

# Anshul Gandhi

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## Research Interests

- Performance Modeling, Queueing Theory, Power Management, Cloud Computing

## Employment

- **Stony Brook University** (Starting Fall 2014)  
Assistant Professor, Department of Computer Science  
Stony Brook, NY, USA
- **IBM T.J. Watson Research Center** (August 2013 - present)  
Post Doctoral Researcher, Cloud Management and Analytics  
Hosts: Andrew Kochut and Li Zhang  
Yorktown Heights, NY, USA

## Education

- **Carnegie Mellon University** (2007-2013)  
Ph.D., Computer Science Department  
Thesis: Dynamic Server Provisioning for Data Center Power Management  
Adviser: Prof. Mor Harchol-Balter  
Committee Members: David Andersen (CMU), Mor Harchol-Balter (CMU), Jeff Kephart (IBM T.J. Watson), Alan Scheller-Wolf (Tepper School of Business, CMU), Karsten Schwan (Georgia Tech)  
Pittsburgh, PA, USA
- **Indian Institute of Technology, Kanpur** (2003-2007)  
B.Tech, Computer Science and Engineering  
CGPA: 3.9/4.0 (Departmental Rank: 1)  
Thesis: Indecomposable Graphs  
Adviser: Prof. Shashank K. Mehta  
Kanpur, UP, India

## Work Experience

- **HP Labs** (Summer 2010)  
Summer Intern  
Hosts: Yuan Chen and Cullen Bash  
Palo Alto, CA, USA
- **Intel Research Pittsburgh** (Summer 2009)  
Summer Intern  
Hosts: Michael Kozuch and Jason Campbell  
Pittsburgh, PA, USA
- **IBM T.J. Watson Research Center** (Summer 2008)  
Summer Intern  
Hosts: Rajarshi Das and Jeff Kephart  
Hawthorne, NY, USA
- **Institute of Theoretical Computer Science, ETH** (Summer 2006)  
Summer Intern  
Hosts: Uli Wagner and Emo Welzl  
Zurich, Switzerland

## Teaching Experience

- Teaching Assistant (Fall 2011)  
15-857: Analytical Performance Modeling and Design of Computer Systems (Graduate Course)  
Instructor: Prof. Mor Harchol-Balter  
Responsibilities: Weekly recitations, office hours, grading.
- Teaching Assistant (Fall 2009)  
15-359: Probability and Computing (Undergraduate Course)  
Instructor: Prof. Ryan O'Donnell  
Responsibilities: Weekly recitations, office hours, grading.

## Awards & Honors

- Winner of the SPEC Distinguished Dissertation Award, 2013.
- Nominated by CMU for the VMWare Fellowship, 2013.
- Awarded travel grants for USENIX Federated Conferences Week 2012 and IFIP Performance 2010.
- Pick of the Month (IGCC 2011 paper) for March 2012 in the IEEE STC on Sustainable Computing.
- Best Paper Award (IGCC 2011 paper), IEEE International Green Computing Conference, 2011.
- Nominated by CMU for the IBM Fellowship, 2011.
- Mentored the CMU Senior Thesis Project that won the 2011 Alumni Award for Undergraduate Excellence.
- Semi-finalist at the MIT Clean Energy Prize 2011 competition.
- Winner of the CMU Cross Campus New Venture Competition, 2011.
- Awarded the Kauffman Foundation Commercialization prize, 2010.
- Awarded the Intel/CMU Summer Fellowship, 2009.
- Awarded the General Proficiency Medal for Best Academic Performance in the Department of Computer Science and Engineering (IIT Kanpur).
- Awarded the Proficiency Medal for the Best Project Work (Indecomposable Graphs) in the Department of Computer Science and Engineering (IIT Kanpur).
- Awarded the Pratibha Scholarship from the state government for academic excellence (IIT Kanpur).

## Publications

- **Adaptive, Model-driven Autoscaling for Cloud Applications**  
Anshul Gandhi, Parijat Dube, Alexei Karve, Andrzej Kochut and Li Zhang.  
*ICAC*, Philadelphia, PA, USA, June 2014.
- **Exact Analysis of an M/M/k with Setup Times via Recursive Renewal Reward**  
Anshul Gandhi, Sherwin Doroudi, Mor Harchol-Balter and Alan Scheller-Wolf.  
*Queueing Systems*, Volume 77, Issue 2, pp. 177-209.
- **Dynamic Management of Caching Tiers**  
Anshul Gandhi.  
*ICPE* (invited abstract), Dublin, Ireland, March 2014.
- **M/G/k with Staggered Setup**  
Anshul Gandhi and Mor Harchol-Balter.  
*Operations Research Letters*, Volume 41, Issue 4, pp. 317-320.
- **Exact Analysis of an M/M/k with Setup Times via Recursive Renewal Reward**  
Anshul Gandhi, Sherwin Doroudi, Mor Harchol-Balter and Alan Scheller-Wolf.  
*SIGMETRICS*, Pittsburgh, PA, USA, June 2013.
- **AutoScale: Dynamic, Robust Capacity Management for Multi-Tier Data Centers**  
Anshul Gandhi, Mor Harchol-Balter, Ram Raghunathan and Michael Kozuch.  
*Transactions on Computer Systems*, Volume 30, Issue 4, Article 14.

- **SOFTScale: Stealing Opportunistically For Transient Scaling**  
Anshul Gandhi, Timothy Zhu, Mor Harchol-Balter and Michael Kozuch.  
*Middleware*, Montreal, Canada, December 2012.
- **Saving Cash by Using Less Cache**  
Timothy Zhu, Anshul Gandhi, Mor Harchol-Balter and Michael Kozuch.  
*HotCloud*, Boston, MA, USA, June 2012.
- **Are sleep states effective in data centers?**  
Anshul Gandhi, Mor Harchol-Balter and Michael Kozuch.  
*International Green Computing Conference*, San Jose, CA, USA, June 2012.
- **Resource Provisioning for Minimizing Data Center SLA Violations and Power Consumption**  
Anshul Gandhi, Yuan Chen, Daniel Gmach, Martin Arlitt and Manish Marwah.  
*Sustainable Computing: Informatics and Systems*, Volume 2, Issue 2, pp. 91-104.
- **The Case for Sleep States in Servers**  
Anshul Gandhi, Mor Harchol-Balter and Michael Kozuch.  
*HotPower*, Cascais, Portugal, October 2011.
- **Distributed, Robust Auto-Scaling Policies for Power Management in Compute Intensive Server Farms**  
Anshul Gandhi, Mor Harchol-Balter, Ram Raghunathan and Michael Kozuch.  
*Open Cirrus Summit*, Atlanta, GA, USA, October 2011.
- **How Data Center Size Impacts the Effectiveness of Dynamic Power Management**  
Anshul Gandhi and Mor Harchol-Balter.  
*49th Annual Allerton Conference on Communication, Control, and Computing*, Allerton, IL, USA, September 2011.
- **Minimizing Data Center SLA Violations and Power Consumption via Hybrid Resource Provisioning (Best Paper Award)**  
Anshul Gandhi, Yuan Chen, Daniel Gmach, Martin Arlitt and Manish Marwah.  
*International Green Computing Conference*, Orlando, FL, USA, July 2011.
- **Optimality Analysis of Energy-Performance Trade-off for Server Farm Management**  
Anshul Gandhi, Varun Gupta, Mor Harchol-Balter and Michael Kozuch.  
*Performance Evaluation*, Vol. 67, Issue 11, pp. 1155-1171.
- **Server Farms with Setup Costs**  
Anshul Gandhi, Mor Harchol-Balter and Ivo Adan.  
*Performance Evaluation*, Vol. 67, Issue 11, pp. 1123-1138.
- **M/G/k with Exponential Setup**  
Anshul Gandhi, Mor Harchol-Balter and Ivo Adan.  
*Madrid Conference on Queueing Theory*, Madrid, Spain, June 2010.
- **Decomposition Results for an M/M/k with Staggered Setup**  
Anshul Gandhi, Mor Harchol-Balter and Ivo Adan.  
*Performance Evaluation Review*, Vol. 38, Issue 2, pp. 48-50.
- **Optimal Power Allocation in Server Farms**  
Anshul Gandhi, Mor Harchol-Balter, Rajarshi Das, and Charles Lefurgy.  
*SIGMETRICS/Performance*, Seattle, WA, USA, June 2009.
- **Power Capping Via Forced Idleness**  
Anshul Gandhi, Mor Harchol-Balter, Rajarshi Das, Jeffrey Kephart and Charles Lefurgy.  
*Workshop on Energy-Efficient Design*, Austin, TX, USA, June 2009.

- **Database Summarization and Publishing in Wireless Environments**

Anshul Gandhi and R.K.Ghosh.

*International Conference on Distributed Computer Networking*, Guwahati, India, December 2006.

## Conference Talks

- Adaptive, Model-driven Autoscaling for Cloud Applications. *ICAC 2014*, June 2014.
- DynamicManagementofCachingTiers. *ICPE 2014*, March 2014.
- Exact Analysis of an M/M/k with Setup Times via Recursive Renewal Reward. *Sigmetrics 2013*, June 2013.
- SOFTScale: Stealing Opportunistically For Transient Scaling. *Middleware 2012*, December 2012.
- Are sleep states effective in data centers? *International Green Computing Conference*, June 2012.
- Distributed, Robust Auto-Scaling Policies for Power Management in Compute Intensive Server Farms. *Open Cirrus Summit*, October 2011.
- The Case for Sleep States in Servers. *HotPower 2011*, October 2011.
- Minimizing Data Center SLA Violations and Power Consumption via Hybrid Resource Provisioning. *International Green Computing Conference*, July 2011.
- Optimality Analysis of Energy-Performance Trade-off for Server Farm Management. *Performance 2010*, November 2010.
- Decomposition Results for an M/M/k with Staggered Setup. *MAMA 2010*, June 2010.
- M/G/k with Exponential Setup. *Madrid Conference on Queueing Theory*, June 2010.
- Power Capping Via Forced Idleness. *Workshop on Energy-Efficient Design*, June 2009.
- Optimal Power Allocation in Server Farms. *Sigmetrics 2009*, June 2009.

## Invited Talks

- Providing Performance Guarantees for Cloud Applications. *School of Computer Science and Informatics, University College Dublin*, March 2014.
- Providing Performance Guarantees for Cloud Applications. *DIMACS Working Group on Algorithms for Green Data Storage, Rutgers University*, December 2013.
- Performance Modeling for Data Center Power Management. *Department of Technology Management, University of California, Santa Cruz*, April 2013.
- Dynamic Capacity Management for Multi-Tier Data Centers. *Computer Science and Engineering Department, University at Buffalo*, March, 2013.
- Dynamic Capacity Management for Multi-Tier Data Centers. *Microsoft Research*, March, 2013.
- Performance Modeling for Data Center Power Management. *Rotman School of Management, University of Toronto*, March 2013.
- Dynamic Capacity Management for Multi-Tier Data Centers. *Department of Computer Science, Stony Brook University*, March, 2013.
- Dynamic Capacity Management for Multi-Tier Data Centers. *Computer Science Department, Binghamton University*, March, 2013.
- Dynamic Capacity Management for Multi-Tier Data Centers. *School of Computing & Information Sciences, Florida International University*, March, 2013.
- Dynamic Capacity Management for Multi-Tier Data Centers. *IBM T.J. Watson Research Center*, December, 2012.
- Exact Analysis of the M/M/2 with Setup Times and other Hard Variants. *INFORMS*, October 2012.
- Dynamic Capacity Management for Multi-Tier Data Centers. *Computer Science Department, New York University*, November 2012.
- Dynamic Capacity Management for Multi-Tier Data Centers. *Computer Science Department Colloquium, Rutgers University*, November 2012.
- Dynamic Capacity Management for Multi-Tier Data Centers. *Computer Science Department, University of California, Santa Cruz*, June 2012.

- AutoScale: Dynamic Power Management for Multi-Tier Data Centers. *CERCS Seminar, Georgia Institute of Technology*, November 2011.
- POW Solutions. *MIT Clean Energy Prize Semi-Finals*, April 2011.
- POW Solutions. *CMU Cross-Campus New Venture Competition*, February 2011.
- Power-efficient Server Provisioning in Server Farms. *Invited Talk, IBM Student Workshop for Frontiers of Cloud Computing*, September 2010.
- POW Solutions. *USF International Business Plan Competition*, March 2010.
- Optimal Power Allocation in Server Farms. *Guest Lecture, Algorithmic Power Management, University of Pittsburgh*, February 2010.
- Optimizing Server Farm Performance in Power-Constrained Environments. *TTC Technology Commercialization Advisory Board Meeting*, October 2009.
- Optimal Power Allocation in Server Farms. *Workshop on Quantitative Models for Production and Communication Networks, Eindhoven University of Technology*, January 2009.
- Power Management in Server Farms. *Parallel Data Laboratory Retreat*, November 2008.

## Patents

- Methods, Systems and Apparatuses to Manage the Operating State of Computing Devices to Achieve Computational and Energy Efficiency. Mor Harchol-Balter, Anshul Gandhi, Varun Gupta and Mike Kozuch (filed).
- Provisioning Data Center Resources. Yuan Chen, Anshul Gandhi, Daniel Gmach, Chris Hyser, Martin Arlitt, Manish Marwah and Cullen Bash (filed).
- Power Budget Allocation in Multi-Processor Systems. Mor Harchol-Balter, Anshul Gandhi, Rajarshi Das and Jeff Kephart (filed).
- Systems and methods for managing power consumption and performance of a processor. Mor Harchol-Balter and Anshul Gandhi (US 8,589,709).

## Program Committee

- CCWS 2014
- ACM Sigmetrics 2014
- USENIX HotCloud 2014
- ICPP 2014
- ACM Sigmetrics 2010 (Shadow PC)

## Refereeing

- IEEE Transactions on Computers, IEEE Transactions on Cloud Computing, ACM/IEEE Transactions on Networking, Performance Evaluation, Annals of Operations Research, IEEE Transactions on Parallel and Distributed Systems, IEEE Transactions on Services Computing, Canadian Operations Research Journal, IEEE Transactions on Network and Service Management, Sustainable Computing, ACM/IEEE ISCA 2013, HotPower 2012.

## Professional Membership

- ACM, INFORMS