Kristensen (Eds.)

# Transactions on Petri Nets and Other Models of Concurrency VI

## Editor-in-Chief

Kurt Jensen  
University of Aarhus  
Faculty of Science, Department of Computer Science  
IT-parken, Aabogade 34, 8200 Aarhus N, Denmark  
E-mail: [kjensen@cs.au.dk](mailto:kjensen@cs.au.dk)

## Guest Editors

Wil M.P. van der Aalst  
Eindhoven University of Technology, The Netherlands  
E-mail: [w.m.p.v.d.aalst@tue.nl](mailto:w.m.p.v.d.aalst@tue.nl)

Marco Ajmone Marsan  
Politecnico di Torino, Italy  
E-mail: [ajmone@polito.it](mailto:ajmone@polito.it)

Giuliana Franceschinis  
Università del Piemonte Orientale "Amedeo Avogadro", Italy  
E-mail: [giuliana.franceschinis@di.unipmn.it](mailto:giuliana.franceschinis@di.unipmn.it)

Jetty Kleijn  
LIACS, Leiden University, The Netherlands  
E-mail: [kleijn@liacs.nl](mailto:kleijn@liacs.nl)

Lars Michael Kristensen  
Bergen University College, Norway  
E-mail: [lmkr@hib.no](mailto:lmkr@hib.no)

ISSN 0302-9743 (LNCS)	e-ISSN 1611-3349 (LNCS)
ISSN 1867-7193 (ToPNoC)	e-ISSN 1867-7746 (ToPNoC)
ISBN 978-3-642-35178-5	e-ISBN 978-3-642-35179-2
DOI 10.1007/978-3-642-35179-2	
Springer Heidelberg Dordrecht London New York	

Library of Congress Control Number: 2012952593

CR Subject Classification (1998): D.2.2-4, F.1.1, D.3.2, C.2.1-4, I.2.2, C.4, H.3.5

© Springer-Verlag Berlin Heidelberg 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](http://www.springer.com))

## Preface by Editor-in-Chief

The sixth issue of LNCS Transactions on Petri Nets and Other Models of Concurrency (ToPNoC) contains revised and extended versions of a selection of the best papers from the workshops and tutorials held at the 32nd International Conference on Application and Theory of Petri Nets and Concurrency, in Newcastle upon Tyne, UK, June 20–24, 2011, edited by Wil van der Aalst and Jetty Kleijn, and a special section on Networks, Protocols, and Services, edited by Giuliana Franceschinis, Lars Michael Kristensen, and Marco Ajmone Marsan. It also contains a paper that was submitted to ToPNoC directly through the regular submission track.

I would like to thank the five guest editors of this special issue: Wil van der Aalst, Jetty Kleijn, Giuliana Franceschinis, Lars Michael Kristensen, and Marco Ajmone Marsan. Moreover, I would like to thank all authors, reviewers, and the organizers of the Petri net conference satellite workshops, without whom this issue of ToPNoC would not have been possible.

August 2012

Kurt Jensen  
Editor-in-Chief

LNCS Transactions on Petri Nets and Other Models of Concurrency (ToPNoC)

# LNCS Transactions on Petri Nets and Other Models of Concurrency: Aims and Scope

ToPNoC aims to publish papers from all areas of Petri nets and other models of concurrency ranging from theoretical work to tool support and industrial applications. The foundation of Petri nets was laid by the pioneering work of Carl Adam Petri and his colleagues in the early 1960s. Since then, an enormous amount of material has been developed and published in journals and books and presented at workshops and conferences.

The annual International Conference on Application and Theory of Petri Nets and Concurrency started in 1980. The International Petri Net Bibliography maintained by the Petri Net Newsletter contains close to 10,000 different entries, and the International Petri Net Mailing List has 1,500 subscribers.

For more information on the International Petri Net community, see:  
<http://www.informatik.uni-hamburg.de/TGI/PetriNets/>

All issues of ToPNoC are LNCS volumes. Hence they appear in all large libraries and are also accessible in LNCS Online (electronically). It is possible to subscribe to ToPNoC without subscribing to the rest of LNCS.

ToPNoC contains:

- revised versions of a selection of the best papers from workshops and tutorials concerned with Petri nets and concurrency;
- special issues related to particular subareas (similar to those published in the *Advances in Petri Nets* series);
- other papers invited for publication in ToPNoC; and
- papers submitted directly to ToPNoC by their authors.

Like all other journals, ToPNoC has an Editorial Board, which is responsible for the quality of the journal. The members of the board assist in the reviewing of papers submitted or invited for publication in ToPNoC. Moreover, they may make recommendations concerning collections of papers for special issues. The Editorial Board consists of prominent researchers within the Petri net community and in related fields.

## Topics

System design and verification using nets; analysis and synthesis, structure and behavior of nets; relationships between net theory and other approaches; causality/partial order theory of concurrency; net-based semantical, logical and algebraic calculi; symbolic net representation (graphical or textual); computer tools for nets; experience with using nets, case studies; educational issues related to nets; higher level net models; timed and stochastic nets; and standardization of nets.

Applications of nets to: biological systems, defence systems, e-commerce and trading, embedded systems, environmental systems, flexible manufacturing systems, hardware structures, health and medical systems, office automation, operations research, performance evaluation, programming languages, protocols and networks, railway networks, real-time systems, supervisory control, telecommunications, and workflow.

For more information about ToPNoC, please see: [www.springer.com/lncs/topnoc](http://www.springer.com/lncs/topnoc)

## **Submission of Manuscripts**

Manuscripts should follow LNCS formatting guidelines, and should be submitted as PDF or zipped PostScript files to [ToPNoC@cs.au.dk](mailto:ToPNoC@cs.au.dk). All queries should be addressed to the same e-mail address.

# LNCS Transactions on Petri Nets and Other Models of Concurrency: Editorial Board

## Editor-in-Chief

Kurt Jensen, Denmark (<http://person.au.dk/en/kjensen@cs.au.dk>)

## Associate Editors

Grzegorz Rozenberg, The Netherlands  
Jonathan Billington, Australia  
Susanna Donatelli, Italy  
Wil van der Aalst, The Netherlands

## Editorial Board

Didier Buchs, Switzerland  
Gianfranco Ciardo, USA  
José-Manuel Colom, Spain  
Jörg Desel, Germany  
Michel Diaz, France  
Hartmut Ehrig, Germany  
Jorge C.A. de Figueiredo, Brazil  
Luis Gomes, Portugal  
Roberto Gorrieri, Italy  
Serge Haddad, France  
Xudong He, USA  
Kees van Hee, The Netherlands  
Kunihiko Hiraishi, Japan  
Gabriel Juhas, Slovak Republic  
Jetty Kleijn, The Netherlands  
Maciej Koutny, UK

Lars M. Kristensen, Norway  
Charles Lakos, Australia  
Johan Lilius, Finland  
Chuang Lin, China  
Satoru Miyano, Japan  
Madhavan Mukund, India  
Wojciech Penczek, Poland  
Laure Petrucci, France  
Lucia Pomello, Italy  
Wolfgang Reisig, Germany  
Manuel Silva, Spain  
P.S. Thiagarajan, Singapore  
Glynn Winskel, UK  
Karsten Wolf, Germany  
Alex Yakovlev, UK

# Preface by Guest Editors

This issue of ToPNoC consists of three parts:

1. the first part comprises the revised versions of a selection of the best papers from the workshops and tutorials held at the 32nd International Conference on Application and Theory of Petri Nets and Concurrency, in Newcastle upon Tyne, UK, June 20–24, 2011, and has been edited by Wil van der Aalst and Jetty Kleijn;
2. the second part consists of papers selected for a special section on Networks, Protocols, and Services and has been edited by Giuliana Franceschinis, Lars Michael Kristensen, and Marco Ajmone Marsan;
3. the third part is formed by the paper “Aggregating Causal Runs into Workflow Nets” by Boudewijn van Dongen, Jörg Desel, and Wil van der Aalst, submitted to ToPNoC directly through the regular submission track.

The remainder of this preface introduces these three parts.

## Best Workshop Papers from Petri Nets 2011

This part contains revised and extended versions of a selection of the best workshop papers presented at the 32nd International Conference on Application and Theory of Petri Nets and Concurrency (Petri Nets 2011).

We, Wil van der Aalst and Jetty Kleijn, are indebted to the program committees of the workshops and in particular their chairs. Without their enthusiastic work this volume would not have been possible. Many members of the program committees participated in reviewing the extended versions of the papers selected for this issue. The following workshops were asked for their strongest contributions:

- PNSE 2011: International Workshop on Petri Nets and Software Engineering (chairs: Michael Duvigneau, Kunihiko Hiraishi, and Daniel Moldt),
- BioPPN 2011: International Workshop on Biological Processes and Petri Nets (chairs: Monika Heiner and Hiroshi Matsuno),
- ART 2011: Applications of Region Theory (chairs: Jörg Desel and Alex Yakovlev),
- CompoNet 2011: International Workshop on Petri Nets Compositions (chairs: Hanna Kludel and Franck Pommereau),
- SUMo 2011: Scalable and Usable Model Checking for Petri Nets and Other Models of Concurrency (chair: Didier Buchs)

The best papers of these workshops were selected in close cooperation with their chairs. The authors were invited to improve and extend their results where possible, based on the comments received before and during the workshop. The

resulting revised submissions were reviewed by three to five referees. We followed the principle of also asking for fresh reviews of the revised papers, i.e., from referees who had not been involved initially in reviewing the original workshop contribution. All papers went through the standard two-stage journal reviewing process and eventually eight were accepted after rigorous reviewing and revising. Presented are a variety of high-quality contributions, ranging from model checking and system verification to synthesis, and from work on Petri-net-based standards and frameworks to innovative applications of Petri nets and other models of concurrency.

The paper by Josep Carmona, *The Label Splitting Problem*, revisits label splitting, a technique to satisfy the synthesis conditions through renaming of problematic labels. To be applicable, the classical theory of regions relies on stringent conditions on the input automaton. Although some relaxations on these restrictions were proposed earlier, in general not every automaton can be synthesized while preserving its behavior using classical approaches. The paper formalizes the problem of label splitting and proposes extensions that improve the applicability of the theory of regions.

The paper *Distributed Control of Discrete-Event Systems: A First Step*, by Philippe Darondeau and Laurie Ricker, is concerned with the synthesis of distributed control implemented by asynchronous message passing automata. A survey of discrete-event systems control is provided. Also distributed Petri nets and their synthesis and translation to asynchronous communicating automata are discussed. Then distributed Petri net synthesis techniques are applied to synthesize distributed supervisory controllers that avoid deadlocks or enforce home states. An algorithm is proposed and its limitations are discussed. As an illustration of the method the paper experiments using the 3-dining philosophers problem, which leads to three (new) distributed solutions of this problem.

The third paper, *Extending PNML Scope: A Framework to Combine Petri Nets Types* by Lom-Messan Hillah, Fabrice Kordon, Charles Lakos, and Laure Petrucci, is concerned with Petri net extensions in the context of the International Standard on Petri nets, ISO/IEC 15909, which comprises three parts. ISO/IEC 15909-3 aims at defining extensions on the whole family of Petri nets. This paper elaborates on an extension framework for the third part of the standard and shows how priorities, times, and inhibitor arcs can be added in the context of an interleaving semantics.

Ekkart Kindler, in his paper *Modelling Local and Global Behaviour: Petri Nets and Event Coordination*, introduces the general idea of Event Coordination, Notation (ECNO) and of ECNO nets. ENCO can be used to define the global behavior of a software system on top of existing class diagrams. One of the major objectives of this notation was to make it easy to integrate model-based code generation with existing structural models, with existing code, and other behavioral models. Basically, the ENCO net describes how the local behavior of the individual parts of the software is coordinated. ECNO nets have been implemented as a Petri net type for the ePNK tool, together with a code

generator that produces code that can be executed by the ECNO execution engine.

In *Model Checking Using Generalized Testing Automata*, Ala-Eddine Ben Salem, Alexandre Duret-Lutz, and Fabrice Kordon continue earlier work on LTL model checking of stuttering-invariant properties. The automata-theoretic approach to model checking of linear-time properties relies on  $\omega$ -automata to represent infinite executions of a model. Different types of automata have been used and the current paper proposes to combine features from Testing Automata, and Transition-Based Generalized Büchi Automata, which leads to the introduction of Transition-Based Generalized Testing Automata. Experiments on benchmark models show that TGTA outperform the other approaches in most of the cases.

The paper *A Domain Specific Language Approach for Genetic Regulatory Mechanisms Analysis*, by Nicolas Sedlmajer, Didier Buchs, Steve Hostettler, Alban Linard, Edmundo López Bóbeda, and Alexis Marechal, describes an approach based on Domain Specific Languages (DSLs). The authors provide a language called GReg that aims to describe genetic regulatory mechanisms and their properties. The language is designed to enable model checking. GReg's objective is to shield the user from the complexity of those underlying techniques. The resulting models can be used to discover emerging properties arising from the complex interactions between biological components.

In his paper *Verifying Parallel Algorithms and Programs Using Coloured Petri Nets*, Michael Westergaard describes an approach for the automatic extraction of Coloured Petri Net models from parallel algorithms and programs where processes communicate via shared memory. This makes it possible to verify software using a formal model obtained from runnable code. An implementation of the translation is presented. Moreover, the technique proposed also supports model-driven development. Consequently, extraction of a model from an abstract description and generation of correct implementation code can be combined.

The last paper based on the best papers from the workshops held at the 32nd International Conference on Application and Theory of Petri Nets and Other Models of Concurrency is of a different flavor as it is based on a competition held in the context of the SUMo 2011 workshop. The paper *Report on the Model Checking Contest at Petri Nets 2011*, by Fabrice Kordon, Alban Linard, Didier Buchs, Maximilien Colange, Sami Evangelista, Kai Lampka, Niels Lohmann, Emmanuel Paviot-Adet, Yann Thierry-Mieg, and Harro Wimmel, presents the results of this competition. The participating tools were compared on several tests (state space generation, deadlock detection and reachability analysis) run on a set of common models (Place/Transition and Symmetric Petri nets). The collected data gave some hints about the way techniques scale up depending on both the property investigated and the characteristics of the model. This paper also presents the lessons learned from the organizers' point of view and lists enhancements required for future Model Checking Contests.

## Special Section on Networks, Protocols, and Services

This part of the present ToPNoC issue is dedicated to papers that focus on Petri net-based techniques and technologies, as well as other models of concurrency, and their applications to the analysis and design of networks, protocols, and services. Computer and telecommunication networks, together with their protocols, constitute key building blocks of most modern IT systems, since they define the infrastructures and the services that make possible the cooperation of users, be they human or machine, through the exchange of information. The engineering of networks, protocols, and services supporting today's advanced use of information technology is a challenging discipline, which requires careful behavioral modelling and validation. This makes networks, protocols, and services an important application domain for the use of Petri net techniques, as well as other models of concurrency.

This special section is based on papers submitted through an open call for contributions and invitation to selected researchers in the application domain. All papers went through a two-stage reviewing process and five papers were accepted for publication.

In *Modelling and Formal Verification of the NEO Protocol*, Christine Choppy, Anna Dedova, Sami Evangelista, Kaïs Klai, Laure Petrucci, and Samir Youcef present their work on the practical application of high-level Petri nets and a suite of supporting computer tools for the modelling and verification of a protocol for the management of large distributed databases. The Petri nets models are constructed based on a reverse-engineering approach from source code, and state space exploration is being used to analyze reliability properties of the election and bootstrap phases of the NEO protocol. One important finding is the identification of several aspects where the present NEO protocol implementation can be improved.

The paper by Sonya Arnold and Jonathan Billington, *An Initial Coloured Petri Net Model of the Hypertext Transfer Protocol Operating Over the Transmission Control Protocol*, concentrates on the use of Coloured Petri Nets (CPNs) for modelling essential features of the Hypertext Transfer Protocol (HTTP), which is currently undergoing revision by the Internet Engineering Task Force. A CPN model of the HTTP protocol is presented that relies on an explicit and rigorous modelling of the service provided by the underlying transport protocol. State spaces and standard behavioral properties of Petri nets are being used to verify liveness and termination properties of HTTP and determine tight upper bounds on interface buffers.

The paper *Privacy Compliance Verification in Cryptographic Protocols* by Suriadi Suriadi, Chun Ouyang, and Ernest Foo focuses on the use of CPNs for constructing executable formal models of privacy enhancing protocols. A representative protocol in the form of the Private Information Escrow Bound to Multiple Conditions Protocol (PIEMCP) is considered. A CPN model of the PIEMCP protocol together with associated modelling techniques is presented and then temporal logic and model checking techniques are used to formulate and verify privacy compliance properties under a range of attack scenarios.

Dario Bruneo, Francesco Longo, and Antonio Puliafito, in their paper *Modeling Energy-Aware Cloud Federations with SRNs*, develop a methodology based on stochastic reward nets to evaluate management policies in the context of infrastructure as a service clouds. Models are developed for cloud infrastructure components and it is shown how these can be used to reason analytically about energy efficiency in hybrid clouds consisting of cooperating private and public clouds. In this context, federation policies allow clouds to cooperate to handle peak request periods for virtual machines while virtual server consolidation policies allow infrastructure shutdown of data centre services.

In their paper *A SAN-Based Modeling Approach to Performance Evaluation of an IMS-Compliant Conferencing Framework*, Stefano Marrone, Nicola Mazzocca, Roberto Nardone, Roberta Presta, Simon Pietro Romano, and Valeria Vittorini propose a component- and template oriented modelling approach based on Stochastic Activity Networks (SANs) for reasoning about the performance of a distributed IP-based multimedia conferencing framework. Performance models built using the proposed approach are validated via comparison with performance measures extracted from a deployed implementation, demonstrating the accuracy of the result obtained with the approach.

## Regular Paper

An earlier version of the paper *Aggregating Causal Runs into Workflow Nets* by B.F. van Dongen, J. Desel, and W.M.P. van der Aalst was submitted to the ART workshop at Petri Nets 2011 and was suggested as a paper for ToPNoC by the workshop organizers. However, to avoid any conflict of interest, the paper was submitted to ToPNoC directly through the regular submission track. This was done because one of the authors (Wil van der Aalst) was also editor of the special issue based on Petri Nets 2011. The reviewing process was handled by the Editor-in-Chief, Kurt Jensen.

The paper *Aggregating Causal Runs into Workflow Nets* provides three algorithms for deriving marked Petri nets from sets of partially-ordered causal runs. The three aggregation algorithms differ with respect to the assumptions about the information contained in the causal runs. Unlike most papers on process mining, the authors use the assumption that events are logged as partial orders instead of linear traces. Although the work is inspired by applications in the process mining and workflow domains, the results are generic and can be applied in other application domains.

## Thanks

As guest editors, we would like to thank all authors and referees who have contributed to this issue: not only is the quality of this volume the result of the high scientific value of their work, but we would also like to acknowledge the excellent cooperation throughout the whole process that has made our work a pleasant task. Finally, we would like to pay special tribute to Lars Madsen of

Aarhus University and Ine van der Ligt of Eindhoven University of Technology, who provided technical support for the composition of this volume and interacted with the authors. We are also grateful to the Springer/ToPNoC team for the final production of this issue.

August 2012

Wil van der Aalst  
Jetty Kleijn  
Giuliana Franceschinis  
Lars Michael Kristensen  
Marco Ajmone Marsan

Guest Editors, Sixth Issue of ToPNoC

# Organization

## Guest Editors

Wil van der Aalst, The Netherlands  
Jetty Kleijn, The Netherlands  
Giuliana Franceschinis, Italy  
Lars Michael Kristensen, Norway  
Marco Ajmone Marsan, Italy

## Co-chairs of the Workshops

Didier Buchs (Switzerland)  
Jörg Desel (Germany)  
Michael Duvigneau (Germany)  
Monika Heiner (Germany)  
Kunihiko Hiraishi (Japan)  
Hanna Klaudel (France)  
Hiroshi Matsuno (Japan)  
Daniel Moldt (Germany)  
Franck Pommereau (France)  
Alex Yakovlev (UK)

## Referees

Arseniy Alekseyev  
David Angeli  
Alessio Angius  
Gianfranco Balbo  
Kamel Barkaoui  
Robin Bergenthum  
Marco Bernardo  
Marcello Bonsangue  
Dragan Bosnacki  
Hanifa Boucheneb  
Marco Beccuti  
Didier Buchs  
Lawrence Cabac  
Massimo Canonico  
Claudine Chaouiya  
Silvano Chiaradonna  
Carla Fabiana Chiasserini

Piotr Chrzastowski-Wachtel  
Gianfranco Ciardo  
Daniele Codetta-Raiteri  
David D'Aprile  
Jörg Desel  
Boudewijn van Dongen  
Claude Dutheillet  
Sami Evangelista  
Guy Gallasch  
Steven Gordon  
Boudewijn Haverkort  
Xudong He  
Kunihiko Hiraishi  
Tommi Junttila  
Hanna Klaudel  
Jetty Kleijn  
Michał Knapik

XVIII Organization

Fabrice Kordon  
Marta Koutny  
Lars Michael Kristensen  
Luciano Lavagno  
Didier Le Botlan  
Charles Lakos  
Chen Li  
Johan Lilius  
Robert Lorenz  
Michela Meo  
Artur Meski  
Patrice Moreaux  
Berndt Müller  
Aurélien Naldi  
Meriem Ouederni

Laure Petrucci  
Franck Pommereau  
Louchka Popova-Zeugmann  
Jean François Pradat-Peyre  
Jean-Francois Raskin  
Markus Siegle  
Kent Inge F. Simonsen  
Andrea Turrini  
Antti Valmari  
Michael Westergaard  
Manuel Wimmer  
Shingo Yamaguchi  
Shaofa Yang  
Mengchu Zhou

# Table of Contents

## Best Workshop Papers from Petri Nets 2011

The Label Splitting Problem . . . . .	1
<i>Josep Carmona</i>	
Distributed Control of Discrete-Event Systems: A First Step . . . . .	24
<i>Philippe Darondeau and Laurie Ricker</i>	
Extending PNML Scope: A Framework to Combine Petri Nets Types . . .	46
<i>Lom-Messan Hillah, Fabrice Kordon, Charles Lakos, and Laure Petrucci</i>	
Modelling Local and Global Behaviour: Petri Nets and Event Coordination . . . . .	71
<i>Ekkart Kindler</i>	
Model Checking Using Generalized Testing Automata . . . . .	94
<i>Ala-Eddine Ben Salem, Alexandre Duret-Lutz, and Fabrice Kordon</i>	
A Domain Specific Language Approach for Genetic Regulatory Mechanisms Analysis . . . . .	123
<i>Nicolas Sedlmajer, Didier Buchs, Steve Hostettler, Alban Linard, Edmundo López Bóbeda, and Alexis Marechal</i>	
Verifying Parallel Algorithms and Programs Using Coloured Petri Nets . . . . .	146
<i>Michael Westergaard</i>	
Report on the Model Checking Contest at Petri Nets 2011 . . . . .	169
<i>Fabrice Kordon, Alban Linard, Didier Buchs, Maximilien Colange, Sami Evangelista, Kai Lampka, Niels Lohmann, Emmanuel Paviot-Adet, Yann Thierry-Mieg, and Harro Wimmel</i>	

## Special Section on Networks, Protocols, and Services

Modelling and Formal Verification of the NEO Protocol . . . . .	197
<i>Christine Choppy, Anna Dedova, Sami Evangelista, Kais Klai, Laure Petrucci, and Samir Youcef</i>	
An Initial Coloured Petri Net Model of the Hypertext Transfer Protocol Operating over the Transmission Control Protocol . . . . .	226
<i>Sonya Arnold and Jonathan Billington</i>	

Privacy Compliance Verification in Cryptographic Protocols . . . . . 251  
*Suriadi Suriadi, Chun Ouyang, and Ernest Foo*

Modeling Energy-Aware Cloud Federations with SRNs . . . . . 277  
*Dario Bruneo, Francesco Longo, and Antonio Puliafito*

A SAN-Based Modeling Approach to Performance Evaluation  
of an IMS-Compliant Conferencing Framework . . . . . 308  
*Stefano Marrone, Nicola Mazzocca, Roberto Nardone,  
Roberta Presta, Simon Pietro Romano, and Valeria Vittorini*

**Regular Paper**

Aggregating Causal Runs into Workflow Nets . . . . . 334  
*Boudewijn F. van Dongen, Jörg Desel, and Wil M.P. van der Aalst*

**Author Index** . . . . . 365