

# ASHOK ANAND

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## EDUCATION

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### **Ph.D. Computer Science, August 2007 - January 2012**

University of Wisconsin, Madison  
GPA: 3.93/4.00  
Advisor: Prof. Aditya Akella  
Title: Architectural Support for Effective Redundancy Elimination  
Area: Networking and Systems.

### **M.S., Computer Science, August 2007 - May 2010**

University of Wisconsin, Madison  
GPA: 3.9/4.00

### **B.Tech., Computer Sciences and Engineering, May 2003**

Indian Institute of Technology, Kharagpur  
GPA 9.13/10.00.

## RESEARCH INTERESTS

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Systems and Networking. Algorithm design, system, measurement and analysis.

## AWARDS AND ACHIEVEMENTS

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Best Paper Award, CoNext 2013.

ACM Sigcomm Doctoral Dissertation Award, 2012, Runner-up.

Outstanding Graduate Student Award in CS department, University of Wisconsin, Madison, 2012.

Google fellowship recipient 2010, one among 15 recipients in total over United States/Canada.

Finalist for Microsoft Research Fellowship, 2009.

Top ranked paper at ACM SIGCOMM WREN workshop, 2009.

WARF Accelerator Award 2009 for SmartRE.

IBM Bravo Award for contribution towards IQUILT project.

IBM Research Division Technical Group Award for contribution towards DAT porting tool.

IBM Research Invention Achievement Award for contribution in patents.

## WORK EXPERIENCE

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**Research Engineer** Instart Logic. March 13 – Present.  
Working on building systems for radically fast web experience.

**Member, Technical Staff** Bell Labs, India. Feb'12 – Feb'13.

Worked on cloudifying middleboxes (e.g., WAN optimizers, IDS, etc.) and on moving baseband processing to cloud.

**Research Assistant** with advisor *Prof. Aditya Akella*. Jan'08 – Jan'12.

Worked on in-network redundancy elimination techniques, traffic engineering in data centers, high performance flash-based key-value stores, and new internet architectures.

**Summer Intern**, Microsoft Research Lab, India. May – Aug'10. Mentor: *Dr. Ramachandran Ramjee and Dr. Venkat Padmanabhan*.

Developed techniques to speedup virtual machine migration.

**Summer Intern**, Microsoft Research Lab, India. May – Aug'08. Mentor: *Dr. Ramachandran Ramjee*.

Investigated the nature of redundancy in network traffic using several enterprise network traces and our University traces, which led into better understanding and new designs.

**Technical Staff Member**, IBM Research Lab, India. June'03 – July'07. Manager: *Dr. Manish Gupta*, Mentor: *Dr. Pradeep Varma*.

Worked on automated analysis of porting issues for large C/C++ programs, and management models for composite applications in service oriented architecture (SOA).

**Summer Intern**, INRIA Research Lab, France. May – July'02. Mentor: *Isabelle Astic*. Developed tool to extend MIB support for IPV6.

## PUBLICATIONS

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### Conferences

1. **Enhancing multimedia accessibility and availability with information-bound references**, *CoNext 2013*.

*Ashok Anand, Athula Balachandran, Vyas Sekar, Aditya Akella and Srinivasan Seshan.*

2. **Adaptive Data Transmission in the Cloud**, *IWQoS 2013*.

Wenfei Wu, Yizheng Chen, Ram Durairajan, Dongchan Kim, *Ashok Anand* and Aditya Akella.

3. **MiG: Efcient Migration of Desktop VMs Using Semantic Compression**, *Usenix 2013*.

Anshul Rai, Ramachandran Ramjee, *Ashok Anand*, Venkata N. Padmanabhan and George Varghese.

4. **XIA: An Architecture for an Evolvable and Trustworthy Internet**, *NSDI 2012*.

Dongsu Han, *Ashok Anand*, Fahad Dogar, Boyan Li, Hyeontaek Lim, Michel Machadoy, Wenfei Wu, Aditya Akella, David Andersen, John Byers, Srinivashan Seshan and Peter Steenkiste.

5. **RPT: Re-architecting Loss Protection for Content-Aware Networks**, *NSDI 2012*.

Dongsu Han, *Ashok Anand*, Aditya Akella and Srinivashan Seshan.

6. **MicroTE: Fine Grained Traffic Engineering for Data Centers**, *CoNext 2011*.

Theophilus Benson, *Ashok Anand*, Aditya Akella and Ming Zhang.

7. **Refactoring Content Overhearing to Improve Wireless Performance**. *MOBICOM 2011* (13.5% acceptance rate).

Shan Hsiang-Shen, Aaron Gember, *Ashok Anand* and Aditya Akella

8. **Cheap and Large CAMs for High-performance Data-intensive Networked Systems**. *NSDI 2010* (16.5% acceptance rate).

*Ashok Anand, Chitra Muthukrishnan, Steven Kappes, Aditya Akella and Suman Nath.*

9. **EndRE: An End-System Redundancy Elimination Service for Enterprises.** *NSDI 2010* (16.5% acceptance rate).  
Bhavish Aggarwal, Aditya Akella, *Ashok Anand*, Pushkar Chitnis, Chitra Muthukrishnan, Athula Nair, Ram Ramjee and George Varghese.
10. **SmartRE: An Architecture for Coordinated Network-wide Redundancy Elimination.** *SIGCOMM 2009* (12.5% acceptance rate). Also appeared as a poster in *NSDI 2009*.  
*Ashok Anand*, Vyas Sekar and Aditya Akella.
11. **Redundancy in Network Traffic: Findings and Implications.** *SIGMETRICS 2009* (15% acceptance rate).  
*Ashok Anand*, Chitra Muthukrishnan, Aditya Akella and Ramachandran Ramjee.
12. **Avoiding File System Micromanagement with Range Writes.** *OSDI 2008*(13.4% acceptance rate)  
*Ashok Anand*, Sayandeep Sen, Andrew Krioukov, Florentina Popovici, Aditya Akella, Andrea Arpaci-Dusseau, Remzi Arpaci-Dusseau and Suman Banerjee.
13. **Packet Caches on Routers: The Implications of Universal Redundant Traffic Elimination.** *SIGCOMM 2008*(12.5% acceptance rate).  
*Ashok Anand*, Archit Gupta, Aditya Akella, Srinivasan Seshan and Scott Shenker.
14. **On Store Placement for Response Time Minimization in Parallel Disks.** *ICDCS 2006*. Extended version in *JPDC 2007*.  
Akshat Verma and *Ashok Anand*.

## Workshops and Short Papers

1. **A Comparative Study of Handheld and Non-Handheld Traffic in Campus WiFi Networks.** *PAM 2011*(workshop).  
Aaron Gember, *Ashok Anand*, and Aditya Akella
2. **A Case for Information-Bound Referencing.** *HotNets 2010*(workshop).  
*Ashok Anand*, Vyas Sekar, Aditya Akella and Srinivasan Seshan
3. **Tracking Semantic Relationships for Effective Data Management in Home Networks.** *HomeNets 2010*(workshop).  
*Ashok Anand*, Aaron Gember, Vyas Sekar and Aditya Akella.
4. **The Case for Fine-grained Traffic Engineering in Data Centers.** *WREN 2010*(workshop).  
Theophilus Benson, *Ashok Anand*, Aditya Akella and Ming Zhang.
5. **Understanding Data Center Traffic Characteristics.** *WREN 2009*(workshop).  
Theophilus Benson, *Ashok Anand*, Aditya Akella and Ming Zhang.
6. **Net-Replay: A New Network Primitive.** *Hotmetrics 2009*(workshop).  
*Ashok Anand* and Aditya Akella.
7. **On Concurrency Improvements in Enterprise SOA Middleware.**  
*Middleware, 2008* (short paper).  
Manish Sethi and *Ashok Anand*.
8. **An open framework for federating integrated management model of distributed IT environment.** *NOMS 2008* (short paper).  
Manish Sethi, *Ashok Anand*, Venkateswara Reddy Madduri, Manish Gupta and Dipayan Gangopadhyay.

## Posters and Demos

1. **CloudSSI: Revisiting SSI in cloud era** *SOCC 2013 Poster*.  
Mansoor Alicherry, *Ashok Anand*, Shoban Preeth Chandrabose and Theophilus Benson.
2. **On lookups in content based routers** *NSDI 2011 Poster*.  
*Ashok Anand*, Nilay Vaish and Aditya Akella
3. **Toward Universal Redundant Traffic Elimination** *GENI GEC9 2010 Plenary Session Demo*.  
*Ashok Anand*, Athula Balachandran, Aditya Akella and Srinivasan Seshan
4. **Flexible Multimedia Content Retrieval Using InfoNames**. *SIGCOMM 2010(Demo)*.  
Arun Kumar, *Ashok Anand*, Athula Balachandran, Vyas Sekar, Aditya Akella and Srinivasan Seshan
5. **A Framework and Tool for Porting Assessment and Remediation**. *ICSM 2004* (industrial applications).  
Donald P. Pazel, Pradeep Varma, Amit M. Paradkar, Beth Tibbits, Ashok Anand and Philippe Charles

## PATENTS

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1. *Method And Apparatus For Providing A Unified Resource View Of Multiple Virtual Machines*. Filed; Mansoor Alicherry, Ashok Anand and Shoban Preeth Chandrabose
2. *Flow Migration Between Virtual Network Appliances in a cloud computing network*. Filed; Mansoor Alicherry, Ashok Anand and Shoban Preeth Chandrabose.
3. *Traffic Redundancy Aware VM Placement for Data Center Networks*. Filed; Ashok Anand and Krishna Puttaswamy
4. *Scaling WAN Optimizer Middleboxes for the Cloud*. Filed; Mansoor Alicherry, Ashok Anand and Shoban Preeth Chandrabose
5. *New Framework Helps Compose and Scale Middlebox Software Modules for Cloud Computing*. Filed; Srinivasa Akella, Ashok Anand, Aaron Gember, Robert Grandl and Theophilus Benson
6. *SliceHash: High-Performance Indexing for Data-Intensive Systems*. Filed; Ashok Anand, Aaron Gember and Aditya Akella
7. *Asymmetric end host redundancy elimination for networks*. Filed; Bhavish Aggarwal, Pushkar V. Chitnis, George Varghese, Ashok Anand, Chitra Muthukrishnan, Athula Balachandran, and Ramachandran Ramjee.
8. US Patent 8509237 *Architecture and system for coordinated network-wide redundancy elimination*. Aditya Akella, Ashok Anand and Vyas Sekar.
9. US Patent 7721259 *System and Method for interactive and integrated software development process and phases*. Issued on May 18,2010; Amit M. Paradkar, Donald Pazel, Pradeep Varma, Beth Tibbits and Ashok Anand.
10. *Deploying Redundancy Elimination on Routers: Algorithms and Applications to Traffic Engineering*. Filed; Aditya Akella, Ashok Anand and Srinivasan Seshan.
11. *Determining System Level Dependencies*. Filed on 30th April 2009; Ashok Anand, Dipayan

Gangopadhyay, Manish Gupta and Manish Sethi.

12. *Prevention of Deadlock in Distributed SOA Computing Environment*. Filed on 29th Nov 2007; Manish Sethi and Ashok Anand.

13. *System and Method for placement of logical data stores to minimize response time*. Filed on 13th Jan 2007; Akshat Verma and Ashok Anand.

14. *Software Migration Orchestration*. Filed on 6th July 2005; Pradeep Varma, Ashok Anand, Beth Tibbits and Donald Pazel.

15. US Patent 7469375 *Systems and methods for managing error dependencies*. Issued on 23rd December, 2008; Ashok Anand, Amit M. Paradkar, Donald P. Pazel, Beth Tibbits and Pradeep Varma.

16. US Patent 7472377 *Systems and methods for determining software package identity during a system build*. Issued on 30th December, 2008; Ashok Anand, Philippe Charles, Amit M. Paradkar, Donald P. Pazel, Beth Tibbits and Pradeep Varma.

## TALKS

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1. **A Case for Information-Bound Referencing** HotNets 2010
2. **Tracking Semantic Relationships for Effective Data Management in Home Networks** HomeNets 2010
3. **Fast and Scalable Approximate Key Lookups** DIMACS (Center for Discrete Mathematics and Theoretical Computer Science), 2010
4. **Cheap and Large CAMs for High-performance Data-intensive Networked Systems**. NSDI 2010
5. **Redundancy in Network Traffic: Findings and Implications**. SIGMETRICS 2009, Microsoft Research Lab Redmond
6. **Net-Replay: A New Network Primitive**. Hotmetrics 2009
7. **Avoiding File System Micromanagement with Range Writes**. OSDI 2008
8. **Packet Caches on Routers: The Implications of Universal Redundant Traffic Elimination**. SIGCOMM 2008

## PROFESSIONAL SERVICE

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**Profram Committee Member:** IWQoS 2013, CoNext 2013

**Technical Reviewer:** ICNP 2012, IC2E 2012, Infocom 2013, InfoCom 2014, ToN 2014, COM-SNETS 2014

## REFERENCES

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**Prof. Aditya Akella**, University of Wisconsin-Madison; [akella@cs.wisc.edu](mailto:akella@cs.wisc.edu)

**Prof. Remzi Arpaci-Dusseau**, University of Wisconsin-Madison; [remzi@cs.wisc.edu](mailto:remzi@cs.wisc.edu)

**Prof. Srinivasan Seshan**, Carnegie Mellon University; [srini@cs.cmu.edu](mailto:srini@cs.cmu.edu)

**Dr. Ramachandran Ramjee**, Microsoft Research Lab, Bangalore; *ramjee@microsoft.com*