An-I (Andy) Wang

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RESEARCH AREAS

File systems, energy-efficient storage, peer-to-peer optimistic replication, performance evaluation, ad hoc network routing, operating systems, distributed systems, and parallel simulation

BIOGRAPHICAL INFORMATION

Citizenship:
United States

Academic degrees:
Ph.D. in Computer Science, University of California, Los Angeles, June 2003
Major: operating systems Minors: computer vision and queueing theory
Dissertation: *Conquest: An Affordable, Fast, and Practical Disk/Persistent-RAM Hybrid File System*
Advisor: Professor Gerald Popek
Committee: Rajive Bagrodia, Stott Parker, Deborah Estrin, and Babak Daneshrad
M.S. in Computer Science, University of California, Los Angeles, March 1998
Thesis: *A Simulation Evaluation for Optimistically Replicate (Peer-to-Peer) Filing Environments*
Advisor: Professor Gerald Popek
B.A. in Computer Science, University of California, Berkeley, May 1995

Awards:
Nominee, University Undergraduate Teaching Award, 2006

Academic positions:
Assistant Professor, Department of Computer Science, FSU, August 2003 - present
Lecturer, UCLA, March 2003 - June 2003
Research Assistant, UCLA, July 1995 - March 2003
Teaching Assistant, January 2000 – June 2000

Other professional positions:
EECS Summer Intern, IBM Almaden Research Center, June 1994 – September 1994

Professional society memberships:
ACM, USENIX

RESEARCH AND CREATIVE ACTIVITY

Publications:

Books and book chapters:

2003 An-I Andy Wang, Peter Reiher, and Geoffrey Kuenning. Book Chapter: "Multipath Routing for Ad Hoc Networks." *Mobile and Wireless Internet: Protocols, Algorithms, and Systems*, Kluwer Academic Publishers, pp. 245 – 262, July 2003.

Journal articles (refereed):

2007 Charles Weddle, Mathew Oldham, Jin Qian, An-I Andy Wang, Peter Reiher, and Geoff Kuenning. PARAID: A Gear-Shifting Power-Aware RAID. *ACM Transactions on Storage (TOS)*. 3(3), October 2007. [33 pages, invited, top 7 papers (7%) from the FAST conference]

2007 An-I Andy Wang, Geoff Kuenning, and Peter Reiher. Using Permuted States and Validated Simulation to Analyze Conflict Rates in Optimistic Replication. *SCS Simulation: Transactions of the Society for Modeling and Simulation International*, 83(8), pp. 551-569, September 2007. [25% acceptance rate]

2006 An-I Andy Wang, Geoff Kuenning, Peter Reiher, and Gerald Popek. The *Conquest* File System: Better Performance Through a Disk/Persistent-RAM Hybrid Design. *ACM Transactions on Storage (TOS)*, 2(3), pp. 309-348, August 2006. [refereed, 24% acceptance rate for the original USENIX conference paper]

2004 Nam T. Nyugen, An-I Andy Wang, Geoffrey H. Kuenning, Peter Reiher. Electric-Field-Based Routing: A Reliable Framework for Routing in MANETs. *ACM SIGMOBILE Mobile Computing and Communications Review*, 8(2), pp. 35-49, April 2004. [refereed]

Conference articles (refereed):

2008 Jin Qian, Christopher Meyers, and An-I Andy Wang. A Linux Implementation Validation of Track-Aligned Extents and Track-Aligned RAIDs. *Proceedings of the 2008 USENIX Annual Technical Conference*, June 2008. [6 pages, 15% acceptance rate].

Mark J. Stanovich, Theodore P. Baker, and An-I Andy Wang. Throttling On-Disk Schedulers to Meet Soft-Real-Time Requirements. *Proceedings of the 14th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS)*, April 2008. [12 pages, 30%? acceptance rate]

2007 Atulya Mahajan, Niranjan Potnis, Kartik Gopalan, and An-I Andy Wang. Modeling VANET Deployment in URBAN Settings. *Proceedings of the 10th ACM/IEEE International Symposium on Modeling, Analysis, and Simulation of Wireless and Mobile Systems (MSWiM)*, October 2007. [10 pages, 25% acceptance rate]

Mark Lewandowski, Mark Stanovich, Theodore Baker, Kartik Gopalan, An-I Andy Wang. Modeling Device Driver Effects in Real-Time Schedulability Analysis: Study of a Network Driver. *Proceedings of the 13th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS)*, April 2007. [12 pages, 36% acceptance rate]

Charles Weddle, Mathew Oldham, Jin Qian, An-I Andy Wang, Peter Reiher, and Geoff Kuenning. PARAID: A Gear-Shifting Power-Aware RAID. *Proceedings of the 5th USENIX Conference on File and Storage Technologies (FAST)*, February 2007. [16 pages, 19% acceptance rate]

2005 An-I Andy Wang, Geoff Kuenning, and Peter Reiher. Using Permuted States and Validated Simulation to Analyze Conflict Rates in Optimistic Replication. *Proceedings of the 2005 International Symposium on Performance Evaluation of Computer and Telecommunication Systems (SPECTS)*, Philadelphia, 27(3), pp. 929 – 939, July 2005. [50% acceptance rate]

An-I Andy Wang, Geoff Kuenning, and Peter Reiher. Using Permuted States to Analyze Conflict Rates in Optimistic Peer-to-Peer Replication. *Proceedings of the ACM International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS),* pp. 376 – 377, June 2005. [20% acceptance rate]

2003 An-I Andy Wang, Geoffrey Kuenning, Peter Reiher, and Gerald Popek. The Effects of Memory-Rich Environments on File System Microbenchmarks. *Proceedings of the 2003 International Symposium on Performance Evaluation of Computer and Telecommunication Systems (SPECTS)*, Montreal, pp. 745 – 754, July 2003. [50% acceptance rate]

2002 An-I Andy Wang, Geoffrey Kuenning, Peter Reiher, and Gerald Popek. *Conquest*: Better Performance Through a Disk/Persistent-RAM Hybrid File System. *Proceedings of the 2002 USENIX Annual Technical Conference*, pp. 15 – 28, June 2002. [24% acceptance rate]

1999 An-I Andy Wang, Peter Reiher, and Rajive Bagrodia. A Simulation Evaluation of Optimistically Replicated Filing in Mobile Environments. *Proceedings of the 18th IEEE International Performance, Computing, and Communication Conference (IPCCC)*, February 1999.

Workshop papers (refereed):

2007 Theodore P. Baker, An-I Andy Wang, and Mark Stanovich. Fitting Linux Device Drivers into an Analyzable Scheduling Framework. *Proceedings of the 3rd Workshop on Operating System Platforms for Embedded Real-Time Applications*, July 2007. [10 pages]

Niranjan Potnis, Atulya Mahajan, An-I Andy Wang, and Kartik Gopalan. Evaluation of Mesh-Enhanced VANET Deployment Models. *Proceedings of the 16th International Conference on Computer Communications and Networks, Workshop on Advanced Networking and Communications*, August 2007 [6 pages, 45%].

2006 Atulya Mahajan, Niranjan Potnis, Kartik Gopalan, and An-I Andy Wang. Evaluation of Mobility Models for Vehicular Ad-Hoc Network Simulations. *Proceedings of the 2nd IEEE International Workshop on Next Generation Wireless Networks*, December 2006. [refereed]

2002 An-I Andy Wang, Peter Reiher, Rajive Bagrodia, and Geoffrey Kuenning. Understanding the Behavior of Conflict-Rate Metric in Optimistic Peer Replication. *Proceedings of the 5th IEEE International Workshop on Mobility in Databases and Distributed Systems (MDDS)*, Aix-en-Provence, France, September 2002.

2001 An-I Andy Wang, Geoffrey Kuenning, Peter Reiher, and Gerald Popek. Position Summary: The *Conquest* File System—Life after Disks. *Proceedings of the 8th IEEE Workshop on Hot Topics in Operating Systems (HotOS)*, May 2001.

1998 Geoffrey Kuenning, Richard Guy, Gerald Popek, Peter Reiher, and An-I Andy Wang. Measuring the Quality of Service of Optimistic Replication. *Proceedings of the 12th European Conference on Object-Oriented Programming (ECOOP) Workshop on Mobility and Replication*, July 1998.

Other writings and productions:

Dissertation and Thesis:

2003 An-I Andy Wang. The *Conquest* File System: A Disk/Persistent-RAM Hybrid Design for Better Performance and Simpler Data Paths, Ph.D. Dissertation. Computer Science Department, University of California, Los Angeles, March 2003.

1998 An-I Andy Wang. A Simulation Evaluation for Optimistically Replicated Filing Environments. Master's Thesis, Computer Science Department, University of California, Los Angeles, 1998.

Work-in-progress reports:

2008 Cory Fox, Dragan Lojpur, An-I Andy Wang. Work-in-Progress Report: Quantifying Temporal and Spatial Localities due to File System Caching, *On-Line Proceedings of the Sixth USENIX Conference on File and Storage Technologies (FAST)*, February 2008. [1 page]

2002 An-I Andy Wang, Geoffrey Kuenning, Peter Reiher, and Gerald Popek. Work-in-Progress Report: *Conquest*: Better Performance Through a Disk/RAM Hybrid File System. *On-Line Proceedings of the First USENIX Conference on File and Storage Technologies (FAST)*, January 2002. [1 page]

Technical reports:

2008 Cory Fox, Dragan Lojpur, An-I Andy Wang. Quantifying Temporal and Spatial Localities in Storage Workloads and Transformations by Data Path Components. Technical Report TR-080406, Department of Computer Science, Florida State University, April 2008.

2007 Mark J. Stanovich, Theodore P. Baker, and An-I Andy Wang. Throttling Disk Schedulers to Meet Soft-Real-Time Requirements. Technical Report TR-071025, Department of Computer Science, Florida State University, October 2007.

Jin Qian and An-I Andy Wang. A Behind-the-Scenes Story on Applying Cross-Layer Coordination to Disks and RAIDs. Technical Report TR-071015, Department of Computer Science, Florida State University, October 2007.

2006 Charles Weddle, Mathew Oldham, Jin Qian, An-I Andy Wang, Peter Reiher, and Geoff Kuenning. PARAID: Gear-Shifting Power-Aware RAID. Technical Report TR-060323, Department of Computer Science, Florida State University, June 2006.

2005 Atulya Mahajan, Niranjan Potnis, Kartik Gopalan, and An-I Andy Wang. Evaluation of Mobility Models for Vehicular Ad-hoc Network Simulations. FSU Technical Report TR-051220, December 2005.

2001 An-I Andy Wang, Peter Reiher, and Rajive Bagrodia. A Simulation Framework and Evaluation for Optimistically Replicated Filing Environments. Technical report CSD-010046, Computer Science Department, University of California, Los Angeles, December 2001.

1999 Mark Yarvis, An-I Andy Wang, Alexey Rudenko, Peter Reiher, and Gerald Popek. Conductor: Distributed Adaptation for Complex Networks. Technical report CSD-990042, Computer Science Department, University of California, 1999.

An-I Andy Wang, Peter Reiher, and Rajive Bagrodia. Validation Experiences of the Simulation Framework for Optimistically Replicated Filing Environments: A Case Study. *Proceedings of the DARPA/NIST Network Simulation Validation Workshop*, May 1999.

1997 An-I Andy Wang, Peter Reiher, and Bagrodia R. A Simulation Framework for Evaluating Optimistically Replicated Filing Environments. Technical report CSD-970018, Computer Science Department, University of California, Los Angeles, 1997.

Patents:

2005 Provisional Patent No. 60/691, 348, FSU File: 05-102 Wang, Power-Aware Redundant Array of Inexpensive Disks (PARAID), 2005

Speeches and addresses:

2008 An-I Andy Wang, PARAID: A Gear-Shifting Power-Aware RAID. Presented at the Computer Science Research Seminar, University of Wisconsin, Madison, April 2008.

An-I Andy Wang, PARAID: A Gear-Shifting Power-Aware RAID. Presented at the Computer Science Research Seminar, University of California, Santa Cruz, March 2008.

2007 An-I Andy Wang, Some Research Frontiers in Storage Systems. Presented at the Computer Science Colloquium, Florida State University, Tallahassee, November 2007.

An-I Andy Wang, PARAID: A Gear-Shifting Power-Aware RAID. Presented at the Computer Science Colloquium, Harvey Mudd College, November 2007.

2006 An-I Andy Wang, Some Research Frontiers in Storage Systems. Presented at the Computer Science Colloquium, Florida State University, Tallahassee, November 2006.

An-I Andy Wang. *Conquest-2*: Improving Energy Efficiency and Performance Through a Disk/RAM Hybrid File System. Presented at the Computer Science Colloquium, UCLA, Los Angeles, May 2006.

2005 An-I Andy Wang. *Conquest-2*: Improving Energy Efficiency and Performance Through a Disk/RAM Hybrid File System. Presented at the Computer Science Colloquium, Florida State University, Tallahassee, December 2005.

An-I Andy Wang. *Conquest-2*: Improving Energy Efficiency and Performance Through a Disk/RAM Hybrid File System. Presented at the Computer Science Colloquium, University of Delaware, Newark, November 2005.

An-I Andy Wang. *Conquest-2*: Improving Energy Efficiency and Performance Through a Disk/RAM Hybrid File System. Presented at the Computer Science Colloquium, University of California, Riverside, May 2005.

2004 An-I Andy Wang. Some Research Frontiers in Storage Systems. Presented at the Computer Science Colloquium, Florida State University, Tallahassee, October 2004.

An-I Andy Wang. Electric-Field-Based Routing: Secure Spatially Disjoint Routes in MANETs. Presented at the DARPA's Proposer's Day for Defense against Cyber Attacks on Mobile Ad Hoc Networks, Virginia, February 18, 2004.

2003 An-I Andy Wang, Geoffrey Kuenning, Peter Reiher, and Gerald Popek. *Conquest*: Preparing for Life After Disks. Presented at the Computer Science Colloquium, Florida State University, Tallahassee, October 2003.

2002 An-I Andy Wang, Geoffrey Kuenning, Peter Reiher, and Gerald Popek. *Conquest*: Preparing for Life After Disks. Presented at the UCLA Advanced Operating Systems Lecture, Los Angeles, CA, November 2002.

An-I Andy Wang, Geoffrey Kuenning, Peter Reiher, and Gerald Popek. *Conquest*: Better Performance Through a Disk/Persistent-RAM Hybrid File System. Presented at the *First USENIX Conference on File and Storage Technologies (FAST)*, Monterey, CA, January 2002.

2001 An-I Andy Wang, Geoffrey Kuenning, Peter Reiher, and Gerald Popek. *Conquest*: RAM as Storage; Disks as Tapes. Presented at the UCLA Advanced Operating Systems Lecture, Los Angeles, CA, November 2001.

1999 An-I Andy Wang, Geoffrey Kuenning, Peter Reiher, and Gerald Popek. Integration of Memory and File System Services via Persistent RAM. Presented at the Computer Science Colloquium, Harvey Mudd College, Claremont, CA, October 1999.

Research grants:

2007 Planning Grant, PI, Council on Research and Creativity, Florida State University, Exploring Opportunities between RAIDs and Storage Components, 2007 – 2008 ($11,999).

2005 Bess Ward Fellows and Thesis Grant (for Mark Carpenter), "Extracting and Exploiting Dependency Information amidst Non-deterministic Program Execution," 2005 - 2006. ($1,000)

NSF Grant: CNS-0509131, Co-PI, (with Ted Baker and Kartik Gopalan) Next-Generation Real-Time Device Architecture, 2005 - 2008. ($547,324)

2004 NSF Grant: CNS-0410896, PI, *Collaborative Research. Conquest-2*: Improving Energy Efficiency and Performance Through a Disk/RAM Hybrid File System, 2004 - 2007. ($450,000, $267,338 to FSU)

First Year Assistant Professor Award, PI, Council on Research and Creativity, Florida State University, *Conquest-2*—Combining Battery-Backed RAM and Threshold-Based Storage Scheme to Conserve Power, 2004 - 2005. ($13,000).

2001 NSF Grant (PI: Peter Reiher): CCR-0098363, Improving Operating Systems by Replacing Hard Disks with Persistent Solid State Memory, 2001 - 2002. ($100,000)

TEACHING AND TRAINING

Courses taught (last five years):

COP4610: Operating Systems Principles (Fall 2007)
Produced 84 PowerPoint slides, revised 1684 PowerPoint slides, 10 homework assignments, and 4 projects
Reviews with a median of 1 on a scale of 1 (highest) to 5 (26 students enrolled, 20 students reviewing)

COP 5641: Kernel and Device Driver Programming (Summer 2007, co-taught with Ted Baker)
Produced 911 PowerPoint slides
Reviews with a median of 1 on a scale of 1 (highest) to 5 (8 students enrolled, 8 students reviewing)

COP5611: Advanced Operating Systems (Spring 2007)
Revised 1519 PowerPoint slides
Reviews with a median of 1 on a scale of 1 (highest) to 5 (22 students enrolled, 17 students reviewing)

COP4610: Operating Systems Principles (Fall 2006)
Produced 291 PowerPoint slides, revised 1393 PowerPoint slides, 10 homework assignments, and 4 projects
Reviews with a median of 1 on a scale of 1 (highest) to 5 (36 students enrolled, 22 students reviewing)

COP5611: Advanced Operating Systems (Spring 2006)
Revised 1514 PowerPoint slides
Reviews with a median of 1.5 on a scale of 1 (highest) to 5 (13 students enrolled, 9 students reviewing)

COP4610: Operating Systems Principles (Fall 2005)
Produced 448 PowerPoint slides, revised 945 PowerPoint slides, 10 homework assignments, and 4 projects
Produced 1 new project assignment: elevator controller synchronization
Reviews with a median of 2 on a scale of 1 (highest) to 5 (58 students enrolled, 29 students reviewing)

CIS6935: LENS Seminar Series (Spring 2005)
Produced 80 PowerPoint slides

COP5611: Advanced Operating Systems (Spring 2005)
Revised 1490 PowerPoint slides
Reviews with a median of 1 on a scale of 1 (highest) to 5 (11 students enrolled, 9 students reviewing)

COP4610: Operating Systems Principles (Fall 2004)
Produced 945 PowerPoint slides, 10 homework assignments, and 4 projects
Reviews with a median of 1 on a scale of 1 (highest) to 5 (83 students enrolled, 51 students reviewing)

CIS6935: Operating Systems Reading Group (Spring 2004)
Produced 449 PowerPoint slides

COP5611: Advanced Operating Systems (Spring 2004)
Produced 1333 PowerPoint slides
Reviews with a median of 1 on a scale of 1 (highest) to 5 (9 students enrolled, 8 students reviewing)

COP 4530: Undergraduate Data Structures, Algorithms, and Generic Programming (Fall 2003)
Produced 1135 PowerPoint slides
Produced 3 data structure projects: hash tables, stacks and queues, and heaps and trees
Reviews with a median of 1.5 on a scale of 1 (highest) to 5 (17 students enrolled, 15 students reviewing)

Ph.D. dissertation directorships:

Sarah Diesburg (Ph.D. in progress, funded by DoE)
Mark Stanovic (Ph.D. in progress, funded by NSF, co-directed with Ted Baker)

Master's thesis directorships:

Christopher Meyers (M.S. in progress, funded by DoE)
Ryan Fishel (M.S. in progress)
Saransh (M.S. in progress)
Cory Fox (M.S. May 2008, funded by NSF)
Mark Stanovic (M.S. May 2008, funded by NSF, co-directed with Ted Baker)
Jin Qian (M.S. December 2007, funded by NSF)
Atuyla Mahajan (M.S. May 2006, funded by FSU, co-directed with Kartik Gopalan)
Nirajan Potnis (M.S. May 2006, funded by FSU, co-directed with Kartik Gopalan)
Charles Weddle (M.S. May 2005, funded by NSF)

Undergraduate honors thesis directorships:

Mark Carpenter (B.S. May 2006, funded by Bess Ward Fellows and Thesis Grant)
Mathew Oldham (B.S. May 2005, funded by NSF and MCI Scholarship)

Masters committee chairpersonships:

David Lary (M.S. May 2008)
Dragan Lojpur (M.S. May 2008, funded by NSF)
Sean Toh (M.S. December 2005)
Zhiqian Hu (M.S. December 2004)

Undergraduate independent research sponsorships:

Bobby Roy (B.S. December 2008)
Nicholas Zatkovich (B.S. May 2008)
Jitan Patel (B.S. December 2007)
BillyJoe Garcia (B.S. December 2007)
Christopher Meyers (B.S. May 2007)
Fang Zhu (B.S. May 2006, co-directed with Kartik Gopalan)
Bill Iliff (B.S. December 2005)
Stephen Baylis (B. S. May 2005, funded by Harris Scholarship, co-directed with Kartik Gopalan)
Amey Kulkarni (B.S. May 2005)
Cory Fox (B.S. May 2005)
James Gonzales (B.S. May 2005)
Kelly Jones (B.S. May 2005)
Micah Villmow (B.S. May 2005)
Carl Owenby (B.S. May 2005)

Graduate student committee memberships:

Paul Nuzzi (M.S. in progress)
Sangeedha Murali (M.S. in progress)
Monika Achury (M.S. in progress)
Paul West (M.S. May 2008)
Mahesh Erande (M.S. December 2007)
Sai Lakshminarayana (M.S. December 2007)
Garret Reece (M.S. August 2006)
Christopher Rivera (M.S. May 2005)
Haifeng Zhao (M.S. December 2004)

MiaoMiao Xu (M.S. December 2004)
Jonathon Busey (M.S. July 2004)

SERVICE

University service:

2007 – 2008 Ph.D. Portfolio Committee
Equipment and Network Committee
COP 4610 Course Committee

2006 – 2007 Ph.D. Portfolio Committee
Faculty Evaluation Committee
COP 4610 Course Committee

2005 – 2006 Ph.D. Portfolio Committee

2003 - 2005 Equipment and Network Committee
Faculty Recruiting Committee

2003 - 2004 Graduate Curriculum Committee
Admission and Aid Committee

Professional activities:

2008 Program committee, the 2008 IFIP International Conference on Embedded and Ubiquitous Computing (EUC), 2008
Reviewer, ACM Transactions on Computers (TOCS)
Reviewer, IEEE Transactions on Computers (TC)
Reviewer, 20th Euromicro Conference on Real-Time Systems (ECRTS)
Reviewer, the 22nd International Conference on Supercomputing (ICS)
Judge, FSU ACM Programming Contest

2007 Reviewer, IEEE Transactions on Mobile Computing (TMC)
Reviewer, the 21st International Conference on Supercomputing (ICS)
Reviewer, the 23rd Annual ACM Symposium on Applied Computing 2008 (SAC)
Judge, FSU ACM Programming Contest
Referee, the 14th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS)

2006 Reviewer, IEEE Transactions on Mobile Computing (TMC)
Referee, the 13th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS)
Referee, the 13th International Symposium on High-Performance Computer Architecture (HPCA)
Referee, the 14th IEEE International Conference on Network Protocols (ICNP)
Judge, FSU ACM Programming Contest
Judge, Second FSU Computer Science Graduate Research Conference
Reviewer, John Wiley & Sons

2005 Head Judge, FSU ACM Programming Contest
Referee, the 4th USENIX Conference on File and Storage Technologies (FAST)
Referee, the 2005 International Symposium on Performance Evaluation of Computer and Telecommunication Systems (SPECTS)
Judge, First FSU Computer Science Graduate Research Conference

2004 Judge, FSU ACM Programming Contest
Referee, the 1st International Conference on Quality of Service in Heterogeneous Wired/Wireless Networks
Program committee, International Workshop on Network Design and Architecture 2004

2003 Referee, the 19th Annual ACM Symposium on Applied Computing 2004 (SAC)