
Third International Conference on the Quantitative Evaluation of Systems **QEST 2006**

Riverside, California

11 – 14 September 2006



Los Alamitos, California

Washington • Tokyo

Copyright © 2006 by The Institute of Electrical and Electronics Engineers, Inc.
All rights reserved.

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries may photocopy beyond the limits of US copyright law, for private use of patrons, those articles in this volume that carry a code at the bottom of the first page, provided that the per-copy fee indicated in the code is paid through the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

Other copying, reprint, or republication requests should be addressed to: IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, P.O. Box 133, Piscataway, NJ 08855-1331.

The papers in this book comprise the proceedings of the meeting mentioned on the cover and title page. They reflect the authors' opinions and, in the interests of timely dissemination, are published as presented and without change. Their inclusion in this publication does not necessarily constitute endorsement by the editors, the IEEE Computer Society, or the Institute of Electrical and Electronics Engineers, Inc.

IEEE Computer Society Order Number P2665
ISBN-10: 0-7695-2665-9
ISBN-13: 978-0-7695-2665-2
Library of Congress Number: 2006931644

Additional copies may be ordered from:

IEEE Computer Society
Customer Service Center
10662 Los Vaqueros Circle
P.O. Box 3014
Los Alamitos, CA 90720-1314
Tel: + 1 800 272 6657
Fax: + 1 714 821 4641
<http://computer.org/cspress>
csbooks@computer.org

IEEE Service Center
445 Hoes Lane
P.O. Box 1331
Piscataway, NJ 08855-1331
Tel: + 1 732 981 0060
Fax: + 1 732 981 9667
[http://shop.ieee.org/store/
customer-service@ieee.org](http://shop.ieee.org/store/customer-service@ieee.org)

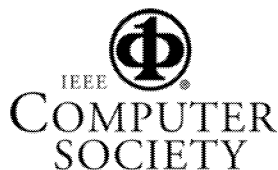
IEEE Computer Society
Asia/Pacific Office
Watanabe Bldg., 1-4-2
Minami-Aoyama
Minato-ku, Tokyo 107-0062
JAPAN
Tel: + 81 3 3408 3118
Fax: + 81 3 3408 3553
tokyo.ofc@computer.org

Individual paper REPRINTS may be ordered at: reprints@computer.org

Editorial production by Bob Werner

Cover art production by Joseph Daigle/Studio Productions

Printed in the United States of America by The Printing House



IEEE Computer Society

Conference Publishing Services

<http://www.computer.org/proceedings/>

Table of Contents: QEST 2006

The International Conference on Quantitative Evaluation of SysTems

Message from the General Chair	x
Message from the Program Committee Chairs.....	xi
Organizers.....	xiii
Technical Program Committee.....	xiv
Reviewers.....	xv

Invited Talk

Causality, Responsibility, and Blame: A Structural-Model Approach.....	3
<i>Joseph Y. Halpern</i>	

Session 1.1: Measurements

Behavior of Available End-to-End Bandwidth: Non-Parametric Approach.....	9
<i>Alexander Chobanyan, Matt Mutka, Shlomo Levental, and Ning Xi</i>	
Continuous Bytecode Instruction Counting for CPU Consumption Estimation.....	19
<i>Andrea Camesi, Jarle Hulaas, and Walter Binder</i>	

Session 1.2: Storage Systems

Toolbox for Dimensioning Windows Storage Systems.....	31
<i>Jalil Boukhobza and Claude Timsit</i>	
Long-Range Dependence at the Disk Drive Level	41
<i>Alma Riska and Erik Riedel</i>	
Rate-Controlled Scheduling of Expired Writes for Volatile Caches	51
<i>Seetharami R. Seelam, Jayaraman Suresh Babu, and Patricia J. Teller</i>	

Session 1.3: Network Models

A Versatile Infinte-State Markov Reward Model to Study Bottlenecks in 2-Hop Ad Hoc Networks.....	63
<i>Anne Remke, Boudewijn R. Haverkort, and Lucia Cloth</i>	
Performance Analysis of Delay Tolerant Networks with Model Checking Techniques	73
<i>Michele Garetto and Marco Gribaudo</i>	
Measuring and Modeling of Application Flow Length in Commercial GPRS Networks	83
<i>Roger Kalden and Boudewijn R. Haverkort</i>	

Modeling Fiber Delay Loops in an All Optical Switch	93
<i>Ana Bušić, Mouad Ben Mamoun, and Jean-Michel Fourneau</i>	
Layered Bottlenecks and their Mitigation	103
<i>Greg Franks, Dorina Petriu, Murray Woodside, Jing Xu, and Peter Tregunno</i>	
Session 1.4: Tools	
QPME — Queueing Petri Net Modeling Environment	115
<i>Samuel Kounev, Christofer Dutz, and Alejandro Buchmann</i>	
Distributed Simulation of Colored Stochastic Petri Nets with TimeNET 4.0	117
<i>Michael Knoke and Armin Zimmermann</i>	
Java Modelling Tools: An Open Source Suite for Queueing Network Modelling and Workload Analysis	119
<i>Marco Bertoli, Giuliano Casale, and Giuseppe Serazzi</i>	
A PMIF Semantic Validation Tool	121
<i>Daniel García, Catalina M. Lladó, Connie U. Smith, and Ramon Puigjaner</i>	
Time Petri Nets Analysis with TINA	123
<i>Bernard Berthomieu and François Vernadat</i>	
UPPAAL 4.0	125
<i>Gerd Behrmann, John Håkansson, Martijn Hendriks, Alexandre David, Paul Pettersen, Kim G. Larsen, and Wang Yi</i>	
Analysis of Real Time Systems through the ORIS Tool	127
<i>L. Sassoli and E. Vicario</i>	
APMC 3.0: Approximate Verification of Discrete and Continuous Time Markov Chains	129
<i>Thomas Héroult, Richard Lassaigne, and Sylvain Peyronnet</i>	
LiQuor: A Tool for Qualitative and Quantitative Linear Time Analysis of Reactive Systems	131
<i>Frank Ciesinski and Christel Baier</i>	
MathMC: A Mathematica-Based Tool for CSL Model Checking of Deterministic and Stochastic Petri Nets	133
<i>José M. Martínez and Boudewijn R. Haverkort</i>	
Traviando — Debugging Simulation Traces with Message Sequence Charts	135
<i>Peter Kemper and Carsten Tepper</i>	
Data Analysis and Visualization within the Möbius Modeling Environment	137
<i>Tod Courtney, Shravan Gaonkar, Mark Griffith, Vinh Lam, Michael McQuinn, Eric Rozier, and William H. Sanders</i>	

Integration of an MPS Modeling Approach into Möbius 139
Andrea Bondavalli, Silvano Chiaradonna, Paolo Lollini, and Fabrizio Squittieri

PACMAN: A PerformAnce Counters MANager for Intel Hyperthreaded Processors 141
Matthew Curtis-Maury, Dimitrios S. Nikolopoulos, and Christos D. Antonopoulos

Invited Talk

Modeling and Optimization Problems in Contact Centers 145
Pierre L'Ecuyer

Session 2.1: Markov Decision Processes

Game-Based Abstraction for Markov Decision Processes 157
Marta Kwiatkowska, Gethin Norman, and David Parker

Compositional Performability Evaluation for STATEMATE 167
Eckard Böde, Marc Herbstritt, Holger Hermanns, Sven Johr, Thomas Peikenkamp, Reza Pulungan, Ralf Wimmer, and Bernd Becker

Session 2.2: Model Checking

Compositional Quantitative Reasoning 179
Krishnendu Chatterjee, Luca de Alfaro, Marco Faella, Thomas A. Henzinger, Rupak Majumdar, and Mariëlle Stoelinga

Model Checking of Continuous-Time Markov Chains by Closed-Form Bounding Distributions 189
Mouad Ben Mamoun, Nihal Pekergin, and Sana Younès

CSL Model Checking for Generalized Stochastic Petri Nets 199
Davide Cerotti, Susanna Donatelli, András Horváth, and Jeremy Sproston

Session 2.3: Lumpability

Efficient Lumpability Check in Partially Symmetric Systems 211
M. Beccuti, S. Baarir, G. Franceschinis, and J-M. Ilié

Lumping Markov Chains with Silent Steps 221
Jasen Markovski and Nikola Trčka

Session 2.4: Markov Models

Optimization of Markov Models with Evolutionary Strategies Based on Exact and Approximate Analysis Techniques 233
Peter Buchholz and Peter Kemper

Bound-Preserving Composition for Markov Reward Models	243
<i>David Daly, Peter Buchholz, and William H. Sanders</i>	

Limiting Behavior of Markov Chains with Eager Attractors.....	253
<i>Parosh Aziz Abdulla, Noomene Ben Henda, Richard Mayr, and Sven Sandberg</i>	

Invited Talk

Designing and Managing Storage Systems: Issues, Techniques, and Challenges	265
<i>Arif Merchant</i>	

Session 3.1: Optimization in Networks

Optimization of Cache Expiration Dates in Content Networks	269
<i>Héctor Cancela and Pablo Rodríguez-Bocca</i>	

Optimal Static Pricing of Reverse-Link DS-CDMA Multiclass Traffic.....	279
<i>Yezekeal Hayel, Victor M. Ramos R., and Bruno Tuffin</i>	

Session 3.2: Reachability

Strategy Improvement for Concurrent Reachability Games	291
<i>Krishnendu Chatterjee, Luca de Alfaro, and Thomas A. Henzinger</i>	

Safe On-The-Fly Steady-State Detection for Time-Bounded Reachability.....	301
<i>Joost-Pieter Katoen and Ivan S. Zapreev</i>	

Probably on Time and within Budget: On Reachability in Priced Probabilistic Timed Automata.....	311
<i>Jasper Berendsen, David N. Jansen, and Joost-Pieter Katoen</i>	

Session 3.3: Queuing

A Tool Support for Automatic Analysis Based on the <i>Tagged Customer Approach</i>	323
<i>Levente Bodrog, Gábor Horváth, Sándor Rácz, and Miklós Telek</i>	

On Single-Class Load-Dependent Normalizing Constant Equations	333
<i>Giuliano Casale</i>	

Exploring Correctness and Accuracy of Solutions to Matrix Polynomial Equations in Queues	343
<i>David Thornley and Harf Zatschler</i>	

Threshold Workload Control in the BMAP/G/1 Queue	353
<i>Ho Woo Lee and Jung Woo Baek</i>	

Session 3.4: Server Systems

Identifying Low-Profile Web Server’s IP Fingerprint.....	365
<i>Mengjun Xie, Keywan Tabatabai, and Haining Wang</i>	
The Fast and the Fair: A Fault-Injection-Driven Comparison of Restart Oracles for Reliable Web Services.....	375
<i>Philipp Reinecke, Aad P.A. van Moorsel, and Katinka Wolter</i>	
Load Balancing for Performance Differentiation in Dual-Priority Clustered Servers.....	385
<i>Ningfang Mi, Qi Zhang, Alma Riska, and Evgenia Smirni</i>	
Author Index	395