Parameswaran Ramanathan

Contact Information

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Research Interests

Genome design, Sensor Networks, Wireless and Wireline Networks, Real-time Systems, Fault-Tolerant Computing, Distributed Systems, Parallel Processing, and Computer Architecture.

Education

Ph. D. Computer Science and Engineering, The University of Michigan, Ann Arbor, 1989.

M. S. E. Computer Engineering, The University of Michigan, Ann Arbor, 1986.

B. Tech. Electrical Engineering, Indian Institute of Technology, Bombay, India, 1984.

Present Position

Associate Dean for Graduate Education, Graduate School, University of Wisconsin, Madison, April 2017–present.

Vilas Distinguished Achievement Professor, Department of Electrical and Computer Engineering, University of Wisconsin, Madison, July 2000–present.

- Affiliate appointment in Computer Sciences Department, University of Wisconsin, Madison
- Member of the Executive Committee and faculty trainer in the Genomic Sciences Tranining Program

Previous Positions Held

Chairman, Department of Electrical and Computer Engineering, University of Wisconsin, Madison, July 2005–June 2009.

Director, University of Wisconsin Wireless and Sensor Networks Consortium (WiseNet), 2006–2013.

Consultant, Hewlett Packard Laboratories, Palo Alto, Cailfornia, September 2011–February 2012.

Visiting Researcher, Microsoft Research, Redmond, Washington, May 2011–September 2011.

Visiting Professor, Kanwal Rekhi School of Information Technology, Indian Institute of Technology, Bombay, India, June 2004–Decembr 2004.

Consultant, Telcordia Technologies, Morristown, New Jersey, July 1998–September 2001.

Associate Professor, Department of Electrical and Computer Engineering, University of Wisconsin, Madison, September 1995–June 2000.

Consultant, AT&T Labs, Whippany, New Jersey, September 1997–June 1998.

Assistant Professor, Department of Electrical and Computer Engineering, University of Wisconsin, Madison, September 1989–1995.

Research Associate, Department of Electrical Engineering & Computer Science, The University of Michigan, Ann Arbor, 1988–89.

Research Assistant, Department of Electrical Engineering & Computer Science, The University of Michigan, Ann Arbor, 1984–89.

Summer Internship, Electronics Division, Bhabha Atomic Research Center, Bombay, India, 1983.

Academic Recognition

- Appointed Vilas Distinguished Achievement Professor by University of Wisconsin, Madison, 2018.
- Fellow of Institute of Electrical and Electronics Engineers (IEEE): *For contributions to real-time systems and networks*
- Fellow of the Commitee of Institutional Cooperation (CIC) Academic Leadership Program, 2006–2007.
- Keynote speaker at International Conference on Heterogeneous Networking for Quality, Reliability, Security, and Robustness, November 2010.
- Keynote speaker at the International Conference on Communications Systems and Networks, January 2009.
- Distinguished Achievement Award for outstanding graduate work in Computer Science and Engineering, College of Engineering, The University of Michigan, Ann Arbor, in 1989.
- Rackham Predoctoral Fellowship from the School of Graduate Studies, The University of Michigan, Ann Arbor, 1988-89.
- First prize in Sixth Annual Student VLSI Design Contest for "A VLSI Architecture for Dynamic Routing in HARTS", in 1988.

Research Accomplishments

Recent focus of my research group is in the area of genomic networks. In a collaborative project with faculty in Biochemistry, Chemistry, and Chemical & Biological Engineering, my group is working on developing computational tools for genome foundries and genome-aided biodesign. Ongoing research projects focus on developing computational algorithms for elucidating DNA-protein binding, for optimizing metabolic pathways, and for identifying gene regulatory networks. The longer term focus of my research is on developing the architectures, the protocols, and the mechanisms needed to meet the diverse quality of service requirements of

applications in wireless and wireline networks. One of the research thrusts involves developing communication support for sustaining end-to-end gigabit throughputs to mobile hosts in future Internet. Another thrust involves developing sensing and communication algorithms in millimeter wave networks. In additional to developing the necessary theoretical algorithms, research also involves implementing and experimenting with these algorithms on network testbeds. In the recent past, I have worked extensively on information exchange and collaborative decision making in wireless ad-hoc microsensor networks. I have also worked extensively on providing quality of service (QoS) assurances to applications in next generation cellular, wireless, and wireline networks. I have also published extensively in the area of fault-tolerant computing on problems such as clock synchronization, checkpointing and rollback recovery, memory testing, and resource placement.

Active Extramural Research Grants

- K. Fawaz, D. A. Noyce, P. Ramanathan, S. Ahn, and M. Chitturi, October 2018–September 2022, Federal Highway Administration, $924,297, Harnessing mobile ad hoc networks to improve vulnerable road user safety.
- D. Schafer, J. Linderoth, M. Gleicher, and P. Ramanathan, August 2017–July 2022, National Science Foundation, $973,173, ECR:Assessing Complex Collaborative STEM Learning at Scale with Epistemic Network Analysis.
- A. Sayeed and P. Ramanathan, June 2017–May 2020, National Science Foundation, $660,991, NeTS:SHF:Medium:Collaborative Research: Integrated Design and Optimization of Millimeter-Wave Multi-Beam MIMO Networks for Gigabit Mobile Access.
- A. Z. Ansari and P. Ramanathan, October 2016–September 2020, National Institutes of Health, $1,035,904 (in direct costs), Integrated computational and experimental methods to elucidate DNA-protein binding.
- A. Sayeed and P. Ramanathan, July 2016–June 2019, National Science Foundation, $775,000, II-NEW: A Beamspace Multiple Input Multiple Output (MIMO) Testbed for Centimeter-Wave and Millimeter-Wave Wireless.
- X. Zhang, P. Ramanathan, and D. van der Weide, July 2015–June 2019, National Science Foundation, $899,279, II-NEW: WiMi: A reconfigurable platform for millimeter-wave wireless networking and sensing.

Past Extramural Research Grants

- N.-S. Kim and P. Ramanathan, July 2015–June 2018, National Science Foundation, $99,999, CI-P: Planning simulation infrastructure evaluation for parallel/distributed computer systems.
- X. Zhang and P. Ramanathan, July 2014–June 2015, National Science Foundation, $100,000, CI-P: Reconfigurable Infrastructure for 60 GHz Wireless Communications, Networking and Sensing.
- P. Ramanathan, B. Maas, K.-C. Wang, and J. Pepin, October 2013–September 2016, Raytheon BBN Technologies, $280,000, Experimenting with persistent live video streaming service.
- A. Ansari, P. Ramanathan, J. Reed, and D. C. Schwartz, W. M. Keck Foundation, $1,215,000, Genome foundries and genome-aided biodesign.

- P. Ramanathan and B. C. Lesieutre, October 2013–September 2016, National Science Foundation, $678,376, CPS:Synergy:Preserving the confidentiality of sensitive information in power system models.
- J. Cecil and P. Ramanathan, September 2012-Feburary 2014, National Science Foundation, $300,000, EAGER:Exploring ultrafast networks for training surgeons using virtual reality based environments.
- K.-C. Wang, J. Pepin, and P. Ramanathan, July 2012-June 2014, Raytheon BBN Technologies, $292,120, GENI WiMAX at Clemson and Handover issues in GENI WiMAX.
- P. Ramanathan, $143,088, September 2010–August 2013, National Science Foundation, EAGER: GENI experiments on mobile gigagbit wireless access with core-to-edge network coding.
- S. Banerjee and P. Ramanathan, $395,572, Feb 15, 2011–Feb 14, 2013, National Science Foundation, II-EN: Enhancing a metro-scale vehicular testbed for flexible whitespace networking.
- S. Banerjee and P. Ramanathan, $25,000, July 2010–June 2011, Rockwell Collins, Laboratory-oriented curriculum based on MIMO software radios.
- S. Baneerjee and P. Ramanathan, $481,765, December 2009–December 2011, National Science Foundation, II-EN: A metroscale vehicular wireless testbed with spectrum awareness and spectrum agility.
- S. Banerjee and P. Ramanathan, $30,000, September 2008 – August 2009, Rockwell Collins, Lab-oriented curriculum based on software-defined radions.
- S. Baneerjee and P. Ramanathan, National Science Foundation. $49,050, April 2008 – March 2009, A Virtualized Vehicular Wireless Testbed with Spectrum Agility.
- P. Ramanathan and R. Nowak, National Science Foundation, $500,000, September 2005–August 2009, NeTS-NOSS: Exploiting mobility for information exchange and collaborative decision-making in sensor networks.
- P. Ramanathan, Johnson Controls, $54,000, September 2007– August 2008, Self-organizing sensor networks for HVAC systems.
- P. Ramanathan, Impound Solutions, $40,000, September 2006–December 2006, Database and user interface design for vehicle impound yards.
- P. Ramanathan and S. Megerian, Johnson Controls, $27,000, January 2006–December 2006, Sensor network architecture for HVAC systems.
- P. Ramanathan, Multidisciplinary University Research Initiative (MURI), $381,185, May 2001–April 2006, Emergent Surveillance Plexus: Wireless Networking.
- P. Ramanathan, A. Sayeed, K. K. Saluja, and Y.-H. Hu, DARPA, $935,000, June 2000–September 2003, Location-centric distributed computation and signal processing in microsensor networks.
- B. Van Veen, L. Scharf, R. Agrawal, S. Hagness, P. Ramanathan, A. Sayeed, Z. Popovic, and M. Varanasi, National Science Foundation, $860,000, September 1999–August 2002, Integrated antennas, receivers, and networks for mobile wireless communication.

- P. Ramanathan, Cisco, $32,000, January 2000, Proportional differentiated services.
- P. Ramanathan, USENIX, $16,000, January 2000, BWmeter: Tools for measuring the capacity and load of Internet paths.
- P. Ramanathan, Telcordia Technologies, $40,000, January 1999–December 2000, Research in wireless networking.
- P. Ramanathan, National Science Foundation, $210,000, February 1996–January 2000, Guaranteed performance communications in distributed real-time systems.
- P. Ramanathan, S. Chalasani, and Y.-H. Hu, National Science Foundation, Equipment valued at $188,000, September 1998, Gigabit ATM network kits research technology distribution programs.
- S. Chalasani, P. Ramanathan, R. Agrawal, and Y.-H. Hu, National Science Foundation, $61,280, January 1997-December 1997, Experimental evaluation of real-time multimedia, and parallel computing applications on an ATM-testbed.
- P. Ramanathan, Westell Technologies Inc., $9,350, November 1997-March 1998, Performance analysis of traffic management issues in ADSL systems.
- P. Ramanathan, National Science Foundation, $180,000, January 1993–December 1996, Time-constrained communication in real-time systems with point–to–point interconnection topology.
- K. Saluja, P. Ramanathan, R. Jain, C. Kime, and S. Chalasani, AT&T Foundation, $28,000, September 1992, Laboratory for the reliable and testable design of digital systems.
- J. Moskwa, P. Ramanathan, and C. Kime, Chrysler Motors Corporation, $90,344, September 1991 – December 1992, Redundancy requirements in 4-wheel automotive electric brake system.
- P. Ramanathan, National Science Foundation, $62,500, July 1990 – December 1992, Message passing in distributed real-time systems.

Patents

- P. Ramanathan and P. Agarwal, *Cellular-fixed call completion and call transfer service from a cellular network provider*, US Patent 6,216,005, April 2001.
- P. Ramanathan and P. Agarwal, *Establishing calls and processing on-going calls in fixed and cellular networks*, US Patent 6,208,864, March 2001.
- P. Agrawal, J.-C. Chen, and P. Ramanathan, "Adaptive video layered coding for voice over wireless IP applications," US Patent 6,434,191, August 2002.
- P. Agrawal, M. Elaoud, P. Ramanathan, C. J. Sreenan, "Method for dynamic connection closing time selection," US Patent 6,606,661, August 2003.
- P. Agrawal, P. Ramanathan, C. J. Sreenan, "Method and appartus for decentralized prioritized scheduling in CSMA/CA wireless system," US Patent 6,721,331, April 2004.
- P. Ramanathan and P. Agarwal, "Switching telephone calls between wireline and cellular telephones," US Patent 7,103,360, September 2006.

- P. Ramanathan and J. C. Mundarath and B. Van Veen, "Distributed scheduling method for multiantenna wireless systems," US Patent 8,179,843, May 2012.
- S. Banerjee, K.-H. Kim. and P. Ramanathan, "Virtualizing battery across a group of personal mobile devices," US Patent 20150019889 , January 2015.
- S. Millican, P. Ramanathan, and K. K. Saluja, "Encrypted Digital Circuit Description Allowing Circuit Simulation," US Patent 9,390,292, July 2016.
- S. Banerjee, P. Ramanathan, K.-H. Kim, "Migrating applications across a group of personal mobile devices based on battery usage," US Patent 9,513,696, December 2016.
- P. Ramanathan and K. K. Saluja, "Encrypted Digital Circuit Description Allowing Singal Delay Simulation," US Patent 9,960,910, May 2018.

Publications

Journal Articles

- D. Bhimsaria, J. A. Rodriguez-Martinez, J. Pan, D. Roston, E. N. Korkmaz, Q. Cui, P. Ramanathan, and A. Z. Ansari, "Specificity landscapers unamsk submaimal binding site preferences of transcription factors," *Proceedings of National Academy of Sciences (PNAS)*, vol. 115, pp. E10586–E10595, Nov. 2018.
- J. Cecil, A. Gupta, M. Pirela-Cruz, and P. Ramanathan, "A network-based virtual reality simulation training approach for orthopedic surgery," *ACM Transactions on Multimedia Computing, Communications, and Applications*, vol. 14, Aug. 2018.
- J. Cecil, A. Gupta, M. Pirela-Cruz, and P. Ramanathan, "A IoMT-based cyber training framework for orthopedic surgery using next generation Internet technologies," *Informatics in Medicine*, May 2018.
- J. Cecil, S. Albuhaood, A. Cecil-Xavier, and P. Ramanathan, "An advanced cyber-physical framework for micro devices assembly," *IEEE Transactions on Systems, Man, Cybernectics: Systems*, pp. 1–15, Aug. 2017.
- J. Cecil, A. Gupta, M. P. Cruz, and P. Ramanathan, "A cyber training frameowrk for orthopedic surgery," *Cogent Medicine*, Dec. 2017.
- A. Eguchi, M. J. Wleklinski, M. C. Spurgat, E. A. Heiderscheit, A. S. Kropornicka, C. K. Vu, D. Bhimsaria, S. A. Swanson, R. Stewart, P. Ramanathan, T. J. Kamp, I. Slukvin, J. A. Thomson, J. R. Dutton, and A. Z. Ansari, "Reprogramming cell fate with a genome-scale library of artificial transcription factors," *Proceedings of National Academy of Sciences (PNAS)*, Dec. 2016.
- G. S. Erwin, M. P. Grieshop, D. Bhimsaria, T. J. Do, J. A. Rodrguez-Martn, C. Mehta, K. Khanna, S. A. Swans, R. Stewart, J. A. Thomson, P. Ramanathan, and A. Z. Ansari, "Synthetic genome readers target clustered binding sites across diverse chromatin states," *Proceedings of National Academy of Sciences (PNAS)*, Nov. 2016.
- D. Wu, B. C. Lesieutre, P. Ramanathan, and B. Kakunoori, "Preserving privacy of AC optimal power flow models in multi-party electric grids," *IEEE Transactions on Smart Grid*, vol. 7, pp. 2050–2060, July 2016.

- R. Ahmed, P. Ramanathan, and K. K. Saluja, "Necessary and sufficient conditions for thermal schedulability of periodic real-time tasks under fluid scheduling model," *ACM Transactions on Embedded Computing Systems*, vol. 15, pp. 49;1–49:25, July 2016.
- A. Ravi, P. Ramanathan, and K. Sivalingam, "Integrated network coding and caching in information centric networks," *Photonic Network Communications*, vol. 30, pp. 416–427, Dec. 2015.
- C.-Y. Huang and P. Ramanathan, "Network level support for gigabit (TCP) flows in wireless mesh networks," *IEEE Transcations on Mobile Computing*, vol. 14, pp. 2073–2085, Oct. 2015.
- C.-Y. Huang, P. Ramanathan, and K. K. Saluja, "Routing TCP flows in underwater mesh networks," *IEEE Journal on Selected Areas in Communication (JSAC): Special Issue on Advances in Military Communications and Networking*, vol. 29, pp. 2022–2032, Dec. 2011.
- C. Yao, K. K. Saluja, and P. Ramanathan, "Calibrating on-chip thermal sensors in integrated circuits: A design-for-calibration approach," *Journal of Electronic Testing: Theory and Applications*, vol. 27, no. 6, pp. 711–721, 2011.
- C. Yao, K. K. Saluja, and P. Ramanathan, "Power and thermal constrained test scheduling under deep submicron technologies," *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, vol. 30, pp. 317–322, Feb. 2011.
- C. Wang, P. Ramanathan, and K. K. Saluja, "Modeling latency-lifetime tradeoffs for target detection in mobile sensor networks," *ACM Transactions on Sensor Networks*, vol. 7, pp. 1–24, Aug. 2010.
- J. Mundarath, P. Ramanathan, and B. D. Van Veen, "Exploiting spatial multiplexing and reuse in multi-antenna wireless ad hoc networks," *Ad Hoc and Sensor Wireless Networks*, vol. 7, no. 2, pp. 281–293, 2009.
- T.-L. Chin, P. Ramanathan, and K. K. Saluja, "Modeling detection latency with collaborative mobile sensing architecture," *IEEE Transactions on Computers*, vol. 58, no. 5, pp. 692–705, 2009.
- G. R. Gupta and P. Ramanathan, "Opportunistic sensing and collaboration for level set estimation," *Ad Hoc and Sensor Wireless Networks*, no. 6, pp. 215–237, 2008.
- J. Mundarath, P. Ramanathan, and B. D. Van Veen, "A distributed downlink scheduling method for multi-user communication with zero-forcing beamforming," *IEEE Transactions on Wireless Communications*, vol. 7, no. 11, pp. 4508–4521, 2008.
- B. Hamdaoui and P. Ramanathan, "A cross-layer admission control framework for wireless ad-hoc networks using multiple antennas," *IEEE Transactions on Wireless Communications*, vol. 6, no. 11, pp. 4014–4024, 2007.
- J. Mundarath, P. Ramanathan, and B. D. Van Veen, "A cross-layer scheme for adaptive antenna array based wireless ad hoc networks in multipath environment," *ACM Wireless Networks (WINET)*, vol. 13, pp. 597–615, Oct. 2007.
- B. Hamdaoui and P. Ramanathan, "Cross-layer optimized conditions for QoS support in multi-hop wireless networks with MIMO links," *Journal on Selected Areas in Communications: Special issue on Cross-layer optimized wireless multimedia communications*, vol. 25, pp. 667–677, May 2007.

- M. Elaoud, B. Hamdaoui, and P. Ramanathan, "Network-level QoS assurances through adaptive allocation of CDMA resources," *ACM Wireless Networks (WINET)*, vol. 12, pp. 79–90, Feb. 2006.

- B. Hamdaoui and P. Ramanathan, "Sufficient conditions for flow admission control in wireless ad-hoc networks," *ACM Mobile Computing and Communication Review (Special issue on Medium Access and Call Admission Control Algorithms for Next Generation Wireless Networks)*, vol. 9, pp. 15–24, Oct. 2005.

- K.-C. Wang and P. Ramanathan, "A cross-layer approach for concurrent delay and throughput assurances in multihop wireless hotspots," *ACM Mobile Networks and Applications*, vol. 10, pp. 341–353, June 2005.

- K.-C. Wang and P. Ramanathan, "QoS assurances through class selection and proportional differentiation in wireless networks," *Journal of Selected Areas in Communications: Special issue on Wireless Ad Hoc Networks*, vol. 23, pp. 573–584, Mar. 2005.

- C. Dovrolis, P. Ramanathan, and K. Claffy, "Packet dispersion techniques and capacity estimation," *IEEE/ACM Transactions on Networking*, vol. 12, pp. 963–977, Dec. 2004.

- T. Clouqueur, K. K. Saluja, and P. Ramanathan, "Fault tolerance in collaborative sensor networks for target detection," *IEEE Transactions on Computers*, vol. 53, pp. 320–333, Mar. 2004.

- B. Hamdaoui and P. Ramanathan, "Network-layer soft handoff approach for mobile wireless IP-based systems," *Journal of Selected Areas on Communications*, vol. 22, pp. 630–642, May 2004.

- V. Phipatanasuphorn and P. Ramanathan, "Vulnerability of sensor networks to unauthorized traversal and monitoring," *IEEE Transactions on Computers*, vol. 53, pp. 364–369, Mar. 2004.

- T. Clouqueur, V. Phipatanasuphorn, P. Ramanathan, and K. K. Saluja, "Sensor deployment strategy for detection of targets traversing a region," *ACM Mobile Networks and Applications*, vol. 8, no. 4, pp. 453–461, 2003.

- C. Dovrolis and P. Ramanathan, "Dynamic class selection and provisioning in proportional differentiated services," *Computer Communications Journal*, vol. 26, pp. 204–221, Feb. 2003.

- L. Tong and P. Ramanathan, "Adaptive power and rate allocation for service curve assurance in DS-CDMA network," *IEEE Transactions on Wireless Communications*, vol. 3, no. 2, pp. 555–564, 2003.

- R. Brooks, P. Ramanathan, and A. Sayeed, "Distributed target classification and tracking in sensor networks," *Proceedings of the IEEE*, vol. 91, no. 8, pp. 1163–1171, 2003.

- C. Dovrolis, P. Ramanathan, and D. Stiliadis, "Proportional differentiated services: Delay differentiation and packet scheduling," *IEEE/ACM Transactions on Networking*, vol. 10, pp. 12–26, Feb. 2002.

- C. Dovrolis, B. Thayer, and P. Ramanathan, "HIP: Hybrid interrupt-polling for the network interface," *ACM Operating Systems Review*, vol. 35, pp. 50–60, Oct. 2001.

- C. Dovrolis and P. Ramanathan, "A case for relative differentiated services and the proportional differentiation model," *IEEE Network (*Special issue on Integrated and Differentiated Services for the Internet*)*, pp. 26–34, Sept. 1999.

- P. Ramanathan, K. Sivalingam, P. Agrawal, and S. Kishore, "Dynamic resource allocation schemes during handoff for mobile multimedia wireless networks," *Journal of Selected Areas in Communications*, pp. 1270–1283, July 1999.

- P. Ramanathan, "Overload management in real-time control applications using (m, k)-firm guarantee," *IEEE Transactions on Parallel and Distributed Systems (*Special issue on Dependable Real-time Systems*)*, pp. 549–559, June 1999.

- K. Dovrolis and P. Ramanathan, "RAFT: Resource aggregation for fault-tolerance in integrated services packet networks," *Computer Communication Review*, vol. 28, pp. 54–77, Apr. 1998.

- S. Chalasani and P. Ramanathan, "Parallel FFT on ATM-based network of workstations," *Cluster Computing*, vol. 1, pp. 13–26, 1998.

- M. Hamdaoui and P. Ramanathan, "Evaluating dynamic failure probability for streams with (m, k)-firm deadlines," *IEEE Transactions on Computers*, vol. 46, pp. 1325–1337, Dec. 1997.

- M. Hamdaoui and P. Ramanathan, "A dynamic priority assignment technique for streams with (m, k)-firm deadlines," *IEEE Transactions on Computers*, vol. 44, pp. 1443–1451, Dec. 1995.

- M. Hamdaoui and P. Ramanathan, "Deferring real-time traffic for improved non-real-time communication in FDDI networks," *IEEE Transactions on Computers*, vol. 44, pp. 1420–1428, Dec. 1995.

- P. Ramanathan and S. Chalasani, "Parallel multigrid algorithms on CM-5," *IEE Proceedings (Part E)*, vol. 142, pp. 177–184, May 1995.

- M. Hamdaoui and P. Ramanathan, "Selection of timed token parameters to guarantee message deadlines," *IEEE/ACM Transactions on Networking*, vol. 3, pp. 340–351, June 1995.

- P. Ramanathan and S. Chalasani, "Placement of resources with multiple adjacency constraints," *IEEE Transactions on Parallel and Distributed Systems*, vol. 6, pp. 511–519, May 1995.

- P. Ramanathan, A. J. Dupont, and K. G. Shin, "Clock distribution in general VLSI circuits," *IEEE Transactions on Circuits and Systems–I: Fundamental Theory and Applications*, vol. 41, pp. 395–404, May 1994.

- N. Homayoun and P. Ramanathan, "Dynamic priority scheduling of periodic and aperiodic tasks in hard real-time systems," *Real-Time Systems*, vol. 6, pp. 207–232, Mar. 1994.

- K. G. Shin and P. Ramanathan, "Real-time computing: A new discipline in computer science and engineering," *Proceedings of the IEEE*, vol. 82, pp. 6–24, Jan. 1994. (Invited paper).

- P. Ramanathan, K. K. Saluja, and M. Franklin, "Testing check bits at no cost in RAMs with on-chip ECC," *IEE Proceedings (Part E)*, vol. 140, pp. 304–312, Nov. 1993.
- P. Ramanathan and K. G. Shin, "Use of common time base for checkpointing and rollback recovery," *IEEE Transactions on Software Engineering*, vol. 19, pp. 571–583, June 1993.
- P. Ramanathan and K. G. Shin, "Delivery of time-critical messages using a multiple copy approach," *ACM Transactions on Computer Systems*, vol. 10, pp. 144–166, May 1992.
- J. W. Dolter, P. Ramanathan, and K. G. Shin, "Performance analysis of virtual cut-through switching in HARTS: A hexagonal mesh multicomputer," *IEEE Transactions on Computers*, vol. 40, pp. 669–680, June 1991.
- P. Ramanathan, K. G. Shin, and R. W. Butler, "Fault-tolerant clock synchronization in distributed systems," *IEEE Computer*, vol. 23, pp. 33–42, Oct. 1990.
- P. Ramanathan, D. D. Kandlur, and K. G. Shin, "Hardware assisted software clock synchronization for homogeneous distributed systems," *IEEE Transactions on Computers*, vol. 39, pp. 514–524, Apr. 1990.
- P. Ramanathan and K. G. Shin, "Reliable broadcast in hypercube multicomputers," *IEEE Transactions on Computers*, vol. 37, pp. 1654–1657, Dec. 1988.
- K. G. Shin and P. Ramanathan, "Transmission delays in hardware clock synchronization," *IEEE Transactions on Computers*, vol. 37, pp. 1465–1467, Nov. 1988.
- K. G. Shin and P. Ramanathan, "Clock synchronization of a large multiprocessor system in the presence of malicious faults," *IEEE Transactions on Computers*, vol. C-36, pp. 2–12, Jan. 1987.

Conference Proceedings

- F. Loh, K. K. Saluja, and P. Ramanathan, "Fault tolerant Cholesky factorization on GPUs," in *Proceedings of Fault Tolrence for HPC at eXtreme Scale (FTXS)*, 2018.
- J. Cecil, A. Gupta, P. Ramanathan, and M. Pirela-Cruz, "Multi-platform virtual reality based simulator systems for orthopedic surgical training," in *Proceedings of IEEE International Systems Conference*, 2018.
- A. Chowdury and P. Ramanathan, "Public order preserving cipher generation scheme for distributed computing," in *Proceedings of Conference on Computer and Commmunications Security (CCS)*, pp. 2273–2275, Oct. 2018.
- A. Chowdury and P. Ramanathan, "PPU: Privacy-aware purchasing unit for residential customers in smart electric grids," in *Proceedings of VLSI Design*, Jan. 2018.
- J. Cecil, A. Gupta, P. Ramanathan, and M. Pirela-Cruz, "A distributed collaborative simulation environment for orthopedic surgical training," in *Proceedings of IEEE International Systems Conference*, pp. 1–8, 2017.
- J. Zhang, X. Zahng, P. Kulkarni, and P. Ramanathan, "OpenMili: A 60 GHz software radio platform with reconfigurable phased-array antenna," in *Proceedings of Mobicom*, pp. 162–175, 2016.

- P. Ramanathan and K. K. Saluja, "Crypt-Delay: Encrypting IP cores with capabilities for gate-level logic and delay simulations," in *Proceedings of Asian Test Symposium (ATS)*, Nov. 2016.

- S. Sur, X. Zhang, P. Ramanathan, and R. Chandra, "Beamspy: Enabling robust 60 GHz links under blockage," in *Proceedings of Networked Systems Design and Implementation (NSDI)*, pp. 193–206, 2016.

- F. Loh, K. K. Saluja, and P. Ramanathan, "Fault tolerance through invariant checking for iterative solvers," in *Proceedings of International Conference on VLSI Design*, Jan. 2016.

- K. Le, P. Ramanathan, and K. K. Saluja, "Privacy assurance in data aggregation for multiple MAX transactions," in *Proceedings of Computer Software and Application Conference*, July 2015.

- S. Sur, V. Venkateswaran, X. Zhang, and P. Ramanathan, "60 GHz indoor networking through flexible beams: A link-level profiling," in *Proceedings of SIGMETRICS*, June 2015.

- R. Ahmed, A. Bansal, B. Kakunoori, , P. Ramanathan, and K. K. Saluja, "Thermal extension of the total bandwidth server," in *Proceedings of International Conference on VLSI Design*, Jan. 2015. **Nripendra Nath Biswas Best Student Paper Award**.

- A. Ravi, P. Ramanathan, and K. Sivalingam, "Integrated network coding and caching in information-centric networks," in *Proceedings of International Conference on Advanced Networks and Telecommunications Systems*, Dec. 2014.

- S. Garg, P. Singh, P. Ramanathan, and R. Sen, "VividhaVahana: Smartphone based vehicle classification and its application in developing region," in *Proceedings of International Conference on Mobile and Ubiquitous Systems: Computing, Networking, and Services*, Dec. 2014.

- Q. Wang, K. Xu, R. Izard, J. Porter, K.-C. Wang, A. Prakash, and P. Ramanathan, "GENI Cinema: A SDN-assisted scalable live video streaming service," in *Proceedings of International Workshop on Computer and Networking Experimental Research using Testbeds*, Oct. 2014.

- J. Cecil, P. Ramanathan, and M. Cruz, "A virtual reality environment for training orthopedic surgeons," in *Proceedings of Clinical Simulation Conference*, Oct. 2014.

- J. Cecil, P. Ramanathan, M. Cruz, and M. B. Rajkumar, "A virtual reality environment for orthopedic surgery," in *Proceedings of Enterprise Integration, Interoperability and Networking*, Oct. 2014.

- D. Wu, B. C. Lesieutre, and P. Ramanathan, "Feasibility of power system structure preserving linear transformations for the AC optimal power flow problem," in *Proceedings of Allerton Conference on Communication, Control, and Computing*, Sept. 2014.

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- P. Ramanathan and K. G. Shin, "A multiple copy approach for delivering messages under deadline constraints," in *Proceedings of Fault-Tolerant Computing Symposium*, pp. 300–307, June 1991.
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- J. W. Dolter, P. Ramanathan, and K. G. Shin, "A microprogrammable VLSI routing controller for HARTS," in *Proceedings International Conference on Computer Design: VLSI in Computers*, pp. 160–163, Nov. 1989.
- P. Ramanathan and K. G. Shin, "Checkpointing and rollback recovery in a distributed system using common time base," in *Proceedings Reliable Distributed Systems*, pp. 13–21, Oct. 1988.
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- K. G. Shin and P. Ramanathan, "Synchronization of a large clock network in the presence of malicious faults," in *Proceedings of Real-Time Systems Symposium*, pp. 13–24, Dec. 1985.

Book Chapters

- B. C. Lesieutre, A. Borden, and P. Ramanathan, "Preserving confidentiality of critical energy infrastructure information," in *Principles of cyber-physical systems: An interdisciplinary approach* (S. Roy and S. Das, eds.), Cambridge University Press, 2015.
- B. Hamdaoui and P. Ramanathan, "Energy-efficient and MAC-aware routing for data aggregation in sensor networks," in *Sensor Network Operations* (S. Phoha, T. La Porta, and C. Griffin, eds.), pp. 291–308, IEEE Press, 2006.
- K.-C. Wang and P. Ramanathan, "Location-centric networking in distributed sensor networks," in *Distributed Sensor Networks* (S. Iyengar and R. Brooks, eds.), ch. 28, pp. 555–572, CRC Press, 2004.
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- P. Ramanathan, K. G. Shin, and R. W. Butler, "Fault-tolerant clock synchronization in distributed systems," in *Global states and time in distributed systems* (Z. Yang and T. A. Marsland, eds.), IEEE Computer Society, Nov. 1993.
- P. Ramanathan, K. G. Shin, and R. W. Butler, "Fault-tolerant clock synchronization in distributed systems," in *Readings in Real-Time Systems* (C. M. Krishna and Y.-H. Lee, eds.), pp. 50–59, IEEE Computer Society, June 1993.

Teaching Accomplishments

Students Supervised

- Supervised projects of 38 Masters students, 18 Ph.D. students, and one Professional degree student.
- Currently supervising projects of six graduate students.

Courses taught at University of Wisconsin-Madison

ECE 252	Introduction to Computer Engineering
ECE 315	Introductory Microprocessor Laboratory
ECE 352	Digital Systems Fundamentals
ECE 353	Introduction to Microprocessor Systems
ECE 361	Advanced Digital Systems
ECE 453	Digital Microprocessors
ECE 537	Communication Networks
ECE 552	Introduction to Computer Architecture
ECE 554	Digital Engineering Laboratory
ECE 707	Mobile and Wireless Networking
ECE 750	Real-time Computing Systems
ECE 753	Fault-tolerant Computing
ECE 755	VLSI Systems Design
ECE 902	Special Topics in Computers: Architectures for Real-Time Applications

Instructional development at University of Wisconsin-Madison

- Upgraded ECE 551 to a flipped format in Spring 2014.
- Taught the first offering of ECE/CS 252 in Fall 2006. This is a freshman course designed to attract more students to Computer Engineering degree program.
- Principal investigator for upgrading the undergraduate microprocessor-based course sequence (ECE 353, ECE 315, ECE 453, and ECE 468). Developed and taught the upgraded version of ECE 453 in Spring 1997.
- Introduced a new graduate course in the area of real-time systems (ECE/CS 750).

Instructional Grants

- College of Engineering DIN, $85,015, July 1997–June 1998, Embedded systems laboratories. (Co-PIs: R. S. Marleau, D. L. Dietmeyer, K. K. Saluja, C. R. Kime, W. J. Tompkins, J. Schowalter).
- Hewlett Packard, $350,000, A cluster of high-end workstations for parallel computation (PI: M. Redmond, Co-PI: F. Cerrina, S. Chalasani, G. Crook, S. Gearhart, H. Guckel, N. Hitchon, J. DePablo, J. Goodman, R. Engelstad)
- College of Engineering DIN, $207,508, July 1996–June 1997, Embedded systems laboratories. (Co-PIs: R. S. Marleau, D. L. Dietmeyer, K. K. Saluja, C. R. Kime, W. J. Tompkins, J. Schowalter).

- Mentor Graphics Corporation, $16,900,000 (in kind), September 1992, A higher education program proposal (PI: C. Kime, Co-PI: D. Wood).

Service Accomplishments

Professional Activities

- Member of IEEE Computer Society's Fellows Committee (2017)
- Panel member of National Institute of Justice 15-year strategic planning forum on broadband communications (2015).
- General Chair of IEEE MASS (2013)
- General Chair of GENI Engineering Conference (2013)
- General Chair of ACM MOBICOM (2011)
- Co-Guest Editor for Special Issue on Recent Advances in Wireless Networks, ACM Mobile Networks and Applications, vol. 11, no. 11, February 2006.
- Associate Editor for IEEE Transcations on Mobile Computing, 2002–2005.
- Associate Editor for Elsevier AdHoc Networks Journal, 2002–2005.
- Member of Editorial Board, IEEE Personal Communications, 2000.
- Associate Editor for IEEE Transactions on Parallel and Distributed Systems from 1996-1999.
- Program Co-Chair for Second International Workshop on Sensor Networks and Applications, 2003.
- Program Committee member for
  - VLSI Design (2015)
  - ICC (2008)
  - SECON (2007, 2013)
  - VTC (2007)
  - Globecom (2006)
  - MASS (2006)
  - International Workshop Wireless Sensor Networks and Applications (2002)
  - MOBIHOC (2003, 2004)
  - MOBICOM (2002, 2003)
  - Dependable Systems and Networks (2002, 2003, 2011)
  - Real-time Technology and Applications Symposium (2000).
  - Conference on Local Computer Networks (1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002)
  - Fault-tolerant Computing Symposium (1997, 1999)
  - International Conference on Distributed Computing Systems (1995, 1997)

  - Real-time Systems Symposium (1994, 1995).
  - International Conference on Engineering Complex Computer Systems (1995).
  - IEEE Workshop on Parallel and Distributed Real-Time Systems (1993).

- Program Co-Chair for DIWANS Workshop co-located with Mobicom 2006.
- Work in Progress Chair for Real-time Technology and Applications Symposium (2000).
- Registration and Finance Chair for Fault-tolerant Computing Symposium (1999).
- Tutorials Chair for MASCOTS 1999.
- Session Chair in the Local Computer Networks, 1996.
- Program Vice Chair for 4th International Workshop on Parallel and Distributed Real-time Systems, April 1996.
- Program Chairman of Workshop on Architectures for Real-Time Applications, April 1994.
- Reviewer for journals including IEEE Transactions on Computers, Software Engineering, Parallel and Distributed Systems, Computer-Aided Design, and Reliability. Also reviewed papers for Journal of Parallel and Distributed Computing, Journal of Electronic Testing: Theory and Applications, IEEE Computer, IEEE Micro, Wireless Networking, and Distributed Computing.
- Reviewer for conferences including Fault-Tolerant Computing Symposium, Real-Time Systems Symposium, Computer Architecture, Design Automation Conference, International Conference on Computer-Aided Design, Reliable Distributed Systems Symposium, and Parallel Processing Conference.
- Reviewer for National Science Foundation and Army Research Office. Panel member for National Science Foundation.