

ADAM C. WIERMAN

California Institute of Technology
Computer Science
1200 E. California Boulevard
MC 256-80
Pasadena, CA 91125
(626) 395-6569
adamw@caltech.edu
<http://www.cs.caltech.edu/~adamw>

RESEARCH OVERVIEW

"Better design through modeling and measurement"

My research focuses on using mathematical models to provide insight into the design of computer systems. I apply analytic models and tools that are traditionally used in the operations research community in order to evaluate the impact of design decisions in systems such as web servers, routers, databases, and beyond. My work applies and often extends techniques in stochastic modeling, queueing theory, scheduling theory, and game theory.

RESEARCH INTERESTS

Performance evaluation of computer systems; Scheduling and resource allocation; Queueing theory; Networking; Sensor networks; Power management; Web server scheduling; Router scheduling; Game theory; Network games.

EMPLOYMENT

2007-pres Assistant Professor of Computer Science
 California Institute of Technology

2006 Visiting Researcher
 EURANDOM Institute
 Hosted by: Ivo Adan and Onno Boxma

EDUCATION

2007 Ph.D. in Computer Science
 Carnegie Mellon University, Pittsburgh, PA
 Advised by Mor Harchol-Balter, Associate Professor.
 Thesis committee: Mor Harchol-Balter, John Lafferty, Bruce Maggs,
 Alan Scheller-Wolf, and Ward Whitt.

2004 Masters of Science in Computer Science
 Carnegie Mellon University, Pittsburgh, PA
 Advised by Mor Harchol-Balter, Associate Professor

2001 B.S. in Computer Science with an additional major in Mathematics,
 and minors in Psychology and Statistics
 Carnegie Mellon University, Pittsburgh, PA
 Advised by Mark Stehlik, Assistant Dean for Undergraduate Education

HONORS

- 2008 Finalist for the Microsoft New Faculty Fellowship
- 2008 Finalist receiving Honorable Mention for the INFORMS Doctoral Dissertation Award for Operations Research in Telecommunications
- 2008 Co-recipient of the CMU School of Computer Science Distinguished Dissertation Award
- 2007 Named a Siebel Scholar
- 2006 Carnegie Mellon Graduate Student Teaching Award recipient
- 2005 Alan J. Perlis School of Computer Science Student Teaching Award recipient
- 2005 Carnegie Mellon Graduate Student Teaching Award Honorable Mention
- 2003 ACM Sigmetrics Best Student Paper Award recipient
- 2003 ACM Sigmetrics Student Travel Grant recipient
- 2003-2006 National Science Foundation Graduate Fellowship recipient
- 2003-2006 Selected for the CMU SCS Speakers Club
- 2001-2007 Graduate Fellowship at Carnegie Mellon University
- 2001 Graduated CMU with University and College Honors, and a 4.0/4.0 GPA
- 2000 Inducted into Phi Kappa Phi
- 2000 Inducted into Phi Beta Kappa
- 2000 Selected for the NSF Random Structures REU summer program
- 1999 Inducted into the National Society of Collegiate Scholars
- 1999-2002 Cross Country and Track Varsity Co-captain
- 1997-2002 Cross Country and Track UAA All-conference Academic team
- 1997 Baltimore Bays Soccer Club scholarship recipient

PUBLICATIONS

Thesis

- [07] Adam Wierman. "Scheduling for today's computer systems: Bridging theory and practice." Ph.D. Thesis. Carnegie Mellon University, Pittsburgh, PA. May 2007. CMU-CS-07-126. **Co-recipient of the Carnegie Mellon School of Computer Science Distinguished Dissertation Award. Finalist receiving Honorable Mention for the INFORMS Doctoral Dissertation Award for Operations Research in Telecommunications.**

Papers Under Preparation

- [08] A.C.C. van Wijk, Onno Boxma, and Adam Wierman. "Polling systems under the Gated/Exhaustive discipline."
- [08] Misja Nuyens and Adam Wierman. "Moment conditions for the foreground-background queue."
- [08] Adam Wierman and David Raz. "Is it possible to balance fairness, politeness, and efficiency?"
- [08] Adam Wierman "Asymptotic cumulants of scheduling policies."
- [08] Samuli Aalto and Urtzi Ayesta and Adam Wierman. "On the Gittins Index in an M/GI/1 queue."

Papers Under Submission

- [08] A.A.A. Kock, L.F.P. Etman, J.E. Rooda, L.J.B.F. Adan, M. van Vuuren, and Adam Wierman. "Aggregate modeling of multi-processing workstations."
- [08] Ho-Lin Chen, Adam Wierman, and Jason Marden. "The effect of local scheduling in load balancing designs."
- [08] Jason Marden and Adam Wierman. "Distributed welfare games with applications to sensor coverage."
- [08] Chang Woo Yang, Adam Wierman, Sanjay Shakkottai, and Mor Harchol-Balter. "Many flows asymptotics for SMART scheduling policies."
- [08] Bianca Schroeder, Mor Harchol-Balter, Arun Iyengar, Erich Nahum and Adam Wierman. "Providing QoS using external scheduling."

Refereed Journal and Conference Publications

- [08] Misja Nuyens, Adam Wierman, and Bert Zwart. "Preventing large sojourn times using SMART scheduling." *Operations Research* (2008) 56(1):88-101.
- [08] Adam Wierman and Misja Nuyens. "Scheduling despite inexact job-size information." *Proceedings of ACM Sigmetrics 2008*.
- [08] Misja Nuyens and Adam Wierman. "The foreground-background queue: a survey." *Performance Evaluation* (2008) 65(3-4):286-307.
- [07] Adam Wierman. "Revisiting the performance of large jobs in the M/GI/1 queue." **Invited paper** in the proceedings of the Allerton conference.
- [07] Adam Wierman, Erik Winands and Onno Boxma. "Scheduling in polling systems." *Performance Evaluation* (2007) 64(9-12):1009-1028.
- [07] Adam Wierman, Erik Winands and Onno Boxma. "Scheduling in polling systems." *Proceedings of IFIP Performance 2007*.
- [07] Adam Wierman. "Fairness and classifications." **Invited paper** in *Performance Evaluation Review* (2007) 34(4):4-12.
- [06] Chang Woo, Adam Wierman, Sanjay Shakkottai, and Mor Harchol-Balter. "Tail asymptotics for policies favoring short jobs in a many-flows regime." *Proceedings of ACM Sigmetrics 2006*.
- [06] Bianca Schroeder, Adam Wierman, and Mor Harchol-Balter. "Closed versus open system models and their impact on performance and scheduling." *Proceedings of NSDI 2006*.
- [06] Adam Wierman, Takayuki Osogami, Mor Harchol-Balter, and Alan Scheller-Wolf. "How many servers are best in a dual-priority M/PH/k system?" *Performance Evaluation* (2006) 63:12,1253-1272.
- [06] Bianca Schroeder, Mor Harchol-Balter, Arun Iyengar, Erich Nahum, and Adam Wierman. "How to determine a good multi-programming level for external scheduling." *Proceedings of IEEE ICDE 2006*.

- [06] Adam Wierman. “On the effect of inexact size information in size based policies.” To appear in *Performance Evaluation Review*. An earlier version appeared in the *MAMA workshop at Sigmetrics 2006*.
- [05] Takayuki Osogami, Adam Wierman, Alan Scheller-Wolf, and Mor Harchol-Balter. “Multi-server queueing systems with multiple priority classes.” *Queueing Systems* (2005) 51:1,331-360.
- [05] Adam Wierman and Mor Harchol-Balter. “Classifying scheduling policies with respect to higher moments of conditional response time.” Proceedings of *ACM Sigmetrics 2005*.
- [05] Adam Wierman, Mor Harchol-Balter, and Takayuki Osogami. “Nearly insensitive bounds on SMART scheduling.” Proceedings of *ACM Sigmetrics 2005*.
- [04] Takayuki Osogami, Adam Wierman, Mor Harchol-Balter, and Alan Scheller-Wolf. “A recursive analysis technique for multi-dimensionally infinite Markov chains.” *Performance Evaluation Review*. (2004) 32:2, 3-5. An earlier version appeared in the *MAMA workshop at Sigmetrics 2004*.
- [04] Adam Wierman, Julia Salzman, Michael Jablonski, and Anant Godbole. “An improved upper bound for the pebbling threshold of the n -path.” *Discrete Mathematics* (2004) 275, 367-373.
- [04] Adam Wierman, Nikhil Bansal, and Mor Harchol-Balter. “A note comparing response times in the M/GI/1/FB and M/GI/1/PS Queues.” *Operations Research Letters* (2004) 32:1, 73-76.
- [04] Adam Wierman and Mor Harchol-Balter. “Formalizing SMART scheduling.” *Performance Evaluation Review*. (2004) 32:2, 12-13. An earlier version appeared in the *MAMA workshop at Sigmetrics 2004*.
- [03] Adam Wierman, Takayuki Osogami, and Jörgen Olsén. “A unified framework for modeling TCP-Vegas, TCP-SACK, and TCP-Reno.” Proceedings of *IEEE MASCOTS 2003*.
- [03] Adam Wierman and Mor Harchol-Balter. “Classifying scheduling policies with respect to unfairness in an M/GI/1.” Proceedings of *ACM Sigmetrics 2003*. **Received the Best Student Paper Award.**
- [03] Adam Wierman, Takayuki Osogami, and Jörgen Olsén. “Modeling TCP-Vegas under on/off traffic.” *Performance Evaluation Review* (2003) 31:2, 6-8. An earlier version appeared in the *MAMA workshop at Sigmetrics 2003*.
- [02] Mor Harchol-Balter, Karl Sigman, and Adam Wierman. “Asymptotic convergence of scheduling policies with respect to slowdown.” *Performance Evaluation* (2002) 49, 241-256.
- [02] Mor Harchol-Balter, Karl Sigman, and Adam Wierman. “Asymptotic convergence of scheduling policies with respect to slowdown.” Proceedings of *IFIP Performance 2002*.
- [02] Mor Harchol-Balter, Karl Sigman, and Adam Wierman. “Understanding the slowdown of large jobs.” *Performance Evaluation Review* (2002) 30:3, 9-11. An earlier version appeared in the *MAMA workshop at Sigmetrics 2002*.

Chapters in Books

- [01] Jack Mostow, Gregory S. Aist, Cathy Huang, Brian Junker, Rebecca Kennedy, Hua Lan, DeWitt Latimer IV, Rollanda O'Connor, Regina Tassone, Brian Tobin, and Adam Wierman. "4-Month evaluation of a learner-controlled reading tutor that listens." Philippe DeCloque and Melissa Holland (Editors), *Speech Technology for Language Learning*. The Netherlands: Swets & Zeitlinger Publishers.

Technical Reports which do not overlap with above lists

- [03] Adam Wierman and Mor Harchol-Balter. "Bounds on a fair policy with near optimal performance." *Carnegie Mellon School of Computer Science Technical Report CMU-CS-03-198*.
- [02] Adam Wierman and Nikhil Bansal. "Competitive analysis of M/GI/1 queueing policies" *Carnegie Mellon School of Computer Science Technical Report CMU-CS-02-201*.

CONFERENCE & INVITED TALKS

- May 2008 "Scheduling for today's systems."
CMU Distinguished Lecture Series
- Mar 2008 "Scheduling for today's systems."
INFORMS Telecommunication Conference, Dissertation Award Finalist Session
- Jan 2008 "Modern scheduling issues."
IBM Research Watson, Host: Cathy Xia and Mark Squillante
- Oct 2007 "Scheduling in polling systems."
The IFIP Performance conference
- Sept 2007 "Revisiting the performance of large jobs in the M/GI/1 queue."
The Allerton Conference, Host: Bruce Hajek and R. Srikant
- July 2007 "Revisiting the performance of large jobs in the M/GI/1 queue."
INFORMS Applied Probability conference
- July 2007 "Scheduling in polling systems."
INFORMS Applied Probability conference
- May 2007 "Scheduling for today's computer systems."
Ph.D. Thesis Defense at CMU
- Mar 2007 "Fairness in queues."
CMU, Host: Mor Harchol-Balter
- Feb 2007 "Scheduling for today's computer systems."
NYU, Host: Michael Pinedo
- Dec 2006 "Levels of information: How much do policies need to know about job sizes."
CWI, the Netherlands, Host: Rudesindo Nunez Queija
- Nov 2006 "Characterizing the effect of inexact size information in size based policies."
INFORMS joint conference
- Nov 2006 "A class of policies that prioritize small jobs."
University of Twente, the Netherlands, Host: Richard Boucherie
- Oct 2006 "Fairness in queues."
EURANDOM Institute, the Netherlands, Host: Onno Boxma
- Sept 2006 "A class of policies that prioritize small jobs."
TU/e, the Netherlands, Host: Ivo Adan
- June 2006 "On the effect of inexact size information in size based policies."
MAMA workshop at Sigmetrics
- May 2006 "Classifying policies that prioritize small jobs."
Stanford University, Hosts: Peter Glynn and Balaji Prabhakar
- Dec 2005 "Understanding the impact of SMART scheduling."

- Columbia University, Host: Ward Whitt
- Nov 2005 “Understanding the effects of SMART scheduling.”
INFORMS joint conference
- July 2005 “Classifying scheduling policies with respect to moments of conditional response time.”
Joint CMU & TU/e Collaborative Workshop
- July 2005 “Classifying scheduling policies with respect to fairness and predictability.”
INFORMS Applied Probability conference
- June 2005 “Classifying scheduling policies with respect to higher moments of conditional response time.”
ACM Sigmetrics
- May 2005 “Classifying scheduling policies with respect to fairness and predictability.”
Lamps of ALADDIN workshop
- July 2004 “Formalizing SMART scheduling.”
EURANDOM Workshop on quantitative models for production and communication networks
- June 2004 “Formalizing SMART scheduling”
MAMA workshop at Sigmetrics
- May 2004 “Scheduling web servers: Theory and practice.”
University of Calgary, Host: Carey Williamson
- May 2004 “Achieving low mean response times while providing fairness.”
CORS/INFORMS joint conference
- Oct 2003 “A unified framework for modeling TCP-Vegas, TCP-SACK, and TCP-Reno.”
IEEE MASCOTS
- Oct 2003 “Prioritization in multiserver queues.”
INFORMS joint conference
- June 2003 “Classifying scheduling policies with respect to unfairness in and M/GI/1.”
ACM Sigmetrics (Best Student Paper Award recipient)
- Sept 2002 “Asymptotic convergence of scheduling policies with respect to slowdown.”
IFIP Performance
- May 2002 “Understanding the slowdown of large jobs in an M/GI/1 system.”
MAMA workshop at Sigmetrics
- Aug 2001 “Reduction of map exploration in S3P.”
MIT Lincoln Laboratory, Host: Jeremy Kepner
- July 2000 “The splitting number.”
East Tennessee State University, Host: Anant Godbole
- July 2000 “The splitting number.”
MAA MathFest

PROFESSIONAL SERVICE

Program Committee and Related:

- 2008 Publicity Chair: ACM Sigmetrics
- 2008 Program Committee: ACM Sigmetrics
- 2008 Program Committee: IEEE Mascots
- 2007 Program Committee: ACM Sigmetrics
- 2007 Conference Webmaster: ACM Sigmetrics
- 2007 Best Paper Committee: ACM Sigmetrics

Invited Referee for Journals and Conferences (each listed only once):

Performance Evaluation (PE), ACM Sigmetrics, IFIP Performance, Queueing Systems: Theory and Applications (QUESTA), QUEST Conference, Journal of Scheduling, ICST ValueTools Conference, Computer Networks, Operations Research (OR), Journal of Parallel and Distributed Computing (JPDC), Applied Mathematics Letters, IEEE INFOCOM, Operations Research Letters, IEEE Transactions on Networking (ToN), IEEE IPDPS, WWW Conference, Performance Evaluation Review (PER).

Session Organizer/Chair (each listed only once):

INFORMS Applied Probability Conference, INFORMS General Meeting, ACM Sigmetrics, IFIP Performance.

UNIVERSITY SERVICE

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| Apr 2008 | Organized Graduate Student Appreciation Week events |
| Feb 2008 | E11 Faculty Mentor |
| 2008-pres | IST Lunch Bunch co-organizer |
| Jan 2008 | Presentation for SISL |
| 2007-pres | Caltech racquetball association faculty advisor |
| 2007-2008 | CS Graduate Student Admissions committee |
| 2007-2008 | CS/EC Hiring committee |
| Nov 2007 | University nominee for Microsoft New Faculty Fellowship |
| Nov 2007 | Presentation for Lee Center |
| Oct 2007 | Met with EAS visiting committee |
| Oct 2007 | Presentation at CS retreat |
| Oct 2007 | Presentation at CMI retreat |
| 2003-2006 | Founded and organized the Random Distance Run at CMU |
| 2003-2006 | Member of the CMU Computer Science Department Speakers Club |
| 2003-2006 | Volunteer for the CMU Computer Science Department Open House |

TEACHING EXPERIENCE

Winter 2007 Co-taught "Introduction to SISL: Topics in Algorithmic Game Theory" with John Ledyard. The course is jointly offered by CS and Economics and included students from 4 different departments. The course had 8 registered students and an attendance of 15-20 students per lecture, including a mixture of undergraduates, graduate students, postdocs, and faculty.

Fall 2007 Co-taught "Queueing Network Games" with Jason Marden (postdoc). The attendance was approximately 20 students per lecture, including a mixture of graduate students, postdocs, and faculty from 6 different departments.

Spring 2006 Received the Carnegie Mellon Graduate Student Teaching Award.

Spring 2005 Received the Alan J. Perlis School of Computer Science Student Teaching Award.

Spring 2005 Received an Honorable Mention for the Carnegie Mellon Graduate Student Teaching Award.

Fall 2004 Teaching Assistant for undergraduate level "Probability and Computing." Taught by: John Lafferty and Mor Harchol-Balter

This was a brand new course, so we designed all lectures and materials as we went. There were 2 TAs for around 25 students. My duties included helping to develop the organization of the course, designing and grading weekly homeworks, teaching a weekly recitation section, maintaining the course web site, and holding weekly office hours. I also organized and taught review sessions before the exams.

Reviews averaged 3.88/4 and are available upon request.

Spring 2004 Teaching Assistant for undergraduate level “Great Theoretical Ideas in CS.”

Taught by: Steven Rudich and Anupam Gupta

There were 6 TAs for around 170 students. My duties included grading exams, designing and grading weekly homework assignments, leading a recitation section, and holding weekly office hours.

I also organized and taught review sessions before the exams.

Reviews averaged 3.93/4 and are available upon request.

Fall 2002 Teaching Assistant for graduate level “Theory of Performance Modeling.”

Taught by: Mor Harchol-Balter

I was the only TA for around 25 students. My duties included grading exams and weekly homework assignments in addition to lecturing four times and holding weekly office hours.

Reviews averaged 4.7/5 and are available upon request.

ADVISING EXPERIENCE

Graduate student advising:

Ragavendran Gopalakrishnan Entered in 2008

Minghong Lin Entered in 2008

Undergraduate student advising:

Sherwin Doroudi 2008 SURF student – winner of a Rose Hills Foundation Fellowship
“A game theoretic approach to the sensor coverage problem.”

Benjamin Flora 2008 SURF student
“SMART online multi-objective scheduling.”

Matthew Maurer 2008 SURF student
“Energy use reduction via power modeling.”

Gwendolyn Stockman Senior honors thesis at CMU in 2005-2006.
“The impact of abandonment in multi-class priority queues.”
Following graduation she attended University of Wisconsin-Madison for graduate school.

REFERENCES

Prof. Mor Harchol-Balter
Computer Science Department
Carnegie Mellon University
Pittsburgh, PA 15213
harchol@cs.cmu.edu

Prof. Onno Boxma
Department of Mathematics and Comp. Sci.
Eindhoven University of Technology
Eindhoven, The Netherlands
boxma@win.tue.nl

Prof. Anupam Gupta
Computer Science Department
Carnegie Mellon University
Pittsburgh, PA 15213
anupamg@cs.cmu.edu

Prof. Alan Scheller-Wolf
Tepper School of Business
Carnegie Mellon University
Pittsburgh, PA 15213
awolf@andrew.cmu.edu

Prof. K. Mani Chandu
Computer Science Department
California Institute of Technology
Pasadena, CA 91125
mani@cs.caltech.edu

Prof. Ward Whitt
Dept. of Industrial Eng. and Oper. Research
Columbia University
New York, New York 10027
ww2040@columbia.edu