Guest Editors' Introduction Special Section on Petri Net Performance Models

THIS special section includes three papers selected from the International Workshop on Petri Nets and Performance Models (PNPM'87) held in Madison, Wisconsin, in August of 1987. The Madison workshop follows the first Workshop on Timed Petri Nets held in Torino, Italy, in July of 1985, with its emphasis on Petri net based models for performance evaluation of computer systems. The proceedings of both the workshops are available from the IEEE Computer Society Press. The area of performance modeling has long been centered on classical queueing theory. However, the Petri net based model has received increasing interest as a candidate performance model for the design of distributed and parallel systems, which are difficult to represent using classical queueing techniques. With this in mind, we are pleased to include three of the best papers from the PNPM'87 workshop. We believe you will find them interesting reading.

The active research in this area has followed two basic themes. First, the models are studied as mathematical entities, in an attempt to understand them more completely, and to find the most efficient approaches to solving for performance measures. Second, the models may be extended to be used as a specification for a more general purpose simulation. The first paper, by Florin and Natkin, illustrates current work in the former track. The second paper, by Haas and Shedler, studies the expressive power of an SPN used as a simulation specification language, and is an example of research following the latter track. The third paper, by Dugan and Ciardo, applies the extended stochastic Petri net model to a nontrivial analysis of replicated file systems.

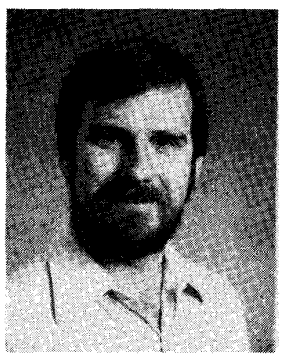
In the first paper, the problem of efficiently determining whether a particular stochastic Petri net (SPN) model is ergodic, and therefore has a steady state solution, is addressed. Exploiting the equivalence between the SPN and homogeneous Markov chains, the authors develop a series of theorems which may be applied to check whether a particular stochastic Petri net is ergodic.

In the second paper, the processes which can be expressed by a stochastic Petri net with nonexponentially distributed firing times are characterized. The results indicate that the more general stochastic Petri net is equivalent to the generalized, semi-Markov processes associated with general purpose simulation languages.

In the third paper, a distributed database with a distributed locking protocol is studied. This problem has been difficult to study using more traditional approaches and demonstrates the steps necessary to model a complex distributed system using these models. One clear point which is made in this paper is the necessity of acquiring software analysis tools in order to actually use Petri net based models in practice.

The Guest Editors wish to thank the authors of the selected papers and the many reviewers who helped select and improve the papers found in this special section. The papers were reviewed for the workshop and again by separate referees for the TRANSACTIONS. The workshop General Chairman (Murata) and Program Cochairmen (Molloy and Vernon) have served as the Guest Editors of this special section. They are grateful to Professor C. V. Ramamoorthy, former Editor-in-Chief, for suggesting this special section.

MICHAEL K. MOLLOY
TADAO MURATA
MARY K. VERNON
Guest Editors



Michael K. Molloy received the B.S. degree in engineering physics and the M.S. degree in mathematics from the University of Illinois in Urbana. After working in industry as a systems engineer, he returned to school to earn a Ph.D. degree in computer science from the University of California, Los Angeles, for his development of the stochastic Petri net model.

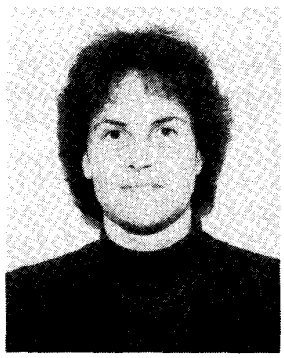
He was an Assistant Professor at the University of Texas at Austin from 1981 to 1986 where he was actively involved in experimental research in the areas of networking and performance evaluation. In 1986, he moved to Carnegie-Mellon University where he was on the faculty in the Department of Computer Science. He is the author of over 20 articles and a book *Fundamentals of Performance Evaluation* published by Macmillan. Since the summer of 1988, he has been employed by Hewlett-Packard in the Workstation R&D Lab located in Fort Collins, CO, where he works on the experimental performance evaluation of distributed systems. He continues to be involved with research on stochastic Petri nets through a project at Colorado State University, where he has an adjunct position.

In 1983, Dr. Molloy received the IBM Faculty Development Award for his work on Stochastic Petri Nets. He has been active in the international workshops on timed and stochastic Petri nets since the first one was held in Torino, Italy, in July of 1985 and was program Co-chairman of the 1987 workshop in Madison, WI.

Tadao Murata (S'62-M'66-SM'77-F'85) received the M.S. and Ph.D. degrees in electrical engineering from the University of Illinois, Urbana.

He is presently a Professor of Electrical Engineering and Computer Science at the University of Illinois, Chicago. During occasional leaves of absence from the University of Illinois, he has taught at the University of California, Berkeley, and Tokai University, Tokyo, Japan, and was invited to visit Petri's Institute at GMD mbH in Germany and several other research institutes and universities in Europe. His current research interests include applications and theory of Petri nets, concurrent computer systems, and data flow and parallel computations. In these areas he has published extensively and been awarded several National Science Foundation research grants since 1975. Prior to that he worked in the area of circuits, systems, and applied graph theory.

Dr. Murata has served on the U.S. National Academy of Sciences Computer Science and Technology Board panels. He is an Editor of the IEEE TRANSACTIONS ON SOFTWARE ENGINEERING and served as the General Chairman of the 1987 International Workshop on Petri Nets and Performance Models. He is also a member of the Association for Computing Machinery, EATCS, IECE, and the Information Processing Society of Japan. He is listed in *Who's Who in Engineering* and *Who's Who in America*.



Mary K. Vernon (S'82-M'82) received the B.S. degree with Departmental Honors in chemistry in 1975, and the M.S. and Ph.D. degrees in computer science from the University of California at Los Angeles in 1979 and 1982, respectively.

In 1983 she was a Visiting Assistant Professor in Computer Science at UCLA and a Research Staff member at the Aerospace Corporation in Los Angeles. She is currently an Assistant Professor in Computer Science at the University of Wisconsin—Madison. Her research interests are in techniques for parallel system performance modeling, analysis of parallel system performance, and multiprocessor architectures.

In 1985 Dr. Vernon received the prestigious Presidential Young Investigator Award from the National Science Foundation. She is a member of the Board of Directors of ACM SIGMETRICS and the Computer Science Advisory Board of the Computer Measurement Group (CMG).