

# Steven Swanson

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Computer Science & Engineering  
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## Research Interests

I am interested in exploring unconventional processor architectures that require novel approaches to problems such as performance, power, and programmability. In the future I plan to study the interactions between architectures, programming languages, and software engineering to make it easier to build high-performance computing systems that are scalable and easy to maintain.

## Education

- Ph.D., Computer Science & Engineering** 2006  
Advisors: Mark Oskin & Susan Eggers  
Dissertation: "The WaveScalar Architecture"  
University of Washington, Seattle, WA.
- M.S., Computer Science & Engineering** 2001  
Advisors: Susan Eggers & Hank Levy  
University of Washington, Seattle, WA.
- B.S., Computer Science and Mathematics with Honors** 1999  
The University of Puget Sound, Tacoma, WA.

## Research

- WaveScalar**, University of Washington 2001-present  
Advisors: Dr. Mark Oskin & Dr. Susan Eggers.  
<http://wavescalar.cs.washington.edu/>  
Developed WaveScalar, a dataflow processor architecture that avoids the scaling and complexity problems of conventional von Neumann processors, while solving the dataflow memory ordering problem of previous dataflow machines. Designed and implemented binary translation and processor simulation infrastructure (over 130K lines of C, C++, and perl) to evaluate WaveScalar.
- The Personal Server**, Intel Corp. 2001  
With Dr. Roy Want.  
Helped to develop and implement a portable, bluetooth-enabled computer with large storage capacity that utilized displays in the environment to interact with its user. Developed usage scenarios, approaches to power management, and software infrastructure for the personal server.
- one.world**, University of Washington 2001  
Advisor: Dr. Gaetano Borriello  
Developed a tuple-space data synchronization system for mobile software components in one.world, a Java-based computing platform for highly-mobile, distributed applications. Did initial work on porting one.world to a handheld computer.
- Simultaneous Multithreading**, University of Washington 1999-2000  
Advisors: Dr. Susan Eggers and Dr. Hank Levy  
Investigated the benefits and costs of speculation on an simultaneous multithreading processor and modified Digital Unix to use a custom synchronization primitive called a "lock box."

## Publications

- Steven Swanson, Andrew Schwerin, Martha Mercaldi, Andrew Petersen, Andrew Putnam, Ken Michelson, Mark Oskin, and Susan J. Eggers. The WaveScalar Architecture. *To Appear in ACM Transactions On Computer Systems*.
- Steven Swanson, Andrew Putnam, Ken Michelson, Martha Mercaldi, Andrew Petersen, Andrew Schwerin, Mark Oskin, and Susan J. Eggers. Area-Performance Trade-offs in Tiled Dataflow Architectures. *To Appear in the 2006 International Symposium on Computer Architecture (ISCA)*.
- Steven Swanson, Ken Michelson, Andrew Schwerin, and Mark Oskin. WaveScalar. In *Proceedings of the 36th International Symposium on Microarchitecture*, 2003.
- Steven Swanson, Luke K. McDowell, Michael M. Swift, Susan J. Eggers, and Henry M. Levy. An Evaluation of Speculative Instruction Execution on Simultaneous Multithreaded Processors. *ACM Transactions on Computer Systems*, volume 15(3), 2003.
- Martha Mercaldi, Steven Swanson, Andrew Petersen, Andrew Putnam, Andrew Schwerin, Mark Oskin, and Susan J. Eggers. Instruction scheduling for a tiled dataflow architecture. *To Appear in the Twelfth International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*.
- Andrew Petersen, Martha Mercaldi, Andrew Putnam, Andrew Schwerin, Steven Swanson, Mark Oskin, and Susan J. Eggers. Controlling control overhead in dataflow architectures. *To Appear in the 2006 International Conference on Parallel Architectures and Compilation Techniques (PACT)*.
- Martha Mercaldi, Steven Swanson, Andrew Petersen, Andrew Putnam, Andrew Schwerin, Mark Oskin, and Susan J. Eggers. Modeling instruction placement on a spatial architecture. *To Appear in the 2006 Symposium on Parallelism in Algorithms and Architectures (SPAA)*.
- Steven Swanson, Ken Michelson, and Mark Oskin. The Death of ILP. In *ASPLOS XI Wild and Crazy Idea Session*, 2004.
- Robert Grimm, Janet Davis, Eric Lemar, Adam MacBeth, Steven Swanson, Tom Anderson, Brian Bershad, Gaetano Borriello, Steven Gribble, and David Wetherall. System Support for Pervasive Applications. *ACM Transactions on Computer Systems*, volume 22(4), 2004.
- Steven Swanson, Ken Michelson, Andrew Schwerin, and Mark Oskin. Dataflow: The Road Less Complex. In *Workshop on Complexity-effective Design*, 2003.
- Andrew Schwerin, Steve Swanson, and Mark Oskin. Measuring the Complexity-effectiveness of Future-generation Silicon Architectures using FPGAs: A Status Report. In *Workshop on Complexity-effective Design*, June 2003.
- Steven Swanson, Ken Michelson, and Mark Oskin. Configuration by Combustion: Online Simulated Annealing for Dynamic Hardware Configuration. In *ASPLOS X Wild and Crazy Idea Session*, 2002.
- Steven Swanson and Mark Oskin. Towards a Universal Building Block of Molecular and Silicon Computation. In *Workshop on Non-Silicon Computing*, 2002.
- Robert Grimm, Janet Davis, Eric Lemar, Adam MacBeth, Steven Swanson, Tom Anderson, Brian Bershad, Gaetano Borriello, Steven Gribble, and David Wetherall. System-level Programming Abstractions for Ubiquitous Computing. In *Workshop on Application Models and Programming Tools for Ubiquitous Computing*, 2001.
- Robert Grimm, Janet Davis, Eric Lemar, Adam MacBeth, Steven Swanson, Tom Anderson, Brian Bershad, Gaetano Borriello, Steven Gribble, and David Wetherall. Systems Directions for Pervasive Computing. In *Proceedings of the 8th Workshop on Hot Topics in Operating Systems*, 2001.
- Perry Fizzano and Steven Swanson. Scheduling Classes on a College Campus. *Computational Optimization and Applications*, volume 16(3), 2000.
- Steven Swanson and Perry Fizzano. General Techniques for Multithreading Algorithms. In *Proceedings of 1999 International Conference on Parallel and Distributed Techniques and Algorithms*, 1999.

## Tech Reports

Andrew Putnam, Steven Swanson, Ken Michelson, Martha Mercaldi, Andrew Petersen, Andrew Schwerin, Mark Oskin, and Susan J. Eggers. The Microarchitecture of a Pipelined WaveScalar Processor: An RTL-based study. Technical Report TR-2005-11-02, University of Washington Computer Science & Engineering, 2005.

Steven Swanson, Martha Mercaldi, Andrew Petersen, Andrew Putnam, Andrew Schwerin, Mark Oskin, and Susan J. Eggers. Balancing Parallelism and Sequentiality in Dataflow Models: Wave-ordered Memory. Technical Report TR-2005-10-03, University of Washington Computer Science & Engineering, 2005.

## Awards

University of Washington CSE Microsoft Endowed Fellowship	2004-2005
Best Student Presentation, 36th Annual International Symposium on Microarchitecture	2003
Intel Graduate Research Fellowship	2002-2003
National Science Foundation Graduate Research Fellow	1999-2002

## Talks and Presentations

“Abandoning the Sinking Chip: The Case for a New Class of Microprocessors” University of Puget Sound, Department of Computer Science and Mathematics.	Sept. 2005
“WaveScalar” IBM Yorktown Research Center.	April 2005
“WaveScalar” 36th Annual International Symposium on Microarchitecture.	Dec. 2003
“WaveScalar and the WaveCache: Execution Without Fetch” Intel, Hillsboro, Oregon.	Oct. 2002
“The Effect of SMT on Speculation” Sun Microsystems and Compaq WRL.	Summer 2001

## Teaching/Advising Experience

<b>Lead Graduate Student</b> , WaveScalar Provided leadership and mentoring to a group of four younger grad students and three undergraduates.	2003-present
<b>Teaching Assistant</b> , Hardware Design Capstone Supported students as they designed and implemented an interactive, multi-media electronic piece of art.	2005
<b>Teaching Assistant</b> , Embedded Systems Capstone Used the personal server (see Research above) as the basis for a range of projects in a lab-based class.	2001
<b>Computer architecture tutor</b> , University of Washington CSE Providing tutoring for introductory computer architecture classes.	2000

## Service

Web chair for ISCA	2007
External reviewer for HPCA	2004, 2005
External reviewer for ISCA	2001, 2003-2005
External reviewer for ASPLOS	2004, 2006
External reviewer for MICRO	2003

## References

Available on request.