KYLE JAMIESON

Department of Computer Science
University College London
Gower Street
London WC1E 6BT

Tel. : +44 (0)20 7679 1390 (voice)
+44 (0)20 7387 1397 (fax)
Email: k.jamieson@cs.ucl.ac.uk
Web: http://www.cs.ucl.ac.uk/staff/k.jamieson

Research interests

Wireless networking and communications systems: architecture, protocols, and applications. Physical layer signal processing and communications design, and cross-layer implications. Embedded wireless sensor networks. Energy efficiency and wireless system design, from the application layer to the physical layer.

Professional Experience

September 2008– **University College London** London, U.K.
Lecturer, Department of Computer Science. Teaching undergraduate and graduate courses in Networked Systems, advising research projects in security and capacity of wireless networks.

Teaching Experience

Lecturer, University College London Department of Computer Science London, U.K.

Fall 2009 Co-teaching undergraduate class COMPGZ01/3035 Networked Systems with Dr. Brad Karp; one-half lecturing responsibilities.

Spring 2009 Co-taught graduate class COMPGZ06/M038 Mobile and Adaptive Systems with Dr. Stephen Hailes and Dr. Brad Karp. One-third lecturing responsibilities.

Spring 2007 **Teaching Assistant**, MIT 6.082 (now 6.02) Introduction to EECS II Cambridge, MA
Assisted Profs. Hari Balakrishnan, Michael Perrott, and Chris Terman in development of labs in wireless data networking; led development of lab in ALOHA medium access control.

Fall, 2005; Spring, 2006 **Guest Lecturer**, Univ. of Maine class INT 598 Sensor Science, Engineering, and Informatics Foundations Orono, ME
Assisted Prof. Silvia Nittel. Gave guest lectures, designed and supervised labs in sensor data collection and modeling.

Spring, 2005 **Head Teaching Assistant**, MIT 6.033 Computer Systems Engineering Cambridge, MA
Assisted Profs. Hari Balakrishnan and Sam Madden. Developed the course design project with other teaching staff. Responsible for planning and teaching tutorial sections, selected recitation sections, and quiz review sessions.

Spring, 2000 **Teaching Assistant**, MIT 6.826 Principles of Computer Systems Cambridge, MA
Assisted Profs. Butler Lampson and Martin Rinard. Prepared weekly problem sets, supervised grading sessions, and gave occasional class lectures.

Education

Massachusetts Institute of Technology Cambridge, MA
Ph.D. in Computer Science, June 2008.
Dissertation topic: "Partial Packet Recovery in Wireless Networks."
Advisor: Prof. Hari Balakrishnan.

M. Eng. in Electrical Engineering and Computer Science, February, 2002.
B. S. in Computer Science and Engineering, June 2001.
B. S. in Mathematics, June 2000.

Refereed Conference Publications

Omprakash Gnawali, Rodrigo Fonseca, Kyle Jamieson, David Moss, Philip Levis. Collection Tree Protocol. In Proceedings of the ACM SenSys Conference (Berkeley, CA, 2009).

Mythili Vutukuru, Hari Balakrishnan, Kyle Jamieson. Cross-Layer Wireless Bit Rate Adaptation. In Proceedings of the ACM SIGCOMM Conference (Barcelona, Spain, 2009).

Mythili Vutukuru, Kyle Jamieson, Hari Balakrishnan. Harnessing Exposed Terminals in Wireless Networks. In Proceedings of the USENIX NSDI Conference (San Francisco, CA, 2008).

Kyle Jamieson, Hari Balakrishnan. PPR: Partial Packet Recovery for Wireless Networks. In Proceedings of the ACM SIGCOMM Conference (Kyoto, Japan, 2007), pp. 409–420.

C. Emre Koskal, Kyle Jamieson, Emre Telatar, Patrick Thiran. Impacts of Channel Variability on Link-Level Throughput in Wireless Networks. In Proceedings of the ACM SIGMETRICS Conference (Saint-Malo, France, 2006), pp. 51–62.

Bret Hull, Kyle Jamieson, Hari Balakrishnan. Mitigating Congestion in Wireless Sensor Networks. In Proceedings of the ACM SenSys Conference (Baltimore, MD, 2004), pp. 134–147.

Benjie Chen, Kyle Jamieson, Hari Balakrishnan, Robert Morris. Span: an Energy-Efficient Coordination Algorithm for Topology Maintenance in Ad Hoc Wireless Networks. In Proceedings of the ACM MobiCom Conference (Rome, Italy, 2001), pp. 85–96.

Refereed Workshop Publications

Rodrigo Fonseca, Omprakash Gnawali, Kyle Jamieson, Phil Levis. Four-Bit Wireless Link Estimation. In Proceedings of the ACM-NSF HotNets Workshop (Atlanta, GA, 2007).

Kyle Jamieson, Hari Balakrishnan, Y. C. Tay. Sift: a MAC Protocol for Event-Driven Wireless Sensor Networks. In Proceedings of the Third European Workshop on Wireless Sensor Networks (EWSN) (Zurich, Switzerland, 2006), pp. 260–275.

Prem Gopalan, Kyle Jamieson, Panayiotis Mavrommatis, Massimiliano Poletto. Signature Metrics for Accurate and Automated Worm Detection. In Proceedings of the ACM Workshop on Recurring Malcode (WORM) (Fairfax, VA, 2006), pp. 65-72.

Kyle Jamieson, Bret Hull, Allen Miu, Hari Balakrishnan. Understanding the Real-World Performance of Carrier Sense. In Proceedings of the ACM SIGCOMM Workshop on Experimental Approaches to Wireless Network Design and Analysis (E-WIND) (Philadelphia, PA, 2005), pp. 52–57.

Refereed Journal Publications

Y. C. Tay, Kyle Jamieson, Hari Balakrishnan. Collision-Minimizing CSMA and its Applications to Wireless Sensor Networks. IEEE Journal on Selected Areas in Communications (J-SAC) 22:6 (2004), 1048–1057.

Benjie Chen, Kyle Jamieson, Hari Balakrishnan, Robert Morris. Span: an Energy-Efficient Coordination Algorithm for Topology Maintenance in Ad Hoc Wireless Networks. ACM Wireless Networks 8:5 (2002), 481–494.

Theses

"The SoftPHY Abstraction: from Packets to Symbols in Wireless Network Design." PhD Thesis, Massachusetts Institute of Technology, Cambridge, MA, June 2008.

"Implementation of a Power-Saving Protocol for Ad Hoc Wireless Networks." MEng Thesis, Massachusetts Institute of Technology, Cambridge, MA, February 2002.

Patents and patents pending

Application Serial No. 11-387,114 (2006): Exploit-based Worm Propagation Mitigation. Prem Gopalan, Kyle Jamieson, Panayiotis Mavrommatis; Mazu Corp.

Application Serial No. 11-387,087 (2006): Email-based Worm Propagation Properties. Prem Gopalan, Kyle Jamieson, Panayiotis Mavrommatis; Mazu Corp.

US Patent No. 7,016,827 (1999): Method and System for Ensuring Robustness in Natural Language Understanding. Ganesh Ramaswamy, Kyle Jamieson, Jan Kleindienst; International Business Machines Corp.

Service and other activities

Program committees

ACM MobiCom Conference 2010.
ACM SIGCOMM Conference 2009 (PC "light"), 2010 (PC member).
ACM SIGCOMM-USENIX Internet Measurement Conference (IMC) 2009.
First ACM International Workshop on Cognitive Radio Networks (CoRoNet) 2009.
International Workshop on Wireless Network Measurements (WiNMee) 2009.
Workshop on Embedded Networked Sensors (EmNets) 2006.

Other

ACM MobiCom Conference 2009 publicity co-chair.
External viva examiner at Cambridge University Computer Laboratory (*viva voce* date: 5 December 2008).
Member, TinyOS-2 Network Protocols Working Group.
External reviewer for ACM SIGCOMM 2001, 2006; ACM HotNets 2003; IEEE Infocom 2007; ACM HotNets 2003; ACM/USENIX MobiSys 2003; ACM SenSys 2003 to 2005, ACM/USENIX NSDI 2004, ACM Transactions on Sensor Networks 2005, 2006; IEEE/ACM Transactions on Networking 2007-2009; IEEE Transactions on Mobile Computing 2005, 2007; ACM Transactions on Sensor Networks 2006-2009.

Selected talks

"Wireless Networks: Overcoming the Challenges, Leveraging the Opportunities." Microsoft Research U.K. (6 March 2009), Cambridge, U.K.

"Wireless Networks: Overcoming the Challenges, Leveraging the Opportunities." Cambridge University Computer Laboratory Systems Research Group Seminar (26 February 2009), Cambridge, U.K.

"Partial Packet Recovery for Wireless Networks." Tufts University ECE Dept. Colloquium (November 27, 2007), Medford, MA.

"net2 Working Group Report." TinyOS Technology Exchange IV (April 28, 2007), Cambridge, MA.

"Mitigating Congestion in Wireless Sensor Networks." Tufts University ECE Dept. Colloquium (October 26, 2004), Medford, MA.

"Span: Topology Maintenance for Energy Efficiency in Ad Hoc Wireless Networks." DIMACS Workshop on Pervasive Networking (May 21, 2001), New Brunswick, NJ.

Internships

Summer 2005	**Mazu Corporation** **Summer intern**. Co-developed a system for Internet worm detection.	Cambridge, MA
Summer 2002	**Microsoft Research** **Summer intern** in the Systems and Networking group.	Redmond, WA
Summer 1998	**IBM Research** **Summer intern** in the Human Language Technologies group. Worked on robust natural language understanding for speech recognition systems.	Yorktown Heights, NY

Professional membership

Member of ACM, IEEE, and IET. Member of Tau Beta Pi and Eta Kappa Nu honor societies.

Personal

Citizenship: UK and US.

Research Projects

Wireless Networks

2007–Present **Conflict Map (CMAP)**

It is well-known that maximizing the number of successful concurrent transmissions is a good way to maximize throughput in a wireless network. Current protocols like CSMA are too conservative in exploiting concurrency because they fail to leverage "exposed terminal" opportunities. CMAP is a design where nodes optimistically assume that concurrent transmissions will succeed, and carry them out in parallel. Then, in response to observed packet errors, they discover which concurrent transmissions are likely to work, and which aren't, dynamically building up a distributed data structure containing a "map" of conflicting transmissions. By listening to ongoing transmissions in the shared medium and consulting the conflict map just before it intends to transmit, each node determines whether to transmit data immediately, or defer to ongoing transmissions.

This work will appear at USENIX NSDI 2008.

2006–Present **Partial Packet Recovery (PPR)**

Bit errors occur in wireless communication when interference or noise overcomes the coded and modulated transmission. Current wireless protocols may code to correct some small number of bit errors, but generally retransmit the whole packet if the coding is insufficient. We observe that retransmissions in current wireless mesh waste network capacity. To overcome this inefficiency, we develop, implement, and evaluate a partial packet recovery (PPR) system. PPR incorporates two new ideas: *SoftPHY*, an expanded physical layer (PHY) interface that provides PHY-independent hints to higher layers about the PHY's confidence in each bit it decodes, and a *postamble scheme* to recover data even when a packet preamble is corrupted and not decodable at the receiver. Finally, we present PP-ARQ, an asynchronous link-layer ARQ protocol built on PPR that allows a receiver to compactly encode a request for retransmission of only those bits in a packet that are likely in error.

This work appeared at ACM SIGCOMM 2007.

Link Estimation

2006–Present **Four-bit Wireless Link Estimation**

Proposals for throughput-enhancing wireless techniques are blossoming in the networking research literature. Network coding, partial packet recovery, hybrid ARQ, rateless codes, and opportunistic forwarding are all sophisticated techniques for increasing throughput. But, their performance improvements are all *predicated* on accurate link estimates to the radio neighbors of each node. In this work, we take a retrospective look at link estimation in sensor networks, and propose a narrow interface to the link estimator. In this work, I proposed the hybrid design of the link estimator and a method for combining infrequent beacon-based link estimates with the bursty stream of data-based link estimates.

This work appeared at ACM HotNets 2007.

2006 **Channel Variability**

In this work, we modeled a sender-receiver pair performing ARQ with packet checksums as a binary erasure channel, and showed that on average, variability at a time scale of a single packet transmission reduces the number of transmissions per packet, while variability at time scales larger than the time it takes to successfully transmit a packet increases the number of transmissions per packet. Thus a highly-variable link works both ways to systems designers: it could help or hurt link-level throughput. In this work, I verified the theory in an implementation on mica2 motes.

This work appeared at ACM SIGMETRICS/Performance 2006.

Sensor Networks

2004 **Fusion**

Network congestion occurs when offered traffic load exceeds available capacity at any point in the network. Congestion causes overall channel quality to degrade and loss rates to rise, leads to buffer drops and increased delays (as in wired networks), and tends to be grossly unfair toward nodes whose data has to traverse a larger number of radio hops. Fusion examines three different techniques: hop-by-hop flow control, rate limiting, and a prioritized MAC protocol. We demonstrate a three-fold improvement in network efficiency using the combination of these techniques.

This work appeared at ACM SenSys 2004.

2003–2005 **Sift**

Nodes in sensor networks often encounter spatially-correlated contention, where multiple nodes in the same neighborhood all sense an event they need to report. Furthermore, in many sensor network applications, it is sufficient if a subset of the sending nodes report the event. Sift is a randomized CSMA protocol for wireless sensor networks designed with the above observations in mind. To reduce latency for the delivery of event reports, Sift uses a fixed-size contention window and a carefully-chosen, non-uniform probability distribution of transmitting in each slot within the window. More recently (2007), others have proposed using Sift as a building block for an opportunistic forwarding protocol similar to ExOR.

This work appeared at EWSN 2006.

Power Control

2001–2002 **Span**

Span is a power saving technique for multi-hop ad hoc wireless networks that reduces energy consumption without significantly diminishing the capacity or connectivity of the network. It builds on the observation that when a region of a shared-channel wireless network has a sufficient density of nodes, only a small number of them need be on at any time to forward traffic for active connections. Nodes make local decisions on whether to sleep, or to join a forwarding backbone as a coordinator. Each node bases its decision on an estimate of how many of its neighbors will benefit from it being awake and the amount of energy available to it. In this work, I implemented the MAC component of Span, and in my Master's thesis, I implemented Span in a testbed of wireless mobile computers.

***This work appeared at ACM MobiCom 2001 and in ACM* Wireless Networks.**