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# Transactions on Petri Nets and Other Models of Concurrency XIII

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## **Preface by Editor-in-Chief**

The 13th 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 held at the 38th International Conference on Application and Theory of Petri Nets and Concurrency (Petri Nets 2017, Zaragoza, Spain, June 25–30, 2017), and the 17th International Conference on Application of Concurrency to System Design (ACSD 2017, Zaragoza, Spain, June 25–30, 2017).

I would like to thank the two guest editors of this special issue: Lars Michael Kristensen and Wojciech Penczek. Moreover, I would like to thank all authors, reviewers, and organizers of the Petri Nets 2017 and ACSD 2017 satellite workshops, without whom this issue of ToPNoC would not have been possible.

September 2018

Maciej Koutny

# **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 foundations of Petri nets were laid by the pioneering work of Carl Adam Petri and his colleagues in the early 1960s. Since then, a huge volume of material has been developed and published in journals and books as well as presented at workshops and conferences.

The annual International Conference on Application and Theory of Petri Nets and Concurrency started in 1980. 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 main libraries and are also accessible on SpringerLink (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
- 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**

The topics covered include: 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.

Also included are applications of nets to: biological systems; security 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; cyber physical systems; and workflow.

For more information about ToPNoC see: <http://www.springer.com/gp/computer-science/lncs/lncs-transactions/petri-nets-and-other-models-of-concurrency-topnoc-/731240>.

## **Submission of Manuscripts**

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

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## Preface by Guest Editors

This volume of ToPNoC contains revised versions of a selection of the best workshop papers presented at satellite events of the 38th International Conference on Application and Theory of Petri Nets and Other Models of Concurrency (Petri Nets 2017) and the 17th International Conference on Application of Concurrency to System Design (ACSD 2017).

As guest editors, we are indebted to the Program Committees of the workshops and in particular to their chairs. Without their enthusiastic support and assistance, this volume would not have been possible. The papers considered for this special issue have been selected in close cooperation with the workshop chairs. Members of the Program Committees participated in reviewing the new versions of the papers eventually submitted.

We received suggestions for papers for this special issue from:

- ATAED 2017: Workshop on Algorithms and Theories for the Analysis of Event Data (Chairs: Wil van der Aalst, Robin Bergenthum, Josep Carmona)
- PNSE 2017: International Workshop on Petri Nets and Software Engineering (Chairs: Lawrence Cabac, Daniel Moldt, Heiko Rölke).

The authors of the suggested papers were invited to improve and extend their results where possible, based on the comments received before and during the workshops. Each resulting revised submission was reviewed by at least two referees. We followed the principle of asking for fresh reviews of the revised papers, also from referees not involved initially in the reviewing of the original workshop contributions. All papers went through the standard two-stage journal reviewing process, and eventually eight were accepted after rigorous reviewing and revising. In addition, we invited the organizers of the eighth edition of the model checking contest to coordinate a paper reporting on the recent results and findings from the tool competition. The paper from the model checking contest was also subject to a two-stage review process and was selected for inclusion in this special volume.

The paper “Computing Alignments of Event Data and Process Models” by Sebastiaan van Zelst, Alfredo Bolt, and Boudewijn van Dongen considers the fundamental problem in process mining of checking conformance between a process model and an event log recorded from a system. The paper reports on large-scale experiments with process models aimed at investigating the impact that parameters of conformance checking algorithms have on the efficiency of computing optimal alignments. The paper concludes that the specific parameter configurations have a significant effect on computation efficiency.

Local process models describe structured fragments of process behavior that occurs in the context of business processes. The paper “Heuristic Mining Approaches for High-Utility Local Process Models” by Benjamin Dalmas, Niek Tax, and Sylvie Norre studies how a collection of process models that provide business insight can be

generated. The paper proposes heuristics to prune the search space in high-utility local process model mining without significant loss of precision. The relation between event log properties and the effect of using the proposed heuristics in terms of search space and precision is also investigated.

The paper “On Stability of Regional Orthomodular Posets” by Luca Bernardinello, Carlo Ferigato, Lucia Pomello, and Adrian Puerto Aubel presents a fundamental study of so-called regional logics corresponding to the set of regions of a transition system ordered by set inclusion. The paper presents initial results related to stability of regional logics representing some first steps toward a full characterization of stability.

The variable ordering used in model checking based on binary decision diagrams is known to have a significant impact on verification performance. The paper “Decision Diagrams for Petri Nets: A Comparison of Variable Ordering Algorithms” by Elvio Gilberto Amparore, Susanna Donatelli, Marco Beccuti, Giulio Garbi, and Andrew Miner presents an extensive experimental comparison of static variable orderings in the context of Petri nets. The paper has led to new insight into fundamental properties exploited by existing variable orderings proposed in the literature.

Modeling complex systems requires a combination of techniques to facilitate multiple perspectives and adequate modeling. The paper “Model Synchronization and Concurrent Simulation of Multiple Formalisms Based on Reference Nets” by Pascale Möller, Michael Haustermann, David Mosteller, and Dennis Schmitz shows how multiple formalisms can be used together in their original representation without the transformation to a single formalism. The authors present an approach to transform modeling languages into Reference Nets, which can be executed with the simulation environment Renew. A finite automata modeling and simulation tool is given to showcase the application of the concept.

Web service composition represents a fundamental problem and its complexity depends on the restrictions assumed. The paper “Complexity Aspects of Web Services Composition” by Karima Ennaoui, Lhouari Nourine, and Farouk Toumani studies the impact of several parameters on the complexity of this problem. The authors show that the problem is EXPTIME-complete if there is a bound on either: the number of instances of services that can be used in a composition, or the number of instances of services that can be used in parallel, or the number of the hybrid states in the finite state machines representing the business protocols of existing services.

The paper “GPU Computations and Memory Access Model Based on Petri net” by Anna Gogolińska, Łukasz Mikulski, and Marcin Piątkowski presents a general and uniform GPU computation and memory access model based on bounded inhibitor Petri nets. The effectiveness of the model is demonstrated by comparing its throughput with practical computational experiments performed on the Nvidia GPU with the CUDA architecture. The accuracy of the model was tested with different kernels.

Testing of fault-tolerant distributed software systems is a challenging task. The paper “Model-Based Testing of the Gorums Framework for Fault-Tolerant Distributed Systems” by Rui Wang, Lars Michael Kristensen, Hein Meling, and Volker Stolz shows how colored Petri net models can be used for model-based test case generation. The authors concentrate on so-called quorum-based distributed systems, and experimentally demonstrate that test cases automatically obtained from colored Petri net models may lead to a high statement coverage.

The Model Checking Contest (MCC) is an annual competition aimed at providing a fair evaluation of software tools that verify concurrent systems using state-space exploration techniques and model checking. The paper “MCC 2017 – The Seventh Model Checking Contest” by Fabrice Kordon, Hubert Garavel, Lom Messan Hillah, Emmanuel Paviot-Adet, Loïc Jezequel, Francis Hulin-Hubard, Elvio Amparore, Marco Beccuti, Bernard Berthomieu, Hugues Evrard, Peter G. Jensen, Didier Le Botlan, Torsten Liebke, Jeroen Meijer, Jiří Srba, Yann Thierry-Mieg, Jaco van de Pol, and Karsten Wolf presents the principles and the results of the 2017 edition of the MCC, which took place along with the Petri Net and ACSD joint conferences.

As guest editors, we would like to thank all authors and referees who contributed to this issue. The quality of this volume is the result of the high scientific standard of their work. Moreover, we would like to acknowledge the excellent cooperation throughout the whole process that has made our work a pleasant task. We are also grateful to the Springer/ToPNoC team for the final production of this issue.

September 2018

Lars Michael Kristensen  
Wojciech Penczek

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