

Peter M. Chen

Address

Department of Electrical Engineering and Computer Science
1301 Beal Ave.
University of Michigan
Ann Arbor, MI 48109-2122
734-763-4472, fax: 734-763-4617
pmchen@umich.edu
<http://www.eecs.umich.edu/~pmchen>

Education

Ph.D. in Computer Science, University of California at Berkeley, November 1992. Advisor: Professor David A. Patterson.
M.S. in Computer Science, University of California at Berkeley, May 1989. Advisor: Professor David A. Patterson.
B.S. in Electrical Engineering (honors in Computer Science), Pennsylvania State University, May 1987.

Employment history

University of Michigan (1993-present)
Associate professor, EECS Department (1999-present)
Assistant professor, EECS Department (1993-1999)
AT&T Research (January-June 2000)
Visiting researcher
Bilkent University in Ankara, Turkey (September-December 1999)
Visiting associate professor
University of California at Berkeley (1987-1993)
Post-doctoral researcher (January-May 1993)
Research assistant on disk array project (1989-1992)
Teaching assistant (September-December 1988)
Amdahl Corporation (summer 1988); Pennsylvania State University biochemistry lab, (1986-1987); IBM (summer 1985); Lehigh University chemical engineering lab (summers of 1982-1984)

Teaching awards

- 2005 EECS Professor of the Year, Michigan chapter of Eta Kappa Nu honor society
- 2001 University of Michigan Amoco Undergraduate Teaching Award
- 1999 EECS Professor of the Year, Michigan chapter of Eta Kappa Nu honor society
- 1999 College of Engineering Teaching Excellence Award, University of Michigan
- 1998 EECS Departmental Teaching Excellence Award, University of Michigan
- 1997 College of Engineering Teacher of the Year, Michigan chapter of Tau Beta Pi honor society
- 1997 College of Engineering 1938E Award for Excellence in Teaching and Mentoring, University of Michigan
- 1996 EECS Professor of the Year, Michigan chapter of Eta Kappa Nu honor society

Research awards

- Award Paper, SOSP 2005
- Best Paper Award, USENIX 2005
- Award Paper, SOSP 2003
- IEEE Senior Member, June 2000
- William C. Carter Award Paper, FTCS 1999
- Best Paper Award, VLDB 1997
- National Science Foundation CAREER Award, 1996
- Best Paper Award, ACM SIGMETRICS 1993
- Best Student Paper Award, Winter USENIX 1990

Courses taught or developed

- ENGR 100 Introduction to Engineering
- EECS 280 Programming and Introductory Data Structures
- EECS 370 Introduction to Computer Organization
- EECS 482 Introduction to Operating Systems
- EECS 582 Advanced Operating Systems
- EECS 598 Hierarchical Storage System Design
- EECS 598 Virtual Machine Technologies and Applications

Course evaluations

Course #	Title	Term	Enrollment	Q1	Q2
EECS 482	Introduction to Operating Systems	W05	37	4.84	4.98
EECS 482	Introduction to Operating Systems	F04	46	4.74	4.94
EECS 482	Introduction to Operating Systems	W04	43	4.68	4.92
EECS 598	Virtual Machine Technologies and Applications	F03	12	4.92	5.00
EECS 482	Introduction to Operating Systems	F02	73	4.23	4.81
EECS 482	Introduction to Operating Systems	F02	82	4.60	4.86
EECS 482	Introduction to Operating Systems	W02	99	4.64	4.86
EECS 482	Introduction to Operating Systems	F01	110	4.38	4.78
EECS 370	Introduction to Computer Organization	F00	93	4.64	4.86
EECS 370	Introduction to Computer Organization	W99	184	4.21	4.61
EECS 482	Introduction to Operating Systems	F98	103	4.17	4.58
EECS 582	Advanced Operating Systems	W98	37	4.36	4.79
EECS 370	Introduction to Computer Organization	F97	153	4.54	4.82
EECS 582	Advanced Operating Systems	W97	37	4.57	4.80
EECS 370	Introduction to Computer Organization	F96	85	4.41	4.89
EECS 582	Advanced Operating Systems	W96	31	3.95	4.08
EECS 370	Introduction to Computer Organization	F95	116	4.31	4.78
EECS 370	Introduction to Computer Organization	W95	108	4.17	4.37
EECS 280	Programming and Introductory Data Structures	F94	134	4.26	4.33
EECS 598	Hierarchical Storage System Design	W94	12	4.29	4.71
EECS 280	Programming and Introductory Data Structures	F93	≈ 60	3.89	4.15

Graduate students

Wee Teck Ng, “Design and Implementation of Reliable Main Memory” (Ph.D., July 1999)

David E. Lowell, “Theory and Practice of Failure Transparency” (Ph.D., August 1999)

Subhachandra Chandra, “An Evaluation of the Recovery-Related Properties of Software Faults” (Ph.D., September 2000)

George W. Dunlap (Ph.D. in progress, expected completion February 2006)

Samuel T. King (Ph.D. in progress, expected completion August 2006)

Ashlesha Joshi (Ph.D. in progress, expected completion August 2008)

Dominic Lucchetti (Ph.D. in progress, expected completion August 2008)

Ph.D. committee member for Rich Uhlig, Jih-Liang Tseng, Kanad Chakraborty, Bruce Jacob, Atri Indiresan, Gheith Abandah, Khawar Zuberi, Yi-Chun Chu, Wu-Chang

Feng, Craig Labovitz, Tarek Abdelzaher, Rob Malan, Scott Johnson, Mark Corner, John Reumann, Haining Wang, Landon Cox.

M.S. advisor for Christina Cardarelli, Christopher M. Aycock, Gurushankar Rajamani, Rajagopalan Sivaramakrishnan, Sukru Cinar, Murtaza Basrai.

Undergraduate special projects directed

Cody Hartwig (2005): “Virtual-machine replay as a tool for architectural workload collection and processing”

Joseph McClain (2003): “Moving the X server from a host OS to a guest OS in a virtual-machine structure”

Michael Cartwright and Gerald Davidson (2002): “Calibrating the Pentium 4 performance counters”

Michael Rodehorst (2002): “Replaying the X protocol with a user-level proxy”

Stephanie Leung and Vincent Young (2001): “Performance evaluation of virtual machines”

George Dunlap (1998): “Implementing a new transport layer in X windows”. Co-author on paper submitted to OSDI 1998.

Vicky Wong (1997): “Undoable file systems”; submitted paper to USENIX 1998.

Norman Ng and Shing-Fai Lam (1996): “Implementing reliable memory in Linux and FreeBSD”

Quintin Burns (1996): “Understanding the file and memory system of Linux”

Professional service

2006 IEEE Symposium on Security and Privacy, program committee

2006 USENIX Security Symposium, program committee

ACM Transactions on Computer Systems, associate editor (2004-present)

2005 USENIX Security Symposium, program committee

2005 International Conference on Distributed Computing Systems (ICDCS), program committee

2004 Symposium on Operating Systems Design and Implementation (OSDI), program co-chair

2003 International Conference on Dependable Systems and Networks (DSN), program committee

2003 Conference on File and Storage Technologies (FAST), program committee

2002 International Conference on Dependable Systems and Networks (DSN), program committee

2001 Workshop on Evaluating and Architecting System Dependability, program committee

1999 International Symposium on Operating Systems Principles (SOSP), program committee

1998 International Symposium on Computer Architecture (ISCA), program committee

1998 Symposium on High Performance Computer Architecture (HPCA), program committee

1997 Sigmetrics Conference on Measurement and Modeling of Computer Systems, program committee

1997 International Symposium on Computer Architecture (ISCA), program committee

1996 Symposium on Operating Systems Design and Implementation (OSDI), program committee

1995 Workshop on I/O in Parallel and Distributed Systems, program committee

1994 Workshop on I/O in Parallel Computer Systems, program committee

Service at the University of Michigan

Chair of reappointment casebook for Jason Flinn, 2004

Chair of tenure casebook for Brian Noble, 2003

Member of tenure/promotion casebooks for Dennis Sylvester (2003), Gary Tyson (2002), Sugih Jamin (2001)

Computer Science and Engineering Executive Committee, 2002-2004

Director of Software Systems Lab, 2001-2004

Computer Science and Engineering Faculty Search Committee, 2001-present

Computer Science and Engineering building steering committee, 2000-2005

College of Engineering committee to consider EECS future and re-organization, 2000

Colleges of Engineering / LS&A committee to review CS degree, 1998-1999

Computer Science and Engineering graduate admissions committee, 1996-1997, 2000-2001

College of Engineering committee to review first course in computing, 1998-1999

Computer Engineering undergraduate advisor, 1998-1999

Computer Science and Engineering curriculum committee, 1995-1996

Grants

Microsoft, "Intrusion detection using OS-level causality", \$12,500, 5/31/05-11/31/05.

Intel Corporation, "Enhancing system reliability and security through virtual machines", \$150,000, 6/1/05-5/31/08, PI.

National Science Foundation CNS-0509093, “Fast, Consistent Distributed File Systems through Operating System Speculation”, \$600,000, 9/1/2005-8/31/2008, co-PI (PI is Jason Flinn).

Intelligence Community Advanced Research and Development Activity (ARDA) NBCHC030104, “Multi-Tiered Distributed Indication, Warning and Defense System”, \$790,825, 10/1/2003-3/31/2005, co-PI (PI is Farnam Jahanian).

National Science Foundation (NSF), “An Infrastructure for Wide Area Pervasive Computing”, \$550,000, 2003-2005, co-PI with 18 other faculty (PI is H. V. Jagadish).

National Science Foundation CCR-0219085, “ITR: CoVirt: Security Defenses for Insecure Operating Systems”, \$420,000, 9/1/2002-8/31/2005, PI.

Intel Corporation, “Virtual-machine security services”, \$105,000, 4/1/02-3/31/05, PI.

National Science Foundation CCR-0098229, “End-User Tracing for Software Replay”, \$240,000, 4/1/2001-3/31/2005, PI.

Dell Computer Corporation Strategic Technology and Research Program, “Using Computer-Generated Feedback to Enhance Learning”, \$23,603, 4/01-3/02, PI.

AT&T research gift, \$50,000, 1/1/00, PI.

National Science Foundation MIP-9521386 supplemental funds to sponsor Workshop on Future Directions in Experimental Computer Science, \$15,400, 4/7/99.

IBM University Partnership Program, #19981020024, \$40,000, 11/98, PI.

Intel Technology for Education 2000, “Utilization of Advanced Intel Based Platforms in Computationally Demanding Tasks”, \$5,400,000, 8/1/97-7/31/00, co-PI with Computer Science and Engineering Faculty.

National Science Foundation MIP-9624869, “CAREER Program: Measuring and Improving Memory’s Resistance to Software Corruption; Relational Instruction”, \$200,000, 7/1/96-6/30/2002, PI.

National Science Foundation MIP-9521386, “Reliable Main-Memory Storage Systems”, \$1,424,501, 12/1/95-11/30/99, PI (co-PIs are Willy Zwaenepoel (Rice University) and Trevor N. Mudge).

Advanced Research Projects Agency, “On Building a Scalable Real-Time Fault-Tolerant System for Embedded Applications”, co-PI (PIs are Kang G. Shin and Farnam Jahanian, \$2,496,964, 9/1/95-8/31/98).

Digital Equipment Corporation, “Rio: A File System for Non-Volatile Memory”, \$57,928 equipment, 3/1/95-2/29/98, PI.

National Science Foundation MIP 9409229, “Research Initiation Award: Designing Hierarchical Storage Systems for Large Capacity and Low Latency”, \$100,000, 8/1/94-7/31/97, PI.

Rackham Graduate School, University of Michigan, “Hierarchical Storage Systems”, \$15,000, 1/1/94-12/31/95, PI.

Invited talks

- 2005 Purdue University, Department of Computer Science, Department Colloquium Series
- 2004 University of Pennsylvania, Department of Computer and Information Science, Departmental Colloquium Series
- 2000 speaker and panelist at IBM Academy of Technology Workshop on Memory-Centric Systems.
- 1999 University of California at San Diego, Qualcomm Lecture Series on New Directions in Systems
- 1994 RAID Forum
- 1990 Disk Array Forum
- 1990 Asilomar Microcomputer Workshop

Rigorously refereed publications

- [King06] Samuel T. King, Peter M. Chen, Yi-Min Wang, Chad Verbowski, Helen J. Wang, and Jacob R. Lorch. SubVirt: Implementing malware with virtual machines. In *Proceedings of the 2006 IEEE Symposium on Security and Privacy*, May 2006.
- [Joshi05] Ashlesha Joshi, Samuel T. King, George W. Dunlap, and Peter M. Chen. Detecting past and present intrusions through vulnerability-specific predicates. In *Proceedings of the 2005 Symposium on Operating Systems Principles (SOSP)*, pages 91-104, October 2005.
- [Nightingale05] Edmund B. Nightingale, Peter M. Chen, and Jason Flinn. Speculative execution in a distributed file system. In *Proceedings of the 2005 Symposium on Operating Systems Principles (SOSP)*, pages 191-205, October 2005. **Award Paper.**
- [King05b] Samuel T. King, George W. Dunlap, and Peter M. Chen. Debugging operating systems with time-traveling virtual machines. In *Proceedings of the 2005 USENIX Technical Conference (USENIX)*, pages 1-15, April 2005. **Best Paper Award.**
- [King05a] Samuel T. King and Peter M. Chen. Backtracking intrusions. *ACM Transactions on Computer Systems*, 23(1):51–76, February 2005. Earlier version appeared in SOSP 2003.
- [King05c] Samuel T. King, Z. Morley Mao, Dominic G. Lucchetti, and Peter M. Chen. Enriching intrusion alerts through multi-host causality. In *Proceedings of the 2005 Network and Distributed System Security Symposium (NDSS)*, February 2005.
- [Chen04] Peter M. Chen. An Automated Feedback System for Computer Organization Projects. *IEEE Transactions on Education*, 47(2):232-240, May 2004.
- [King03a] Samuel T. King and Peter M. Chen. Backtracking intrusions. In *Proceedings of the 2003 Symposium on Operating Systems Principles (SOSP)*, pages 223-236, October 2003. **Award Paper.**

- [King03b] Samuel T. King, George W. Dunlap, and Peter M. Chen. Operating System Support for Virtual Machines. In *Proceedings of the 2003 USENIX Technical Conference (USENIX)*, pages 71-84, June 2003.
- [Dunlap02] George W. Dunlap, Samuel T. King, Sukru Cinar, Murtaza Basrai, and Peter M. Chen. ReVirt: Enabling Intrusion Analysis through Virtual-Machine Logging and Replay. In *Proceedings of the 2002 Symposium on Operating Systems Design and Implementation (OSDI)*, pages 211-224, December 2002.
- [Chandra02] Subhachandra Chandra and Peter M. Chen. The Impact of Recovery Mechanisms on the Likelihood of Saving Corrupted State. In *Proceedings of the 2002 International Symposium on Software Reliability Engineering (ISSRE)*, pages 91-101, November 2002.
- [Chen01] Peter M. Chen and Brian D. Noble. When virtual is better than real. In *Proceedings of the 2001 Workshop on Hot Topics in Operating Systems (HotOS)*, pages 133-138, May 2001.
- [Ng01] Wee Teck Ng and Peter M. Chen. The Design and Verification of the Rio File Cache. *IEEE Transactions on Computers*, 50(4):322-337, April 2001. Earlier version appeared in FTCS 1999.
- [Lowell00] David E. Lowell, Subhachandra Chandra, and Peter M. Chen. Exploring Failure Transparency and the Limits of Generic Recovery. In *Proceedings of the 2000 Symposium on Operating Systems Design and Implementation (OSDI)*, pages 289-304, October 2000.
- [Chandra00] Subhachandra Chandra and Peter M. Chen. Whither Generic Recovery from Application Faults? A Fault Study using Open-Source Software. In *Proceedings of the 2000 International Conference on Dependable Systems and Networks (DSN)*, pages 97-106, June 2000.
- [Zhou99] Yuanyuan Zhou, Peter M. Chen, and Kai Li. Fast Cluster Failover Using Virtual Memory-Mapped Communication. In *Proceedings of the 1999 International Conference on Supercomputing*, pages 373-382, June 1999.
- [Ng99] Wee Teck Ng and Peter M. Chen. The Systematic Improvement of Fault Tolerance in the Rio File Cache. In *Proceedings of the 1999 Symposium on Fault-Tolerant Computing (FTCS)*, pages 76-83, June 1999. **William C. Carter Award Paper.**
- [Chen99] Peter M. Chen and David E. Lowell. Reliability Hierarchies. In *Proceedings of the 1999 Workshop on Hot Topics in Operating Systems (HotOS)*, pages 168-173, March 1999.
- [Ng98] Wee Teck Ng and Peter M. Chen. Integrating Reliable Memory in Databases. *International Journal on Very Large Data Bases*, 7(3):194-204, August 1998. Earlier version appeared in VLDB 1997.
- [Lowell98b] David E. Lowell and Peter M. Chen. Persistent Messages in Local Transactions. In *Proceedings of the 1998 Symposium on Principles of Distributed Computing (PODC)*, pages 219-226, June 1998.

- [Chandra98] Subhachandra Chandra and Peter M. Chen. How Fail-Stop are Faulty Programs? In *Proceedings of the 1998 Symposium on Fault-Tolerant Computing (FTCS)*, pages 240–249, June 1998.
- [Lowell97] David E. Lowell and Peter M. Chen. Free Transactions with Rio Vista. In *Proceedings of the 1997 Symposium on Operating Systems Principles (SOSP)*, pages 92–101, October 1997.
- [Ng97] Wee Teck Ng and Peter M. Chen. Integrating Reliable Memory in Databases. In *Proceedings of the 1997 International Conference on Very Large Data Bases (VLDB)*, pages 76–85, August 1997. **Best Paper Award.**
- [Chen96b] Peter M. Chen, Wee Teck Ng, Subhachandra Chandra, Christopher M. Aycock, Gurushankar Rajamani, and David Lowell. The Rio File Cache: Surviving Operating System Crashes. In *Proceedings of the 1996 International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, pages 74–83, October 1996.
- [Ng96] Wee Teck Ng, Christopher M. Aycock, Gurushankar Rajamani, and Peter M. Chen. Comparing Disk and Memory’s Resistance to Operating System Crashes. In *Proceedings of the 1996 International Symposium on Software Reliability Engineering (ISSRE)*, pages 185–194, October 1996.
- [Jacob96] Bruce L. Jacob, Peter M. Chen, Seth Silverman, and Trevor Mudge. An Analytical Model for Designing Memory Hierarchies. *IEEE Transactions on Computers*, 45(10):1180–1194, October 1996.
- [Chen95d] Peter M. Chen and Edward K. Lee. Striping in a RAID Level 5 Disk Array. In *Proceedings of the 1995 ACM SIGMETRICS Conference on Measurement and Modeling of Computer Systems (SIGMETRICS)*, pages 136–145, May 1995.
- [Chen94d] Peter M. Chen and David A. Patterson. A New Approach to I/O Performance Evaluation—Self-Scaling I/O Benchmarks, Predicted I/O Performance. *ACM Transactions on Computer Systems*, 12(4):308–339, November 1994. Earlier version appeared in SIGMETRICS 1993.
- [Chen94b] Peter M. Chen, Edward K. Lee, Ann L. Drapeau, Ken Lutz, Ethan L. Miller, Srinivasan Seshan, Ken Shirriff, David A. Patterson, and Randy H. Katz. Performance and Design Evaluation of the RAID-II Storage Server. *Journal of Distributed and Parallel Databases*, 2(3):243–260, July 1994. also appeared in the 1993 International Parallel Processing Symposium Workshop on I/O in Parallel Computer Systems.
- [Chen94c] Peter M. Chen, Edward K. Lee, Garth A. Gibson, Randy H. Katz, and David A. Patterson. RAID: High-Performance, Reliable Secondary Storage. *ACM Computing Surveys*, 26(2):145–188, June 1994.
- [Drapeau94] Ann L. Drapeau, Ken Shirriff, Edward K. Lee, Peter M. Chen, Garth A. Gibson, John H. Hartman, Ethan L. Miller, Srinivasan Seshan, Randy H. Katz, Ken Lutz, and David A. Patterson. RAID-II: A High-Bandwidth Network File Server. In *Proceedings of the 1994 International Symposium on Computer Architecture (ISCA)*, pages 234–244, April 1994.

- [Chen93b] Peter M. Chen and David A. Patterson. Storage Performance–Metrics and Benchmarks. *Proceedings of the IEEE*, 81(8):1151–1165, August 1993.
- [Chen93a] Peter M. Chen and David A. Patterson. A New Approach to I/O Performance Evaluation–Self-Scaling I/O Benchmarks, Predicted I/O Performance (conference version). In *Proceedings of the 1993 ACM SIGMETRICS Conference on Measurement and Modeling of Computer Systems (SIGMETRICS)*, pages 1–12, May 1993. **Best Paper Award.**
- [Katz93] Randy H. Katz, Peter M. Chen, Ann L. Drapeau, Edward K. Lee, Ken Lutz, Ethan L. Miller, Srinivasan Seshan, and David A. Patterson. RAID-II: Design and Implementation of a Large Scale Disk Array Controller. In *1993 Symposium on Integrated Systems*, April 1993.
- [Chen90b] Peter M. Chen and David A. Patterson. Maximizing Performance in a Striped Disk Array. In *Proceedings of the 1990 International Symposium on Computer Architecture (ISCA)*, pages 322–331, May 1990.
- [Chen90a] Peter M. Chen, Garth Gibson, Randy H. Katz, and David A. Patterson. An Evaluation of Redundant Arrays of Disks Using an Amdahl 5890. In *Proceedings of the 1990 ACM SIGMETRICS Conference on Measurement and Modeling of Computer Systems (SIGMETRICS)*, pages 74–85, May 1990.
- [Seltzer90] Margo I. Seltzer, Peter M. Chen, and John K. Ousterhout. Disk Scheduling Revisited. In *Proceedings of the Winter 1990 USENIX Technical Conference (USENIX)*, pages 313–324, January 1990. **Best Student Paper Award.**

Book chapters

- [Chen97] Peter M. Chen and Edward K. Lee. *Disk Array Striping*. Prentice-Hall, 1997. Recovery in Database Management Systems.
- [Chen95a] Peter M. Chen. Memory and Mass Storage Systems. CRC Press, 1995. The Engineering Handbook (chapter 136).

Other publications

- [Basrai04] Murtaza Basrai and Peter M. Chen. Cooperative ReVirt: Adapting Message Logging for Intrusion Analysis. Technical Report CSE-TR-504-04, University of Michigan, November 2004.
- [King02] Samuel T. King and Peter M. Chen. Operating System Extensions to Support Host-Based Virtual Machines. Technical Report CSE-TR-465-02, University of Michigan, September 2002.
- [Lowell98a] David E. Lowell and Peter M. Chen. Discount Checking: Transparent, Low-Overhead Recovery for General Applications. Technical Report CSE-TR-410-99, University of Michigan, December 1998.
- [Jacob97] Bruce L. Jacob, Peter M. Chen, Seth Silverman, and Trevor Mudge. Comment on An Analytical Model for Designing Memory Hierarchies. *IEEE Transactions on Computers*, 46(10):1151, October 1997.

- [Chen96a] Peter M. Chen. Optimizing Delay in Delayed-Write File Systems. Technical Report CSE-TR-293-96, University of Michigan, May 1996.
- [Jahanian96] Farnam Jahanian, Kang G. Shin, and Peter M. Chen. Middleware and Communication Services for Embedded Fault-Tolerant Systems. *First International Workshop on HPC Technology for Embedded Applications*, April 1996.
- [Chen95b] Peter M. Chen, Christopher M. Aycock, Wee Teck Ng, Gurushankar Rajamani, and Rajagopalan Sivaramakrishnan. Rio: Storing Files Reliably in Memory. Technical Report CSE-TR-250-95, University of Michigan, July 1995.
- [Chen95c] Peter M. Chen, Christopher M. Aycock, and Gurushankar Rajamani. Reliable File Caches. Technical Report CSE-TR-233-95, University of Michigan, April 1995.
- [Chen94a] Peter M. Chen. A Survey of Optimizations for Modern Storage Systems, July 1994.
- [Chen94e] Peter M. Chen and David A. Patterson. Unix I/O Performance in Workstations and Mainframes. Technical Report CSE-TR-200-94, University of Michigan, March 1994.
- [Chen92] Peter M. Chen. *Input-Output Performance Evaluation: Self-Scaling Benchmarks, Predicted Performance*. PhD thesis, University of California, November 1992.
- [Lee92] Edward K. Lee, Peter M. Chen, John H. Hartman, Ann L. Chervenak Drapeau, Ethan L. Miller, Randy H. Katz, Garth A. Gibson, and David A. Patterson. RAID-II: A Scalable Storage Architecture for High-Bandwidth Network File Service. Technical Report UCB/CSD 92/672, University of California at Berkeley, February 1992.
- [Katz89] Randy H. Katz, John K. Ousterhout, David A. Patterson, Peter Chen, Ann Chervenak, Rich Drewes, Garth Gibson, Ed Lee, Ken Lutz, Ethan Miller, and Mendel Rosenblum. A Project on High Performance I/O Subsystems. *Computer Architecture News (CAN)*, 17(5):24–31, September 1989.
- [Patterson89] David A. Patterson, Peter M. Chen, Garth Gibson, and Randy H. Katz. Introduction to Redundant Arrays of Inexpensive Disks (RAID). *COMPCON Spring 1989*, Spring 1989.

Patent and software disclosures

Method for backtracking intrusions, disclosed to University of Michigan Office of Technology Transfer, September 16, 2003.