

## Swastik K. Brahma

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EDUCATIONAL BACKGROUND	<b>University of Central Florida, Orlando, FL, USA</b> <ul style="list-style-type: none"><li>• Ph.D., Computer Science (expected graduation date: May 2011)<ul style="list-style-type: none"><li>* Dissertation title: <i>Resource Allocation and Pricing in Dynamic Spectrum Access Networks</i></li><li>* Advisor: Professor Mainak Chatterjee</li></ul></li><li>• M.S., Computer Science, May 2008 (CGPA 3.6/4)</li></ul> <b>West Bengal University of Technology, Kolkata, India.</b> <ul style="list-style-type: none"><li>• B.Tech., Computer Science and Engineering, July 2005 (CGPA 7.7/10)</li></ul>	
RESEARCH INTERESTS	<ul style="list-style-type: none"><li>• <b>Dynamic Spectrum Access (DSA) and Cognitive Radio:</b> Network design and performance analysis, spectrum sensing/switching, media access control (MAC) layer, cross-layer protocol optimization, IEEE 802.22, wireless mesh;</li><li>• <b>Network Economics:</b> Incentive based routing, spectrum trading, service pricing, applied game theory, auction models, algorithmic mechanism design, resource management;</li><li>• <b>Spectrum Sharing in Wireless Networks:</b> Performance optimization, bargaining theory, co-operation enforcement models, interference constraints, noise models;</li><li>• <b>Ad Hoc and Sensor Networks:</b> Congestion control, routing, energy efficiency, MAC design, network performance analysis;</li></ul>	
HONORS AND AWARDS	<ul style="list-style-type: none"><li>• IEEE Globecom Conference, <b>Best Paper Award</b>, 2008.</li><li>• IEEE WowMom Conference, <b>Best Phd Forum Award</b>, 2009.</li><li>• <b>NSF Student Travel Award</b> in the IEEE WowMom conference, 2009.</li></ul>	
PROFESSIONAL EXPERIENCE	<ul style="list-style-type: none"><li>• <b>Summer Research Intern</b> (Summer 2004): Image Processing Group headed by Dr. Subhamoy Maitra, Indian Statistical Institute, Kolkata, India.</li><li>• <b>Summer Intern</b> (Summer 2003): Workshop on Microsoft Visual Basic and SQL Server at Nishan Systems, Kolkata, India.</li><li>• <b>Graduate Research Assistant</b> (Spring 2007 - Present): School of Electrical Engineering &amp; Computer Science, University of Central Florida, USA.</li><li>• <b>Graduate Teaching Assistant</b> (Fall 2005 - Present):<ul style="list-style-type: none"><li>• CGS 3285 Computer Network Concepts</li><li>• CNT 4703 Design and Implementation of Computer Communication Networks</li></ul></li></ul>	
PUBLICATIONS	<u>Journal papers:</u> <ul style="list-style-type: none"><li>• S. Brahma and M. Chatterjee, "Truthful Optimal Path Auction Design for Incentive based Routing in Dynamic Spectrum Access Networks", under review in IEEE/ACM Transactions on Networking.</li><li>• S. Brahma, M. Chatterjee and K. Kwiat, "A Novel Approach for Channel Access in DSA Networks: The Spectrum Bargaining Game", under review in IEEE/ACM Transactions on Networking.</li><li>• S. Brahma, M. Chatterjee and K. Kwiat, "Rate Matching based Congestion Control and Fairness Abstraction in Wireless Sensor Networks", conditionally accepted in Elsevier journal of Computer Communications.</li><li>• S. Sengupta, S. Brahma, M. Chatterjee and N. Sai Shankar, "Self-coexistence Among Interference-aware IEEE 802.22 Networks with Enhanced Air-interface", conditionally accepted in Elsevier journal of Pervasive and Mobile Computing.</li></ul>	

#### Conference Papers:

- S. Brahma and M. Chatterjee, “Spectrum Sharing in Secondary Networks: A Bargain Theoretic approach”, under review in IEEE Globecom 2011.
- S. Brahma and M. Chatterjee, “A Truthful Optimal Path Auction for DSA Networks”, To appear in ICST CrownCom 2011.
- S. Brahma and M. Chatterjee, “A Bargaining Framework for Fair Channel Allocation in Dynamic Spectrum Access Networks”, IEEE Globecom 2010, pp. 1-6.
- S. Brahma, M. Chatterjee and K. Kwiat “Congestion Control and Fairness in Wireless Sensor Networks”, IEEE PerSeNS March 2010, pp. 413 - 418.
- S. Brahma and M. Chatterjee, “Mitigating Self-interference among IEEE 802.22 Networks: A Game Theoretic Perspective”, IEEE Globecom 2009, pp. 1-6.
- S. Brahma and M. Chatterjee, “Interference avoidance among IEEE 802.22 networks: A Game Theoretic Approach”, IEEE WowMom 2009, pp. 1-3 (**Best PhD Forum Award**).
- S. Sengupta, R. Chandramouli, S. Brahma and M. Chatterjee, “A game theoretic framework for distributed self-coexistence among IEEE 802.22 networks”, IEEE Globecom 2008, pp. 1-6 (**Best Paper Award**).
- S. Sengupta, S. Brahma, M. Chatterjee and S. Shankar N, “Enhancements to cognitive radio based IEEE 802.22 air-interface”, IEEE International Conference on Communications (ICC) June 2007, pp. 5155-5160.

#### RESEARCH PROJECTS

##### **Auction Models for Dynamic Spectrum Access (DSA):**

Static allocation of spectrum to service providers creates an artificial scarcity. This has motivated a paradigm shift from static spectrum allocation towards the concept of secondary users borrowing idle spectrum from primary spectrum licensees, without causing harmful interference to the latter. To motivate primaries for allowing usage of their idle spectrum for secondary use, an incentive, generally in the form of monetary benefit, has to be given to them. In this project, the focus is on developing new auction models to facilitate trading of spectrum between primary and secondary license holders. The auction models considered have the property of being individually-rational and incentive-compatible.

##### **Incentive Based Routing in Dynamic Spectrum Access (DSA) Networks:**

This research addresses the problem of incentive based routing in DSA networks, where each secondary node incurs a cost for routing traffic from a flow while providing a certain degree of QoS to the flow. In the absence of techniques to induce nodes for truthfully reporting their cost and QoS capabilities (considered as private information) to the routing mechanism, there may be an unnecessary overpayment of incentives provided to the nodes for routing traffic. The focus of this research is to design a path auction based routing scheme for DSA networks that can enforce honest revealing of private information to be a dominant strategy for every node in the path auction game, while minimizing the payment that needs to be given to the nodes that forward traffic. Issues of multiple path routing are also investigated in this research.

##### **Wireless Regional Area Networking based on IEEE 802.22:**

New IEEE standardization activities coupled with FCC’s spectrum policy reform and federally funded research programs (e.g., DARPA XG and NSF NeTS ProWiN) are now the major push towards the commercial deployment of IEEE 802.22 networks. These networks are designed to operate in the under-utilized TV bands by detecting and avoiding primary TV transmission bands in a time and space variant manner. In this research, the focus is on the enhancements of IEEE 802.22 air-interfaces (PHY and MAC) and the feasibility of solving problems like self-coexistence and hidden incumbents. Studying IEEE 802.22 mesh network through interference mitigation and power controlling is another focus of this project.

##### **Congestion Control in Wireless Sensor Networks:**

This research investigates designing of a distributed algorithm for congestion control in wireless sensor networks. The aim is to assign a fair and efficient rate to each node in

the network. Since the application requirements in sensor network follow no common trait, a design objective is to abstract the notion of fairness, and develop a generic utility controlling module. Such separation of the utility and fairness controlling modules enable each one to use a separate control law, thereby portraying a more flexible design. Another design objective is to make the congestion control independent of the underlying routing algorithm.

**SensorSim: A Java based event driven simulator for Sensor Networks:**

This project involves developing an extensible, concurrent discrete event-driven simulator for sensor networks. Internal code for the simulator is written in Java. SensorSim has a layered architecture. Simulated nodes are built as an assembly of objects which represent either a hardware component, a software component or a resource of the node.

RELEVANT  
COURSES

Computer Network Design and Distributive Processing, Computer Communication Networks Architecture, Network Optimization, Design and Analysis of Algorithms, Computational Complexity, Approximation Algorithms, Operating Systems Design Principles, Advanced Computer Architecture, Expert Systems and Knowledge Engineering, Software Engineering, Random Processes, Neural Networks.

SKILLS

- Programming Languages:
  - C, C++, Java, Matlab
- OS:
  - Linux, Windows.
- Simulators:
  - ns2, TOSSIM (TinyOS mote simulator)
- Experience with Cisco routers in setting up testbeds.

REFERENCES

Available upon request.