

Matthew Curtis-Maury, Ph.D.

Virginia Tech

Department of Computer Science

VT CRC Knowledge Works II

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EDUCATION

- **Virginia Tech.** Ph.D. in Computer Science. May 2008
Thesis: "Improving the Efficiency of Parallel Applications on Multithreaded and Multicore Systems"
Advisor: Dimitrios S. Nikolopoulos
Outstanding Graduate Student Award – Doctoral
- **The College of William and Mary.** MS in Computer Science. May 2005
- **Wake Forest University.** BS with Honors in Computer Science, Math Minor. May 2003

RESEARCH INTERESTS

- High Performance Computing/Computer Architecture at the Hardware/Software Interface
 - Emerging Architectures: CMP-/SMT-/Cell-based Multiprocessors
 - Online/Adaptive Optimizations Using Hardware Performance Counters
 - Performance Modeling of Multilayered Parallel Computers
 - Power-Aware/Energy-Aware Execution

SELECTED RESEARCH CONTRIBUTIONS

- **Evaluated the performance** of OpenMP applications running on simultaneous multithreaded systems using hardware performance counters [IWOMP05, QEST05] and compared the results to chip multiprocessor SMPs to determine to what extent resource duplication alleviates contention.
- Proposed **energy-aware concurrency throttling** [HPPAC06, ICS06, TPDS] to reduce the number of threads used to execute application phases where doing so is predicted to benefit performance and reduce power consumption and found that both can often be improved simultaneously.
- Developed a **performance prediction model** [ICS06, GreenCom07, TPDS] for parallel applications running on SMPs that utilizes hardware performance counters to determine application characteristics and predict performance for varying levels of concurrency and processor bindings.

HONORS AND AWARDS

- Received "Outstanding Graduate Student Award – Doctoral" from CS@VT (2008)
- MICRO-39 Travel Grant, to attend International Symposium on Microarchitecture (2006)
- Intel Travel Scholarship, to attend International Conference on Supercomputing (2006)
- Best Paper Award, First International Workshop on OpenMP (2005)
- Finalist, DOE High-Performance Computer Science Fellowship (2005)
- BS with honors in computer science (2003)

PROFESSIONAL AND RESEARCH EXPERIENCE

- **NetApp, Inc,** RTP, NC
File System Performance Development Engineer May 2008 – Present
 - Worked as part of the WAFL Performance Engineering Group to improve the performance of the file system.

- Contributed to new features and bug fixes for the buffer cache, consistency point, and multiprocessor subsystems.
- **Virginia Tech**, Blacksburg, VA
Graduate Research Assistant Fall 2006 – May 2008
 - Performed research on energy-efficiency in high-performance applications on parallel systems.
 - Created a model of scalability based on regression analysis of hardware counters.
 - Developed a runtime system to dynamically optimize concurrency of parallel applications to improve performance and energy-efficiency.
- **Lawrence Livermore National Laboratory**, Livermore, CA
Computation Technical Scholar Summer 2007
 - Utilized statistical techniques to identify program phases with similar execution properties.
 - Evaluated machine learning to predict the scalability of parallel applications on multi-core systems (work published in [GreenCom07]).
- **The College of William and Mary**, Williamsburg, VA
Research Assistant Fall 2005 – Summer 2006
 - Evaluated the performance of OpenMP codes on both SMT- and CMP-based multiprocessors.
 - Investigated prediction-based techniques for improving program energy-efficiency.
- **GuardianEdge Technologies**, Williamsburg, VA
Software Developer Intern Summer 2005
 - Participated in design and documentation processes of large software development project.
 - Implemented initial USB smart-card communication infrastructure.
 - Designed, developed, and integrated PCMCIA smart-card communication interface.

TEACHING EXPERIENCE

- *Guest Lecturer* for Introduction to Computer Organization course at Virginia Tech.
 - Lectured for 3 classes on performance evaluation of computer systems (Spring 2007).
 - Lectured for 3 classes on multiprocessor organization (Spring 2007).
 - Lectured for 1 class on performance evaluation of computer systems (Fall 2007).
- *Guest Lecturer* for senior-level Operating Systems course at William and Mary.
 - Lectured for 3 classes (Fall 2005).
- *Teaching Assistant*, Computer Science Department, William and Mary.
 - Algorithms (Fall 2003/Spring 2004) – Graded written homeworks and programming projects (requested by professor to be serve as TA a second time).
 - Operating Systems (Fall 2004) – Graded student projects in the NACHOS operating system, including student interviews and code evaluation.
 - Programming Languages (Spring 2005) – Graded homeworks and projects.
 - Concepts in Computer Science (Spring 2005) – Taught lab section (instructor effectiveness 4.8/5.0 compared to course average 4.27).
- *Teaching Assistant*, Math Department, Wake Forest University.
 - Foundations of Calculus (Fall 2002) – Administered review sessions on introductory calculus material and graded homeworks and quizzes.

PROFESSIONAL SERVICE

Program Committee Member for International Scientific Conferences

- IEEE International Workshop on Middleware Engineering 2009 (ME 2009)

Peer-reviewer for International Scientific Conferences

Transactions on Parallel and Distributed Systems 2007 (TPDS), International Symposium on Computer Architecture 2008 (ISCA), Supercomputing 2009 (SC), European Conference on Parallelism 2008 (Euro-Par), International Conference on Parallel Processing 2006 and 2008 (ICPP), Workshop on State-of-the-Art in Scientific and Parallel Computing 2006 (PARA), Journal of Systems and Software 2007 (JSS), Workshop on High-Performance Power-Aware Computing 2007 (HPPAC), International Forum on Next Generation Multicore/Manycore Technologies 2008 (IFMT)

Student Volunteer at International Scientific Conferences

- Supercomputing 2006 (SC06)

ACADEMIC SERVICE

- Vice-President, Graduate Student Association, College of William and Mary, 2004-2005

MEMBERSHIPS

Association for Computing Machinery, ACM Special Interest Group on Computer Architecture, IEEE Computer Society, IEEE Technical Committee on Scalable Computing, Upsilon Pi Epsilon - International Computer Science Honor Society

PUBLICATIONS

Refereed Journal Publications

1. **Matthew Curtis-Maury**, Filip Blagojevic, Christos D. Antonopoulos, Dimitrios S. Nikolopoulos. "Prediction-based Power-Performance Adaptation of Multithreaded Scientific Codes". Accepted, to appear in *Transactions on Parallel and Distributed Systems*.
2. Filip Blagojevic, Dimitrios S. Nikolopoulos, Alexandros Stamatakis, Christos D. Antonopoulos, **Matthew Curtis-Maury**. "Runtime Scheduling of Dynamic Parallelism on Accelerator-Based Multi-core Systems". To appear in *Parallel Computing*, November 2007.
3. **Matthew Curtis-Maury**, Christos D. Antonopoulos, Dimitrios S. Nikolopoulos. "On the Design of Online Predictors for Power-Performance Adaptation of Multithreaded Programs". To appear in *Journal of Autonomic and Trusted Computing*.

Refereed Conference Publications

1. Filip Blagojevic, Costin Iancu, Katherine A. Yelick, Dimitrios S. Nikolopoulos, Benjamin Rose, **Matthew Curtis-Maury**. "Scheduling Dynamic Parallelism on the Cell BE". In *15th Meeting of the IBM HPC Systems Scientific Computing User Group (ScicomP)*, Barcelona, Spain, May, 2009.
2. Filip Blagojevic, Costin Iancu, Katherine A. Yelick, Dimitrios S. Nikolopoulos, Benjamin Rose, **Matthew Curtis-Maury**. "Scheduling Dynamic Parallelism on Accelerators". In *International Conference on Computing Frontiers*, Ischia, Italy, May, 2009.
3. **Matthew Curtis-Maury**, Ankur Shah, Filip Blagojevic, Dimitrios S. Nikolopoulos, Bronis R. de Supinski, Martin Schulz. "Prediction Models for Multi-dimensional Power-Performance Optimization on Many Cores". In *International Conference on Parallel Architectures and Compilation Techniques*, Toronto, Canada, October 2008.

4. Filip Blagojevic, **Matthew Curtis-Maury**, Jae-Seung Yeom, Scott Schneider, Dimitrios S. Nikolopoulos. "Modeling and Scheduling Hybrid Parallelism on a PlayStation3 Cluster". In *Proceedings of International Conference on Cluster Computing and the Grid*, Lyon, France, May 2008.
5. **Matthew Curtis-Maury**, Christos D. Antonopoulos, Dimitrios S. Nikolopoulos. "A Comparison on Online and Offline Strategies for Program Adaptation." In *Proceedings of the 45th ACM Southeast Conference*, Winston-Salem, NC, March 2007. ACM Press.
6. **Matthew Curtis-Maury**, Christos D. Antonopoulos, Dimitrios S. Nikolopoulos. "PACMAN: A PerformAnce Counters MANager for Intel Hyperthreaded Processors". In *Proceedings of the Third International Conference on the Quantitative Evaluation of Systems*, Riverside, CA, September 2006. IEEE Computer Society Press. Tools session.
7. **Matthew Curtis-Maury**, James Dzierwa, Christos D. Antonopoulos, Dimitrios S. Nikolopoulos. "Online Power-Performance Adaptation of Multithreaded Programs using Hardware Event-Based Prediction". In *Proceedings of the Twentieth International Conference on Supercomputing*, pp. 157-166, Cairns, Queensland, Australia, June 2006. ACM Press.
8. **Matthew Curtis-Maury**, Taping Wang, Christos D. Antonopoulos, Dimitrios S. Nikolopoulos. "Integrating Multiple Forms of Multithreaded Execution on multi-SMT Systems: A Study with Scientific Workloads". In *Proceedings of the Second International Conference on the Quantitative Evaluation of Systems*, pp. 199-208, Torino, Italy, September 2005. IEEE Computer Society Press.

Refereed Workshop Publications

1. Dimitrios S. Nikolopoulos, Godmar Back, Jyotirmaya Tripathi, **Matthew Curtis-Maury**. "VT-ASOS: Holistic System Software Customization on Many Cores". In *NSF Next Generation Software Program Workshop*, Miami, FL, April 2008.
2. **Matthew Curtis-Maury**, Karan Singh, Sally A. McKee, Filip Blagojevic, Dimitrios S. Nikolopoulos, Bronis R. de Supinski, Martin Schulz. "Identifying Energy-Efficient Concurrency Levels using Machine Learning". In *Proceedings of the International Workshop on Green Computing*, Austin, TX, September 2007.
3. **Matthew Curtis-Maury**, Christos D. Antonopoulos, Dimitrios S. Nikolopoulos. "Dynamic Program Stirring on Multiple Cores: How Hardware Performance Monitors can Help Regulate Performance, Power, and Temperature Simultaneously". In *Proceedings of the Workshop on Functionality of Hardware Performance Monitors*, Orlando, FL, December 2006.
4. **Matthew Curtis-Maury**, James Dzierwa, Christos D. Antonopoulos, Dimitrios S. Nikolopoulos. "Online Strategies for High-Performance Power-Aware Thread Execution on Emerging Multiprocessors". In *Proceedings of the Second International Workshop on High-Performance Power-Aware Computing*, Rhodes, Greece, April 2006.
5. **Matthew Curtis-Maury**, Xiaoning Ding, Christos D. Antonopoulos, Dimitrios S. Nikolopoulos. "An Evaluation of OpenMP on Current and Emerging Multithreaded/Multicore Processors". In *Proceedings of the First International Workshop on OpenMP*, Eugene, Oregon, June 2005. Springer Verlag. **Best Paper Award**.

PRESENTATIONS

Invited Seminar Presentations

1. *Improving the Efficiency of Parallel Applications on Multithreaded and Multicore Systems through Prediction-based Adaptation*. Invited talk at the Computer Systems Laboratory, Department of Computer Engineering, Cornell University. November 19, 2007.

Conference Presentations

1. *Identifying Energy-Efficient Concurrency Levels Using Machine Learning*. At the International Workshop on Green Computing, Austin, TX, September 2007.
2. *A Comparison of Online and Offline Adaptation Strategies for Program Adaptation*. At the 45th ACM Southeast Conference, Winston-Salem, NC, March 2007.

3. *Dynamic Program Stirring on Multiple Cores: How Hardware Performance Monitors can Help Regulate Power, Performance, and Temperature Simultaneously.* At the Workshop on the Functionality of Hardware Performance Monitors, Orlando, FL, December 2006.
4. *PACMAN: A PerformAnce Counters MANager for Intel Hyperthreaded Processors.* At the Third International Conference on the Quantitative Evaluation of Systems, Riverside, CA, September 2006.
5. *Online Power-Performance Adaptation of Multithreaded Programs using Hardware Event-Based Prediction* At the 20th International Conference on Supercomputing. Cairns, Queensland, Australia, June, 2006.
6. *Integrating Multiple Forms of Multithreaded Execution on multi-SMT Systems: A Study with Scientific Workloads.* At the Second International Conference on the Quantitative Evaluation of Systems, Torino, Italy, September 2005.
7. *An Evaluation of OpenMP on Current and Emerging Multithreaded/Multicore Processors.* At the First International Workshop on OpenMP, Eugene, Oregon, June 2005.

SOFTWARE

- *PACMAN: PerformAnce Counter MANager.* Library to manage Intel Pentium 4 hardware performance monitors for continuous, online optimization on Hyperthreaded Intel processors. Available at <http://www.cs.vt.edu/~mfcurt/pacman>. (Many current users.)

CURRENT AND PAST COLLABORATORS

Dr. Bronis R. de Supinski, Dr. Martin Schulz (LLNL), Prof. Sally A. McKee, Karan Singh, Major Bhadauria (Cornell University), Prof. Christos Antonopoulos (University of Thessaly), Xiaoning Ding (Ohio State University), Tanping Wang (College of William and Mary), Prof. Dimitrios S. Nikolopoulos, Filip Blagojevic, Scott Schneider, Prof. Kirk W. Cameron, Dong Li (VT)

CO-SUPERVISED STUDENTS

- Naren Sundaravaradan (*B.S. expected May 2008* from VT) – Analyzing and Improving the Thermal Properties of Parallel Scientific Applications.
- Ankur Shah (*M.S. expected May 2008* from VT) – Integrating Concurrency Throttling and DVFS to Improve the Energy-Efficiency of Parallel Applications.
- James Dzierwa (B.S. with Highest Honors, May 2006 from W&M) – Implementing a Power Estimator for the Intel Pentium 4 based on Hardware Performance Counters.

COMPUTER SKILLS

- Programming Languages – C, C++, Java, SQL, Shell Script, R, Fortran, OpenGL
- Parallel Programming – OpenMP, MPI, Pthreads
- Operating Systems – Linux, Unix, Mac OS X, Windows