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Maciej Koutny · Jetty Kleijn  
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# Transactions on Petri Nets and Other Models of Concurrency XII

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

The 12th 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 37th International Conference on Application and Theory of Petri Nets and Concurrency (Petri Nets 2016, Toruń, Poland, 19–24 June 2016), and the 16th International Conference on Application of Concurrency to System Design (ACSD 2016, Toruń, Poland, 19–24 June 2016). It also contains one paper submitted directly to ToPNoC.

I would like to thank the two guest editors of this special issue: Jetty Kleijn and Wojciech Penczek. Moreover, I would like to thank all authors, reviewers, and organizers of the Petri Nets 2016 and ACSD 2016 satellite workshops, without whom this issue of ToPNoC would not have been possible.

July 2017

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. All queries should be addressed 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 strongest workshop papers presented at satellite events of the 37th International Conference on Application and Theory of Petri Nets and Other Models of Concurrency (Petri Nets 2016) and the 16th International Conference on Application of Concurrency to System Design (ACSD 2016).

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 were 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 2016: Workshop on Algorithms & Theories for the Analysis of Event Data (chairs: Wil van der Aalst, Robin Bergenthum, and Josep Carmona),
- PNSE 2016: International Workshop on Petri Nets and Software Engineering (chairs: Lawrence Cabac, Lars Michael Kristensen, and Heiko Rölke).

The authors of these 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 to these first eight papers, one paper was submitted directly to the Editor-in-Chief of the ToPNoC series through the regular submission track and handled by him as is usual for journal submissions.

The main purpose of the paper “Properties of Plain, Pure, and Safe Petri Nets” by Kamila Barylska, Eike Best, Uli Schlachter, and Valentin Spreckels, is to demonstrate that it is worthwhile and useful to aim for a partial characterization of the state spaces of plain, pure, and safe Petri nets. It gives a set of necessary conditions for a Petri net to be plain, pure, and safe, and describes some applications of these conditions both in practice (for Petri net synthesis) and in theory (e.g., as part of a characterization of the reachability graphs of live and safe marked graphs).

The paper “Similarity-Based Approaches for Determining the Number of Trace Clusters in Process Discovery” by Pieter De Koninck and Jochen De Weerd, considers trace clustering techniques used to partition an event log into subsets with a lower degree of variation. It presents approaches to determine the appropriate number of clusters in a trace clustering context. Two approaches built on similarity are proposed: a stability- and a separation-based method. Both approaches are tested on multiple

real-life datasets to investigate the complementarity of the different components leading to results suggesting that both are successful in identifying an appropriate number of trace clusters.

Imposing access control onto workflows considerably reduces the set of users authorized to execute the workflow tasks. The paper “Log- and Model-Based Techniques for Security-Sensitive Tackling of Obstructed Workflow Executions” by Julius Holderer, Josep Carmona, Farbod Taymouri, and Günter Müller, envisages a new hybrid approach. The workflow and its authorizations into a Petri net are flattened and encode the obstruction with a corresponding ‘obstruction marking’. Depending on whether a log is provided or not, different actions are taken.

Nowadays, distributed storage systems are ubiquitous, very often under the form of a hierarchy of multiple caches. In their paper “Formal Modelling and Analysis of Distributed Storage Systems”, Jordan de la Houssaye, Franck Pommereau, and Philippe Deniel, propose a formal modelling framework to design distributed storage systems, with the innovating feature of separating the various concerns like data-model, operations, policy, consistency, topology, etc. They focus on performance analysis. The potential of the approach is illustrated by an example.

The integrated management of business processes and master data is a fundamental problem. The paper “DB-Nets: On The Marriage of Colored Petri Nets and Relational Databases”, by Marco Montali and Andrey Rivkin, studies the foundations of the problem, arguing that contemporary approaches struggle to find a suitable equilibrium between data- and process-related aspects. The paper proposes a new formal model, called db-nets, that balances these two pillars through the marriage of colored Petri nets and relational databases.

Transition systems are a powerful formalism, which is widely used for process model representation from event logs. The paper “Transition Systems Reduction: Balancing between Precision and Simplicity” by Sergey A. Shershakov, Anna A. Kalenkova, and Irina A. Lomazova, proposes an original approach to discovering transition systems that perfectly fit event logs and whose size is adjustable depending on the user’s need. The suggested approach allows the user to achieve the required balance between simple and precise models.

Partial order reduction is an important method for reducing state spaces. The paper “Stubborn Set Intuition Explained” by Antti Valmari and Henri Hansen, focuses on the differences between stubborn sets and other partial order methods. The deadlock-preserving stubborn set method is compared with the deadlock-preserving ample set and persistent set methods. Conditions to ensure that the reduced state space preserves the ordering of visible transitions are discussed and solutions to the ignoring problem are analyzed, both when only safety properties are to be preserved and when also liveness properties are relevant.

In the area of process mining, decomposed replay has been proposed to be able to deal with nets and logs containing many different activities. The paper “Decomposed Replay Using Hiding and Reduction as Abstraction”, by H.M.W. Verbeek, shows an example net and log for which the decomposed replay may take much more time, and

provides an explanation of why this is the case. To mitigate this problem, the paper proposes an alternative way to abstract the subnets from the single net, and shows that the decomposed replay using this alternative abstraction is faster than the monolithic replay.

Finally, the paper “Multiplicative Transition Systems” by Józef Winkowski was submitted directly to ToPNoC through the regular submission track. This article is concerned with algebras, called multiplicative transition systems, whose elements can be used to represent the runs of a system. The paper discusses how these algebras can represent discrete as well as continuous and partially continuous runs.

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 value 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.

July 2017

Jetty Kleijn  
Wojciech Penczek

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