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Transactions on Petri Nets and Other Models of Concurrency II

Special Issue on Concurrency in Process-Aware Information Systems

Springer

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

Guest Editor

Wil M.P. van der Aalst
Technical University of Eindhoven
Department of Mathematics and Computer Science
Den Dolech 2, 5612 AZ Eindhoven, The Netherlands
E-mail: w.m.p.v.d.aalst@tue.nl

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Preface by Editor-in-Chief

This is the second volume of the Journal entitled "LNCS Transactions on Petri Nets and Other Models of Concurrency" (ToPNoC). This special issue of ToPNoC focuses on a particular topic: *Concurrency in Process-Aware Information Systems*. Like some of the volumes in the earlier "Advances in Petri Nets" series, this volume provides a comprehensive state-of-the-art overview on a more focused topic. Process-Aware Information Systems have become one of the most important application domains of Petri nets. For example, workflow technology is driven by languages closely related to Petri nets, and various analysis techniques ranging from workflow verification to process mining benefit from decades of concurrency research. This explains why this first special issue of ToPNoC is devoted to Process-Aware Information Systems.

As Editor-in-Chief of ToPNoC, I would like to thank the editor of this special issue: Wil van der Aalst. Moreover, I would like to thank all authors and reviewers whose efforts have contributed to this interesting and highly relevant ToPNoC volume.

January 2009

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 Other Models of 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 online in Springerlink (electronically). Simultaneously the ToPNoC volumes form a Journal, and 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 at the annual Petri net conferences
- Special sections/issues within 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 proposed for inclusion in ToPNoC as special sections/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 different kinds of systems and application fields, e.g.: flexible manufacturing systems, real-time systems, embedded systems, defense systems, biological systems, health and medical systems, environmental systems, hardware structures, telecommunications, railway networks, office automation, workflows, supervisory control, protocols and networks, the Internet, e-commerce and trading, programming languages, performance evaluation, and operations research.

For more information about ToPNoC, please see: `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. All queries should be addressed to the same e-mail address.

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

Preface by Guest Editor

Process-aware information systems support operational business processes by combining advances in information technology with recent insights from management science. Workflow management systems are typical examples of such systems. However, many other types of information systems are also "process aware" even if their processes are hard-coded or only used implicitly (e.g., ERP systems). The shift from data orientation to process orientation has increased the importance of process-aware information systems. Moreover, advanced analysis techniques ranging from simulation and verification to process mining and activity monitoring allow for systems that support process improvement in various ways.

Information technology has changed business processes within and between enterprises. More and more work processes are being conducted under the supervision of information systems that are driven by process models. Examples are workflow management systems such as FLOWer, FileNet, and Staffware; advanced middleware software such as WebSphere; enterprise resource planning systems such as SAP and Oracle; as well as many domain specific systems. It is hard to imagine enterprise information systems that are unaware of the processes taking place. Although the topic of business process management using information technology has been addressed by consultants and software developers in depth, more fundamental approaches towards such Process-Aware Information Systems (PAISs) have been rather uncommon. It wasn't until the 1990s that researchers started to work on the foundations of PAISs. Clearly, concurrency theory is an essential ingredient in these foundations as business processes are highly concurrent involving all types of routing logic and resource allocation mechanisms.

PAISs play an important role in Business Process Management (BPM). There exist many definitions of BPM. Here we will use the following definition: "Business process management (BPM) is a field of knowledge that combines knowledge from information technology and knowledge from management sciences and applies this to operational business processes". BPM can be seen as an extension of Workflow Management (WFM), which primarily focuses on the automation of business processes.

The term "business process" should be interpreted in a broad sense. It also encompasses other types of operational processes that need to be supported. For example, scientific computing using grid technology is definitely included when talking about process-aware information systems. The challenges in scientific workflows go beyond classical workflows and, e.g., grid technology will enable new forms of BPM.

Different models of concurrency have been used to model workflows, typically aiming at their analysis. For example, a particular variant of Petri nets, called

workflow nets, has been widely used for the modeling and analysis of workflows. Moreover, many workflow management systems use a graphical notation close to Petri nets. There are interesting challenges in the modeling of PAISs, e.g., high-level Petri nets can be used to describe process languages and standards (EPCs, YAWL, BPMN, BPEL, etc.) and the architectures of the systems supporting these languages. The resulting models can be used for all kinds of analysis, e.g., verification and performance analysis. Moreover, there are also interesting challenges in the discovery of concurrent processes (cf. process mining techniques).

This special issue of ToPNoC focuses on concurrency in PAISs. The papers in this ToPNoC volume address the various problems related to designing, implementing, and analyzing PAISs. Many of the papers address the concurrency aspect by using Petri nets. Different papers address the issue of language transformations either for the purpose of interoperability or analysis. In many cases, Petri-net-based analysis techniques are used to verify a certain property. There is a special focus on interacting systems as these are more difficult to handle. This focus is triggered by the emerging service-oriented architectures. Some papers also address problems related to synthesis and process mining in a PAIS environment. Note that information systems increasingly produce enormous event logs that can be used for analysis purposes.

This volume of ToPNoC is interesting both for researchers working in concurrency theory and people working on business process management as it identifies and addresses the challenges posed by PAISs. Moreover, it is also valuable for practitioners involved in the development of new PAISs or the application of existing systems.

This topical volume of ToPNoC contains 16 papers. The authors of these papers were invited to submit a paper based on their expertise in this area. All invited papers were reviewed by four referees. In the first round of reviews, some papers were rejected, some were accepted (with minor revisions), and some were asked to submit a revised version. Based on a second round of reviewing (again by three or four referees), the final decisions were made. As Editor of the special issue, I would like to thank the reviewers and authors for doing an outstanding job. I would also like to thank the two secretaries involved in preparing the final version of this volume: Ine van der Ligt (Eindhoven University of Technology) and Dorthe Haagen Nielsen (University of Aarhus). I would also like to thank the Springer LNCS/ToPNoC team for handling things in an efficient and effective manner.

In the remainder of this preface, the contributions are briefly summarized.

The first paper titled "Process-Aware Information Systems: Lessons to Be Learned from Process Mining" serves two purposes. On the one hand, it provides an introduction to this special issue by giving an overview of the domain. On the other hand, it presents a rather personal view on the research in this area and the lessons that can be learned from recent insights provided by process mining.

The second paper "Model-Based Software Engineering and Process-Aware Information Systems" by Ekkart Kindler aims to bridge the gap between Model-Based Software Engineering (MBSE) and PAIS.

The paper "Petri Net Transformations for Business Processes: A Survey" by Niels Lohmann, Eric Verbeek, and Remco Dijkman focuses on the challenges related to translating one process language to another. The authors discuss transformations related to BPMN, YAWL, EPCs, Petri nets, and BPEL.

Frank Puhlmann and Mathias Weske discuss the π-calculus as a formal foundation for PAIS in their paper "A Look Around the Corner: The Pi-Calculus". They use the workflow patterns to discuss the applicability of the π-calculus in this domain.

The paper "newYAWL: Towards Workflow 2.0" by Nick Russell and Arthur ter Hofstede focuses on a concrete workflow language: newYAWL. Using colored Petri nets, the semantics of newYAWL and architectural considerations are discussed.

Michael Köhler-Bußmeier, Matthias Wester-Ebbinghaus, and Daniel Moldt present a Petri-net-based organizational model called SONAR in their paper "A Formal Model for Organisational Structures behind Process-Aware Information Systems". The goal is to devote more attention to organizational aspects in an integrated manner.

The paper "Flexibility in Process-Aware Information Systems" by Manfred Reichert, Stefanie Rinderle-Ma, and Peter Dadam focuses on one of the most important challenges for PAISs: flexibility. After formulating some requirements, it is shown how these are addressed in the ADEPT2 tool.

The paper "Business Grid: Combining Web Services and the Grid" by Ralph Mietzner, Dimka Karastoyanova, and Frank Leymann discusses requirements for the so-called "business grid". While grids are studied in detail in the context of e.g., scientific workflows, the grid community is disconnected from the BPM community and this paper advocates the unification of results from both domains.

Karsten Wolf focuses on service interaction in his paper "Does My Service Have Partners?". The paper provides results for both the controllability of single-port services and multiple-port services.

The paper "Deciding Substitutability of Services with Operating Guidelines" by Christian Stahl, Peter Massuthe, and Jan Bretschneider is related to the paper by Karsten Wolf. Using the so-called "operating guidelines" three substitutability notions are operationalized.

The paper "A Framework for Linking and Pricing No-Cure-No-Pay Services" by Kees van Hee, Eric Verbeek, Christian Stahl, and Natalia Sidorova also looks at services but now from a "pricing" point of view. It is shown how a Petri-net-based framework can be used to compute the price of a service orchestration.

In his paper "Empirical Studies in Process Model Verification" Jan Mendling addresses the need for more empirical research in this area. He discusses several large-scale verification studies and the lessons that can be learned from this.

While most of the papers discussed so far mainly focus on the design and analysis of process models or systems, the last four papers focus on process mining, i.e., the analysis of behavior observed in real life (e.g., based on event logs, example scenarios, or interactions).

The paper "Process Mining: Overview and Outlook of Petri Net Discovery Algorithms" by Boudewijn van Dongen, Ana Karla Alves de Medeiros, and Lijie Wen gives an overview of existing mining techniques. Using various quality notions, 13 Petri-net discovery algorithms (all available in ProM) are reviewed.

The paper "Construction of Process Models from Example Runs" by Robin Bergenthum, Jörg Desel, Sebastian Mauser, and Robert Lorenz proposes a novel approach for the automatic construction of Petri nets based on example runs. In this work, example scenarios rather than event logs are used as input.

Hong-Linh Truong and Schahram Dustdar address the need for the analysis of service interaction in their paper "Online Interaction Analysis Framework for Ad-Hoc Collaborative Processes in SOA-Based Environments". The paper presents the VOIA (Vienna Online Interaction Analysis) framework and discusses some experiments.

The paper "Exploiting Inductive Logic Programming Techniques for Declarative Process Mining" by Federico Chesani, Evelina Lamma, Paola Mello, Marco Montali, Fabrizio Riguzzi, and Sergio Storari concludes this special issue. The paper combines inductive logic programming with a declarative language to discover less structured processes. The approach is implemented as a ProM plug-in called DecMiner.

The papers in this ToPNoC volume provide a good overview of PAIS research. Some papers focus on the foundations of PAIS, while others try to apply existing (Petri-net-based) techniques to business process management. Therefore, this volume provides a useful blend of theory, practice, and tools related to concurrency and PAIS research.

January 2009 Wil van der Aalst
Guest Editor, Special Issue of ToPNoC on Concurrency in PAIS

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Wil van der Aalst, The Netherlands

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