William Thies

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Research Interests

Programming languages, compilers, computer architectures, parallel computing, programmable microfluidics, technologies for developing regions.

Education

Massachusetts Institute of Technology 2002—Aug. 2008 [Expected]
Ph.D. Candidate, Computer Science and Engineering

Advisor: Saman Amarasinghe.

New England Biolabs Aug. 2004
Certified Molecular Biologist

Intensive two-week course on experimental molecular biology, with significant laboratory experience.

Massachusetts Institute of Technology 1997—2002
Bachelors of Science, Mathematics
Bachelors of Science, Computer Science and Engineering
Masters of Engineering, Computer Science and Engineering

Undergraduate concentration in economics; graduate concentration in biology. GPA: 5.0/5.0.

Professional Experience

MIT Computer Science and Artificial Intelligence Laboratory, Compilers Group
Cambridge, MA Jan. 2000—present

Research assistant. Led the design and implementation of StreamIt, a language and compiler for high-performance streaming applications. Also developed programmable microfluidic chips for automating biology protocols, as well as TEK, an email-based search engine for the developing world.

Compaq Computer Corporation, Cambridge Research Lab
Cambridge, MA Jun. 1999—Aug. 2000

Research intern. Implemented Array SSA Form, a new compiler representation, in Compaq's *Swift* optimizing Java compiler. Developed a multi-threaded model of computation based on Array SSA.

MIT Media Laboratory, Epistemology and Learning Group
Cambridge, MA Sep. 1997—Sep. 1999

Software engineer. Developed a Java version of StarLogo, a massively parallel programming language and modeling environment. Applied StarLogo to research pattern formation in the Drosophila retina.

JENTEK Sensors, Inc.
Watertown, MA May 1998—Aug. 1998

Software engineer. Developed electromagnetic sensing software for use by Army, Navy, and Fortune 500 companies. Specialized in graphical user interface, data visualization, and instrument control.

Pennsylvania State University, Entomology Department
University Park, PA Feb. 1996—Aug. 1997

Computer programmer. Designed and implemented fourteen artificial life models for inclusion in Camazine et al., *Self-Organization in Biological Systems*, Princeton University Press, 2001.

Teaching and Mentoring Experience

Teaching Assistanceship
Introduction to Algorithms (MIT 6.046) with Charles Leiserson and Piotr Indyk Fall 2004
Delivered weekly lecture-style recitations; helped to prepare problem sets and exams.

Co-supervision of M.Eng. Students

1. Nada Amin Sep. 2006—present
   Thesis: Design Automation for Microfludic Chips (upcoming).

2. David Zhang Sep. 2005—Sep. 2007
   Thesis: A Streaming Computation Framework for the Cell Processor.
   Published in the Workshop on Design, Architecture and Simulation of CMPs (2007).

3. Abdulbasier Aziz Apr. 2006—Jul. 2007
   Thesis: Image-Based Motion Estimation in a Stream Programming Language.

4. Matthew Drake Oct. 2004—May 2006
   Thesis: Stream Programming for Image and Video Compression.
   Published in the International Parallel and Distributed Processing Symposium (2006).

5. Janis Sermulins Jun. 2003—May 2006
   Thesis: Cache Optimizations for Stream Programs.
   Published in the Conference on Languages, Compilers, and Tools for Embedded Systems (2005).

6. Sitij Agrawal Mar. 2003—Aug. 2004
   Thesis: Linear State-Space Analysis and Optimization of StreamIt Programs.
   Published in the Int. Conf. on Compilers, Arch., and Synthesis for Embedded Systems (2005).

7. Jeremy Wong Sep. 2001—Jan. 2004
   Thesis: Modeling the Scalability of Acyclic Stream Programs.

8. Andrew Lamb Mar. 2002—Jun. 2003
   Thesis: Linear Analysis and Optimization of Stream Programs.
   Published in the Conference on Programming Language Design and Implementation (2003).

Co-supervision of Undergraduate Students

9. Ceryen Tan Sep. 2007—present
   Project: Mapping StreamIt to network processors.

10. Pratik Kotkar May 2007—present
    Project: Development and deployment of an Audio Wiki.
    Poster in the Workshop on Wireless Systems: Advanced Research and Development (2008).

11. Jonathan Birnbaum — Sep. 2007—present
    Project: Voice-based interfaces for an Audio Wiki.

12. Jimmy Li — Sep. 2006—present
    Project: Mapping StreamIt to the Cell processor.
    Published in the Workshop on Design, Architecture and Simulation of CMPs (2007).

13. Michael D'Ambrosio — Jan. 2007—May 2007
    Results: Partial implementation of compressed-domain video transformations for H.264.

14. Shirley Fung — Sep. 2006—Mar. 2007
    Results: Partial implementation of H.264 video encoding in StreamIt.

15. Thayaparan Kailainathan — Feb. 2006—Aug. 2006
    Results: Accurate estimation of number of Internet search results in a disconnected environment.

16. Mahendrakumar Senthivel — Feb. 2006—Aug. 2006
    Results: Internationalization of TEK search client, including translation to Tamil.

17. Thayarupan Rajendram — Feb. 2006—Aug. 2006
    Results: Disconnected query checking for TEK client.

18. Marjorie Cheng — May 2005—Aug. 2005
    Results: New user interface for TEK client.

19. Jasper Lin — Dec. 2001—Mar. 2005
    Results: Broad contributions to StreamIt compiler, from optimizations to parallelization.

20. Satish Ramaswamy — Mar. 2003—Jan. 2004
    Results: StreamIt implementations of FFTs and other kernels.

21. Tazeen Mahtab — May 2001—Sep. 2002
    Results: Complete implementation of the TEK server.

22. Ali Meli — Jun. 2002—Aug. 2002
    Results: StreamIt implementation of feature-aided radar tracking.

23. Chris Leger — Jun. 2002—Aug. 2002
    Results: StreamIt implementation of a vocoder and six sorting routines.

24. Matthew Brown — Sep. 2001—Nov. 2001
    Results: StreamIt implementation of an FM radio receiver.

25. Genevieve Cuevas — May 2001—Aug. 2001
    Results: Complete implementation of the TEK client.

26. Saad Shakhshir — May 2001—Aug. 2001
    Results: Robust transport layer for TEK.

27. Mark Halsey — May 2001—Aug. 2001
    Results: Testing and database support for TEK.

Co-supervision of Staff

28. Allyn Dimock — Sep. 2005—Jun. 2007
    Results: Broad contributions to StreamIt backends, optimizations, and robustness.

29. Damon Berry — Oct. 2001—Mar. 2002
    Results: Robust release and installation package for TEK client.

Refereed Journal Publications

1. William Thies, Frédéric Vivien, and Saman Amarasinghe, A Step Towards Unifying Schedule and Storage Optimization, *Transactions on Programming Languages and Systems* 29 (2007), no. 6.

2. William Thies, John Paul Urbanski, Todd Thorsen, and Saman Amarasinghe, Abstraction Layers for Scalable Microfluidic Biocomputing, *Natural Computing* (2007).

3. Blaise Gassend, Charles W. O'Donnell, William Thies, Andrew Lee, Marten van Dijk, and Srinivas Devadas, Learning Biophysically-Motivated Parameters for Alpha Helix Prediction, *BMC Bioinformatics* 8(Suppl 5) (2007), no. S3.

4. John Paul Urbanski, William Thies, Christopher Rhodes, Saman Amarasinghe, and Todd Thorsen, Digital Microfluidics Using Soft Lithography, *Lab on a Chip* 6 (2006), no. 1, 96–104.

5. Saman Amarasinghe, Michael I. Gordon, Michal Karczmarek, Jasper Lin, David Maze, Rodric M. Rabbah, and William Thies, Language and Compiler Design for Streaming Applications, *International Journal of Parallel Programming* (2005).

Refereed Conference Publications

6. William Thies, Vikram Chandrasekhar, and Saman Amarasinghe, A Practical Approach to Exploiting Coarse-Grained Pipeline Parallelism in C Programs, In *International Symposium on Microarchitecture (MICRO)*, 2007.

7. Michael I. Gordon, William Thies, and Saman Amarasinghe, Exploiting Coarse-Grained Task, Data, Pipeline Parallelism in Stream Programs, In *International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, 2006.

8. William Thies, John Paul Urbanski, Todd Thorsen, and Saman Amarasinghe, Abstraction Layers for Scalable Microfluidic Biocomputers, In *International Meeting on DNA Computing (DNA)*, 2006.

9. Sitij Agrawal, William Thies, and Saman Amarasinghe, Optimizing Stream Programs Using Linear State Space Analysis, In *International Conference on Compilers, Architecture, Synthesis for Embedded Systems (CASES)*, 2005.

10. Jiawen Chen, Michael I. Gordon, William Thies, Matthias Zwicker, Kari Pulli, and Frédo Durand, A Reconfigurable Architecture for Load-Balanced Rendering, In *SIGGRAPH / Eurographics Workshop on Graphics Hardware*, 2005.

11. William Thies, Michal Karczmarek, Janis Sermulins, Rodric Rabbah, and Saman Amarasinghe, Teleport Messaging for Distributed Stream Programs, In *Symposium on Principles and Practice of Parallel Programming (PPoPP)*, 2005.

12. Janis Sermulins, William Thies, Rodric Rabbah, and Saman Amarasinghe, Cache Aware Optimization of Stream Programs, In *Conference on Languages, Compilers, Tools for Embedded Systems (LCTES)*, 2005.

13. Amy Williams, William Thies, and Michael D. Ernst, Static Deadlock Detection for Java Libraries, In *European Conference on Object-Oriented Programming (ECOOP)*, 2005.

14. Andrew A. Lamb, William Thies, and Saman Amarasinghe, Linear Analysis and Optimization of Stream Programs, In *Conference on Programming Language Design and Implementation (PLDI)*, 2003.

15. Michal Karczmarek, William Thies, and Saman Amarasinghe, Phased Scheduling of Stream Programs, In *Conference on Languages, Compilers, Tools for Embedded Systems (LCTES)*, 2003.

16. Michael I. Gordon, William Thies, Michal Karczmarek, Jasper Lin, Ali S. Meli, Andrew A. Lamb, Chris Leger, Jeremy Wong, Henry Hoffmann, David Maze, and Saman Amarasinghe, A Stream Compiler for Communication-Exposed Architectures, In *International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, 2002.

17. William Thies, Michal Karczmarek, and Saman Amarasinghe, StreamIt: A Language for Streaming Applications, In *International Conference on Compiler Construction (CC)*, 2002.

18. Libby Levison, William Thies, and Saman Amarasinghe, Providing Web Search Capability for Low-Connectivity Communities, In *International Symposium on Technology and Society (ISTAS)*, 2002.

19. William Thies, Janelle Prevost, Tazeen Mahtab, Genevieve T. Cuevas, Saad Shakhshir, Alexandro Artola, Binh D. Vo, Yuliya Litvak, Sheldon Chan, Sid Henderson, Mark Halsey, Libby Levison, and Saman Amarasinghe, Searching the World Wide Web in Low-Connectivity Communities, In *International World Wide Web Conference, Global Community Track*, 2002.

20. William Thies, Frédéric Vivien, Jeffrey Sheldon, and Saman Amarasinghe, A Unified Framework for Schedule and Storage Optimization, In *Conference on Programming Language Design and Implementation (PLDI)*, 2001.

Refereed Workshop Publications

21. Pratik Kotkar, William Thies, and Saman Amarasinghe, An Audio Wiki for Publishing User-Generated Content in the Developing World, In *HCI for Community and International Development (Workshop at CHI)*, 2008.

22. Blaise Gassend, Charles W. O'Donnell, William Thies, Andrew Lee, Marten van Dijk, and Srinivas Devadas, Predicting Secondary Structure of All-Helical Proteins Using Hidden Markov Support Vector Machines, In *Workshop on Pattern Recognition in Bioinformatics (PRIB)*, 2006.

23. Libby Levison, Bill Thies, and Saman Amarasinghe, The TEK Search Engine, In *Workshop on Development by Design (DYD)*, 2001.

Refereed Poster Abstracts and Short Publications

24. Pratik Kotkar, William Thies, and Saman Amarasinghe, An Audio Wiki for Building Local Repositories of Knowledge in the Developing World, In *Poster Session, Workshop on Wireless Systems: Advanced Research and Development (WISARD)*, 2008.

25. Blaise Gassend, Charles W. O'Donnell, William Thies, Andrew Lee, Marten van Dijk, and Srinivas Devadas, Learning Biophysically-Motivated Parameters for Alpha Helix Prediction, In *Poster Session, International Conference on Research in Computational Molecular Biology (RECOMB Poster Session)*, 2006.

26. William Thies, John Paul Urbanski, Mats Cooper, David Wentzlaff, Todd Thorsen, and Saman Amarasinghe, Programmable Microfluidics, In *Wild and Crazy Ideas Session, International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS WACI)*, 2004.

27. William Thies, Michal Karczmarek, Michael Gordon, David Maze, Jeremy Wong, Henry Hoffmann, Matthew Brown, and Saman Amarasinghe, A Common Machine Language for Grid-Based Architectures, In *ACM SIGARCH Computer Architecture News*, 2002.

28. William Thies, Chemical Weathering in Bondhusbreen Glacier Valley, Norway: Implications for Global Carbon Cycle Models. In *EOS Trans. American Geophysical Union, 78 (17)* Spring Meeting, 1997.

Other Publications

29. William Thies, Steven Hall, and Saman Amarasinghe, Mapping Stream Programs into the Compressed Domain, Tech. Report MIT-CSAIL-TR-2007-055, Massachusetts Institute of Technology, 2007. *Under review.*

30. Peter Mattson, William Thies, Lance Hammond, and Michael Vahey, Streaming Virtual Machine Specification, Version 1.0, Tech. report, 2004, `http://www.morphware.org`.

31. William Thies, A Unified Framework for Schedule and Storage Optimization, M.Eng. Thesis, Massachusetts Institute of Technology, 2002.

Grants

1. Programmable Microfluidics: A Universal Substrate for Biological Computing.
   National Science Foundation ($550,000).
   Co-authored with Saman Amarasinghe, Todd Thorsen, and Jeremy Gunawardena, 2005.

2. uBox: A Low-Cost Device for Monitoring and Improving Drug Adherence.
   National Collegiate Inventors & Innovators Alliance ($19,930).
   Co-authored with Manish Bhardwaj, Sara Cinnamon, Alex Krull, Jessica Leon, Nikhil Nadkarni, Goutam Reddy, Oliver Venn, and Amy Smith, 2007.

3. uBox: A Low-Cost Device for Monitoring and Improving Rural Tuberculosis Treatment Programs.
   MIT IDEAS Competition ($7,500).
   Co-authored with Manish Bhardwaj, Sara Cinnamon, Alex Krull, Jessica Leon, Nikhil Nadkarni, Oluwarotimi Okunade, Goutam Reddy, Jayodita Sanghvi, and Oliver Venn, 2007.

Liaising to Funding Agencies

I served as the primary MIT representative to the Morphware Forum, a consortium of over 35 institutions (instigated by DARPA under the Polymorphous Computing Architectures program) that met regularly from 2001 to 2006 to establish a shared environment for portable programming on emerging multicore architectures. Via detailed conversations and 14 national meetings, I played a critical role in writing, refining, and establishing consensus on the Streaming Virtual Machine, an intermediate layer that served as a focus of the forum.

Conference Talks

1. A Practical Approach to Exploiting Coarse-Grained Pipeline Parallelism in C Programs.
   International Symposium on Microarchitecture (MICRO) Dec. 2007

2. Predicting Secondary Structure of All-Helical Proteins
   Using Hidden Markov Support Vector Machines.
   Workshop on Pattern Recognition in Bioinformatics (PRIB) Aug. 2006

3. Abstraction Layers for Scalable Microfluidic Biocomputers.
   International Meeting on DNA Computing (DNA) Jun. 2006

4. Optimizing Stream Programs Using Linear State Space Analysis.
   International Conference on Compilers, Architecture, and Synthesis for Embedded Systems (CASES) Sep. 2005

5. Teleport Messaging for Distributed Stream Programs.
   Symposium on Principles and Practice of Parallel Programming (PPoPP) Jun. 2005

6. Programmable Microfluidics.
   Wild and Crazy Ideas Session, International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS WACI) Oct. 2004

7. StreamIt: A Language for Streaming Applications.
   International Conference on Compiler Construction (CC) Apr. 2002

8. A Unified Framework for Schedule and Storage Optimization.
   Conference on Programming Language Design and Implementation (PLDI) Jun. 2001

Invited Talks

1. Programmable Microfluidics.
   Microsoft Research, India Dec. 2007
   University of California, Berkeley Oct. 2007
   Stanford University Oct. 2007
   Pennsylvania State University Apr. 2007

2. Providing Internet Search for Low-Connectivity Regions.
   Princeton University Mar. 2007
   Google New York Jul. 2005

3. StreamIt: A Compiler Infrastructure for Stream Programs.
   IBM Programming Languages Day May 2004

4. Architectures, Languages, and Compilers for the Streaming Domain (Tutorial).
   International Conf. on Parallel Architecture and Compilation Techniques Sep. 2003

5. The TEK System: Browsing the Web in Low-Connectivity Communities.
   HP Labs India Jan. 2002
   Indian Institute of Technology, Madras Jan. 2002
   University of Moratuwa Jan. 2002

Software Artifacts

1. StreamIt Compiler Infrastructure — Oct. 2003—present
   Over 700 unique, registered downloads from 225 institutions.
   `http://cag.csail.mit.edu/streamit`

2. TEK: An Email-Based Web Browser — Jul. 2003—present
   Freely-distributed installation CD has reached users in over 30 countries.
   `http://cag.csail.mit.edu/tek`

3. AutoCAD Plugin for Microfluidic Chips — Nov. 2007—present
   Newly released tool for automating the design of microfluidic chips.
   `http://cag.csail.mit.edu/biostream/cad`

Professional Service

Founder

MIT Student Project Expo	2001—2008
MIT Reading Group on Information and Communication Technologies for Development	2003, 2007
MIT Compiler Reading Group	2006

Program Committee Member

International Conference on Development by Design	2002
International Workshop on Parallel and Distributed Embedded Systems	2005
Student Workshop, MIT Computer Science and Artificial Intelligence Laboratory	2005
Workshop on Software Tools for MultiCore Systems (STMCS)	2008

Reviewer

Conference on Programming Language Design and Implementation (PLDI)	2004, 2006, 2007, 2008
European Conference on Parallel and Distributed Computing (Euro-Par)	2008
International Conference on Parallel Architecture and Compilation Techniques (PACT)	2006
International Conference on Supercomputing (ICS)	2002
International Conference on Arch. Support for Prog. Lang's and OS's (ASPLOS)	2004, 2006, 2008
International Symposium on Computer Architecture (ISCA)	2007
International Symposium on Code Generation and Optimization (CGO)	2008
International Symposium on Microarchitecture (MICRO)	2001
International Symposium on Software Testing and Analysis	2008
Lab on a Chip (LOC)	2007
Symposium on Principles and Practice of Parallel Programming (PPoPP)	2005
Symposium on Principles of Programming Languages (POPL)	2005, 2006
Transactions on Architecture and Code Optimization (TACO)	2005
Transactions on Embedded Computing Systems (TECS)	2007
Transactions on Parallel and Distributed Systems (TPDS)	2007
Workshop on Software Tools for Multi-Core Systems (STMCS)	2006

Honors

National co-winner, Eta Kappa Nu Outstanding EECS Student Award	2001
Siebel Scholar ($25,000 scholarship to "top 5" computer science students at MIT)	2000
Eta Kappa Nu, Tau Beta Pi, Sigma Xi, and Phi Beta Kappa honor societies	2000, 2001
Finalist, Westinghouse Science Talent Search	1997
Eagle Scout	1994

References

1. Saman Amarasinghe
   Associate Professor, EECS
   Massachusetts Institute of Technology
   32 Vassar Street
   Cambridge, MA, 02139
   (617) 253-8879
   saman@csail.mit.edu

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   Associate Professor, EECS
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