

Jorjeta G. Jetcheva

Major Areas of Expertise

- Networking, IP mobility, wireless computing, routing protocols, multicast, distributed systems and algorithms, peer-to-peer computing.

Education

- *Carnegie Mellon University*, Pittsburgh, PA. Ph.D. in Computer Science, May 2004. Advisor: David B. Johnson. Dissertation: *Adaptive Demand-Driven Multicast Routing in Wireless Multi-Hop Ad Hoc Networks*.
- *Carnegie Mellon University*, Pittsburgh, PA. M.S. in Computer Science, May 2001. Advisor: David B. Johnson.
- *Mount Holyoke College*, South Hadley, MA. B.A. in Computer Science (*Summa Cum Laude*) and Mathematics, May 1997.

Work Experience

- *Independent Consultant*, November 2008 to Present
Provide consulting services to local and state government agencies regarding wireless broadband access strategies, network architecture design and deployment, and public safety communication infrastructure development.
- *Firetide, Inc.*, Los Gatos, CA, *Systems Architect*, July 2004 to October 2008.
 - ♦ Provided the technology vision and architectural support for the evolution of the Firetide Networking Infrastructure product line. This work resulted in the filing of a number of patent applications (see Patent Applications section below). The product line included the following:
 - * **Mesh Node.** The mesh network looks like an Ethernet switch to external networks and devices, but performs Layer 3 routing internally, enabling adaptive multi-hop wireless connectivity for providing wireless coverage across large geographic areas.
 - * **802.11 Access Point.** The Firetide AP supports the connectivity of standard 802.11 clients, along with enhanced services for Firetide CPEs (see next bullet), including differentiated services through tiered rate limiting, as well as automatic power control.
 - * **Customer Premises Equipment (CPE).** The Firetide CPE is a wireless client that connects to standard 802.11 APs, and has enhanced capabilities when connected to a Firetide AP, including differentiated services through tiered rate limiting, and power control.
 - * **Mobility Controller.** The Firetide Mobility Controller provides Layer 3 roaming capabilities for mesh nodes and AP clients for seamless mobility across Layer 3 domains.
 - * **Enterprise Controller.** This platform provided deployment assist tools including automatic AP channel assignment, AP power control, and coverage estimation.
 - ♦ Designed the Firetide Mesh Routing Protocol (FMRP), which proved to be the key differentiator for Firetide relative to competing products, and established the company as a technology leader. FMRP uses source routing and flow state, and is based on on-demand and proactive routing mechanisms. FMRP routes over multiple interfaces per

node, including wired interfaces in use as mesh links. It uses a novel routing metric that takes into account link properties as well as self-interference along a path, and incorporates wired mesh links. FMRP maintains multiple paths per destination, enabling fast failover recovery and load balancing of traffic across the mesh.

- ✦ Designed mechanisms to enable seamless mobility of single- and dual-radio mesh nodes within a mesh network, and also across mesh networks connected to the same or different Layer 3 domains.
- ✦ Developed novel mechanisms for maximizing performance of multi-radio mesh networks through a suite of algorithms for automatic topology control, power control and channel assignment in multi-radio mesh networks that transform the original topology of the mesh into one in which the best links in the network are utilized, capacity is allocated based on expected traffic patterns, and self-interference along traffic paths, and across the network is minimized.
- ✦ Designed innovative mechanisms for interoperability of mesh networks with Ethernet LANs, that prevent broadcast storms and enable load balancing when the two types of networks are interconnected at multiple points.
- ✦ Developed a channel assignment algorithm for a set of APs which maximizes performance by balancing the performance of individual APs with the overall performance of the set, taking into account local channel conditions at each AP, as well as the potential impact on the performance of other APs within interference range of the AP.
- ✦ Designed innovative mechanisms for load balancing of CPEs across APs, tiered access for CPEs, as well as automatic power control for each AP based on currently associated CPEs.
- ✦ Guided the software development team in the implementation of the protocols and algorithms for the Firetide mesh system, mobility controller, and wireless access products.
- ✦ Represented the company externally, including participation in conference program committees, leadership role in IEEE 802.11s standard development, representation at the Wi-Fi alliance, invited talks, and technical panels.
- ✦ Oversaw all patent filing for the company, as well as, litigation matters.
- *Sprint Advanced Technology Labs*, Burlingame, CA, *Intern*, May 2000 to August 2000. Developed tools for traffic engineering analysis of packet-level data collected at a POP (Point-of-Presence) in the Sprint backbone. Used these tools to analyze traffic patterns in the backbone and their implications for traffic engineering.
- *DataViews Corporation*, Northampton, MA, *Intern*, June 1996 to August 1996. Tested and debugged a large dynamic data visualization software package.
- *Mount Holyoke College, Computer Facilities Department*, South Hadley, MA, *Computer Assistant*, Fall 1995 to Spring 1997. Helped students with computer usage problems at the college computer laboratories.
- *Smith College, Computer Science Department*, Northampton, MA, *Research Assistant*, June 1995 to August 1995. Implemented the first version of several computational geometry algorithms invented by my supervisors, Professors Ileana Streinu and Joseph O'Rourke, along with a visualization of the progress of the algorithms.

Implementation Experience

- C/C++, Tcl/Tk, Perl, Matlab, ns-2 simulator, FreeBSD networking, shell scripting.

Teaching Experience

- *Carnegie Mellon University*, Pittsburgh, PA, *Teaching Assistant*, Spring 2001. TA for 15441, Computer Networks, an undergraduate networking class.
- *Carnegie Mellon University*, Pittsburgh, PA, *Teaching Assistant*, Fall 1999. TA for 15412, Operating Systems: Design and Implementation, an undergraduate operating systems class.
- *Mount Holyoke College*, South Hadley, MA, *Teaching Assistant*, Fall 1996 and Spring 1997. TA for CS 101, Programming in C, an undergraduate introductory programming class.
- *Mount Holyoke College*, South Hadley, MA, *Teaching Assistant*, Fall 1995. TA for MATH 127, Seminar in Algebra, an undergraduate introductory abstract algebra class.

Journal Papers

1. Jorjeta G. Jetcheva and David B. Johnson. Routing Characteristics of Ad Hoc Networks with Unidirectional Links. *Elsevier Journal of Ad Hoc Networks*. Vol. 4, Issue 3, pp. 303-325, May 2006.
2. Supratik Bhattacharyya, Christophe Diot, Jorjeta Jetcheva, and Nina Taft. Geographical and Temporal Characteristics of Inter-POP Flows: View from a Single POP. *European Transactions on Telecommunications (ETT)*, Vol. 13, No. 1, pp. 5–22, January/February 2002. Invited paper.

Revised from a version published as: POP-Level and Access-Link-Level Traffic Dynamics in a Tier-1 POP. *ACM SIGCOMM Internet Measurement Workshop (IMW)*, San Francisco, CA, November 2001.
3. David A. Maltz, Josh Broch, Jorjeta Jetcheva, and David B. Johnson. The Effects of On Demand Behavior on Routing Protocols for Multi-Hop Wireless Ad Hoc Networks. *IEEE Journal on Selected Areas in Communications (JSAC)*, Special Issue on Mobile and Wireless Networks, Vol. 17, No. 8, pp. 1439–1453, August 1999.

Refereed Publications and Technical Reports

1. Jorjeta G. Jetcheva and David B. Johnson. *Multicast Routing in Ad Hoc Networks with Unidirectional Links*. Technical Report CMU-CS-04-175, Computer Science Department, Carnegie Mellon University, Pittsburgh, PA, December 2004.
2. Jorjeta G. Jetcheva and David B. Johnson. *A Performance Comparison of On-Demand Multicast Routing Protocols for Ad Hoc Networks*. Technical Report CMU-CS-04-176, Computer Science Department, Carnegie Mellon University, Pittsburgh, PA, December 2004.
3. Jorjeta G. Jetcheva, Yih-Chun Hu, Santashil PalChaudhuri, Amit Kumar Saha, and David B. Johnson. Design and Evaluation of a Metropolitan Area Multitier Wireless Ad Hoc Network Architecture. *Proceedings of the 5th IEEE Workshop on Mobile Computing Systems and Applications (WMCSA 2003)*, Monterey, CA, October 2003.
4. Jorjeta G. Jetcheva and David B. Johnson. Adaptive Demand-Driven Multicast Routing in Multi-Hop Wireless Ad Hoc Networks. *In Proceedings of the ACM Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc 2001)*, Long Beach, CA, October 2001.
5. Ashwin Sridharan, Supratik Bhattacharyya, Christophe Diot, Roch Guerin, Jorjeta Jetcheva, and Nina Taft. On the Impact of Aggregation on the Performance of Traffic-

Aware Routing. *In Proceedings of the 17th International Teletraffic Congress (ITC 2001)*, Salvador da Bahia, Brazil, September 2001.

6. Nina Taft, Supratik Bhattacharyya, Christophe Diot, and Jorjeta Jetcheva. Understanding Traffic Dynamics at a Backbone POP. *In Proceedings of SPIE ITCOM+OPTICOMM Workshop on Scalability and Traffic Control in IP Networks*, Denver, CO, August 2001.
7. Josh Broch, David A. Maltz, David B. Johnson, Yih-Chun Hu, and Jorjeta Jetcheva. A Performance Comparison of Multi-Hop Wireless Ad Hoc Network Routing Protocols. *Proceedings of the Fourth Annual International Conference on Mobile Computing and Networking (MobiCom 1998)*, pp. 85–97, ACM, Dallas, TX, October 1998.

Standards Organizations Publications

1. David B. Johnson, David A. Maltz, Yih-Chun Hu, and Jorjeta G. Jetcheva. The Dynamic Source Routing Protocol for Mobile Ad Hoc Networks (DSR). Internet-Draft, Internet Engineering Task Force (IETF), draft-ietf-manet-dsr-06, November 21, 2001.
Revised from a version published as: draft-ietf-manet-dsr-05, March 2, 2001.
Revised from a version published as: draft-ietf-manet-dsr-04, November 17, 2000.
2. Jorjeta G. Jetcheva, Yih-Chun Hu, David A. Maltz, and David B. Johnson. A Simple Protocol for Multicast and Broadcast in Mobile Ad Hoc Networks. Internet-Draft, Internet Engineering Task Force (IETF), draft-ietf-manet-simple-mbcast-01, July 20, 2001.
Revised from a version published as: draft-ietf-manet-simple-mbcast-00, November 17, 2000.
3. Jorjeta G. Jetcheva and David B. Johnson. The Adaptive Demand-Driven Multicast Protocol for Mobile Ad Hoc Networks. Internet-Draft, Internet Engineering Task Force (IETF), draft-jetcheva-manet-admr-00, July 13, 2001.

Other Publications

1. Jorjeta G. Jetcheva. *Adaptive Demand-Driven Multicast Routing in Multi-Hop Wireless Ad Hoc Networks*. Ph.D. Dissertation. Technical Report CMU-CS-04-126, Computer Science Department, Carnegie Mellon University, Pittsburgh, PA, May 2004.
2. Jorjeta G. Jetcheva. *NOW (Network of Workstations) Distributed Supercomputer for Computer Vision*. Undergraduate Thesis, Mount Holyoke College, South Hadley, MA, May 1997.

Patent Applications

1. Jorjeta G. Jetcheva, Sachin Kanodia, Murali Repakula and Mohan Natarajan. *Route Optimization for On-Demand Routing Protocols for Mesh Networks*. July 2005.
2. Jorjeta G. Jetcheva, Sachin Kanodia, Murali Repakula and Sivakumar Kailas. *Utilizing Multiple Mesh Network Gateways in a Shared Access Network*. July 2005.
3. Jorjeta G. Jetcheva, Sivakumar Kailas and Mohan Natarajan. *Method for Enabling the Efficient Operation of Arbitrarily Interconnected Mesh Networks*. July 2005.
4. Bhargav Bellur, Ravi Prakash, Amar Singhal, Jorjeta G. Jetcheva. *Effective Bandwidth Path Metric and Path Computation Algorithm for Wireless Mesh Networks with Wired Links*. March 2006.

5. Jorjeta G. Jetcheva, Sivakumar Kailas, Sachin Kanodia, Mohan Natarajan. *A Multi-Channel Assignment Method for Multi-Radio Multi-Hop Wireless Mesh Networks*. September 2006.
6. Jorjeta G. Jetcheva, Sachin Kanodia, Sivakumar Kailas, Murali Repakula. *Mesh Node Mobility Across Static and Mobile Mesh Networks*. October 2006.
7. Sachin Kanodia, Mohan Natarajan, Jorjeta G. Jetcheva. *Bonding Multiple Radios in Wireless Multi-Hop Mesh Networks*. September 2006.
8. Jorjeta G. Jetcheva, Ravi Prakash, Vinay Gupta, Sachin Kanodia and Mohan Natarajan. *Channel Assignment for Wireless Access Networks*. January 2008.

Major Software Artifacts

1. *Multicast extensions to the ns-2 network simulator*. Includes implementations of the ADMR and ODMRP multicast routing protocols for ad hoc networks. Code available for download at http://www.monarch.cs.rice.edu/multicast_extensions.html.
2. *Monarch wireless and mobile extensions to the ns-2 network simulator*. Distributed with the standard public release of ns-2 since version 2.1b7. Joint work with Josh Broch, David A. Maltz, and Yih-Chun Hu. Original code available for download at <http://www.monarch.cs.rice.edu/cmu-ns.html>.

Professional Service

- *Invited Speaker*, The Third IEEE Workshop on Wireless Mesh Networks, WiMesh 2008, San Francisco, CA, USA.
- *Session Chair*, The Third IEEE Workshop on Wireless Mesh Networks, WiMesh 2008, San Francisco, CA, USA.
- *Program Committee Member*, The International Conference on Mobile Technology, Applications and Systems, Mobility 2008, Yilan, Taiwan.
- *Program Committee Member*, The 27th IEEE International Conference on Distributed Computing Systems, ICDCS 2007, Toronto, Ontario, Canada.
- *Program Committee Member*, The Fourth IEEE Communications Society Conference on Sensor, Mesh and Ad Hoc Communications and Networks, SECON 2007, San Diego, CA, USA.
- *Program Committee Member*, The Third IEEE Communications Society Conference on Sensor, Mesh and Ad Hoc Communications and Networks, SECON 2006, Reston, VA, USA.
- *Program Committee Member*, The Third IEEE Conference on Mobility, Mobility 2006 Conference, Bangkok, Thailand.
- *International Advisory Committee Member*, The First International Conference on Communication System Software and Middleware, COMSWARE 2006, January 8-12, 2006, New Delhi, India.
- *Participant* in the IEEE 802.11s (mesh) standards process and co-author of the winning draft proposal (SEE-Mesh).
- *Refereed papers* for workshops, conferences, and journals including ACM MobiCom, ACM MobiHoc, ACM MobiSys, ACM SIGCOMM, IEEE INFOCOM, IEEE ICDCS, IEEE WCNC, IEEE ICC, ACM/IEEE *Transactions on Networking*, IEEE *Transactions on Mobile Computing*, IEEE *Journal on Selected Areas in Communications* (JSAC), and ACM *Mobile Computing and Communications Review* (MC2R).
- *Co-Founder and Co-Chair of Women@SCS*, Carnegie Mellon University, Pittsburgh, PA,

Spring 1999 to Spring 2001. An organization for facilitating social and professional interaction among graduate and undergraduate women students and faculty within the School of Computer Science at Carnegie Mellon, and for organizing and participating in outreach programs to increase the exposure of young girls to computer science. <http://www.cs.cmu.edu/~women/>.

- *Invited Panel Participant.* Women in Computer Science: The Carnegie Mellon Experience, Grace Hopper 2000 Celebration for Women in Computing, ACM and Computing Research Association, Cape Cod, MA, September 2000.
- *Outreach Workshop Participant.* “Build Your Own Robot” workshop at the Expanding Your Horizons Conference, a national one-day event aimed at increasing young women’s interest in mathematics and science, Pittsburgh, PA, March 2000 and March 2001.
- *Mentoring Project Participant.* Big Sister/Little Sister mentoring project, School of Computer Science, Carnegie Mellon University, 1999–2001. Met with undergraduate women studying computer science and discussed various aspects of computer science education and career opportunities.
- *Program Committee Member, and Session Chair.* SOCS-3: Third CMU Symposium on Computer Systems, a student-run systems conference, Carnegie Mellon University, October, 2000. <http://lcs.ece.cmu.edu/socs/>.
- *Chair,* Computer Science Club, Mount Holyoke College, South Hadley, MA, Fall 1996 and Spring 1997.

Honors and Awards

- Graduate Fellowship, Carnegie Mellon University, Pittsburgh, PA, Fall 1997 to Spring 2004.
- Summa Cum Laude in Computer Science, Mount Holyoke College, South Hadley, MA, May 1997.
- Mary Lyon Scholar, Mount Holyoke College, South Hadley, MA, May 1997.
- High Honors Undergraduate Thesis Defense, Mount Holyoke College, South Hadley, MA, May 1997.
- Sigma Xi, Mount Holyoke College, South Hadley, MA, Spring 1997.
- Bardwell Memorial Scholarship, Mount Holyoke College, South Hadley, MA, Spring 1997.
- Phi Beta Kappa (top 2% in class), Mount Holyoke College, South Hadley, MA, Fall 1996.
- Abby Howe Turner Award for Excellence in Biology, Mount Holyoke College, South Hadley, MA, Fall 1994.
- Sarah Williston Scholar, Mount Holyoke College, South Hadley, MA, Spring 1994 to 1997.
- Full Tuition Scholarship, Mount Holyoke College, South Hadley, MA, Fall 1993 to Spring 1997.