



**2003 Illinois International Multiconference on
Measurement, Modelling, and Evaluation of
Computer-Communication Systems:
PNPM ♦ Tools ♦ NSMC ♦ PMCCS**

September 2-7, 2003 Urbana and Monticello, Illinois, USA

Sponsored by the Coordinated Science Laboratory at the University of Illinois

**P N P M ♦ T o o l s ♦ N S M C
F I N A L P R O G R A M**

PNPM 2003 (the 10th International Workshop on Petri Nets and Performance Models)
Performance TOOLS 2003 (13th International Conference on Modelling Techniques and Tools for
Computer Performance Evaluation)
NSMC '03 (International Conference on the Numerical Solution of Markov Chains)



<http://www.crhc.uiuc.edu/Multi>

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W e l c o m e

The 2003 Illinois International Multiconference on Measurement, Modelling, and Evaluation of Computer-Communication Systems encompasses four conferences: **PNPM 2003** (the 10th International Workshop on Petri Nets and Performance Models), **Performance TOOLS 2003** (the 13th International Conference on Modelling Techniques and Tools for Computer Performance Evaluation), **NSMC '03** (the 4th International Conference on the Numerical Solution of Markov Chains), and **PMCCS-6** (the 6th International Workshop on Performability Modeling of Computer and Communication Systems).

This year's Multiconference follows a long tradition of grouping related conferences on modeling methodology, solution methods, and applications together in a synergistic way. In addition to the main technical tracks of each of the associated conferences, we are pleased to present:

Three Keynote Speakers: Valeriy A. Naumov (presenting "The Life and Work of A. A. Markov," his paper with Gely P. Basharin), David Nicol (presenting "Multiscale Modeling and Simulation of Worm Effects on the Internet Routing Infrastructure," his paper with Michael Liljenstam and Jason Liu), and Jean Peccoud (presenting "Modeling Networks of Molecular Interactions in the Living Cell: Structure, Dynamics, and Applications," his paper with Kent Vander Velden).

Invited Speaker: Frederica Darema presenting "Performance Engineered Systems."

Four Tutorials: "Layered Resource, Layered Queues and Software Bottlenecks" (Murray Woodside, Carleton University), "Formal Modeling and Analysis of Hybrid Systems" (Rajeev Alur, University of Pennsylvania), "Software Rejuvenation - Modeling and Analysis" (Kalyan Vaidyanathan, Sun Microsystems), and "Numerical Analysis Approaches for Large Markov Chains - Experiments, Observations and some New Results" (Peter Buchholz, University of Dresden).

Many Software Presentations and Demonstrations: Presenting the latest software tools for evaluating the performance, dependability, and performability of computer systems and networks.

In addition to the technical program, there will be plenty of opportunity to interact with other researchers during the breaks, lunches, welcome reception, banquet, and the Performability Workshop (PMCCS-6). The tutorials and three main conferences will be held at the University of Illinois Coordinated Science Laboratory, which performs research concerning new and innovative computing, communications, signal processing, and control technologies. PMCCS-6 will be held at Allerton Park and Conference Center. The Park, which was originally a private estate, consists of a magnificent 17th-century-style manor house with extensive formal gardens highlighted by over 120 sculptures, all situated in a large nature preserve on the Sangamon River. The estate was given to the University of Illinois in 1946 to be used as an educational and research center and as a forest, wildlife, and plant-life preserve. Allerton provides a unique opportunity for Workshop participants to interact together in an informal setting.

I hope to see you in Illinois in September!

William H. Sanders
General Chair

Detailed Final Program

Tuesday, September 2

8:30-9:00	continental breakfast and registration in room 301 CSL	
9:00-noon	track 1: Tutorial A1 - 141 CSL	track 2: Tutorial B1 - 469A CSL
	Layered Resources, Layered Queues and Software Bottlenecks <i>presented by Murray Woodside (Carleton University)</i>	Software Rejuvenation - Modeling and Analysis <i>presented by Kalyan Vaidyanathan (SUN Microsystems)</i>
noon-1:30	lunch in the Ballroom of the Illini Union	
1:30-4:30	track 1: Tutorial A2 - 141 CSL	track 2: Tutorial B2 - 469A CSL
	Formal Modeling and Analysis of Hybrid Systems <i>presented by Rajeev Alur (University of Pennsylvania)</i>	Numerical Analysis Approaches for Large Markov Chains - Experiments, Observations and Some New Results <i>presented by Peter Buchholz (University of Dresden)</i>
6:00-8:00 pm	welcome reception in room 301 CSL	

Wednesday, September 3

7:45-8:15	continental breakfast outside B02 CSL	
8:15-8:35	Welcome message B02 CSL	
8:35-10:35	track 1: PNPM: Fluid Stochastic Petri Nets and Symbolic Approaches - B02 CSL <i>Session chair: Dan Deavours</i>	track 2: Tools: Tools for Measuring, Benchmarking, and On-line Control - 301 CSL <i>Session chair: Boudewijn Haverkort</i>
	Computing Response Time Distributions Using Stochastic Petri Nets and Matrix Diagrams <i>Andrew S. Miner (Iowa State University)</i> Performance Evaluation with Asynchronously Decomposable SWN: Implementation and Case Study <i>Clément Delamare (Université de Reims Champagne-Ardenne), Yvon Gardan (Université de Reims Champagne-Ardenne), and Patrice Moreaux (Université Paris Dauphine)</i> Stationary Analysis of FSPNs with Mutually Dependent Discrete and Continuous Parts <i>Reinhard German (Friedrich-Alexander Universität Erlangen-Nürnberg), Marco Gribaudo (Università di Torino), Gabor Horváth (Technical University of Budapest), and Miklos Telek (Technical University of Budapest)</i> Discrete-State and Fluid Stochastic Petri Net Models for Open-Loop Video-on-Demand Systems: A Comparative Case Study <i>Armin Heindl (TU Berlin) and Ernst W. Biersack (Institut Eurécom)</i>	A Low-Cost Infrastructure for High Precision High Volume Performance Measurements of Web Clusters <i>Kai-Steffen Jens Hielscher and Reinhard German (University of Erlangen-Nürnberg)</i> MIBA: A Micro-Benchmark Suite for Evaluating InfiniBand Architecture Implementations <i>Balasubramanian Chandrasekaran (The Ohio State University), Pete Wyckoff (Ohio Supercomputer Center), and Dhableswar K. Panda (The Ohio State University)</i> WebAppLoader: A Simulation Tool Set for Evaluating Web Application Performance <i>Katinka Wolter (Humboldt-Universität zu Berlin) and Kristian Kasproicz (Technische Universität Berlin)</i> A Comprehensive Toolset for Workload Characterization, Performance Modeling and On-line Control <i>Li Zhang, Zhen Liu, Anton Riabov, Monty Schulman, Cathy Xia, and Fan Zhang (IBM Thomas J. Watson Research Center)</i>
10:35-10:50	break outside B02 CSL	

10:50-noon	<p>B02 CSL: KEYNOTE SPEAKER: Jean Peccoud <i>Pioneer Hi-Bred International, Inc., USA</i> presenting “Modeling Networks of Molecular Interactions in the Living Cell: Structure, Dynamics, and Applications” by Kent Vander Velden (<i>Pioneer Hi-Bred International, Inc., USA</i>) and Jean Peccoud <i>Introduced by William H. Sanders</i></p>	
noon-1:30	<p>lunch in Illini Union rooms 209, 210, 211 (buffet is in 210)</p>	
1:30-3:00	<p>track 1: NSMC: Improving Classical Solution Methods - B02 CSL <i>Session chair: Amy N. Langville</i></p> <p>A Direct Projection Method for Markov Chains <i>Michele Benzi (Emory University)</i></p> <p>Adaptive Methods for the Computation of PageRank <i>Sepandar Kamvar, Taher Haveliwala, and Gene Golub (Stanford University)</i></p> <p>Algebraic Schwarz Methods for the Numerical Solution of Markov Chains <i>Ivo Marek (Czech Institute of Technology) and Daniel B. Szyld (Temple University)</i></p>	<p>track 2: PNP: Model Construction - 301 CSL <i>Session chair: Robert Jones</i></p> <p>SWN Client-Server Composition Operators in the OsMoSys Framework <i>Giuliana Franceschinis (Università del Piemonte Orientale), Valeria Vittorini (Università di Napoli), Stefano Marrone (Seconda Università di Napoli), and Nicola Mazzocca (Seconda Università di Napoli)</i></p> <p>Performance Queries on Semi-Markov Stochastic Petri Nets with an Extended Continuous Stochastic Logic <i>Jeremy T. Bradley, Nicholas J. Dingle, Peter G. Harrison, and William J. Knottenbelt (Imperial College London)</i></p> <p>Building Petri Net Scenarios for Dependable Automation Systems <i>Simona Bernardi and Susanna Donatelli (Università di Torino)</i></p>
3:00-3:30	<p>break outside B02 CSL</p>	
3:30-5:00	<p>track 1: NSMC: Simulation and More! - B02 CSL <i>Session chair: Carl D. Meyer</i></p> <p>Rate Tilting for Fast Simulation of Level/Phase Processes <i>Jingxiang Luo and Winfried K. Grassmann (University of Saskatchewan)</i></p> <p>On the Exact Simulation of Functionals of Stationary Markov Chains <i>Jean-Marc Vincent and Corine Marchand (Laboratoire ID-IMAG, France)</i></p> <p>Hypergraph-Based Parallel Computation of Passage Time Densities in Large Semi-Markov Models <i>Jeremy T. Bradley (Imperial College London), Nicholas J. Dingle (Imperial College London), William J. Knottenbelt (Imperial College London), and Helen J. Wilson (University of Leeds)</i></p>	<p>track 2: Tools: Tools for Evaluation of Stochastic Models - 301 CSL <i>Session chair: Peter Buchholz</i></p> <p>Logical and Stochastic Modeling with SMART <i>Gianfranco Ciardo (College of William and Mary), R. L. Jones III (ASRC Aerospace Corporation), A. S. Miner (Iowa State University), and R. Siminiceanu (College of William and Mary)</i></p> <p>The PEPS Software Tool <i>Anne Benoit (CNRS-INRIA-INPG-UJF, France), Leonardo Brenner (PUCRS, Brazil), Paulo Fernandes (PUCRS, Brazil), Brigitte Plateau (CNRS-INRIA-INPG-UJF, France), and William J. Stewart (North Carolina State University)</i></p> <p>The Modest Modeling Tool and Its Implementation <i>Henrik Bohnenkamp (University of Twente), Holger Hermanns (University of Twente and Saarland University), Joost-Pieter Katoen (University of Twente), and Ric Klaren (University of Twente)</i></p>
5:00-5:30	<p>301 CSL - INVITED SPEAKER: Frederica Darema <i>National Science Foundation, USA</i> presenting “Performance Engineered Systems” <i>Introduced by William H. Sanders</i></p>	

Thursday, September 4

8:00-8:30	continental breakfast outside B02 CSL	
8:30-10:30	<p>track 1: NSMC: Large State Spaces and Kronecker Structures - B02 CSL <i>Session chair: Daniel Szyl</i></p> <p>Block SOR for Kronecker Structured Representations <i>Peter Buchholz (Dresden University of Technology) and Tugrul Dayar (Bilkent University)</i></p> <p>Aggregation of Stochastic Automata Networks with Replicas <i>Anne Benoit (CNRS-INRIA-INPG-UJF, France), Leonardo Brenner (PUCRS, Brazil), Paulo Fernandes (PUCRS, Brazil), and Brigitte Plateau (CNRS-INRIA-INPG-UJF, France)</i></p> <p>Symbolic State-Space Exploration and Numerical Analysis of State-Sharing Composed Models <i>Salem Derisavi (University of Illinois at Urbana-Champaign), Peter Kemper (Universität Dortmund), and William H. Sanders (University of Illinois at Urbana-Champaign)</i></p> <p>Algorithms for an Irreducible and Lumpable Strong Stochastic Bound <i>Jean-Michel Fourneau, M. Lecoq, and F. Quessette (Universite de Versailles Saint-Quentin en Yvelines)</i></p>	<p>track 2: tool demonstration presentations - 301 CSL <i>Session chair: Falko Bause</i></p> <p>Graphical Modelling of Process Algebras with DrawNET <i>S. Gilmore and M. Gribaudo</i></p> <p>TrafGen: A Network Performance Analyzer <i>R. Benaini, K. Sbata, and P. Vincent</i></p> <p>DrawNET Xe: GUI and Formalism Definition Language <i>A. Baravalle, G. Franceschinis, M. Gribaudo, V. Lanfranchi, M. Iacono, M. Mazzocca, and V. Vittorini</i></p> <p>PROPHECY: A Web-based Performance Analysis and Modelling System for Parallel and Distributed Applications <i>V. E. Taylor, X. Wu, and R. Stevens</i></p> <p>Dependable-LQNS: A Performability Modeling Tool for Layered Systems <i>O. Das and M. Woodside</i></p> <p>CASPA: A Performance Evaluation Tool Based on Stochastic Process Algebra and Symbolic Data Structures <i>M. Kuntz, M. Siegle, and E. Werner</i></p> <p>MOSEL-2: Modeling, Specification and Evaluation Language, Revision 2 <i>J. Barner, K. Begain, B. Beutel, and G. Bolch</i></p> <p>New Features in the ProC/B Toolset <i>M. Arns, M. Eickhoff, M. Fischer, C. Tepper, and M. Völker</i></p> <p>Model Checking of CTMCs and Discrete Event Simulation Integrated into the APNN Toolbox <i>P. Buchholz, M. Fischer, P. Kemper, and C. Tepper</i></p> <p>The Möbius Modeling Environment <i>T. Courtney, D. Daly, S. Derisavi, V. Lam, and W. H. Sanders</i></p> <p>FiFiQueues: Fixed-Point Finite-Buffer Queueing Networks <i>R. Sadre and B. Haverkort</i></p> <p>NVision:IP - A Visualization Tool for Security Analysis of Large and Complex Networks <i>K. Lakkaraju, R. Bearavolu, and W. Yurcik</i></p> <p>SimP²: A Performance Modeling Tool for Evaluating P2P File Sharing Networks <i>K. Kant and R. Iyer</i></p> <p>A Java Performance Monitoring Tool <i>M. Harkema, D. Quartel, R. van der Mei, and B. Gijzen</i></p> <p>Adding Performance Evaluation to the LTSA Tool <i>T. Ayles, A. J. Field, and J. N. Magee</i></p> <p>The UCM2LQN Tool: from Software Engineering Scenarios to Software Performance Models <i>M. Woodside and D. B. Petriu</i></p>
10:30-10:50	break outside B02 CSL	

10:50-noon	<p>B02 CSL - KEYNOTE SPEAKER: David M. Nicol <i>University of Illinois at Urbana-Champaign, USA</i> presenting “Multiscale Modeling and Simulation of Worm Effects on the Internet Routing Infrastructure” by David M. Nicol, Michael Liljenstam, and Jason Liu <i>Introduced by Peter Kemper</i></p>	
noon-1:30	<p>lunch in Illini Union rooms 209, 210, 211 (buffet is in 210)</p>	
1:30-3:00	<p>track 1: NSMC Work-in-Progress Short Papers - B02 CSL <i>Session chair: Winfried Grassmann</i></p> <p>Comparing Implicit Representations for Large CTMCs <i>Gianfranco Ciardo (College of William and Mary), Massimo Forno (Università di Torino, Italy), Paul L. Grieco (College of William and Mary), and Andrew S. Miner (Iowa State University)</i></p> <p>A Reduced-Stiffness Method for the Transient Solution of Discrete-Time Markov Chains <i>Graham Horton and Sanja Lazarova-Molnar (University of Magdeburg, Germany)</i></p> <p>Updating the Stationary Solution of an Irreducible Markov Chain <i>Amy N. Langville and Carl D. Meyer (North Carolina State University)</i></p> <p>A Distribution Estimation Method for Bounding the Reward Measures of Large MRMs <i>Sandor Racz (Ericsson Research Hungary), Arpad Tari (Technical University of Budapest), and Miklos Telek (Technical University of Budapest)</i></p>	<p>track 2: PNP: Ergodicity and Product Form - 301 CSL <i>Session chair: Ramon Puigjaner</i></p> <p>On Non-Ergodic Infinite-State Stochastic Petri Nets <i>Falko Bause (Universität Dortmund)</i></p> <p>On the Relations Between BCMP Queueing Networks and Product Form Solution Stochastic Petri Nets <i>Gianfranco Balbo (Università di Torino), Steve C. Bruell (University of Iowa), and Matteo Sereno (Università di Torino)</i></p> <p>Computational Algorithms for Product-Form of Competing Markov Chains <i>Matteo Sereno (Università degli Studi di Torino)</i></p>
3:00-3:30	<p>break outside B02 CSL</p>	
3:30-5:00	<p>track 1: Tools: Queueing Models - B02 CSL <i>Session chair: Gianfranco Balbo</i></p> <p>An M/G/1 Queueing System with Multiple Vacations to Assess the Performance of a Simplified Deficit Round Robin Model <i>L. Lenzini, B. Meini, E. Mingozzi, and Giovanni Stea (University of Pisa)</i></p> <p>Queueing Models with Maxima of Service Times <i>Peter Harrison (Imperial College London) and Soraya Zertal (Université de Versailles)</i></p> <p>Heuristic Optimization of Scheduling and Allocation for Distributed Systems with Soft Deadlines <i>Tao Zheng and Murray Woodside (Carleton University)</i></p>	<p>track 2: tool demonstration session #1 - B13 CSL</p> <p>The tools presented in the Thursday morning session will be demonstrated.</p>
5:00-6:00	<p>break</p>	
6:00-7:00	<p>reception in the Grand Gallery of the Grainger Engineering Library</p>	
7:00	<p>banquet in the Grand Gallery of the Grainger Engineering Library</p>	

Friday, September 5

8:00-8:30	continental breakfast outside B02 CSL	
8:30-10:30	<p>track 1: NSMC: Theoretical Advances - B02 CSL <i>Session chair: Tugrul Dayar</i></p> <p>Non-Skip-Free M/G/1-Type Markov Chains and Laurent Matrix Power Series <i>Dario A. Bini and Beatrice Meini (Università di Pisa, Italy)</i></p> <p>Finding Equilibrium Probabilities of QBD Processes by Spectral Methods When Eigenvalues Vanish <i>Winfried K. Grassmann (University of Saskatchewan)</i></p> <p>Improved Bounds for a Condition Number for Markov Chains <i>Michael Neumann (University of Connecticut at Storrs) and Jianhong Xu (University of West Florida)</i></p> <p>The Highest Singular Coefficients in Singular Perturbation of Stochastic Matrices <i>Konstantin E. Avrachenkov (INRIA Sophia Antipolis, France) and Moshe Haviv (The Hebrew University of Jerusalem, Israel)</i></p>	<p>track 2: Tools: MAPs and Phase-Type Distributions - 301 CSL <i>Session chair: Miklos Telek</i></p> <p>Necessary and Sufficient Conditions for Representing General Distributions by Coxians <i>Takayuki Osogami and Mor Harchol-Balter (Carnegie Mellon University)</i></p> <p>A Closed-Form Solution for Mapping General Distributions to Minimal PH Distributions <i>Takayuki Osogami and Mor Harchol-Balter (Carnegie Mellon University)</i></p> <p>An EM-Algorithm for MAP Fitting from Real Traffic Data <i>Peter Buchholz (Dresden University of Technology)</i></p> <p>The Correlation Region of Second-Order MAPs with Application to Queueing Network Decomposition <i>Armin Heindl (TU Berlin), Ken Mitchell (University of Missouri), and Appie van de Liefvoort (University of Missouri)</i></p>
10:30-10:50	break outside B02 CSL	
10:50-noon	<p>B02 CSL - KEYNOTE SPEAKER: Valeriy A. Naumov <i>Lappeenranta University of Technology, Lappeenranta, Finland</i> presenting “The Life and Work of A. A. Markov” by Gely P. Basharin (<i>Peoples’ Friendship University, Moscow, Russia</i>) and Valeriy A. Naumov <i>Introduced by William J. Stewart</i></p>	
noon-1:30	lunch in Illini Union rooms 209, 210, 211 (buffet is in 210)	
1:30-3:00	<p>track 1: NSMC: General Interest - B02 CSL <i>Session chair: Raymond Marie</i></p> <p>Approximate Mean Value Analysis Based on Markov Chain Aggregation by Composition <i>Dorina C. Petriu and Murray Woodside (Carleton University)</i></p> <p>Reversed Processes, Product Forms, Non-Product Forms and a New Proof of the BCMP Theorem <i>Peter G. Harrison (Imperial College London)</i></p> <p>Analysis of Inhomogeneous Markov Reward Models <i>Miklos Telek (Technical University of Budapest, Hungary), Andras Horvath (Universita di Torino) and G. Horvath (Technical University of Budapest, Hungary)</i></p>	<p>track 2: PNP: Timed Petri Nets - 301 CSL <i>Session chair: Tadao Murata</i></p> <p>Distributed Semi-Markov Processes in Stochastic T-Timed Petri Nets <i>Stefan Haar (INRIA, IRISA)</i></p> <p>State Class Timed Automaton of a Time Petri Net <i>Didier Lime and Olivier H. Roux (IRCCyN - Institut de Recherche en Communication et Cybernétique de Nantes)</i></p> <p>A Discrete Time Model for Performance Evaluation and Correctness Verification of Real Time Systems <i>Giacomo Bucci, Luigi Sassoli, and Enrico Vicario (Università di Firenze)</i></p>
3:00-3:20	break outside B02 CSL	

3:20-4:50	<p><i>track 1: Tools: Supporting Model-Based Design of Systems - B02 CSL</i> <i>Session chair: Peter Harrison</i></p> <p>EvalVid - A Framework for Video Transmission and Quality Evaluation <i>Jirka Klaue, Berthold Rathke, and Adam Wolisz (Technical University of Berlin)</i></p> <p>A Class-Based Least-Recently Used Caching Algorithm for World-Wide Web Proxies <i>Boudewijn R. Haverkort (University of Twente), Rachid El Abdouni Khayari (University of the Federal Armed Forces, München, Germany), and Ramin Sadre (RWTH Aachen)</i></p> <p>Performance Analysis of a Software Design using the UML Profile for Schedulability, Performance and Time <i>Jing Xu, Murray Woodside, and Dorina Petriu (Carleton University)</i></p>	<p><i>track 2: tool demonstration session #2 - B13 CSL</i></p> <p>The tools presented in the Thursday morning session will be demonstrated.</p>
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Tutorials

TUTORIAL A1:

Layered Resources, Layered Queues and Software Bottlenecks

presented by Murray Woodside, Carleton University

Abstract:

In distributed systems many potential bottlenecks are at logical resources such as single-threaded processes and buffer pools; we will call these “software bottlenecks.” The activation of a software bottleneck depends on the system activities during the holding time of the resources. Layered resource effects mean that one bottleneck can cause saturation at several higher-layer resources, which often makes diagnosis confusing. Analysis with layered queues, however, can give insight. Detection and identification involve knowing the relative utilization of different resources. Mitigation involves provisioning, software architecture, and the organization of execution during a resource holding time. Software and hardware bottlenecks interact, so an understanding of hardware saturation is also required.

The tutorial will describe the mechanisms of software bottlenecks, and how to detect and mitigate them, based on measurements or on analysis of a model.

Bio:

Murray Woodside holds the OCRI/NSERC Research Chair in Software Performance Engineering at Carleton University, and has published widely in performance modeling, especially of software systems. He is one of the founders of the Workshop on Software and Performance (WOSP) and is an associate editor of *Performance Evaluation*. He is also a past Chairman of ACM Sigmetrics, and a member of the IFIP working group on computer performance.

TUTORIAL A2:

Formal Modeling and Analysis of Hybrid Systems

presented by Rajeev Alur, University of Pennsylvania

Abstract:

A hybrid system consists of a discrete program embedded in, and reacting to, a continuous environment. The modeling paradigm of hybrid automata has proved to be a useful tool for specification and analysis of such systems. A hybrid automaton consists of a finite state machine whose states are annotated with differential and algebraic constraints for continuous dynamics. This tutorial surveys the foundations and tools for this modeling paradigm. In particular, we will discuss tools for reachability analysis of hybrid automata, decidable fragments of hybrid automata, modeling notations for structured descriptions of networks of hybrid automata, application areas, and directions for future research.

Bio:

Rajeev Alur (<http://www.cis.upenn.edu/~alur/>) is a Professor of Computer and Information Science at the University of Pennsylvania. He obtained his bachelor’s degree in computer science from the Indian Institute of Technology at Kanpur in 1987, and his PhD in computer science from Stanford University in 1991. Before joining Penn in 1997, he was with the Computing Science Research Center in Bell Laboratories. His areas of research include formal modeling and analysis of reactive systems, hybrid systems, concurrency theory, and design automation for embedded software. His awards include the President of India’s Gold Medal for academic excellence (1987), the US National Science Foundation’s CAREER (1997) and ITR (2001) awards, and an Alfred P. Sloan Faculty Fellowship (1999).

Software Rejuvenation - Modeling and Analysis*Kalyan Vaidyanathan, SUN**Abstract:*

As society's dependence on computer systems increases, computer failures that result in significant losses will become more common. It has now been established that even for applications that have relatively less complex software, most failures in computer systems are due to software bugs. Hence, software reliability is one of the weakest links in system reliability. In this tutorial, we will first give an overview of software fault classification and briefly discuss software reliability in the testing/debugging phase. Models for software fault tolerance in the operational phase for different software layers will then be briefly described. Environment diversity is the newest approach to fault tolerance in software. A proactive form of environment diversity called "software rejuvenation" forms the crux of this tutorial and will be covered in some detail.

We will discuss the phenomenon of software aging that has been reported in widely used software and also in high-availability and safety-critical systems. To counteract this phenomenon, the proactive technique of software rejuvenation has been proposed. It essentially involves gracefully terminating an application or a system and restarting it in a clean internal state. We will discuss methods of evaluating the effectiveness of software rejuvenation in operational software systems and determining optimal times to perform rejuvenation. This is done by developing stochastic models that tradeoff the cost of unexpected failures due to software aging with the overhead of proactive fault management. We will then describe measurement-based models that are constructed using workload and resource usage data collected from the UNIX operating system over a period of time. The measurement-based models are the first steps towards predicting aging-related failures, intended to help development of strategies for software rejuvenation triggered by actual measurements. Rejuvenation has also been extended to cluster systems, where our analyses show that it results in a significant increase in system availability. Finally, we discuss the implementation of a software rejuvenation agent in a major commercial server.

Bio:

Kalyan Vaidyanathan (kalyan.vaidyanathan@sun.com) received his Ph.D. degree in Electrical and Computer engineering from Duke University in 2002. He is currently a member of the technical staff at the RAS Computer Analysis Laboratory, Sun Microsystems, San Diego, CA. His research interests include software reliability, fault tolerant systems, performance and dependability evaluation of computer systems, and computer security.

Numerical Analysis Approaches for Large Markov Chains - Experiments, Observations and Some New Results

Peter Buchholz, University of Dresden, Germany

Abstract:

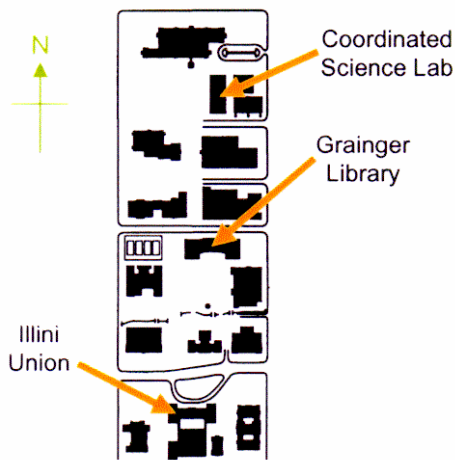
Computation of the stationary distribution vector of finite Markov chains is a key step in many analysis and validation procedures for stochastic systems. From a numerical analysis point of view, the problem is equivalent to the computation of the solution of a singular system of equations of order n and rank $n-1$. Many different solution techniques are applicable for the solution, but realistic examples tend to be huge and sparse such that their solution is a cumbersome task even on contemporary machines, so that the availability of efficient analysis methods in software tools is absolutely necessary to gain acceptance for this kind of analysis.

The goal of the tutorial is the presentation of an overview of contemporary techniques for Markov chain analysis. Major aspects are implementation issues and an experimental comparison of different techniques applied to a large set of example models. In particular it is shown why the most efficient techniques that are developed for sparse matrix representations cannot be combined with recently developed data structures to store transition matrices like Kronecker product representations or matrix diagrams. Consequently, some new approaches for preconditioning and efficient solution are introduced for Kronecker structured matrices and it is experimentally shown that these methods are very efficient and allow the analysis of large models with up to 10^7 states in an acceptable time on a contemporary PC.

Bio:

Peter Buchholz obtained his Diploma degree in 1987, his PhD in 1991, and his Habilitation degree in 1996, all from the department of computer science of the University of Dortmund. From 1987 until 1999 he was a researcher, assistant professor, and lecturer at the department of computer science of the University of Dortmund. Since 1999 he has been an associate professor for modeling and simulation at the department of computer science of the Technical University of Dresden. Dr. Buchholz's research interests are numerical analysis techniques for Markov chains, the combination of qualitative and quantitative analysis of discrete event systems, software tool development for performance analysis, and application of performance analysis to communication systems and logistic networks. Since 1985 he has worked on the development and application of numerical analysis techniques for Markov chains, and implementation of a large number of analysis techniques in different analysis tools (NUMAS, MACOM, HiQPN-Tool, and APNN-Toolbox); since 1987 he has worked on Kronecker structures for the representation for transition matrices, and development of several new analysis techniques for this kind of matrix structure.

Local Information



The conferences will be held on the campus of the University of Illinois at Urbana-Champaign, except for PMCCS, which will be held at the Robert Allerton Park and Conference Center in Monticello, Illinois (a short drive from Urbana-Champaign). All PNP, Tools, and NSMC presentations and tutorials will take place in the University of Illinois's Coordinated Science Laboratory building (1308 West Main St. in Urbana, erroneously listed as the "Computer and Systems Research Laboratory" on many campus maps); continental breakfasts will be available there in the mornings. On September 2 lunch will be at the University of Illinois Illini Union Ballroom. The September 3-5 lunches will be in private rooms in the University of Illinois Illini Union. On September 4, an evening banquet will be held in the Grainger Engineering Library on the UI campus. To the left is a map showing the layout of the engineering quad, with all of the buildings hosting Multiconference events marked.

Transportation

It is far more convenient to fly into the Champaign, Illinois airport (CMI) than to fly to a hub (such as Chicago) and try to come the rest of the way via bus, train, or rental car. If you are going to be staying at the Holiday Inn (see below) or somewhere else not within walking distance of the UI campus, and will be driving a car to the meetings, please indicate on the registration form that you will need parking hang tags, which are available for \$6 per day.

For PMCCS attendees: A van will be available for shuttling PMCCS attendees from Urbana-Champaign to Monticello and back, but you will likely find it more convenient to rent a car and drive yourself. Due to construction work, Allerton Park cannot be accessed via its main entrance, and must be approached via a back route; you are advised to follow the instructions and map posted on the Park's web site (<http://www.conted.uiuc.edu/allerton/>), rather than using directions from an online map site.

If you do want to use a rental car, either between cities or for local use, you can get a University of Illinois conference attendee discount from National Car Rental (www.nationalcar.com); give them identification number 6201011 when you make the reservation. (For your information, the cost of a one-way National rental car from Ohare Airport to Champaign will typically be in the range of \$40-\$80.)

The Illini Limo taxi company can take you from the Champaign airport into town for about \$10. They are out at the airport to meet most flights, unless they're busy. You can phone them at +1 (217) 384-5892.

If you choose to fly into Chicago and take a bus to Champaign, you may find the Bluebird Charter Coach service (www.bluebirdcharter.com) convenient. Note that it drops passengers at the south end of campus, so you would then have a rather long walk (or taxi ride) to get to your hotel.

If you choose to fly to Chicago and then drive a rental car to Champaign, be advised that the drive is almost 3 hours. Below is one set of possible driving directions for getting from Ohare Airport in Chicago to the Coordinated Science Laboratory building in Champaign. You may wish to consult a site like MapQuest or Yahoo Maps to obtain maps or other alternative directions.

1. Start going northeast on Departures.
2. Merge onto I-190 EAST.
3. Merge onto I-294 SOUTH towards Indiana, at exit 1D. You will have to pay tolls on this road.
4. Merge onto I-80 WEST (towards Iowa/I-57).
5. Merge onto I-57 SOUTH towards Memphis, at exit 151A on the left.
6. Merge onto I-74 EAST towards Indianapolis, at exit 237A.

7. Take the Lincoln Avenue exit, number 183.
8. Turn right on North Lincoln Avenue.
9. Turn right onto West Main Street.

Hotel accommodation for PNP/Tools/NSMC portion in Urbana-Champaign:

For the portion of the conference being held in Urbana-Champaign on September 2-5, two blocks of hotel rooms have been reserved. You must make your hotel reservation yourself. There are a limited number of rooms available, so please book early.

1. One block is being held at the Illini Union, which is the student union of the University of Illinois. This block is available for four nights, for people arriving on or after September 1, and departing on or before September 5. Since this lodging is within easy walking distance of conference events, we recommend that you choose this option unless you need to stay in Urbana-Champaign until September 6. Rates are as follows: single occupancy \$72/\$83, double occupancy \$83/88, triple occupancy \$93, quad occupancy \$97, suite \$165. Block is being held until **July 25, 2003**. Ask for "Illinois Multi Conference."

The Illini Union
1401 West Green St.
Urbana, IL 61801
telephone: +1 (217) 333-3030
fax: +1 (217) 333-0804
<http://www.union.uiuc.edu/services/guestrooms.html>

2. The second block is being held at the Holiday Inn Hotel & Conference Center. This block is available for five nights, for people arriving September 1 or later, and departing on or before September 6. It is not within easy walking distance (about 1.6 miles away), so you will need to drive to campus. We will have one or more vans available to shuttle participants between the Holiday Inn and campus, but you may find it more convenient to rent a car. (The Holiday Inn does offer shuttle service to and from the airport. You can arrange that in advance or call them when you arrive at the airport.) Rates are \$65 single or \$75 double. Block is being held until **July 25, 2003**. Ask for "Illinois Multiconference."

Holiday Inn Hotel & Conference Center
1001 W. Killarney
Urbana, IL 61801
telephone: +1 (217) 328-7900
fax: +1 (217) 328-5427
<http://www.sixcontinentshotels.com/h/d/Hi/hd/cmiub>

Hotel accommodation for PMCCS workshop in Monticello:

Accommodation will be on-site at the conference center and will be arranged by the Multiconference organizers. Payment for accommodation has been built into the registration fee. There is a place on the registration form where you can indicate lodging preferences.

If you wish to stay at a nearby local hotel instead of on-site, contact Jenny Applequist (applequi@crhc.uiuc.edu) for help.

Weather:

Typical temperatures in early September range from daytime highs in the lower 80s Fahrenheit (lower 20s Celsius) to nighttime lows of about 60 F (about 15 C).

For more information or help:

Contact Jenny Applequist (applequi@crhc.uiuc.edu, +1 217-244-8920), who is handling local arrangements for the Multiconference.