Introduction to the Special Section on Petri Nets and Performance Models

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1 INTRODUCTION

On 11-14 September 2001, the Ninth International Workshop on Petri Nets and Performance Models (PNPM '01) took place at the Rheinisch-Westfälische Technische Hochschule (RWTH) Aachen [1]. The aim of the workshop was to provide a forum for original contributions in the area of timed and stochastic Petri nets and their usage for performance and dependability evaluation. Earlier workshops in this series took place in Torino, Italy (1985), Madison, WI, (1987), Kyoto, Japan (1989), Melbourne, Australia (1991), Toulouse, France (1993), Durham, NC, (1995), Saint Malo, France (1997), and Zaragoza, Spain (1999). The proceedings of all these conferences were published by IEEE CS Press.

PNPM '01 was held in conjunction with two other workshops: the 11th GI/ITG Conference on Measuring, Modelling and Evaluation of Computer and Communications Systems [2] and the joint workshops Process Algebra and Performance Modeling and Probabilistic Methods in Verification (PAPM-ProbMiV) [3]. The three workshops had separate tracks with contributed presentations but shared invited speakers, tool presentations, and a tutorial program.

Forty papers were submitted to PNPM '01 out of which the program committee selected, after an intensive review process, 23 papers for presentation. Out of these 23 papers, four papers have been extended and undergone another review procedure, after which they have been selected for inclusion in the current special issue of IEEE Transactions on Software Engineering.

The 10th International Workshop on Petri Nets and Performance Models has been planned for September 2003 and will be hosted by professor William Sanders at the University of Illinois at Urbana-Champaign.

2 SELECTED PAPERS

In “Product Form Solutions for Generalized Stochastic Petri Nets,” authored by G. Balbo et al., a class of Generalized Stochastic Petri Nets is identified for which the stationary probability distribution can be factored out into a product of terms. This product-form forms the basis for solution algorithms which are much more efficient than those based on the explicit generation and numerical solution of the underlying Markov chain. Previously, only product-form results were known for “ordinary” stochastic Petri nets; the current paper generalizes these results to stochastic Petri nets which also contain immediate transitions.

In “Time Domain Analysis of Non-Markovian Stochastic Petri Nets with PRI Transitions,” authored by A. Horvath and M. Telek, the transient analysis of stochastic Petri nets with general delay distributions and the "preemptive repeat identical" preemption policy is considered. This preemption policy is known to pose hard analytical challenges but is required in many modeling situations. The paper presents a time-domain solution which has better numerical properties than previously known transform-domain solutions. The authors demonstrate the analysis method with several examples and also show that the impact of the PRI preemption policy on the obtained performance measure of interest is substantial.

In “Fluid Stochastic Petri Nets Augmented with Flush-Out Arcs: A Transparent Analysis Technique,” authored by M. Gribaudo and A. Horvath, a new transient analysis method for Fluid Stochastic Petri Nets (FSPNs) is presented. FSPNs have “discrete places” which contain distinct tokens, as usual, but also so-called “fluid places” which may hold continuous quantities, i.e., certain amounts of “fluid.” The formalism is useful for modeling hybrid (discrete-continuous) systems and also for situations where portions of a large discrete state space, e.g., buffer fillings, can be represented by a continuous amount of fluid; the latter is a well-known concept in applied performance evaluation known as a fluid-flow approximation. The paper presents a new analysis method for FSPNs, based on Kronrecker algebra, an approach which was originally developed for dealing with large state spaces of Markovian models.

In “The Möbius Framework and its Implementation,” the authors D.D. Deavours et al. describe the Möbius framework in which multiple modeling formalisms, such as stochastic activity networks, stochastic Petri nets, and stochastic process algebras, as well as multiple solution
techniques can coexist in the same tool environment. Models expressed in different domain-specific formalisms may interact via so-called “abstract functional interfaces.” This allows for a tool realization which is modular with respect to both the modeling formalisms and the solvers. Such a modular tool architecture allows the sharing of software components and, thus, provides an infrastructure for the cooperation between researchers and system performance engineers.

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REFERENCES


Gianfranco Ciardo received the PhD degree in computer science from Duke University, Durham, North Carolina, in 1989 and a Laurea degree in scienze dell’ informazione from the University of Torino, Italy. He is a professor of computer science at the College of William and Mary, Williamsburg, Virginia. He has been a visiting professor at the University of Torino, Italy, and the Technical University of Berlin, Germany, and held research positions at HP Labs, Palo Alto, California; Software Productivity Consortium, Herndon, Virginia; and CSELT, Torino, Italy. He is active in both theoretical research and tool building for logic and stochastic analysis of discrete-state models; symbolic model checking; performance and reliability evaluation of complex hardware/software systems, in particular, clusters of web servers; and Petri nets and Markov models. Dr. Ciardo is on the editorial board of IEEE Transactions on Software Engineering and was a keynote speaker at PNPM ’01. His conference involvement include being program cochair (in 1995 and 2003) of PNPM, organization chair (in 1999) of the International Conference on Application and Theory of Petri Nets (ICATPN), and vice program chair (in 2000) and vice general chair (in 1998) of the IEEE International Computer Performance and Dependability Symposium (IPDS). He is a member of ACM and a senior member of IEEE.

Reinhard German received the PhD degree in engineering and a Habilitation degree from this University. He is an associate professor of system simulation at the Institute for Computer Networks and Communication Systems in the Computer Science Department of the University of Erlangen-Nürnberg, Germany. Prior to this, he was with the Technische Universität Berlin, where he first received a doctoral fellowship from the German research council, then worked in a research project funded by Siemens München, and then was an assistant professor. In 1995, he visited the Performability Engineering Research Group at the University of Illinois at Urbana-Champaign. His research is focused on the performance and dependability evaluation of distributed and embedded systems, both model-based and measurement-based. Model-based methods include queuing systems, stochastic Petri nets, and simulation; special attention is given to the analysis of non-Markovian models. Measurement-based methods include hardware and software modifications of distributed systems for high-volume and high-resolution monitoring. He initiated the development of the stochastic Petri net modeling tool TimeNET and wrote a monograph entitled “Performance Analysis of Communication Systems: Modeling with Non-Markovian Stochastic Petri Nets.”

Boudewijn R. Haverkort obtained an engineering and the PhD degree in computer science, both from the University of Twente, in 1986 and 1991, respectively. He has been a professor for performance evaluation and distributed systems in the Computer Science Department of the RWTH Aachen since 1995. Prior to this appointment, he was a lecturer in the Computer Science Department at the University of Twente in the Netherlands and a visiting researcher in the Teletraffic Research Centre at the University of Adelaide. His research interests encompass model-based performance and dependability evaluation of computer-communication systems, model checking, parallel and distributed computing, communication systems, Web-based information systems and fault-tolerant computer systems; on these topics, he lectures both at the RWTH Aachen and in industry. He has published more than 75 papers in international journals and conference proceedings, edited several books and conference proceedings, wrote a monograph on model-based performance evaluation of computer and communication systems, and is the codeveloper of the software performance tools FiFiQueues, SPN2MGM, and PARSECS. He has been a senior member of the IEEE since 2001.