

Amit Kumar Saha

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- Education**
- PhD**, Department of Computer Science, February 2007
Rice University, Houston, Texas, USA.
Advisor: Dr. David B. Johnson
Dissertation: *Throughput and Coverage Improvement in Wireless Mesh Networks.*
- Master of Science**, Department of Computer Science, May 2003
Rice University, Houston, Texas, USA.
Advisor: Dr. David B. Johnson
Dissertation: *Energy Saving and Partition Bridging using Directional Antennas in Mobile Ad Hoc Networks.*
- Bachelor of Technology (Honours)** in Computer Science and Engineering, June 1999
Indian Institute of Technology, Kharagpur, West Bengal, India.
Advisor: Dr. A. K. Majumdar
Dissertation: *Content Based Image Retrieval from Image Databases.*

Qualification Summary Industry experienced in the design, analysis, and implementation of protocols in the area of networking, including wired and wireless networks, and distributed systems. Strong software development skills with emphasis on quality of delivered product. Excellent communication skills and extensive research and development background in wireless networks and distributed systems.

Experience **Software Engineer, Tropos Networks Inc.** March 2007 – Present
Sunnyvale, CA, USA

I was a member of the Routing, Roaming, and Radio Management team at Tropos Networks. I have extensive hands-on research and development experience in stationary and mobile components of IEEE 802.11/Wi-Fi networks and Wi-Fi mesh networks. As part of the development team, I have in-depth experience in proposing a design, presenting the design to a wider audience, implementing the design, performing elaborate indoor and outdoor tests, repeating the entire cycle, if necessary, and finally releasing the product to the QA team. I have worked on several projects including the following substantial ones:

- *Mobile Node.* I was an integral member of two person team that designed, implemented, and tested an IEEE 802.11a/b/g based mobile node. This mobile node provides users to connect to deployed wireless mesh networks at vehicular speeds. I performed elaborate performance evaluation and comparison with other products; I performed indoor wireless tests as well as outdoor drive tests. The results were summarized in a technical paper that was submitted for publication at a reputed ACM conference.
- *Security.* In order to ensure that Tropos software would not run on fraudulent hardware, I designed, developed, and tested a symmetric key security feature that allows the software on a Tropos unit to authenticate the hardware.
- *Multicast.* Most recently, I am working on developing a multicast solution for the Tropos MetroMesh architecture. This would allow clients in the wireless mesh network to subscribe to multicast sources.
- *Outage Management.* I designed, implemented, and tested an outage management system for Tropos Networks' mesh products. The outages would be logged at the individual units and logs would then be downloaded for offline analyses, thus allowing for identification of

outages, their durations, and their root causes. *This software was running on live Tropos Networks deployments within a month of my joining the company.*

- *Performance Evaluation.* In order to evaluate new releases and products, I developed from scratch a fully automated test suite that would perform throughput tests on all possible links on an outdoor wireless mesh network. The test suite included graphical representation of the end results of the performed tests. Additionally, as part of testing performed during the development process, I developed several automated test scripts.

Research Assistant, Monarch Group, Rice University Fall 2000 – Fall 2006 **Houston, TX, USA**

Since the start of my PhD career at Rice, I have been a member of the Mobile Networking Architecture (Monarch) group (<http://monarch.cs.rice.edu>). I have worked on several projects but the following are most directly related to my research interests:

- **Throughput and Coverage Improvement in Wireless Mesh Networks** Fall 2004 – Present
A wireless mesh network includes a number of static, wireless base stations that are strategically deployed and controlled by the system. These base stations wirelessly forward user traffic over multiple hops to “gateway” base stations, each of which additionally has a connection to the internet. My research is part of the Transit Access Points (TAPs) project at Rice University (<http://www.taps.rice.edu/>) and is also relevant to the emerging IEEE 802.16 standard being promoted by the WiMAX Forum. Both the IEEE 802.16 Working Group and the TAPs project envision providing wireless broadband access to residential and public areas, with end clients possibly being mobile. As part of my PhD dissertation, I have addressed the problem of routing among base stations for best-effort traffic in the presence of simultaneous traffic, a condition that earlier routing protocols have neglected. In my work, I have also taken into account the effects of channel loss and channel modulation rates.

In collaboration with Byoung-Jo (“J”) Kim and N.K. Shankar from AT&T Labs, Middletown, NJ, USA, I have also developed a scheme to increase the coverage of base stations thus covering a given geographical area more economically than with existing schemes. This new scheme also improves the capacity of the covered area by allowing for spatial radio resource reuse. We have proposed this work in the IEEE 802.16 Task Group meetings.

- **Physical Realization of Ad hoc Networks (PRAN)** Fall 2003 – Summer 2004
I, together with Khoa To, Santashil PalChaudhuri, and Shu Du, fellow graduate students at Rice University, developed a novel, portable system for physical implementation of ad hoc network routing protocols. This system, called PRAN, allows the use of existing simulation models of protocols, without modification, to create a physical implementation of the same protocol. This helps in easier debugging, validation, reuse, and maintenance, as a single code base can now be used for both simulation and physical implementation. Our system works in FreeBSD and Linux and currently has physical implementations of DSR and AODV, two common routing protocols for mobile ad hoc networks, created from the unmodified *ns-2* simulation models of these two protocols. We presented a live demonstration of our work at the Tenth Annual International Conference on Mobile Computing and Networking (MobiCom 2004).
- **Modeling Mobility in Vehicular Ad Hoc Networks** Fall 2003 – Summer 2004
I developed a tool to generate movement scenario files compatible to the *ns-2* network simulator, from real road mapping data, making these scenarios more realistic than synthetic scenarios. This work used the publicly accessible U.S. Census Bureau TIGER/Line database and is also adaptable to other sources of real mapping data.
- **Directional Antennas in Mobile Ad Hoc Networks** Fall 2001 – Spring 2003
In my M.S. thesis, I explored two novel uses of the capability of directional antennas to transmit packets over longer distances, using the same power as an omni directional antenna. First, I used directional antennas to bridge permanent network partitions by

adaptively transmitting selected packets over a longer distance. Second, I used directional antennas to repair routes in use; when an intermediate node along the route moves out of wireless transmission range, I bridge the route breakage by using the capability of a directional antenna to transmit packets over a longer distance.

Research Intern, AT&T Labs, Middletown, NJ, USA

Summer 2005

Working with Byoung-Jo (“J”) Kim and N.K.Shankar in the Mobile Wireless Network Research Group, I analyzed the feasibility and advantages of packet forwarding using wireless backhaul in a conventional IEEE 802.16 environment. I developed a scheme to increase the coverage of base stations thus covering a given geographical area more economically than with existing schemes. This new scheme also improves the capacity of the covered area by allowing for spatial radio resource reuse. We proposed this work in the IEEE 802.16 Task Group meetings.

Research Intern, Microsoft Research, Redmond, WA, USA

Summer 2003

Working with Alec Wolman in the Systems and Networking Group, I designed and implemented an SNMP-based IEEE 802.11a/b wireless access point monitoring client. The data collected is analyzed to infer statistics about the access points and the usage of a wireless network in a real corporate setting.

Teaching Assistant, Rice University

Fall 2000 – Fall 2002

Department of Computer Science, Houston, TX, USA

My responsibilities as a teaching assistant primarily involved helping students in projects and laboratory assignments through tutorial sessions and one-on-one meetings with students, clarifying material taught by the instructor, and helping the instructor in grading examinations and assignments. I served as a teaching assistant for the following four courses:

- Intermediate Programming — *Dr. John Greiner*, Fall 2000
- Operating Systems — *Dr. David B. Johnson*, Spring 2001
- Computer Systems Architecture — *Dr. Scott Rixner*, Fall 2001, Fall 2002
- Advanced Microprocessor Architecture — *Dr. Scott Rixner*, Spring 2003

Software Engineer, Hughes Software Systems

May 1999 – June 2000

Gurgaon, Haryana, India

This company was an end-to-end communication solutions provider in the field of telecommunication infrastructure, service provision, and more recently, business process outsourcing sectors. This company was bought over by Flextronics Software Systems (FSS) and then by Aricent. During my stay there, I worked on the following telecommunication related projects:

- Designed and implemented a web-based network management tool to extract information from call detail records (CDRs) that are obtained from telephone switches.
- Designed and implemented a fraud management tool for GSM traffic. This tool tapped the information from SS7 links, used in GSM networks, and used this information to detect and notify, in real time, fraudulent behavior in the network.
- Designed and implemented a CORBA-based security server for an optical network management tool. This server implemented fine grained access control up to the level of individual procedures of objects in the network management tool.

Publications

Design and Implementation of an IEEE 802.11 based Mobile Node. *Amit Saha, Mukesh Gupta, Cyrus Behroozi, Danny E. Goodman, Michael Ren*. (Submitted for publication) The 7th Annual International Conference on Mobile Systems, Applications and Services (MobiSys 2009)

Identifying High Throughput Paths in 802.11 Mesh Networks: a Model-based Approach. *Theodoros Salonidis, Michele Garetto, Amit Saha, Edward Knightly*. The 15th IEEE International Conference on Network Protocols (ICNP 2007), Oct, 2007.

Safari: A Self-Organizing, Hierarchical Architecture for Scalable Ad Hoc Networking. *Shu Du, Ahamed Khan, Santashil PalChaudhuri, Ansley Post, Amit Kumar Saha, Peter Druschel, David B. Johnson, Rudolf Riedi*. Accepted for publication in Elsevier Ad Hoc Networks Journal, 2007.

RMAC: A Routing-Enhanced Duty-Cycle MAC Protocol for Wireless Sensor Networks. *Shu Du, Amit Kumar Saha, David B. Johnson*. The 26th Annual IEEE Conference on Computer Communications (INFOCOM 2007), May, 2007.

Design and Performance of PRAN: A System for Physical Implementation of Ad Hoc Network Routing Protocols. *Amit Kumar Saha, Khoa To, Santashil PalChaudhuri, Shu Du, David B. Johnson*. IEEE Transactions on Mobile Computing, pages 463–479, Vol. 6, No. 4, April 2007. A preliminary version of this paper was published in ACM SIGCOMM Asia Workshop April, 2005.

Routing Improvements Using Directional Antennas in Mobile Ad Hoc Networks. *Amit Kumar Saha, David B. Johnson*. Proceedings of IEEE Globecom 2004, November-December 2004.

Modeling Mobility for Vehicular Ad Hoc Networks. *Amit Kumar Saha, David B. Johnson*. Poster in the First ACM International Workshop on Vehicular Ad Hoc Networks (VANET 2004), pages 91–92, October 2004.

Adaptive Clock Synchronization in Sensor Networks. *Santashil PalChaudhuri, Amit Kumar Saha, David B. Johnson*. Proceedings of the Third Symposium on Information Processing in Sensor Networks (IPSN 2004), pages 340–348, April 2004.

Treecast: A Stateless Addressing and Routing Architecture for Sensor Networks. *Santashil PalChaudhuri, Shu Du, Amit Kumar Saha, David B. Johnson*. Proceedings of the Fourth International Workshop on Algorithms for Wireless, Mobile, Ad Hoc and Sensor Networks (WMAN 2004), April 2004.

Design and Evaluation of a Metropolitan Area Multitier Wireless Ad Hoc Network Architecture. *Jorjeta Jetcheva, Yih Chun Hu, Santashil PalChaudhuri, Amit Kumar Saha, David B. Johnson*. Proceedings of the Fifth IEEE Workshop on Mobile Computing Systems and Applications (WMCSA 2003), pages 32–43, October 2003.

An Object Oriented Fuzzy Data Model for Similarity Detection in Image Databases. *Indrajit Bhattacharya, Amit Kumar Saha, and Dr. A.K.Majumdar*. IEEE Transaction on Knowledge and Data Engineering, pages 1186–1189, Vol. 14, No. 5, 2002.

Depth Estimation by Integrating Multiscale Edge and Region Features from a sequence of Airborne Images. *Amit Kumar Saha, Anoop Mishra, Dr. Jharna Majumdar*. Proceedings of IEEE Knowledge Based Computer Systems, December 1998.

Technical Skills

Standards: IEEE 802.11, 802.3, 802.1X, EAP, TCP/IP, HTTP, XML, VLAN DHCP, GRE Tunnels, BGP, RIP, OSPF, IGMP.

Development languages, tools, and operating systems: C, C++, C#, Perl, Java; Linux, FreeBSD, Windows XP; gdb, Wireshark/Ethereal.

Patent

US patent pending, “Incorporation of Mesh Base Stations in a Wireless System”, *AT&T Corporation*.

Two confidential pending patent applications made on behalf of Tropos Networks Inc.

Awards and Honors

Recipient of the *Dr. B.C.Roy Gold Medal* in 1999, awarded by IIT Kharagpur, Kharagpur, West Bengal, India, to the single graduating student with the best mix of academics and extra curricular activities.

Awarded the Rice Graduate Fellowship for the academic year 2000-2001.

I was the president of *Friends of Young Minds* (<http://www.ruf.rice.edu/~foym>), a student organization at Rice University that used to collect computers from donors in and around Houston,

test and fix the computers, and send them to organizations working for underprivileged children in India.

**Additional
Activities**

Reviewed technical papers for journals such as, ACM Transactions on Modeling and Computer Simulations, ACM Transactions on Mobile Computing, IEEE Transactions on Computers, IEEE Transactions on Vehicular Technology, Elsevier Ad Hoc Networks, and conferences such as, IEEE INFOCOM, IEEE GLOBECOM, IEEE SECON, ACM MobiHoc, ICDCS, DCOSS.

References

Available on request