Matt Welsh

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I am a computer scientist and technology leader with 20 years of experience as an engineering director, software engineer, and professor. I have a strong research background in distributed systems, networks, mobile computing, and embedded systems. I have designed and implemented large systems supporting more than a billion users, led engineering teams at successful startups, deployed wireless sensors on active volcanoes, and published more than 70 scientific papers. I enjoy working on the bleeding edge of technology and developing products to improve the lives of users all over the world.

Education

University of California, Berkeley, Ph.D., Computer Science, December 2002
Thesis advisor: Dr. David Culler. Thesis title: *An Architecture for Highly Concurrent, Well-Conditioned Internet Services.*

University of California, Berkeley, M.S., Computer Science, December 1999

Cornell University, B.S., Computer Science, May 1996

Experience

OctoML
VP of Engineering
April 2020 - present

I am the head of engineering at OctoML, a Seattle-based startup developing technology to optimize and secure machine learning models for deployment.

Apple, Inc.
Software Development Engineer
January 2020 - April 2020

Following the acquisition of Xnor.ai by Apple, I joined Apple for several months as a tech lead and manager for the former Xnor Platform and Services team.

Xnor.ai
Principal Engineer
March 2019 - January 2020

Xnor.ai was a Seattle-based startup developing highly efficient deep learning models for edge devices. Xnor was acquired by Apple in January 2020.

Google, Inc.
Principal Engineer
June 28, 2010 - March 1, 2019

At Google, I was a Principal Engineer and engineering director on the Chrome Mobile team, developing techniques to make the web faster and use less data with a focus on the next billion users in emerging markets such as India, Indonesia, and sub-Saharan Africa. I led several teams of over 40 engineers in the Seattle and Kirkland offices.

Harvard University School of Engineering and Applied Sciences
Gordon McKay Professor of Computer Science
July 1, 2010 - July 1, 2011

At Harvard, I led a research group focused on the areas of wireless sensor networks, distributed computing, and programming languages. I taught graduate courses on operating systems, wireless networking, and distributed computing, and undergraduate courses on operating systems and systems programming. I advised around 20 postdocs, graduate students, and undergraduate researchers.

Harvard University School of Engineering and Applied Sciences
Thomas D. Cabot Associate Professor of Computer Science
July 1, 2007 - June 30, 2010

Harvard University School of Engineering and Applied Sciences
Assistant Professor of Computer Science
July 1, 2003 - June 30, 2007

Intel Research, Berkeley
Senior Researcher
August 2002 - July 2003

I spent a year following my PhD at the Berkeley Intel Research lab, working with Prof. David Culler and team on wireless sensor network technologies.

Publications, Talks, Service

Thesis Work

An Architecture for Highly Concurrent, Well-Conditioned Internet Services. Matt Welsh. Ph.D. Thesis, University of California, Berkeley, December 8, 2002.

A System Supporting High-Performance Communication and I/O in Java. Matt Welsh. Master's Thesis, University of California, Berkeley, December 16, 1999.

Books

Running Linux. Matthias Kalle Dalheimer and Matt Welsh. O'Reilly and Associates, Inc., ISBN 0-596-00760-4, Fifth Edition, December 2005.

Linux Installation and Getting Started. Matt Welsh. SSC, Inc., ISBN 0-916151-77-8, February 1995.

Book Chapters

"Volcano Monitoring: Addressing Data Quality Through Iterative Deployment," G. Werner Challen and M. Welsh. In L. Girod, M. Allen, J. Brusey, and E. Gaura (Eds.), *Designing and Deploying Embedded Sensing Systems*, Springer-Verlag, 2010.

"Protocol Designs for Wireless Sensor Networks," O. Gnawali and M. Welsh. In Dipankar Raychaudhuri and Mario Gerla, (Eds.), *Emerging Wireless Technologies and the Future Internet*, Cambridge University Press, 2009.

"A Whole-Network Approach to Sensor Network Programming," M. Welsh and S. Madden. In N. Bulusu and S. Jha (Eds.), *Wireless Sensor Networks: A Systems Perspective*, Artech House, 2004.

"A Prehospital Database System for Emergency Medical Services," N. Hashmi, M. Gaynor, M. Pepe, M. Welsh, W. W. Tollefsen, S. Moulton, and D. Myung. In Stuart Barnes and Eusebio Scornavacca (Eds.), *Unwired Business: Cases in Mobile Business*, IRM Press, 2005.

"TinyOS: An Operating System for Wireless Sensor Networks." P. Levis, S. Madden, J. Polastre, R. Szewczyk, K. Whitehouse, A. Woo, D. Gay, J. Hill, M. Welsh, E. Brewer, and D. Culler. In W. Weber, J. Rabaey, and E. Aarts (Eds.), *Ambient Intelligence*, Springer-Verlag, 2004.

Journal Articles

"Sensor Networks for the Sciences," M. Welsh. In *Communications of the ACM*, Vol. 53 No. 11, pages 36-39, DOI 10.1145/1839676.1839690, November 2010.

"Monitoring Motor Fluctuations in Patients With Parkinson's Disease Using Wearable Sensors," S. Patel, K. Lorincz, R. Hughes, N. Huggins, J. Growdon, D. Standaert, M. Akay, J. Dy, M. Welsh, and P. Bonato. In *IEEE Transactions on Information Technology in Biomedicine*, Volume 13(6), pages 864-873, November 2009.

"Implementing Public-Key Infrastructure for Sensor Networks," D. J. Malan, M. Welsh, and M. D. Smith. In *ACM Transactions on Sensor Networks*, 4(4), pages 22:1-22:23, 2008.

"The Advanced Health and Disaster Aid Network: A Lightweight Wireless Medical System for Triage,"

T. Gao, T. Massey, L. Selavo, D. Crawford, B.-R. Chen, K. Lorincz, V. Shnayder, L. Hauenstein, F. Dabiri, J. Jeng, A. Chanmugam, D. White, M. Sarrafzadeh, and M. Welsh. In *IEEE Transactions on Biomedical Circuits and Systems*, 1(3), pages 203 - 216, September 2007.

"Reventador Volcano 2005: Eruptive Activity Inferred from Seismo-Acoustic Observation," J. M. Lees, J. B. Johnson, M. Ruiz, L. Troncoso, and M. Welsh, In *Journal of Volcanology and Geothermal Research*, 176(1), pages 179-190, September 2008.

"Sensor web enables rapid response to volcanic activity," A.G. Davies, S. Chien, R. Wright, A. Miklius, P.R. Kyle, M. Welsh, J.B. Johnson, D. Tran, S.R. Schaffer, and R. Sherwood. In *EOS Trans. AGU*, 87(1), pp. 1-5, 2006.

"Deploying a Wireless Sensor Network on an Active Volcano," G. Werner-Allen, K. Lorincz, M. Ruiz, O. Marcillo, J. Johnson, J. Lees, and M. Welsh. In *IEEE Internet Computing*, Special Issue on Data-Driven Applications in Sensor Networks, March/April 2006.

"MoteTrack: A Robust, Decentralized Approach to RF-Based Location Tracking," K. Lorincz and M. Welsh. In *Personal and Ubiquitous Computing*, Special Issue on Location and Context-Awareness, Springer-Verlag, 2006. In press.

"Sensor Networks for Emergency Response: Challenges and Opportunities," K. Lorincz, D. Malan, T. R. F. Fulford-Jones, A. Nawoj, A. Clavel, V. Shnayder, G. Mainland, S. Moulton, and M. Welsh. In *IEEE Pervasive Computing*, Special Issue on Pervasive Computing for First Response, Vol. 3, No. 4, October/December, 2004.

"iRevive, a Pre-hospital Mobile Database for Emergency Medical Services," W. Tollefsen, M. Pepe, D. Myung, M. Gaynor, M. Welsh, and S. Moulton. In *International Journal of Healthcare Technology and Management (IJHTM)*, Summer, 2004.

"Integrating Wireless Sensor Networks with the Grid," M. Gaynor, M. Welsh, S. Moulton, A. Rowan, E. LaCombe, and J. Wynne. In *IEEE Internet Computing*, Special Issue on Wireless Grids, Vol. 8, No. 4, July/August, 2004.

"The Ninja Architecture for Robust Internet-Scale Systems and Services." S. D. Gribble, M. Welsh, R. von Behren, E. A. Brewer, D. Culler, N. Borisov, S. Czerwinski, R. Gummadi, J. Hill, A. Joseph, R.H. Katz, Z.M. Mao, S. Ross, and B. Zhao. In *Journal of Computer Networks*, Special Issue on Pervasive Computing, Vol. 35, No. 4, March, 2001. Awarded best paper out of all 2001 Journal of Computer Networks papers.

"Jaguar: Enabling Efficient Communication and I/O in Java." M. Welsh and D. Culler. In *Concurrency: Practice and Experience*, Special Issue on JavaGrande Applications, Vol. 12, No. 1, January, 2000.

"U-Net/SLE: A Java-based User-Customizable Virtual Network Interface." M. Welsh, D. Oppenheimer,

and D. Culler. In *Journal of Scientific Programming*, Special Issue on High Performance Java Compilation and Runtime Issues, Vol. 7, No. 2, 1999.

Conference and Workshop Papers

"Flywheel: Google's Data Compression Proxy for the Mobile Web," V. Agababov, M. Buettner, V. Chudnovsky, M. Cogan, B. Greenstein, S. McDaniel, M. Piatek, C. Scott, M. Welsh, and B. Yin. In *Proceedings of the 12th USENIX Symposium on Networked Systems Design and Implementation (NSDI 2015)*, May 2015.

"Mobile Network Performance from User Devices: A Longitudinal, Multidimensional Analysis," A. Nikravesh, D. R. Choffnes, E. Katz-Bassett, Z. Morley Mao, and M. Welsh. In *Proceedings of the Passive and Active Measurements Conference (PAM 2014)*, March 2014.

"Diagnosing Path Inflation of Mobile Client Traffic," K. Zarifis, T. Flach, S. Nori, D. Choffnes, R. Govindan, E. Katz-Bassett, Z. Morley Mao, and M. Welsh. In *Proceedings of the Passive and Active Measurements Conference (PAM 2014)*, March 2014.

"Simbeeotic: A Simulator and Testbed for Micro-Aerial Vehicle Swarm Experiments," B. Kate, J. Waterman, K. Dantu, and M. Welsh. In *Proceedings of the 11th ACM/IEEE Conference on Information Processing in Sensor Networks (IPSN 2012)*, April 2012.

"Programming Micro-Aerial Vehicle Swarms with Karma," K. Dantu, B. Kate, J. Waterman, P. Bailis, and M. Welsh. In *Proceedings of ACM SenSys 2011*, November 2011.

Mapping the Urban Wireless Landscape with Argos, Ian Rose and Matt Welsh. In *Proceedings of the 8th ACM Conference on Embedded Networked Sensor Systems (SenSys'10)*, November 2010.

"Dyson: An Architecture for Extensible Wireless LANs," R. Murty, J. Padhye, A. Wolman, and M. Welsh. In *Proceedings of the 2010 USENIX Annual Technical Conference*, June 2010.

"IDEA: Integrated Distributed Energy Awareness for Wireless Sensor Networks," G. W. Challen, J. Waterman and M. Welsh. In *Proceedings of the 8th Annual International Conference on Mobile Systems, Applications and Services (MobiSys'10)*, June 2010.

"Mercury: A Wearable Sensor Network Platform for High-Fidelity Motion Analysis," K. Lorincz, B. R. Chen, G. W. Challen, A. Roy Chowdhury, S. Patel, P. Bonato, and M. Welsh. In *Proceedings of the 7th ACM Conference on Embedded Networked Sensor Systems (SenSys'09)*, November 2009.

"White Space Networking with Wi-Fi like Connectivity," P. Bahl, R. Chandra, T. Moscibroda, R. Murty, and M. Welsh. In *Proceedings of ACM SIGCOMM 2009*, August, 2009. Winner of best paper award.

"Peloton: Coordinated Resource Management for Sensor Networks." J. Waterman, G. W. Challen, and M.

Welsh. In *Proceedings of the 12th Workshop on Hot Topics in Operating Systems (HotOS-XII)*, May, 2009.

"An Architecture for Extensible Wireless LANs." R. Murty, J. Padhye, A. Wolman, and M. Welsh. In *Proceedings of the Seventh ACM Workshop on Hot Topics in Networks (HotNets-VII)*, October, 2008.

"Resource Aware Programming in the Pixie OS." K. Lorincz, B.-R. Chen, J. Waterman, G. Werner-Allen, and M. Welsh. In *Proceedings of the 6th ACM Conference on Embedded Networked Sensor Systems (SenSys'08)*, November 2008.

"Lance: Optimizing High-Resolution Signal Collection in Wireless Sensor Networks." G. Werner-Allen, S. Dawson-Haggerty, and M. Welsh. In *Proceedings of the 6th ACM Conference on Embedded Networked Sensor Systems (SenSys'08)*, November 2008.

"Flask: Staged Functional Programming for Sensor Networks." G. Mainland, G. Morrisett, and M. Welsh. In *Proceedings of the 13th ACM SIGPLAN International Conference on Functional Programming (ICFP 2008)*, September 2008.

"Pixie: An Operating System for Resource-Aware Programming of Embedded Sensors." K. Lorincz, B.-R. Chen, J. Waterman, G. Werner-Allen, and M. Welsh. In *Proceedings of The Fifth Workshop on Embedded Networked Sensors (HotEmNets'08)*, June 2008.

"LiveNet: Using Passive Monitoring to Reconstruct Sensor Network Dynamics." B.-R. Chen, G. Peterson, G. Mainland, and M. Welsh. In *Proceedings of the 4th IEEE/ACM International Conference on Distributed Computing in Sensor Systems (DCOSS 2008)*, Santorini Island, Greece, June 2008.

"CitySense: An Urban-Scale Wireless Sensor Network and Testbed." R. Murty, G. Mainland, I. Rose, A. Roy Chowdhury, A. Gosain, J. Bers, and M. Welsh. In *Proceedings of the 2008 IEEE International Conference on Technologies for Homeland Security*, Waltham, MA, May 2008.

"Wireless Medical Sensor Networks in Emergency Response: Implementation and Pilot Results." T. Gao, C. Pesto, L. Selavo, Y. Chen, J. Ko, J. Lim, A. Terzis, A. Watt, J. Jeng, B.-R. Chen, K. Lorincz, and M. Welsh. In *Proceedings of the 2008 IEEE International Conference on Technologies for Homeland Security*, Waltham, MA, May 2008.

"Analysis of Feature Space for Monitoring Persons with Parkinson's Disease With Application to a Wireless Wearable Sensor System," S. Patel, K. Lorincz, R. Hughes, N. Huggins, J. H. Growdon, M. Welsh, and P. Bonato. In *Proceedings of the 29th IEEE EMBS Annual International Conference*, Lyon, France, August 2007.

"Participatory User Centered Design Techniques for a Large Scale Ad-Hoc Health Information System," T. Gao, T. Massey, L. Selavo, M. Welsh, and M. Sarrafzadeh. In *First International Workshop on Systems and Networking Support for Healthcare and Assisted Living Environments (HealthNet'07)*, San

Juan, Puerto Rico, June 2007.

"A Utility-Based Approach to Bandwidth Allocation and Link Scheduling in Wireless Networks," Q. Ma, D. C. Parkes, and M. Welsh. In *Proceedings of the First International Workshop on Agent Technology for Sensor Networks (ATSN-07)*, Honolulu, May 2007.

"Cobra: Content-based Filtering and Aggregation of Blogs and RSS Feeds," I. Rose, R. Murty, P. Pietzuch, J. Ledlie, M. Roussopoulos, and M. Welsh. In *Proceedings of the 4th USENIX/ACM Symposium on Networked Systems Design and Implementation (NSDI 2007)*, Cambridge, MA, April 2007.

"The Regiment Macroprogramming System," R. Newton, G. Morrisett, and M. Welsh. In *Proceedings of the International Conference on Information Processing in Sensor Networks (IPSN'07)*, Cambridge, MA, April 2007.

"Towards a Dependable Architecture for Internet-Scale Sensing," R. Murty and M. Welsh. In *Proceedings of the Second Workshop on Hot Topics in Dependability (HotDep'06)*, Seattle, November 2006.

"Fidelity and Yield in a Volcano Monitoring Sensor Network," G. Werner-Allen, K. Lorincz, J. Johnson, J. Lees, and M. Welsh. In *Proceedings of the 7th USENIX Symposium on Operating Systems Design and Implementation (OSDI 2006)*, Seattle, November 2006.

"Design of a Decentralized Electronic Triage System," T. Massey, T. Gao, M. Welsh, and J. Sharp. In *Proceedings of the American Medical Informatics Association Annual Conference (AMIA 2006)*, Washington, DC, November 2006.

"Ad-Hoc Multicast Routing on Resource-Limited Sensor Nodes," B.-R. Chen, K.-K. Muniswamy-Reddy, and M. Welsh. In *Proceedings of the Second ACM/Sigmobile Workshop on Multi-hop Ad Hoc Networks: from theory to reality (REALMAN'06)*, Florence, Italy, May 2006.

"Communicating Data from Wireless Sensor Networks using the HL7v3 Standard." S. Baird, S. Dawson-Haggerty, D. Myung, M. Gaynor, M. Welsh, and S. Moulton. In *Proceedings of the International Workshop on Wearable and Implantable Body Sensor Networks (BSN 2006)*, April 2006.

"Network-Aware Operator Placement for Stream-Processing Systems." P. Pietzuch, J. Ledlie, J. Shneidman, M. Roussopoulos, M. Welsh, and M. Seltzer. In *Proceedings of the 22nd International Conference on Data Engineering (ICDE 2006)*, April 2006.

"Firefly-Inspired Sensor Network Synchronicity with Realistic Radio Effects." G. Werner-Allen, G. Tewari, A. Patel, M. Welsh, and R. Nagpal. In *Proceedings of the 3rd ACM Conference on Embedded Networked Sensor Systems (SenSys'05)*, November 2005.

"Vital Signs Monitoring and Patient Tracking Over a Wireless Network." T. Gao, D. Greenspan, M.

Welsh, R. R. Juang, and A. Alm. In *Proceedings of the 27th IEEE EMBS Annual International Conference*, September 2005.

"Improving Patient Monitoring and Tracking in Emergency Response." T. Gao, D. Greenspan, and M. Welsh. In *Proceedings of the International Conference on Information Communication Technologies in Health*, July 2005.

"Decentralized, Adaptive Resource Allocation for Sensor Networks." G. Mainland, D. C. Parkes, and M. Welsh. In *Proceedings of the 2nd USENIX/ACM Symposium on Networked Systems Design and Implementation (NSDI 2005)*, May, 2005.

"MoteTrack: A Robust, Decentralized Approach to RF-Based Location Tracking." K. Lorincz and M. Welsh. In *Proceedings of the International Workshop on Location- and Context-Awareness (LoCA 2005) at Pervasive 2005*, May, 2005.

"Building up to Macroprogramming: An Intermediate Language for Sensor Networks." R. Newton, Arvind, and M. Welsh. In *Proceedings of the Fourth International Conference on Information Processing in Sensor Networks (IPSN'05)*, April, 2005.

"MoteLab: A Wireless Sensor Network Testbed." G. Werner-Allen, P. Swieskowski, and M. Welsh. In *Proceedings of the Fourth International Conference on Information Processing in Sensor Networks (IPSN'05)*, Special Track on Platform Tools and Design Methods for Network Embedded Sensors (SPOTS), April, 2005.

"A Cost-Space Approach to Distributed Query Optimization in Stream Based Overlays." J. Shneidman, P. Pietzuch, M. Welsh, M. Seltzer, and M. Roussopoulos. In *Proceedings of the 1st IEEE International Workshop on Networking Meets Databases (NetDB)*, April, 2005.

"Evaluating DHT-Based Service Placement for Stream-Based Overlays." P. Pietzuch, J. Shneidman, J. Ledlie, M. Welsh, M. Seltzer, and M. Roussopoulos. In *Proceedings of the Fourth International Workshop on Peer-to-Peer Systems (IPTPS'05)*, Ithaca, NY, February, 2005.

"Monitoring Volcanic Eruptions with a Wireless Sensor Network." G. Werner-Allen, J. Johnson, M. Ruiz, J. Lees, and M. Welsh. In *Proceedings of the Second European Workshop on Wireless Sensor Networks (EWSN'05)*, Istanbul, January, 2005.

"Simulating the Power Consumption of Large-Scale Sensor Network Applications," V. Shnayder, M. Hempstead, B.-R. Chen, G. Werner-Allen, and M. Welsh. In *Proceedings of the Second ACM Conference on Embedded Networked Sensor Systems (SenSys'04)*, Baltimore, MD, November, 2004.

"A Public-Key Infrastructure for Key Distribution in TinyOS Based on Elliptic Curve Cryptography," D. Malan, M. Welsh, and M. Smith. In *Proceedings of the First IEEE International Conference on Sensor and Ad hoc Communications and Networks (SECON)*, Santa Clara, CA, October, 2004.

"Using Virtual Markets to Program Global Behavior in Sensor Networks," G. Mainland, L. Kang, S. Lahaie, D. C. Parkes, and M. Welsh. In *Proceedings of the 11th ACM SIGOPS European Workshop*, Leuven, Belgium, September, 2004.

"Open Problems in Data Collection Networks," J. Ledlie, J. Shneidman, M. Welsh, M. Seltzer, and M. Roussopoulos. In *Proceedings of the 11th ACM SIGOPS European Workshop*, Leuven, Belgium, September, 2004.

"Region Streams: Functional Macroprogramming for Sensor Networks," R. Newton and M. Welsh. In *Proceedings of the First International Workshop on Data Management for Sensor Networks (DMSN)*, Toronto, Canada, August, 2004.

"Wireless Sensor Network Applications," M. Gaynor, S. Moulton, M. Welsh, A. Rowan, E. LaCombe, and J. Wynne. In *Proceedings of the 2004 Americas Conference on Information Systems (AMCIS 2004)*, August, 2004.

"CodeBlue: An Ad Hoc Sensor Network Infrastructure for Emergency Medical Care," D. Malan, T.R.F. Fulford-Jones, M. Welsh, and S. Moulton. In *Proceedings of the MobiSys 2004 Workshop on Applications of Mobile Embedded Systems (WAMES 2004)*, Boston, MA, June, 2004.

"Programming Sensor Networks using Abstract Regions," M. Welsh and G. Mainland. In *Proceedings of the First USENIX/ACM Symposium on Networked Systems Design and Implementation (NSDI '04)*, San Francisco, CA, March 2004.

"Exposing Resource Tradeoffs in Region-Based Communication Abstractions for Sensor Networks," M Welsh. In *Proceedings of the 2nd ACM Workshop on Hot Topics in Networks (HotNets-II)*, Cambridge, MA, November 2003.

"TOSSIM: Accurate and Scalable Simulation of Entire TinyOS Applications," P. Levis, N. Lee, M. Welsh, and D. Culler. In *Proceedings of the First ACM Conference on Embedded Networked Sensor Systems (SenSys) 2003*, Los Angeles, CA, November 2003.

"The nesC Language: A Holistic Approach to Networked Embedded Systems," D. Gay, P. Levis, R. von Behren, M. Welsh, E. Brewer, and D. Culler. In *Proceedings of Programming Language Design and Implementation (PLDI) 2003*, San Diego, CA, June 2003.

"Adaptive Overload Control for Busy Internet Servers," M. Welsh and D. Culler. In *Proceedings of the 4th USENIX Conference on Internet Technologies and Systems (USITS'03)*, Seattle, WA, March 2003.

"Overload Management as a Fundamental Service Design Primitive," M. Welsh and D. Culler. In *Proceedings of the Tenth ACM SIGOPS European Workshop*, Saint-Emilion, France, September, 2002.

"Ninja: A Framework for Network Services," R. von Behren, E. Brewer, N. Borisov, M. Chen, M. Welsh, J. MacDonald, J. Lau, S. Gribble, and D. Culler. In *Proceedings of the 2002 Usenix Annual Technical Conference*, Monterey, California, June, 2002.

"SEDA: An Architecture for Well-Conditioned, Scalable Internet Services." M. Welsh, D. Culler, and E. Brewer. In *Proceedings of the 18th Symposium on Operating Systems Principles (SOSP-18)*, Banff, Canada, October 21-24, 2001.

"Virtualization Considered Harmful: OS Design Directions for Well-Conditioned Services." M. Welsh and D. Culler. In *Proceedings of the 8th Workshop on Hot Topics in Operating Systems (HOTOS-VIII)*, Schloss Elmau, Germany, May 20-23, 2001.

"Achieving Robust, Scalable Cluster I/O in Java." M. Welsh and D. Culler. In *Proceedings of the Fifth ACM SIGPLAN Workshop on Languages, Compilers, and Runtime Environments for Scalable Computers (LCR2K)*, Rochester, NY, June, 2000.

"The MultiSpace: An Evolutionary Platform for Infrastructural Services." S. Gribble, M. Welsh, E. Brewer, and D. Culler. In *Proceedings of the 1999 USENIX Annual Technical Conference*, Monterey, California, June 6-11, 1999.

"U-Net/SLE: A Java-based User-Customizable Virtual Network Interface." M. Welsh, D. Oppenheimer, and D. Culler. Presented at the Java for High-Performance Network Computing workshop at EuroPar '98, Southampton, England, September 4, 1998.

"Incorporating Memory Management into User-Level Network Interfaces." M. Welsh, A. Basu, and T. von Eicken. In *Proceedings of Hot Interconnects V*, Stanford, California, August 21–23, 1997.

"A Comparison of ATM and Fast Ethernet Network Interfaces for User-Level Communication." M. Welsh, A. Basu, and T. von Eicken. In *Proceedings of the Third International Symposium on High-Performance Computer Architecture (HPCA-3)*, San Antonio, Texas, February 1–5, 1997.

"Low-Latency Communication over Fast Ethernet." M. Welsh, A. Basu, and T. von Eicken. In *Proceedings of Euro-Par '96*, Lyon, France, August 27–29, 1996.

Abstracts and Posters

"A Wireless Seismoacoustic Sensor Network for Monitoring Activity at Volca´n Reventador, Ecuador." M. Welsh, G. Werner-Allen, K. Lorincz, O. Marcillo, M. Ruiz, J. Johnson, and J. Lees. Cities On Volcanoes 4 Conference, Quito, January 23-27, 2006 (abstract).

"A Wireless, Low-Power Motion Analysis Sensor for Stroke Patient Rehabilitation." M. John, T.R.F. Fulford-Jones, P. Bonato, and M. Welsh. Abstract 143281, Biomedical Engineering Society (BMES) 2005 Annual Fall Meeting, Baltimore, MD, September 28-October 1, 2005 (abstract).

"Infrasonic Monitoring of Eruptions at Tungurahua Volcano, Ecuador using a Wireless Sensor Network." G. Werner-Allen, J. Johnson, M. Ruiz, J. Lees, and M. Welsh. Eos Trans. American Geophysical Union, 85(47), Fall Meet. Suppl., Abstract SF44A-03, December 13-17, 2004, San Francisco, CA (abstract).

"TinyBench: The Case For A Standardized Benchmark Suite for TinyOS Based Wireless Sensor Network Devices." M. Hempstead, D. Brooks, and M. Welsh. First IEEE Workshop on Embedded Networked Sensors (EmNets'04), Tampa, Florida, November 2004 (poster).

"A Dynamic Sensor Network for Emergency Medical Services," D. Myung, S. Baird, M. Pepe, M. Gaynor, M. Welsh, and S. Moulton. Poster, 9th Annual New England Regional Trauma Conference, November 18-19, 2004, Burlington, MA.

"A Portable, Low-Power, Wireless Two-Lead EKG System," T. R. F. Fulford-Jones, G.-Y. Wei, and M. Welsh. Poster, 26th IEEE EMBS Annual International Conference, San Francisco, September, 2004.

"Vital Dust: Wireless sensors and a sensor network for real-time patient monitoring." D. Myung, B. Duncan, D. Malan, M. Welsh, M. Gaynor, and S. Moulton. Poster, 8th Annual New England Regional Trauma Conference, November 20-21, 2003, Burlington, MA.

"Resuscitation Monitoring With a Wireless Sensor Network," M. Welsh, D. Myung, M. Gaynor, and S. Moulton. Abstract and poster session, American Heart Association, Resuscitation Science Symposium. Abstract, in Supplement to Circulation: Journal of the American Heart Association, October 28, 2003.

Technical Reports

"Flask: A Language for Data-driven Sensor Network Programs," G. Mainland, M. Welsh, and G. Morrisett. Harvard University Technical Report TR-13-06, May, 2006.

"Sensor Networks for Medical Care." Victor Shnayder, Bor-rong Chen, Konrad Lorincz, Thaddeus R. F. Fulford-Jones, and Matt Welsh. Harvard University Technical Report TR-08-05, April, 2005.

"MoteTrack: A Robust, Decentralized Location Tracking System for Disaster Response," K. Lorincz and M. Welsh. Harvard University DEAS Technical Report, March, 2004.

"A Design Framework for Highly Concurrent Systems." M. Welsh, S. D. Gribble, E. A. Brewer, and D. Culler. UC Berkeley Technical Report UCB/CSD-00-1108, April, 2000.

"Querying Large Collections of Music for Similarity." M. Welsh, N. Borisov, J. Hill, R. von Behren, and A. Woo. UC Berkeley Technical Report UCB/CSD-00-1096, November, 1999.

"Tigris: A Java-Based Cluster I/O System." Matt Welsh. UC Berkeley Technical Report UCB/CSD-00-1095, June, 1999.

“User Customization of Virtual Network Interfaces with U-Net/SLE.” D. Oppenheimer and M. Welsh. UC Berkeley Technical Report UCB/CSD-98-995, February 1998.

“Incorporating Memory Management into User-Level Network Interfaces.” M. Welsh, A. Basu, and T. von Eicken. Technical Report TR97-1620, Cornell University, November 1996.

“Real-Time Hausdorff-Fraction Motion Tracking on a Clustered Workstation.” M. Welsh and N. Ahmed. Cornell University, December 1995.

“Shared-Memory Multiprocessor Support for Split-C.” M. Welsh and J. DeCristofaro. Cornell University, May 1995.

Invited Talks

“Making the Mobile Web Fast,” Stanford University CS144, November, 2012.
—. Invited Talk, Princeton University, December, 2012.
“The Next Decade of Sensor Networking,” Keynote Talk, Seventh European Conference on Wireless Sensor Networks (EWSN 2010), Coimbra, Portugal, February 17, 2010.
“How to Program a Macroscope,” Computer Science Colloquium Series, Harvard University, December 3, 2009.
“A New Era of Resource Responsibility for Sensor Networks,” Keynote Talk, Eighth International ACM Workshop on Data Engineering for Wireless and Mobile Access, Providence, Rhode Island, June 29, 2009.
—. Invited Talk, Computer Science Systems Colloquium, University of California, San Diego, January 8, 2010.
—. Invited Talk, Systems Seminar, MIT, November 18, 2009.
—. Invited Talk, Systems Seminar, University of Washington, November 2, 2009.
—. Invited Talk, Systems Seminar, Cornell University, October 23, 2009.
—. Invited Talk, DISI Seminar Series, University of Trento, Italy, May 22, 2009.
—. Distinguished Lecture, University of Utah School of Computing, March 23, 2009.
“Mercury: A Wearable Sensor Network Platform for High-Fidelity Motion Analysis.” Biosensors: Engineering Concepts and Medical Applications, Harvard University, May 8, 2009.
“Lessons from the Field: Sensor Networks for the Sciences,” Keynote Talk, International Conference on Distributed Computing in Sensor Systems (DCOSS), Santorini Island, Greece, June 2008.
“The Fiji Platform for Data-Intensive Sensor Network Applications,” Keynote Talk, 3rd Federated Event on Distributed Computing Techniques, Oslo, Norway, June 2008.
—. Invited Talk, Intel Research, Seattle, WA, March 2008.
“CitySense: An Open, Urban-scale Sensor Network Testbed.” Invited Talk, Microsoft Research, Redmond, WA, March 2008.
“Lance: Priority-Driven Data Storage and Extraction for Sensor Networks.” Invited Talk, IBM Research, Hawthorne, NY, December 2007.
“Fiji: A Macroprogramming Framework for Data-Intensive Sensor Network Applications.” SUNY Buffalo Computer Science and Engineering Department Colloquium, October 2007.

“Deploying a Sensor Network on an Active Volcano.” Invited Talk, USENIX Annual Technical Conference, Boston, MA, June 1, 2006.
—. Invited Talk, Indian Institute of Technology, Kanpur, August 9, 2006.
—. Invited Talk, Indian Institute of Technology, Bombay, August 22, 2006.
—. Invited Talk, Harvard University Initiative in Innovative Computing Lecture Series, October 4, 2006.
“Monitoring Volcanic Eruptions with a Wireless Sensor Network.” Distinguished Lecture, University of Virginia, Charlottesville, VA, January 26, 2006.
“Where do we go from here? The Big Problems in sensor networks.” Keynote, Wireless Sensing Solutions Conference, Chicago, IL, September 28, 2005.
“CodeBlue: A Wireless Sensor Network for Medical Care and Disaster Response.” Cal-IT2 Colloquium, San Diego, CA, June 29, 2005.
“Market-Based Programming Paradigms for Sensor Networks.” Brown University Computer Science Colloquium, Providence, RI, October 27, 2004.
“Sensor Networks for Emergency Medical Care.” Keynote, Fourth Workshop on Applications and Services in Wireless Networks (ASWN’04), Boston, MA, August 10, 2004.
“Programming Primitives for Wireless Sensor Networks.” Boston University Computer Science Colloquium, Boston, MA, October 1, 2003.
“Programming in the Large: The next generation of distributed systems.” Intel Research, Portland, OR, May 13, 2003.
“nesC: A Component-Oriented Language for Networked Embedded Systems.” Microsoft Research, Redmond, WA, March 25, 2003.
“Extreme Overload and Concurrency in Internet Services.” Emerging Technology Special Interest Group, Software Development Forum, Palo Alto, CA, February 11, 2003.
“SEDA: An Architecture for Robust, Well-Conditioned Internet Services.” Apache Development Team Meeting, July 17, 2002.
“SEDA: Enabling Robust Performance for Busy Internet Servers.” Systems Design and Implementation Seminar, Carnegie-Mellon University, November 15, 2001. Internet and Distributed Systems Seminar, Stanford University, April 18, 2001. Systems Seminar, University of Washington, April 27, 2001.
“Designing Systems for High Concurrency.” Loudcloud, Sunnyvale, CA, September 2000. BEA WebLogic, San Francisco, CA, July 2000.
“Building Efficient, Scalable Systems in Java.” IBM T.J. Watson Research Center, Hawthorne, NY, May 2000.
“New Challenges for the Linux Community.” O’Reilly Open Source Convention, Monterey, CA, July 2000. Keynote presentation, LinuxForum 2000, Ska˚ne-Sjælland Linux Users Group, Copenhagen, Denmark, March 2000.
“The UC Berkeley Ninja Project.” Second Jini Technology Community Meeting. Annapolis, MD, October 1999.
“Jaguar: Bridging the Java Server Performance Gap.” Fujitsu Laboratories, Kawasaki, Japan, June 1999; Tokyo Institute of Technology, Tokyo, June 1999.
“Play Safe, Go Fast: Using Java to Improve Performance.” Keynote presentation, ACM 1999 Java Grande Conference, San Francisco, CA, June 1999.
“The UC Berkeley Ninja Project: Highlights and Ongoing Work.” Second Workshop on Desktop Access to Remote Resources, Albuquerque, NM, February 1999.

“The UC Berkeley Network of Workstations and Millennium Projects.” Workshop on Global and Cluster Computing, Tsukuba, Japan, March 1998.
“The U-Net and U-Net/MM User-Level Network Architectures.” Systems Engineering Research Institute, KAIST, Taejon, South Korea, October 1997.
“Linux and Operating Systems Research.” Centrum voor Wiskunde en Informatica, Amsterdam, July 1997; Ecole Supe´rieure d’Inge´nieurs en Electrotechnique et Electronique, Paris, May 1997; The UK UNIX User Group, London, February 1997.
“ATM and Fast Ethernet Network Interfaces for User-Level Communication.” Systems Research Group seminar. University of Newcastle, Newcastle-upon-Tyne, England, April 1997.
“Imminent Death of UNIX Predicted?” Linux Track Keynote, The Digital Equipment Corporation Users’ Society. San Francisco, California, December 1995.

Teaching

Systems Programming and Machine Organization (CS61), Harvard University, Fall 2009. CUE Course Guide rating: 4.3/5.0, instructor rating: 4.5/5.0

Wireless Sensor Networks (CS263), Harvard University, Spring 2009. CUE Course Guide rating: 4.4/5.0, instructor rating: 4.5/5.0

Systems Programming and Machine Organization (CS61), Harvard University, Fall 2008. CUE Course Guide rating: 4.4/5.0, instructor rating: 4.6/5.0

Systems Programming and Machine Organization (CS61), Harvard University, Spring 2008. CUE Course Guide rating: 4.3/5.0, instructor rating: 4.7/5.0

Operating Systems (CS161), Harvard University, Spring 2007. CUE Course Guide rating: 4.9/5.0, instructor rating: 4.9/5.0

Internet-Scale Sensing (CS260r), Harvard University, Fall 2006. CUE Course Guide rating: 3.8/5.0, instructor rating: 4.4/5.0

Operating Systems (CS161), Harvard University, Spring 2006. CUE Course Guide rating: 4.5/5.0, instructor rating: 4.7/5.0

Wireless Communications and Sensor Networks(CS263), Harvard University, Fall 2005. CUE Course Guide rating: 4.6/5.0, instructor rating: 4.8/5.0

Operating Systems (CS161), Harvard University, Spring 2005. CUE Course Guide rating: 4.7/5.0 instructor rating: 5.0/5.0

Wireless Communications and Sensor Networks(CS263), Harvard University, Fall 2004. CUE Course Guide rating: 4.7/5.0, instructor rating: 4.9/5.0

Operating Systems (CS161), Harvard University, Spring 2004. CUE Course Guide rating: 4.8/5.0, instructor rating: 4.9/5.0

Modern Distributed Systems (CS263), Harvard University, Fall 2003. CUE Course Guide rating: 4.4/5.0, instructor rating: 4.5/5.0

Head Teaching Assistant, Operating Systems (CS162), UC Berkeley, Spring 2001. Instructor: Prof. Anthony Joseph.

Advising

Ph.D. advisees at Harvard: Geoff Werner Challen, Geoffrey Mainland, Rohan Murty, Ian Rose, Jason Waterman, Bor-rong Chen, Konrad Lorincz, Atanu Roy Chowdhury, Breanne Duncan, Victor Shnayder.

Postdoc advisees at Harvard: Karthik Dantu, Alex Wissner-Gross.

Service

General chair, HotMobile 2014
Program committee, MobiSys 2013
Program committee, HotMobile 2013
Program committee, SOCC 2012
Program committee, NSDI 2012
Program committee, MobiSys 2012
Program chair, HotOS 2011
Steering comittee chair, ACM SenSys
Program committee, SIGCOMM 2010
Program committee, IPSN 2010
Program committee, EWSN 2010
General Chair, HotMobile 2014, Santa Barbara, CA, February 26-27, 2014.
Program committee, MobiSys 2013, Taipei, Taiwan, June 25-28, 2013.
Program committee, HotMobile 2013, Jekyll Island, GA, February 26-27, 2013.
Program committee, SOCC 2012, San Jose, CA, October 14-17, 2012.
Program committee, MobiSys 2012, Lake District, UK, June 25-29, 2012.
Program committee, NSDI 2012, San Jose, CA, April 25-27, 2012.
Editor-in-chief, ACM *Transactions on Sensor Networks*, 2010-2011.
Program Chair, 13th Workshop on Hot Topics in Operating Systems (HotOS 2011), Napa Valley, CA, March 2011.
Program committee, SIGCOMM 2010, New Delhi, India, August 30-September 3, 2010.
Program committee, IPSN 2010, Stockholm, Sweden, April 12-16, 2010.
Program committee, EWSN 2010, Coimbra, Portugal, February 17-19, 2010.
Program Co-chair, SenSys 2009, Berkeley, CA, November 4–6, 2009.

Program committee, IPSN 2009, San Francisco, CA, April 15–17, 2009.
Program committee, NSDI 2009, Boston, MA, April 22–24, 2009.
Program committee, International Workshop on Urban, Community, and Social Applications of Networked Sensing Systems (UrbanSense08), Raleigh, NC, November 4, 2008.
Program committee, EMSOFT 2008, Atlanta, GA, October 19–24, 2008.
Program committee and industry sponsorship chair, ACM SenSys 2008, Raleigh, NC, November 5–7, 2008.
Program committee, ICDCS 2008, Beijing China, June 17–20, 2008.
Program committee, IE ’08 Workshop on Smart Sensing and Situation Awareness in Sensor Networks, Seattle, WA, July 21–22, 2008.
Program committee, MobiSys 2008, Breckenridge, CO, June 17–20, 2008.
Program committee, BodyNets 2008, Tempe, AZ, March 13–15, 2008.
Program committee, 2007 USENIX Annual Technical Conference, Santa Clara, CA, June 17–22, 2007.
Program committee, First International Workshop on Agent Technology for Sensor Networks (ATSN 07), Honolulu, HI, May 14, 2007.
Program committee, International Conference on Distributed Computing in Sensor Systems (DCOSS 2007), Santa Fe, NM, June 18–20, 2007.
Program Co-chair, International Conference on Information Processing in Sensor Networks (IPSN 2007), Cambridge, MA, April 25-27, 2007.
Program committee member, 3rd Workshop on Real, Large Distributed Systems (WORLDS ’06), Seattle, WA, November 5, 2006.
Program Co-chair, The Third IEEE Workshop on Embedded Networked Sensors (EmNets 2006), Cambridge, MA, May 30-31, 2006.
Program committee member, International Workshop on Wearable and Implantable Body Sensor Networks (BSN’06), Cambridge, MA, April 3-5, 2006.
Program committee member, 2006 European Workshop on Wireless Sensor Networks (EWSN’06) Zurich, Switzerland, February 13-15, 2006.
Program committee member, 5th International Symposium on Information Processing in Sensor Networks (IPSN 2006), Nashville, TN, April 19-21, 2006.
Program committee member, 3rd Symposium on Networked Systems Design and Implementation (NSDI’06), San Jose, CA, May 8-10, 2006.
Editorial board member, Concurrency and Computation: Practice and Experience, journal published by John Wiley and Sons, 2001–2005. Geoffrey C. Fox and Anthony J. G. Hey, editors-in-chief.
Program committee member, 2nd International VLDB Workshop on Data Management for Sensor Networks (DMSN’05), Trondheim, Norway, August 29, 2005.
Program committee member, 3rd ACM Conference on Embedded Networked Sensor Systems (SenSys’05), San Diego, CA, November 2-4, 2005.
Program vice-chair (systems track), Distributed Computing in Sensor Systems (DCOSS), Marina del Rey, CA, June 30-July 1, 2005.
Program committee member, 14th International World Wide Web Conference (WWW 2005), Chiba, Japan, May 10-14, 2005.
Program committee member, Workshop on Sensors, Platforms and Tools for Networked Embedded Systems (SPOTS’05), Los Angeles, CA, April 24-27, 2005.

Program committee member, International Workshop on Data Management for Sensor Networks (DMSN 2004), Toronto, Canada, August 30, 2004.
Program committee member, 6th Symposium on Operating Systems Design and Implementation (OSDI 2004), San Francisco, CA, December 6-8, 2004.
Program committee member, 24th International Conference on Distributed Computing Systems (ICDCS 2004), Tokyo, Japan, March 23-26, 2004.
Program committee member, Third USENIX Virtual Machine Research and Technology Symposium (VM'04), San Jose, CA, May 6-7, 2004.
Program committee member, Joint ACM Java Grande/ISCOPE 2002 Conference, Seattle, WA, November 3-5, 2002.
Program committee member, Second USENIX Java Virtual Machine Research and Technology Symposium (JVM '02). San Francisco, CA, August 1-2, 2002.
Program committee member, IEEE International Symposium on Cluster Computing and the Grid (CCGrid 2002), Berlin, May 22-24, 2002.
Program committee member, Joint ACM Java Grande/ISCOPE 2001 Conference, Palo Alto, CA, June 2-4, 2001.
Work-in-Progress session chair and program committee member, USENIX Java Virtual Machine Research and Technology Symposium (JVM '01), Monterey, CA, April 23-24, 2001.
Expert Group Member, Sun Java Community Process, "New I/O APIs for the Java Platform" (JSR- 51), 2000-2001. Defined a new set of I/O interfaces for Java, which are included in v1.4 of the Java Development Kit (JDK).

Honors and Awards

Most Influential PLDI Paper Award, 2013, for "The nesC Language: A Holistic Approach to Networked Embedded Systems."

Selected for DARPA Computer Science Study Group, 2010.

Best paper award, SIGCOMM 2009, "White Space Networking with Wi-Fi like Connectivity."

IBM Faculty Award, 2009.

Finalist, Microsoft New Faculty Fellowship, 2006.

National Science Foundation CAREER Award, 2006-2010.

Best paper awarded out of all 2001 Journal of Computer Networks papers: "The Ninja Architecture for Robust Internet-Scale Systems and Services." Journal of Computer Networks, Volume 35, Issue 4, March 2001.

National Science Foundation Graduate Research Fellowship, 1997-2000.