

VIVEK SHRIVASTAVA

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EDUCATION

Ph.D. Candidate, Computer Sciences,

Advisor: Dr. Suman Banerjee,

Thesis: *Optimizing Enterprise Wireless Networks through Centralization*

University of Wisconsin, June 2004 - June 2010.

M.S., Computer Science,

University of Wisconsin, May 2006.

GPA 3.93/4.0

B.Tech., Computer Sciences and Engineering,

Indian Institute of Technology, May 2004.

Department Rank 2/41, Institute Rank 2/200

RESEARCH INTERESTS

Mobile and wireless networking. Protocol/application/algorithm development, measurement and analysis.

HONORS

Best paper award at Mobicom 2009

Awarded 2009-2010 IBM PhD Fellowship

Third Prize Cisco Network Programming Contest - UW Madison, 2007

First Prize ACM Student Research Competition - Mobicom 2006

Student Rank One Merit Scholarship 2000-2001

Merit Scholarship - All India Talent Search Competition, 1999

PUBLICATIONS

[1] CENTAUR: Realizing the Full Potential of Centralized WLANs through a Hybrid Data Path. Vivek Shrivastava, Nabeel Ahmed, Shravan Rayanchu, Suman Banerjee, S. Keshav, Konstantina Papagiannaki, and Arunesh Mishra. In Proc. of **ACM Mobicom 2009**. (**Best paper Award**).

[2] 802.11n Under the Microscope. Vivek Shrivastava, Shravan Rayanchu, Jongwoon Yoonj, Suman Banerjee. In Proc. **ACM/USENIX Internet Measurement Conference 2008**.

[3] A Measurement Study of a Commercial-grade Urban WiFi Mesh. Vladimir Brik, Shravan Rayanchu, Sharad Saha, Sayandeep Sen, Vivek Shrivastava, Suman Banerjee. In Proc. **ACM/USENIX Internet Measurement Conference 2008**.

[4] Understanding the Limitations of Transmit Power Control for Indoor WLANs. Vivek Shrivastava, Dheeraj Agrawal, Arunesh Mishra, Suman Banerjee, Tamer Nadeem. In Proc. **ACM/USENIX Internet Measurement Conference 2007**.

- [5] Interference Mitigation in WLANs with Speculative Scheduling (short paper). Nabeel Ahmed, Vivek Shrivastava, Arunesh Mishra, Suman Banerjee, Srinivasan Keshav, Dina Papagiannaki. In Proc. of **ACM Mobicom 2007**.
- [6] Towards an Architecture for Efficient Spectrum Slicing. Suman Banerjee, Arunesh Mishra, Vladimir Brik, Vivek Shrivastava, and Victor Bahl. In Proc. of **IEEE HotMobile, 2007**
- [7] Load Balancing Large Scale RFID Systems. Quenfeng Dong, Ashutosh Shukla, Vivek Shrivastava, Dheeraj Agrawal, Suman Banerjee and Kaushik Kar. In Proc. of **IEEE Infocom Minisymposium, 2007**
- [8] On the (In)feasibility of Fine Grained Power Control. Vivek Shrivastava, Dheeraj Agrawal, Arunesh Mishra, Suman Banerjee, and Tamer Nadeem. **ACM Mobicom SRC, September 2006 (First Prize in Student Research Competition)**
- [9] Distributed Channel Management in Uncoordinated Wireless Environments. Arunesh Mishra, Vivek Shrivastava, Dheeraj Agrawal and Suman Banerjee. In Proc. of **ACM Mobicom, 2006**.
- [10] Partially Overlapped Channels Not Considered Harmful. Arunesh Mishra, Vivek Shrivastava, Suman Banerjee and William Arbaugh. In Proc. of **ACM Sigmetrics, 2006**.
- [11] Natural Selection in Peer-to-Peer Streaming: From the Cathedral to the Bazaar. Vivek Shrivastava and Suman Banerjee. In Proc. of **ACM Nossdav 2005**.
- [12] Phase-based adaptive branch predictor: Seeing the forest for the trees. Karthik Jayaraman, Vivek Shrivastava, Brian Pellin, Martin Hock, Mikko H. Lipasti. In Proc. of **IEEE HPCA Workshop on Introspective Architecture, 2005**

UNDER SUBMISSION

- [1] PIE in the Sky: Online Passive Interference Estimation for Enterprise WLANs. Vivek Shrivastava, Shravan Rayanchu, Suman Banerjee, and Konstantina Papagiannaki.

SELECT RESEARCH PROJECTS

Channel Management in Wireless LANs

In this project, we address the joint problem of channel assignment, i.e., assigning channels to access points and load balancing, i.e., assigning clients to access points such that the overall network throughput is maximized according to a client-driven fairness objective. Built practical centralized and distributed solutions separately tailored for both enterprise and hotspot environments. Through carefully studied experiments, we showed the ability to use partially overlapped channels in both 2.4 and 5 GHz band, can improve spectrum utilization by a factor of 3 in dense ap deployments. Our Work was published at conferences such as ACM Mobicom and ACM Sigmetrics.

Analysis of city wide commercial mesh network

Wireless Mesh Networks (WMNs) represent a new and promising paradigm that uses multi-hop communications to extend WiFi networks. Several WMNs are already deployed and operational. Since the clients pay the same flat rate, the throughput sharing should also be fair. In this project we are working closely with Madcity Networks, that has deployed a city wide mesh network comprising of 750 access points in Madison, WI. We are working closely with the company to identify the performance bottlenecks and other practical implementation challenges.

Online passive conflict graph generation for enterprise WLANs

Trends in enterprise WLAN usage and deployment point to the need for tools that can capture interference in real time. Such a tool for interference estimation can enable WLAN managers

to improve the network performance by dynamically adjusting operating parameters like channel of operation and transmit power of access points, but also diagnose and potentially proactively fix problems. Prior work on interference estimation using active probes impose significant overhead and cannot be employed to continuously obtain interference information as they evolve over time. In this project, we present the design, implementation and detailed evaluation of a Passive Interference Estimator (PIE) that can dynamically generate fine grained interference estimates across an entire WLAN. The most attractive feature of PIE is that it imposes no measurement traffic, and yet provides an accurate estimate of WLAN interference as it changes with client mobility, dynamic traffic loads and varying channel conditions.

Centralized Scheduling in Enterprise Wireless LANs

Wireless LANs are commonplace installations in enterprise environments. Their ease of use and deployment, however, are accompanied by a difficulty in their management and security. While centralization of some control plane tasks has been shown to be feasible, centralization mechanisms on the data plane are significantly harder to realize. The reason is that they need to take into account the inherent variability in the wireless medium while offering bounded delay and latency. In this paper, we first, present a comprehensive study of the various problems that arise in data plane centralization in an enterprise WLAN, and then, demonstrate that overall performance is best optimized through a hybrid approach that allows a limited amount of centralization to co-exist with decentralized, randomized channel access methods.

EXPERIENCE

Dec 2004 - date,

Research Assistant, (with Dr. Suman Banerjee)

WiNGs Research Group

My research work has focused on developing efficient and practical spectrum utilization mechanisms, particularly for the unlicensed band. Projects include channel management and power control in 802.11, design and implementation of in-building infrastructure testbeds.

June 2009 - Sep 2009,

Research Intern, (with Dr. Kang-won Lee)

IBM Research, Hawthorne, NY.

Worked on optimizing the performance of data centers using novel virtual machine migration mechanisms.

June 2008 - Sep 2008,

Technical Intern, (with Daniel Aguayo)

Meraki Inc., San Francisco, CA.

Worked on monitoring client performance for Meraki mesh networks (Details are confidential).

June 2006 - Aug 2006,

Research Intern, (with Dr. Tamer Nadeem)

Siemens Research, Princeton, NJ.

Worked on load balancing enterprise WLAN using association and power control. Designed the system so that a central controller efficiently assigns the client to suitable access points that provides improved throughput and delay properties.

May 2005 - Aug 2005,

Software Design Engineer

Windows Fundamental Group, Microsoft, WA.

Worked on a prototype implementation CAVE (Compatibility of Applications using Virtual Environments) of application compatibility strategies using virtual machines.

Sep 2003 - July 2004,

Research Intern, (with Dr. Gautam Barua)

Microsoft Academic Alliance, Guwahati, India.

Implemented a cluster based routing protocol for providing Quality of Service and Security in Mobile Ad Hoc Networks under Windows CE.NET. The project was a part of Microsoft Embedded Systems research.

May 2003 - July 2003,

Research Intern, (with Dr. Niels Nes)

Center for Mathematics and Computer Science, Amsterdam, The Netherlands

As member of X100 Database project, developed an algorithm for real time compression of statistical data for our prototype database kernel.

REFERENCES

Available upon request.