

# ANANTH RAJAGOPALA - RAO

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## OBJECTIVE

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I am interested in a career as part of a team designing, building and deploying large-scale distributed systems.

## EDUCATION

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2004 – 2007 [University of California, Berkeley](#)  
*Ph.D. in Computer Science* Expected December 2007  
Advisor: Prof. Ion Stoica

2001 – 2003 [University of California, Berkeley](#)  
*M.S. in Computer Science*

1997 - 2001 [Indian Institute of Technology, Madras, India](#)  
*Bachelor of Technology, Computer Science and Engineering*

## WORK EXPERIENCE

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**Internship at Microsoft Research Labs, Redmond, WA (05/2004-08/2004):** In my second internship at Microsoft Research (MSR), I conducted several measurement studies on the 802.11 test-beds at MSR and at Intel-Portland. Through these measurements, we have gained a better understanding of how interference, data rate, power levels etc. affect performance in these networks.

**Internship at Microsoft Research Labs, Redmond, WA (05/2003-08/2003):** During my first Internship at MSR, I worked with Lili Qiu, Lidong Zhou and Victor Bahl to develop an online, simulation-based fault-diagnosis framework for multi-hop wireless networks. Through this framework we are able to effectively capture complex interactions between different layers of the protocol stack and diagnose multiple simultaneous faults quickly and accurately.

**Internship at IBM India Research Lab, New Delhi (05/2000 – 07/2000):** Combinatorial Auctions (CA) are auctions where the bidders place a single bid on a combination of items. Winner determination in CAs is NP-complete. My project with the e-commerce group involved the evaluation of various heuristics to calculate a good approximate solution for this problem.

## RESEARCH INTERESTS

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- Wireless Networks
- Peer-to-Peer Systems

## RESEARCH PROJECTS

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**Inferring Interference Patterns in Wireless Networks (01-2007 – current):** Having an accurate knowledge of the interference pattern in a wireless network has a number of applications *e.g.* channel assignment, scheduling, resource provisioning, admission control and so on. Most commonly used heuristics based on number of hops or the signal strength do not work well across all scenarios. On the other hand, measuring link interference exhaustively takes a lot of time even in small networks. In this work, we develop a scheme to learn the interference pattern of a wireless network over time by making inferences based only on the observed performance of existing traffic.

**End-to-end Fairness using Local Weights (EFLoW) (01/2005 – 06/2007):** While many experimental MAC layers (including OML proposed and implemented by us) have shown promise in achieving fairness amongst nodes that directly compete with each other for the wireless medium, assigning these “local” weights correctly to ensure end-to-end fairness in a multi-hop network requires global knowledge of link capacities and flow demands. Obtaining up-to-date information can prove very expensive since either of these can change very frequently. We have proposed and implemented a distributed increase-decrease algorithm that converges to the correct weights using only local information at each iteration.

**A TDMA Overlay for 802.11 Wireless Networks (09/2003 – 05/2007):** Recent experience of many researchers with 802.11 networks has shown that the MAC layer can be very inefficient (due to collisions) and unfair in certain cases. In this project, we try to solve these problems using an Overlay MAC Layer (OML) that implements TDMA-like scheduling above the MAC layer. We have implemented OML in a test-bed and shown that we can improve the throughput and fairness of 802.11 in several scenarios. I presented this work at Mobisys 2005 in Seattle, WA.

**Data-centric Storage in Wireless Networks (05-2002 - 2003):** The goal of this project is to build a DHT infrastructure on top of a wireless network without using an underlying routing layer. Such an infrastructure will allow us to gather, store and query data in a sensor network. This project is joint work with Dr. Scott Shenker and Dr. Sylvia Ratnasamy (Intel Research - Berkeley). I presented this work at Mobicom 2003 in San Diego, CA.

## PUBLICATIONS

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### Refereed Papers

Ananth Rao and Ion Stoica, [An Overlay MAC layer for 802.11 Networks](#), *MOBISYS*, Seattle, WA, April 2005.

Ananth Rao, Sylvia Ratnasamy, Christos Papadimitriou, Scott Shenker, Ion Stoica, [Geographic Routing without Location Information](#), *MOBICOM*, San Diego, CA, September 2003.

Lili Qiu, Paramvir Bahl, Ananth Rao, and Lidong Zhou, [Troubleshooting Wireless Mesh Networks](#), *Computer Communications Review*, October 2006.

J. Padhye, S. Agarwal, V. Padmanabhan, L. Qiu, A. Rao and B. Zill, [Estimation of Link Interference in Static Multi-hop Wireless Networks](#), *Internet Measurement Conference*, Berkeley, CA, October 2005.

Ananth Rao, Karthik Lakshminarayanan, Sonesh Surana, Richard Karp and Ion Stoica, [Load Balancing in Structured P2P Systems](#), *IPTPS*, Berkeley, CA, February 2003.

Ananth Rao, B. S. Manoj and C. Siva Ram Murthy, [Multi-hop Cellular Networks: The Architecture and Routing Protocols](#), *PIMRC*, San Diego, CA, September 2001.

B. S. Manoj, Ananth Rao and C. Siva Ram Murthy, [Link Life Based Routing Protocol for Ad-hoc Wireless Networks](#), *IC3N*, Scottsdale, AZ, October 2001.

### Tech Reports

Ananth Rao and Ion Stoica, [EFLoW: End-to-end Fairness using Local Weights](#), Tech Report, EECS-2007-107, UC Berkeley, 2007.

Karthik Lakshminarayanan, Ananth Rao., Ion Stoica and Scott Shenker, [Flexible and Robust Large Scale Multicast using \*i3\*](#), Tech Report, CS-02-1187, UC Berkeley, 2002.

### COURSE WORK

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- **Fall 2001**
  - CS262A: Advanced Topics in Computer Systems
  - CS267: Applications of Parallel Computers
  - CS270: Combinatorial Algorithms and Data Structures
- **Spring 2002**
  - CS268: Computer Networks
  - CS294-5: Analysis and Design of Cryptographic Primitives
- **Fall 2002**
  - STAT200A: Intro. to Probability and Statistics at Advanced Level
- **Spring 2004**
  - STAT200B: Intro. to Probability and Statistics at Advanced Level
- **Spring 2004**
  - CS281A: Statistical Learning Theory
- **Fall 2005**
  - CS294: SIGCOMM 2006 Mock Program Committee

### TEACHING EXPERIENCE

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**Fall 2002:** Graduate Student Instructor (GSI) for **EE122: Computer Networks**, the undergraduate course on Computer Networks at UC Berkeley.

### REFERENCES

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Prof. Ion Stoica  
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Prof. Lili Qiu  
Assistant Professor, Computer Science Department  
University of Texas at Austin  
<mailto:lili@cs.utexas.edu>