

HONGWEI ZHANG

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Research Interests

- ◇ Areas:
 - *Wireless cyber-physical systems*: real-time wireless networking, cross-layer optimization of wireless networking and networked control
 - *Wireless, vehicular, embedded, and sensor networks*: interference-oriented networking, predictable QoS, mobility, application-adaptivity, architecture, data storage and processing
 - *Dependable networked and distributed systems*: dependable middleware, fault-tolerant network protocols, fault containment, self-stabilization, security
 - ◇ Methodology:
 - *Science and engineering of experimentation*: testbeds, simulators, measurement-based modeling and analysis, resource management in federated networking and computing infrastructures
 - *Theory*: control theory, optimization, mathematical modeling, formal methods
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Education

- ◇ *Ph.D.*, Computer Science & Engineering, The Ohio State University, August 2006
 - ◇ *M.S.*, Computer Engineering, Chongqing University, China, June 2000
 - ◇ *B.S.*, Computer Engineering, Chongqing University, China, June 1997
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Experience

- ◇ *Assistant Professor*, Wayne State University, January 2007 -
 - ◇ *Instructor*, Wayne State University, August 2006 - December 2006
 - ◇ *Research Intern*, Motorola Labs, June - September 2005
 - ◇ *Graduate Research Associate*, The Ohio State University, September 2001 - August 2006
 - ◇ *Graduate Fellow*, The Ohio State University, September 2000 - August 2001
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Honors & Awards

- ◇ National Science Foundation (NSF) CAREER Award, 2011
- ◇ Spotlight Paper of the November 2010 issue of the IEEE Transactions on Mobile Computing, 2010
- ◇ Best Paper Candidate, IEEE International Conference on Network Protocols (ICNP), 2010
- ◇ Excellence in Teaching Award, College of Liberal Arts and Sciences, Wayne State University, 2009
- ◇ Outstanding Research Award, Department of Computer Science and Engineering, The Ohio State University, 2006
- ◇ Graduate Fellow, The Ohio State University, 2000
- ◇ Honorable Mention in the International Mathematical Contest in Modeling, USA, 1997

- ◇ Distinguished Graduates of Sichuan Province, China, 1997
 - ◇ Certificate of Software Engineer, Bureau of Computer Software Engineer Qualification Test, China, 1996
 - ◇ Second Prize in the National Mathematical Contest in Modeling, China, 1995
 - ◇ Distinguished Students, Chongqing University, China, 1993 - 1997
 - ◇ Scholarships:
 - BIRS/MSRI Scholarship, International Workshop on Self-stabilizing Distributed Systems, 2004
 - SIEMENS Prize, SIEMENS Ltd., Germany, 1998
 - IDG China Computer-World Scholarship, 1997
 - Longfuhang Scholarship, Longfuhang Ltd., Taiwan, 1996
 - Baoshan Scholarship for Distinguished Students, Shanghai Baoshan Ltd., China, 1995
 - Highest-Rank Scholarship for Outstanding Students, Chongqing University, China, 1993 - 1997
 - ◇ Honor Societies:
 - Phi Kappa Phi, Upsilon Pi Epsilon
 - Inclusion in *Biltmore Who's Who Among Executives and Professionals*: 2011
 - Inclusion in *Madison Who's Who Among Executives and Professionals*, 2010
 - Inclusion in *Man of The Year in Education*, American Biographical Institute, 2009
 - Inclusion in *Cambridge Who's Who*, 2008
 - Inclusion in *AcademicKeys Who's Who in Sciences Higher Education*, 2008
 - Inclusion in *Strathmore's Who's Who*, 2007
 - Inclusion in *Marquis Who's Who in Science and Engineering*, 2006
 - Inclusion in *Marquis Who's Who in America*, 2005
 - Member of SIEMENS International Student Circle, SIEMENS Ltd., Germany, 1999
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Funding

External Funding:

Summary statistics:

- 5 NSF awards (including a CAREER Award), 2 industry awards, 1 foundation award
- Total project funding: \$3,008,205
- Zhang's share: \$1,296,095, 3 WiMAX base stations, 1 GENI rack server
- ◇ PI, *A Cross-Layer Approach to Taming Cyber-Physical Uncertainties in Vehicular Wireless Networking and Platoon Control*, NSF CPS program (medium size), 09/01/2011 - 08/31/2014; Co-PIs: Le Yi Wang, George Yin; Funding: \$900,000, Zhang's share:\$370,016
- ◇ PI, *Taming Uncertainties in Reliable, Real-Time Messaging for Wireless Networked Sensing and Control*, NSF CAREER program, 09/01/2011 - 08/31/2016; Funding: \$425,000 + WSU cost share of \$134,876
- ◇ PI, *WiMAX Prototyping in Metro Detroit: Integrating GENI Engineering with Wireless Network Applications and Science*, NSF GENI program, 10/01/2011 - 09/31/2014; Co-PIs: TJ Giuli, Jing Zhu, Xiangying Yang, Patrick Gossman; Total funding: \$298,890 + WiMAX base stations + in-kind from Ford, Intel, and CTN, Zhang's share: \$298,890 + three WiMAX base stations
- ◇ Senior Personnel, *Network-Agile Multi-Provisioned Infrastructure for GENI and ExoGENI*, NSF GENI program, 10/01/2011 - 09/31/2014; PIs: Ilija Baldine, Jeff Chase; Zhang's share: 1 GENI rack server

- ◇ Co-PI (PI from WSU), *GENI-fying and Federating Autonomous Kansei Wireless Sensor Networks*, **NSF** GENI program, 10/01/2008 - 09/31/2011; PI: Anish Arora, Co-PIs: Rajiv Ramnath, Vipul Gupta, Sami Ayyorgun; Total funding: \$500,000, Zhang's share: \$127,874
- ◇ PI, *Heterogeneous Wireless Connectivity Module for Urban Telematics Systems*, **GM Research**, 08/01/2011 - 03/31/2012; Funding: \$59,841
- ◇ PI, *Vehicular Networking for Connected Caravanning*, **Ford Research**, 12/02/2010 - 05/18/2011; Funding: \$14,474
- ◇ Senior Personnel (consulting on sensor and wireless mesh networking), *Detroit Connected Community Initiative*, **Knight Foundation** Digital Opportunity Challenge Grant, 12/01/2009 - 12/31/2011; Total funding: \$810,000 for systems and service cost in establishing two Internet-connected wireless mesh communities in Detroit; Zhang's work is voluntary in this project

Wayne State University Internal Funding:

- ◇ PI, *Portable Wireless Platforms for Hands-on Learning of Computer Networks, Distributed Systems and Embedded Systems*, **Wayne State University** Omnibus Education Fund, 2011; Funding: \$7,330
- ◇ PI, *Intelligent Sensing and Wireless Networking for Smart Energy Grids with Alternative-Energy Sources*, **Wayne State University** Faculty GRA Competition, 2010; Co-PI: Caisheng Wang, Feng Lin; Funding: ~\$30,000
- ◇ PI, *Predictable Wireless Networking for Vehicular Cyber-Physical Systems*, **Wayne State University** Faculty Research Grant, 2009; Funding: \$10,000
- ◇ Co-PI, *Hierarchical and Distributed Control for Alternative-Energy Cyber-Physical Systems*, **Wayne State University** Faculty GRA Competition, 2009; PI: Caisheng Wang, Co-PI: Feng Lin; Funding: ~\$30,000
- ◇ PI, *Dependable Messaging in Wireless Sensor networks*, **Wayne State University** Faculty Setup Fund, 2006-2010; Funding: \$220,000

Impact Statistics of Publications

- ◇ By *Harzing's Publish or Perish* software which uses data from Google Scholar:
 - Citation: 1,531+
 - h-index: 16+
 - g-index: 39+
- ◇ Our findings on data-driven link estimation and routing in multi-hop wireless networks have been widely accepted and impacted systems practice; for instance, the default TinyOS routing protocol (i.e., Collection Tree Protocol) incorporates the idea of data-driven link estimation.

Journal Papers

- ◇ Qiao Xiang, Hongwei Zhang, Jinhong Xu, Xiaohui Liu, Loren J. Rittle, "When In-Network Processing Meets Time: Complexity and Effects of Joint Optimization in Wireless Sensor Networks", *IEEE Transactions on Mobile Computing (TMC)*, 10(10), October 2011 (A short version appeared in *IEEE RTSS* 2009)
- ◇ Hongwei Zhang, "Experimental Analysis of Link Estimation Methods in Low Power Wireless Networks", *Tsinghua Science and Technology (Elsevier/Tsinghua)*, special issue on "Wireless Mobile Computing and Networking", 16(5), October 2011 (Invited paper; a short version appeared in *WASA* 2011)

- ◇ Hongwei Zhang, Lifeng Sang, Anish Arora, “Comparison of Data-driven Link Estimation Methods in Low-power Wireless Networks”, *IEEE Transactions on Mobile Computing (TMC)*, 9(11), November 2010 (A short version appeared in *IEEE SECON* 2009) (**Spotlight Paper of the November 2010 issue of TMC**)
- ◇ Lifeng Sang, Anish Arora, Hongwei Zhang, “On Link Asymmetry and One-way Estimation in Wireless Sensor Networks”, *ACM Transactions on Sensor Networks*, 6(2), February 2010
- ◇ Hongwei Zhang, Lifeng Sang, Anish Arora, “On the Convergence and Stability of Data-driven Link Estimation and Routing in Sensor Networks”, *ACM Transactions on Autonomous and Adaptive Systems*, special issue on ”Self-adaptive and Self-organizing Wireless Networking Systems”, 4(3), July 2009 (Acceptance rate: 10% = 4/40; A short version appeared in *WICON* 2008)
- ◇ Hongwei Zhang, Anish Arora, Prasun Sinha, “Link Estimation and Routing in Sensor Network Backbones: Beacon-based or Data-driven?”, *IEEE Transactions on Mobile Computing*, 8(5), May 2009 (A short version appeared in *IEEE INFOCOM* 2006.)
- ◇ Hongwei Zhang, Anish Arora, Young-ri Choi, Mohamed Gouda, “Reliable Bursty Converge-cast in Wireless Sensor Networks”, *Computer Communications (Elsevier)*, special issue on ”Sensor-Actuator Networks”, 30(13), September 2007 (Acceptance rate: 20%; A short version appeared in *ACM MobiHoc* 2005.)
- ◇ Vinayak Naik, Anish Arora, Prasun Sinha, Hongwei Zhang, “Sprinkler: A Reliable and Energy Efficient Data Dissemination Service for Extreme Scale Wireless Networks of Embedded Devices”, *IEEE Transactions on Mobile Computing*, 6(7):762-776, July 2007 (A short version appeared in *IEEE RTSS* 2005.)
- ◇ Hongwei Zhang, Anish Arora, “Guaranteed Fault Containment and Local Stabilization in Routing”, *Computer Networks (Elsevier)*, 50(18):3585-3607, December 2006
- ◇ Anish Arora, Hongwei Zhang, “LSRP: Local Stabilization in Shortest Path Routing”, *IEEE/ACM Transactions on Networking*, 14(3):520-531, June 2006 (Authors in alphabetic order; a short version appeared in *IEEE-IFIP DSN* 2003.)
- ◇ Young-ri Choi, Mohamed Gouda, Hongwei Zhang, Anish Arora, “Stabilization of Grid Routing in Sensor Networks”, *AIAA Journal of Aerospace Computing, Information, and Communication*, 3:214-233, May 2006
- ◇ A. Arora, P. Dutta, S. Bapat, V. Kulathumani, Hongwei Zhang, V. Naik, V. Mittal, H. Cao, M. Demirbas, M. Gouda, Y. R. Choi, T. Herman, S. Kulkarni, U. Arumugam, Mikhail Nesterenko, A. Vora, M. Miyashita, “A Line in the Sand: A Wireless Sensor Network for Target Detection, Classification, and Tracking”, *Computer Networks (Elsevier)*, 46(5):605-634, December 2004 (**Second most downloaded paper of the year**)
- ◇ Hongwei Zhang, Anish Arora, “GS³: Scalable Self-configuration and Self-healing in Wireless Sensor Networks”, *Computer Networks (Elsevier)*, 43(4):459-480, November 2003 (Acceptance rate: 24% = 6/25; A short version appeared in *ACM PODC* 2002.)
- ◇ Junhui Zhao, Yi-Liang Chen, Zhong Chen, Feng Lin, Caisheng Wang, Hongwei Zhang, “Modeling and Control of Discrete Event Systems Using Finite State Machines with Variables and Their Applications in Power Grids”, *Systems & Control Letters (Elsevier)*, to appear
- ◇ Xi Ju, Hongwei Zhang, Divya Sakamuri, “NetEye: A User-Centered Wireless Sensor Network Testbed for High-Fidelity, Robust Experimentation”, *International Journal of Communication Systems (Wiley)*, to appear

Conference Papers

- ◇ Feng Lin, Michael Polis, Caisheng Wang, Le Yi Wang, Hongwei Zhang, “Hierarchical Control and Management of Virtual Microgrids for Vehicle Electrification”, *IEEE Transportation Electrification Conference and Expo (ITEC)*, 2012
- ◇ Xin Che, Xi Ju, Hongwei Zhang, “The Case for Addressing the Limiting Impact of Interference on Wireless Scheduling”, *19th IEEE International Conference on Network Protocols (ICNP)*, 2011 (Acceptance rate: 16% = 31/189)
- ◇ Jun Huang, Shucheng Liu, Guoliang Xing, Hongwei Zhang, Jianping Wang, Liusheng Huang, “Accuracy-Aware Interference Modeling and Measurement in Wireless Sensor Networks”, *31st IEEE International Conference on Distributed Computing Systems (ICDCS)*, 2011 (Acceptance rate: 15%)
- ◇ Hongwei Zhang, “Experimental Analysis of Link Estimation Methods in Low Power Wireless Networks”, *6th International Conference on Wireless Algorithms, Systems, and Applications (WASA)*, 2011 (Review scores: 5, 5, 4 out of 5)
- ◇ Junhui Zhao, Zhong Chen, Feng Lin, Caisheng Wang, Hongwei Zhang, “Safety Control of PHEVs in Distribution Networks Using Finite State Machines with Variables”, *North American Power Symposium (NAPS)*, 2011
- ◇ Shucheng Liu, Guoliang Xing, Hongwei Zhang, Jianping Wang, Jun Huang, Mo Sha, Liusheng Huang, “Passive Interference Measurement in Wireless Sensor Networks”, *18th IEEE International Conference on Network Protocols (ICNP)*, 2010 (Acceptance rate: 18.2% = 31/170) (**Best Paper Candidate**, 6 out of 170 submissions)
- ◇ Xin Che, Xiaohui Liu, Xi Ju, Hongwei Zhang, “Adaptive Instantiation of the Protocol Interference Model in Mission-Critical Wireless Networks”, *7th IEEE Communications Society Conference on Sensor, Mesh and Ad Hoc Communications and Networks (SECON)*, 2010 (Acceptance rate: 21% = 63/300)
- ◇ Mukundan Sridharan, Wenjie Zeng, William Leal, Xi Ju, Rajiv Ramnath, Hongwei Zhang, Anish Arora, “From Kansei to KanseiGenie: Architecture of Federated, Programmable Wireless Sensor Fabrics”, *6th International Conference on Testbeds and Infrastructures for the Development of Networks and Communities (TridentCom)*, 2010
- ◇ Qiao Xiang, Jinhong Xu, Xiaohui Liu, Hongwei Zhang, Loren J. Rittle, “When In-Network Processing Meets Time: Complexity and Effects of Joint Optimization in Wireless Sensor Networks”, *30th IEEE Real-Time Systems Symposium (RTSS)*, 2009 (Acceptance rate: <20%)
- ◇ Hongwei Zhang, Lifeng Sang, Anish Arora, “Comparison of Data-driven Link Estimation Methods in Low-power Wireless Networks”, *6th IEEE Communications Society Conference on Sensor, Mesh and Ad Hoc Communications and Networks (SECON)*, 2009 (Review scores: 5, 5, 4 out of 5; Acceptance rate: 18.8% = 81/431)
- ◇ Hongwei Zhang, Lifeng Sang, Anish Arora, “On Biased Link Sampling in Data-driven Link Estimation and Routing in Low-power Wireless Networks”, 4th International Wireless Internet Conference (WICON), 2008 (invited paper)
- ◇ Lifeng Sang, Anish Arora, Hongwei Zhang, “On Exploiting Asymmetric Wireless Links via One-way Estimation”, *8th ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc)*, 2007 (Acceptance rate: 18% = 27/146)
- ◇ Hongwei Zhang, Anish Arora, Prasun Sinha, “Learn on the Fly: Data-driven Link Estimation and Routing in Sensor Network Backbones”, *25th IEEE International Conference on Computer Communications (INFOCOM)*, 2006 (Acceptance rate: 18% = 252/1400)

- ◇ E. Ertin, A. Arora, R. Ramnath, M. Nesterenko, V. Naik, S. Bapat, V. Kulathumani, M. Sridharan, Hongwei Zhang, H. Cao, “Kansei: A Testbed for Sensing at Scale”, *5th IEEE/ACM International Conference on Information Processing in Sensor Networks, Special Track on Platform Tools and Design Methods for Network Embedded Sensors (IPSN/SPOTS)*, 2006
- ◇ Hongwei Zhang, Anish Arora, Young-ri Choi, Mohamed Gouda, “Reliable Bursty Converge-cast in Wireless Sensor Networks”, *6th ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc)*, 2005 (Review scores: 4, 4, 4 out of 5; Acceptance rate: 14% = 40/281)
- ◇ Vinayak Naik, Anish Arora, Prasun Sinha, Hongwei Zhang, “Sprinkler: A Reliable Data Dissemination Service for Wireless Embedded Devices”, *26th IEEE Real-Time Systems Symposium (RTSS)*, 2005
- ◇ A. Arora, R. Ramnath, E. Ertin, P. Sinha, S. Bapat, V. Naik, V. Kulathumani, Hongwei Zhang, H. Cao, M. Sridhara, S. Kumar, N. Seddon, C. Anderson, T. Herman, N. Trivedi, C. Zhang, M. Gouda, Y. R. Choi, M. Nesterenko, R. Shah, S. Kulkarni, M. Aramugam, L. Wang, D. Culler, P. Dutta, C. Sharp, G. Tolle, M. Grimmer, B. Ferriera, K. Parker, “ExScal: Elements of an Extreme Scale Wireless Sensor Networks”, *11th IEEE International Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA)*, 2005
- ◇ Hongwei Zhang, Anish Arora, Zhijun Liu, “A Stability-oriented Approach to Improving BGP Convergence”, *23rd IEEE Symposium on Reliable Distributed Systems (SRDS)*, 2004 (Acceptance rate: 23%)
- ◇ Anish Arora, Hongwei Zhang, “LSRP: Local Stabilization in Shortest Path Routing”, *IEEE-IFIP International Conference on Dependable Systems and Networks (DSN)*, 2003 (Review scores: 5, 4, 4 out of 5; Acceptance rate: 21%)
- ◇ Hongwei Zhang, Anish Arora, “GS³: Scalable Self-configuration and Self-healing in Wireless Networks”, *21st ACM Symposium on Principles of Distributed Computing (PODC)*, 2002 (Acceptance rate: 29%)
- ◇ Hongwei Zhang, Arjan Durresi, “Differentiated Multi-Layer Survivability in IP/WDM Networks”, *8th IEEE-IFIP Network Operations and Management Symposium (NOMS)*, 2002 (Acceptance rate: 32%)

Workshop & Short Conference Papers

- ◇ Xi Ju, Hongwei Zhang, Wenjie Zeng, Mukundan Sridharan, Jing Li, Anish Arora, Rajiv Ramnath, Yufeng Xin, “LENS: Resource Specification for Wireless Sensor Network Experimentation Infrastructures”, *6th ACM International Workshop on Wireless Network Testbeds, Experimental evaluation and Characterization (WiNTECH)* (in conjunction with ACM MobiCom’11), 2011
- ◇ Xiaohui Liu, Hongwei Zhang, Qiao Xiang, “Towards Predictable Real-Time Routing for Wireless Networked Sensing and Control”, *Cyber-Physical-Systems (CPS) Week Workshop on Real-Time Wireless for Industrial Applications (RealWin)*, 2011
- ◇ Hongwei Zhang, “Taming Uncertainties in Wireless Messaging for Automotive Cyber-Physical Systems”, *NSF/USCAR Workshop for Developing Dependable and Secure Automotive Cyber-Physical Systems from Components*, 2011
- ◇ Hongwei Zhang, “Invisible Networking for Connected Vehicles”, *NSF/NASA Workshop on Highly Controllable Dynamic Heterogeneous Networking*, 2011

- ◇ Hongwei Zhang, “Predictable Messaging in Wireless Automotive CPS”, *NITRD/NSF National Workshop on Research on Transportation Cyber-Physical Systems: Automotive, Aviation, and Rail*, 2008
 - ◇ Vinayak Naik, Emre Ertin, Hongwei Zhang, Anish Arora, “Wireless Testbed Bonsai”, *2nd International Workshop on Wireless Network Measurement (WinMee)*, 2006
 - ◇ Hongwei Zhang, Anish Arora, “Brief Announcement: Continuous Containment and Local Stabilization in Path-vector Routing”, *24th ACM Symposium on Principles of Distributed Computing (PODC)*, 2005 (Acceptance rate: 22%)
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- Book**
- ◇ Hongwei Zhang, “Dependable Messaging in Wireless Sensor Networks”, VDM Publishing House Ltd., Germany, 2009. ISBN-NR: 978-3-639-11031-9 (Based on the author’s Ph.D. dissertation)
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- Book Chapters**
- ◇ Mukundan Sridharan, Wenjie Zeng, William Leal, Xi Ju, Rajiv Ramnath, Hongwei Zhang, Anish Arora, “KanseiGenie: Software Infrastructure for Resource Management and Programmability of Wireless Sensor Network Fabrics”, *Next Generation Internet Architectures and Protocols*, Krishna Moorthy Sivalingam et al. (editors), Springer, 2011
 - ◇ Hongwei Zhang, Vinayak Naik, “Data Transport Control in Wireless Sensor Networks”, *Handbook of Wireless Ad Hoc and Sensor Networks*, Sudip Misra, Isaac Woungang, and Subhas C. Misra (editors), Springer, 2009
 - ◇ Divya Sakamuri, Hongwei Zhang, “Elements of Sensornet Testbed Design”, *Handbook of Sensor Networks*, Yang Xiao, Hui Chen, and Frank H. Li (editors), World Scientific Publishing Co, 2009
 - ◇ Hongwei Zhang, Anish Arora, Prasun Sinha, Loren J. Rittle, “Messaging in Sensor Networks: Addressing Wireless Communications and Application Diversity”, *Handbook of Real-Time and Embedded Systems*, Insup Lee, Joe Leung, and Sang Son (editors), CRC Press, 2007
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- Posters**
- ◇ Anish Arora, Rajiv Ramnath, Hongwei Zhang, Vipul Gupta, Sami Ayyorgun, Mukundan Sridharan, Wenjie Zeng, Xi Ju, “Kansei Genie: Federated Sensing Platforms”, 3rd NSF GENI Engineering Conference, 2008
 - ◇ Hongwei Zhang, Lifeng Sang, Anish Arora, Unraveling the Subtleties of Link Estimation and Routing in Wireless Sensor Networks, ACM SIGCOMM, 2008
 - ◇ Anish Arora, Prasun Sinha, Emre Ertin, Vinayak Naik, Hongwei Zhang, Mukundan Sridhara, Sandip Bapat, “ExScal Backbone Network Architecture”, *3rd ACM/USENIX International Conference on Mobile Systems, Applications, and Services (MobiSys)*, 2005
 - ◇ Anish Arora, Rajiv Ramnath, Emre Ertin, Prasun Sinha, Sandip Bapat, Vinayak Naik, Vinod Kulathumani, Hongwei Zhang, et al., “Project ExScal”, *International Conference on Distributed Computing in Sensor Systems (DCOSS)*, 2005
 - ◇ Anish Arora, Emre Ertin, Rajiv Ramnath, Vinayak Naik, Sandip Bapat, Hongwei Zhang, Chris Anderson, Gavin Fox, John Wieseman, “Kansei: Sensor Network Testbed for At-Scale Experiments”, *2nd TinyOS Technology Exchange*, 2005
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- Other Publications**
- ◇ Hongwei Zhang, “Dependable Messaging in Wireless Sensor Networks”, *Ph.D. dissertation, The Ohio State University, USA*, 2006

- ◇ Hongwei Zhang, “An Engineering Network Security Model”, *Master thesis, Chongqing University, China*, 2000
 - ◇ Hongwei Zhang, “Efficient Database Transactions in Large Scale Networked Systems”, *Journal of Computer Applications, Chinese Computer Federation*, August 1999
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- Papers Under Review**
- ◇ Xin Che, Hongwei Zhang, Xiaohui Liu, Xi Ju, “Adaptive Instantiation of the Protocol Interference Model in Mission-Critical Wireless Networks”, *ACM Transactions on Sensor Networks*
 - ◇ Xin Che, Hongwei Zhang, Xi Ju, “The Case for Addressing the Limiting Impact of Interference on Wireless Scheduling”, *IEEE/ACM Transactions on Networking*
 - ◇ Xiaohui Liu, Hongwei Zhang, Qiao Xiang, ”Taming Uncertainties in Real-Time Routing for Wireless Networked Sensing and Control”, *ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc)*, 2012
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- Patent**
- ◇ Loren J. Rittle, Hongwei Zhang, “A System for Application-Driven Packing and Scheduling of Information Elements in a Multi-Hop Wireless Sensor Network”, *US patent #20070268127* (pending)
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- Systems Developed or In Development**
- ◇ *GENI WiMAX Network for Wireless Cyber-Physical Systems and Vehicular Networking*
Wayne State University, Ford Research, Intel Labs, Community Telecommunications Network, 2011 - present

WiMAX represents a latest broadband wireless access technology that employs cutting-edge wireless communication techniques such as MIMO and OFDMA, and it serves as a basic platform for evaluating broadband wireless access in real-world settings. WiMAX is expected to play a major role in areas such as smart grid, smart transportation, vehicular infotainment, and community Internet access. Towards building an experimental infrastructure for research, education, and application exploration, we are deploying a multi-sector/cell WiMAX network in Metro Detroit which supports handoff, virtualization, and scientific measurement. The WiMAX network will be connected via VLAN to the GENI backbone network. We are also developing and deploying a WiMAX mobile station platform that supports scientific measurement as well as application exploration. This GENI WiMAX network is expected to enable research, education, and application exploration in smart transportation, smart grid, wireless networked sensing and control, and community services.

- ◇ *KanseiGenie: Federated Autonomous Wireless Sensor Networks*
Ohio State University, Wayne State University, LANL, SUN Microsystems, ETRI, 2008 - present

KanseiGenie provides researchers with programmability, virtualization, and slice-based experimentation on federated, autonomous wireless sensor network (WSN) infrastructures. The federated *Kansei* and *NetEye* testbeds have been operational for over two years, and we also expect to federate with other testbeds from US, India, and China which have different sensing and wireless networking technologies.

These KanseiGenie experimentation infrastructures provide a rich set of features for researchers, including: (1) an integrated researcher portal that allows authenticated users to interact with a wide range of WSN fabrics such as XSM, TelosB, Stargate, and laptop arrays;

(2) support for both web-based and programmatic interactions, such as experiment scheduling and results retrieval; (3) a scripting environment for composing long-running, complex, and/or phased experiments; and (4) the *KanseiGenie Doctor* which periodically measures the number of available nodes, their health, radio link quality, and other relevant networking metrics.

◇ *NetEye: Networked Embedded Sensing Testbed*

Wayne State University, Detroit, Michigan, USA, 2008 - present

NetEye consists of 130 TelosBs (with IEEE 802.15.4 radios), 46 eMotes (with IEEE 802.15.4 radios), 15 Dell Vostro laptops (with IEEE 802.11 b/g radios), and one compute server which are deployed in the Maccabees Building — the Computer Science building at Wayne State University. In addition to providing a local facility for supporting research and educational activities, NetEye is federated with Kansei as a part of the KanseiGenie consortium; KanseiGenie consortium is initiated to enable experimentation across shared, widely distributed sensor network testbeds at organizations such as Wayne State University, The Ohio State University, Los Alamos National Laboratory, and ETRI, Korea. NetEye and the KanseiGenie consortium are implemented to be interoperable with NSF GENI (i.e., Global Environment for Network Innovations), and have been incorporated into the national GENI facility. NetEye also provides live sensing data (e.g., environmental noise, temperature, and humidity) that can be used to drive experimentations and to provide useful information about occupational health in urban universities.

◇ *Application-adaptive Messaging for Wireless Sensor Networks*

Motorola Labs, Schaumburg, Illinois, USA, August 2005

As a research intern at Motorola Labs, I proposed an architectural and algorithmic framework for application-adaptive messaging. Taking into account application properties (e.g., traffic and data correlation patterns) in network structuring and scheduling, application-adaptive messaging significantly improves network performance (e.g., packet delivery reliability and energy efficiency).

Using a testbed of Tmote Sky sensor nodes with light sensors, the experiment demonstrated the feasibility and benefits of my proposal. For the experiment, I implemented my proposal in TinyOS/Maté; I also implemented a GUI interface which presented the packet delivery performance and the sensing state in the network.

◇ *ExScal: Extreme Scale Wireless Sensor Networking*

DARPA Networked Embedded Systems Technology (NEST) field demonstration

Avon Park, Florida, USA, December 2004

The experiment demonstrated the scalability of our system software on the largest sensor network ever deployed at its time: 985 XSM motes, 203 MICA2 motes, and 203 Stargates were deployed in an area of 1,260 meters by 288 meters. We successfully demonstrated target detection, classification, and tracking in this large-scale sensor network.

My major responsibilities in the project were twofold. Firstly, to provide real-time and reliable data transport over the IEEE 802.11b mesh network of the 203 Stargates, I studied the IEEE 802.11b link properties (e.g., MAC transmission time and reliability) in the presence of bursty event traffic, and accordingly I designed and implemented a data-driven link estimation and routing protocol *Learn On The Fly* (LOF). Instead of using beacon packets, LOF estimates link properties based on data traffic itself. Since it models the network state in the presence of data traffic, LOF chooses routes that incur shorter delay and less energy

consumption than those chosen by beacon-based protocols (e.g., those using beacon-based ETX metric). The paradigm of data-driven link estimation has been incorporated into the default TinyOS routing protocol CTP (i.e., Collection Tree Protocol). Secondly, to reduce channel contention and to balance load at the XSM mote network, I assisted in designing the routing protocol *Logical Grid Routing* (LGR).

◇ *A Line in the Sand: A Wireless Sensor Network for Target Detection, Classification, and Tracking*

DARPA NEST field demonstration

MacDill Air Force base, Florida, USA, August 2003

The experiment demonstrated the potential of sensor networks for unattended ground sensing over a large, distributed region. More specifically, we showcased how to detect, classify, and track various types of objects (such as persons and cars) using 90 MICA2 motes.

My major responsibility in the project was designing and implementing mechanisms to transport, reliably and in real-time, large bursts of data packets from different network locations to a base station (one major technical challenge of the project). With existing messaging services, only 50% data were successfully delivered and packet delivery was also significantly delayed, which was insufficient for supporting application logic. To tackle this challenge, I studied the limitations of existing transport control techniques, and I designed a new protocol *Reliable Bursty Convergecast* (RBC): to alleviate retransmission-incurred channel contention, I introduced differentiated contention control; to improve channel utilization and to reduce ack-loss, I designed a window-less block acknowledgment scheme that guarantees continuous packet forwarding (regardless of packet as well as ack loss) and replicates the acknowledgment for a packet. Moreover, I designed mechanisms to handle varying ack-delay and to reduce delay in timer-based retransmissions. With RBC, 96% data were successfully delivered in real-time such that the network goodput was close to optimal.

◇ *Kansei: Sensor Network Testbed for At-Scale Experiments*

The Ohio State University, USA, 2004 - 2006

Consisting of 210 XSM motes, 500 TelosB motes, and 210 Stargates, Kansei provides a testbed infrastructure to conduct large scale experiments with both IEEE 802.11 and mote networks.

My involvement in building Kansei has been (1) designing the 210-node 802.11 network such that link and network properties in Kansei mimic those outdoor, (2) designing the experiment scheduler to enable flexible and dependable experimentation, and (3) setting up the hardware and software platforms for Kansei. To facilitate high-fidelity wireless network experimentation, in particular, I have studied both indoor and outdoor wireless link properties, and have co-designed the network system (such as signal attenuators and small form-factor omni-directional antennae) to enable high-fidelity experimentation with reconfigurable network setup (e.g., node distribution density, wireless link reliability, etc.).

Invited talks ◇ “From Open-Loop Sensing to Closed-Loop Sensing and Control: Challenges to Embedded Wireless Networking”,

- University of Michigan - Ann Arbor, Ann Arbor, Michigan, October 2011

- University of British Columbia, Vancouver, Canada, October 2011

- Kent State University, Kent, Ohio, October 2011

- University of Michigan - Dearborn, Dearborn, Michigan, September 2011

- Tsinghua University (Beijing), Chinese Academy of Science (Beijing), Chongqing University (Chongqing), China, August 2011
- ◇ “LENS: Language for Embedded Networked Sensing”, 11th NSF GENI Engineering Conference, Denver, Colorado, July 2011
- ◇ “From Open-Loop Sensing to Closed-Loop, Real-Time Sensing and Control: Challenges to Wireless Networking”, Merit Member Conference, Merit Networks, Ann Arbor, Michigan, June 2011
- ◇ “Broadband in Metro Detroit: Smart Grids, Smart Transportation and Smart Community”, NSF/OSTP US Ignite Workshop, National Science Foundation, Arlington, Virginia, May 2011
- ◇ “Towards Predictable Messaging for Mission-Critical Wireless Networked Sensing and Control”, Spring Conference of the IEEE Southeast Michigan, April 2010
- ◇ “Taming Uncertainty and Heterogeneity in Resource Specification for WSN Federations”, 4th NSF GENI Engineering Conference, Raleigh, North Carolina, March 2010
- ◇ “Dependable Messaging in Wireless Cyber-Physical Systems”, Department of Electrical and Computer Engineering, Wayne State University, January 2010
- ◇ “KanseiGenie: Architecture and ORCA Integration”, 4th NSF GENI Engineering Conference, Miami, Florida, April 2009
- ◇ “Messaging in Wireless Cyber-physical Systems: Predictability in an Uncertain World”, GM Research, Warren, MI, November 2008
- ◇ “Messaging in Wireless Cyber-physical Systems: Predictability in an Uncertain World”, Bosch Research, Palo Alto, California, October 2008
- ◇ “Slice Control and Programmability in Wireless Sensor Networks”, 3rd NSF GENI Engineering Conference, Palo Alto, California, October 2008
- ◇ “Federated, Autonomous Kansei Wireless Sensor Networks”, 2nd NSF GENI Engineering Conference, Arlington, Virginia, March 2008
- ◇ “Dependable Messaging in Wireless Sensor Networks”, Merit Member Conference, Merit Networks, Ann Arbor, Michigan, June 2007
- ◇ “On Evolving An Integration Environment: the *Kansei* Consortium”, Microsoft Research Sensor Networks Workshop, Woodinville, Washington, October 2005
- ◇ “Continuous Fault Containment and Local Stabilization in Path-vector Routing”, BIRS/MSRI International Workshop on Self-stabilizing Distributed Systems, Banff, Alberta, Canada, October 2004
- ◇ “A Stability-oriented Approach to Improving BGP convergence”, BIRS/MSRI International Workshop on Self-stabilizing Distributed Systems, Banff, Alberta, Canada, October 2004

Professional Activities

- ◇ Consulting
 - Developing the WiMAX, wireless mesh, and sensor networks of the Detroit Connected Community Initiative (DCCI), 2010 -
- ◇ Session Chair
 - 6th International Conference on Wireless Algorithms, Systems, and Applications (WASA), 2011
 - 7th IEEE Communications Society Conference on Sensor, Mesh and Ad Hoc Communications and Networks (SECON), 2010

- International Workshop on Mobile Device and Urban Sensing (MODUS), 2008
- ◇ Local Arrangements Chair
 - International Symposium on Stabilization, Safety, and Security of Distributed Systems (SSS), 2008
- ◇ Program Committee Member
 - IEEE International Conference on Communications (ICC): 2012, 2010
 - IEEE Global Communications Conference (GLOBECOM): 2012, 2011, 2010, 2008
 - IEEE International Conference on Computer Communications and Networks (ICCCN): 2012 - 2007
 - ACM International Conference on Modeling, Analysis, and Simulation of Wireless and Mobile Systems (MSWiM), 2012
 - IEEE International Conference on Networking, Architecture, and Storage (NAS): 2012, 2011
 - IEEE/ACM International Workshop on Quality of Service (IWQoS): 2012, 2011
 - International Symposium on Stabilization, Safety, and Security of Distributed Systems (SSS), 2012
 - ACM International Workshop on Wireless Network Testbeds, Experimental Evaluation and Characterization (WiNTECH): 2011
 - IEEE Sensor Applications Symposium (SAS): 2011, 2010
 - ACM Symposium on Applied Computing (SAC): 2010
 - ICST International Conference on Broadband Communications, Networks and Systems (BROADNETS): 2010
 - International Conference on Future Computer and Communication (ICFCC): 2010
 - International Conference on Multimedia and Ubiquitous Engineering (MUE): 2010, 2009
 - International Conference on Wireless Access in Vehicular Environments (WAVE): 2009, 2008
 - International Symposium on Stabilization, Safety, and Security of Distributed Systems (SSS): 2009
 - IEEE International Conference on High Performance Computing (HiPC): 2009
 - International Conference on Sensor Technologies and Applications (SENSORCOMM): 2009 - 2007
 - IEEE International Conference on Advanced Information Networking and Applications (AINA): 2009
 - ICST International Conference on Heterogeneous Networking for Quality, Reliability, Security and Robustness (QShine): 2009
 - International Symposium on Innovations and Real-time Applications of Distributed Sensor Networks (IRADSN): 2009
 - IEEE First International Workshop on Generation C Wireless Networks (GenCWINets): 2008
 - ICST International Conference on Scalable Information Systems (INFOSCALE): 2008
 - IEEE International Conference on Ubiquitous Intelligence and Computing (UIC): 2008
 - IEEE International Conference on Distributed Computing in Sensor Systems (DCOSS): 2007
 - International World Wide Web Conference (WWW): 2007
 - International Workshop on Protocols and Algorithms for Reliable and Data Intensive

Sensor Networks (PARIS): 2007

- ◇ Paper Referee
 - *Journals and Magazines:* IEEE/ACM Transactions on Networking, ACM Transactions on Sensor Networks, IEEE Transactions on Mobile Computing, IEEE Transactions on Dependable and Secure Computing, ACM Transactions on Autonomous and Adaptive Systems, IEEE Transactions on Parallel and Distributed Systems, IEEE Transactions on Computers, IEEE Transactions on Vehicular Technology, IEEE Network, IEEE Communications Surveys and Tutorials, Computer Networks (Elsevier), Ad Hoc Networks (Elsevier), Information Processing Letters (Elsevier), Distributed Computing (Springer-Verlag), Journal of Parallel and Distributed Computing (Elsevier), Information Sciences (Elsevier), Theoretical Computer Science (Elsevier), Computer Journal (Oxford), AIAA Journal of Aerospace Computing, Information, and Communication (JACIC), International Journal of Ad Hoc and Ubiquitous Computing (Inderscience), Journal of High Speed Networks, International Journal of Distributed Sensor Networks (IJDSN), International Journal of Information and Computer Security (Inderscience), EURASIP Journal on Advances in Signal Processing
 - *Conferences:* ACM SenSys, ACM PODC, ACM WSNA, IEEE INFOCOM, IEEE ICNP, IEEE DSN, IEEE ICDCS, IEEE SRDS, IEEE RTSS, IEEE SECON, IEEE MASS, IEEE NOMS, IEEE AINA, SSS, WinMee, OPODIS, FSTTCS, TRIDENTCOM, CODES+ISSS
- ◇ Proposal Review Panel Member and Reviewer
 - National Science Foundation (NSF)
 - Department of Homeland Security (DHS)
 - International reviewer for the Romania National Council for Research and Development
- ◇ Member
 - ACM, ACM SIGCOMM, ACM SIGMOBILE, ACM SIGBED, ACM SIGMETRICS
 - IEEE, IEEE Communication Society, IEEE Computer Society
 - USENIX, SAE
 - IEEE Technical Committees on Ad Hoc & Sensor Communications & Networks, Computer Communications, Tactical Communications, Wireless Communications, Internet, Communications Systems Integration & Modeling, Communications Switching & Routing, Communications and Information Security, Communications Software, Multimedia Communications, Wearable Information Systems, Fault Tolerant Computing, Mathematical Foundations of Computing, Security and Privacy

**University
Activities**

- ◇ Member, Academic Technology Advisory Group, Wayne State University, 2011 -
- ◇ Member, Technology Advisory Committee, College of Engineering, 2011 -
- ◇ Chair, Distinguished Lectures Committee, Department of Computer Science, 2011 -
- ◇ Member, Personnel and Salary Committee, Department of Computer Science, 2011 -, 2008 - 2010
- ◇ Member, Graduate Committee, Department of Computer Science, 2008 -
- ◇ Member, Networking Advisory Committee, Department of Computer Science, 2006 - 2011
- ◇ Member, Undergraduate Committee, Department of Computer Science, 2007
- ◇ Member, Equity and Excellence Advisory Committee, Wayne State University, 2007
- ◇ Member, Graduate Professional Scholarship Committee, Graduate School, 2007

- ◇ Member, Scholarship Awards Committee, Department of Computer Science, 2006, 2007
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Educational Activities

- ◇ Undergraduate Teaching
 - Introduction to Computer Networks
- ◇ Graduate Teaching
 - Data Communication and Computer Networks
 - Advanced Computer Networking
 - Broadband Network Architecture
- ◇ Research Advising
 - Current postdoc: Xi Ju
 - Current Ph.D. students: Xin Che, Yu Chen, Chuan Li, Xiaohui Liu, Qiao Xiang
 - Current Master student: Vineeth Rakesh Mohan
 - Graduated: Balaji Palaniswami (Master), Xi Ju (Ph.D.), Bo Mi (Ph.D.), Divya Sakamuri (Master, female), Aparna Radhakrishnan (Master, female)
- ◇ Ph.D. Dissertation Committee
 - Mochan Shrestha, Amal Alhosban (female), Guoxing Zhan, Masud Ahmed (ECE), Sharrukh Zaman, Jiayu Gong (ECE), Musab Al-Hadrusi (ECE), Jianqiang Luo, Peng Quan (Mechanical Engineering), Eyad Hailat, Yong Xi, Safwan Al-Omari
- ◇ Ph.D. Qualifying Exam Committee
 - Amal Alhosban (female), Shinnan Wang, Farhana Dewan (female), Masud Ahmed (ECE), Guoxing Zhan, Sharrukh Zaman, John Cavicchio, Jianqiang Luo, Mochan Shrestha, Eyad Hailat, Tom Carroll
- ◇ Master Thesis Committee
 - Nirodha Abeywardana, Guoxing Zhan, Chenjia Wang, Santhi Movva (female), Brandon Szeliga, Mandeep Kaur (female), Deeksha Ganju (female)
- ◇ Undergraduate Research
 - Marc Rush (UWB networks), Talia Selitsky (female; environmental monitoring sensornets)
- ◇ Education Outreach
 - Wireless sensor network demonstrations (partly based on the NetEye sensor network testbed):
 - 45 students from Cass Tech High School of Detroit, Michigan, January 18, 2012
 - K-12 students from Metro Detroit, “GO-Computing: Gaining Options Through Computing” event, December 10, 2011
 - College students from Shanghai University, China, July, 2011
 - Minority students of the NSF BPC Information Management and Systems Engineering (IMSE) program at Wayne State University: January 22, 2011
 - High-school female students of the “Go-girls Go cyber” event: November 6, 2010, March 27, 2010
 - Avondale Meadows Upper Elementary (in Auburn Hills, MI) students, 2008; Water quality (e.g., pH, turbidity, temperature) monitoring along Clinton River, Auburn Hills, MI; media coverage by Detroit Public TV and Wayne Regional Education Service Agency (RESA).
 - High-school students of International Academy, 2008
 - Pre-major undergraduate students of Wayne State University, 2007

- High-school students of the Dearborn Center for Math, Science and Technology (DCMST), 2006
 - Wireless sensor network lectures:
 - Female college students from North Africa and Middle East, May 23, 2011
 - MBA students of Wayne State University, 2007
 - High-school students of the Dearborn Center for Math, Science and Technology (DCMST), 2006
 - Faculty Judge for Wayne State University Graduate Exhibitions, March 28, 2010
 - Wayne State University Graduate Open House, March 28, 2010
 - Wayne State University Graduate Open House, 2009
 - Wayne State University Scholars Day, 2007
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**Personal
Data**

- ◇ Permanent Resident of USA
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Reference

Available on request.