

Srinivasan Keshav

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EDUCATION

Ph.D. in Computer Science, University of California at Berkeley *August 1991*
Awarded the Sakrison Prize for the best dissertation in the EECS department

B.Tech. in Computer Science, Indian Institute of Technology, Delhi *May 1986*
Awarded the Director's Gold Medal

EMPLOYMENT

University of Waterloo, Professor *July 2008 –*
University of Waterloo, Associate Dean (Graduate) Faculty of Mathematics *July 2015–June 2017*
University of Waterloo, Cisco Systems Research Chair in Smart Grid *July 2012–June 2017*
University of Waterloo, Canada Research Chair (Tier II) *July 2004 –June 2014*
University of Waterloo, Associate Professor *August 2003 - June 2008*

Alan Turing Institute for Data Science, Visiting Researcher *June 2017-August 2017*

Bee Networkx Corp., Co-founder and Director *June 2007 –*

Ensim Corp., Co-founder, CTO, General Manager, and Director *June 1998 - July 2003*

GreenBorder Technologies Inc., Co-Founder *October 2000 - March 2007*

Cornell University, Associate Professor *August 1996 – June 1999*

Columbia University, Visiting Faculty *September - December 1995*

Indian Institute of Technology, Delhi, Visiting Faculty *January - May 1993*

AT&T Bell Laboratories, Member of Technical Staff *August 1991 - August 1996*
AT&T Bell Laboratories, Intern *June 1989 - August 1989, July 1990-August 1990*

Xerox PARC, Intern *June 1988 - August 1988*
Hindustan Computers Limited, Delhi, Intern *May 1985 – July 1985*

AWARDS AND HONORS

- Fellow, Institute of Electrical and Electronics Engineers, 2019
- Senior Member, Institute of Electrical and Electronics Engineers, 2017
- Fellow, Association for Computing Machinery, 2012
- Elected Chair of ACM SIGCOMM--the premier professional organization for computer networking researchers, 2013-2017

- Cisco Systems Research Chair in Smart Grid, 2012-2017
- University of Waterloo Outstanding Performance Award 2008, 2013, 2018
- NSERC Discovery Accelerator Supplement Award, 2007-2010
50 such awards are granted across all scientific disciplines in Canada
- Tier II Canada Research Chair in Tetherless Computing, 2004-2014
1000 such chairs were awarded across all disciplines in Canada
- Fiona Ip Li '78 and Donald Li '75 Excellence in Teaching Award, Cornell University, 1998
- Alfred P. Sloan Fellow in Computer Science, 1997-1999.
A total of 112 fellowships are awarded annually in seven fields
- ACM SIGCOMM selected two of my papers as among the ``... most important papers that have appeared in *Computer Communication Review* over the past 25 years,’’ January 1995. These papers also received Test-of-Time awards in 2006
- Best Paper Awards at ACM SIGCOMM 1991, ACM MOBICOM 2009, ACM SIGCOMM Green Networking Workshop, 2010, IEEE SmartGridComm 2012, ACM eEnergy 2013, and BuildSys 2013
- Best Poster Award, ACM eEnergy 2015
- Recipient of the Sakrison Prize, awarded annually for a ``truly outstanding piece of research,’’ EECS department, UC Berkeley, 1992
- Director's Gold Medal for best all-round performance in the graduating class, Indian Institute of Technology, Delhi, May 1986
- National Talent Scholarship, Government of India, 1980-86.
Awarded annually to 100 students selected from over 100,000 applicants

PUBLICATIONS

Note on author order: Student co-authors appear first unless they are marginal contributors; peer co-authors are in order of relative contribution.

Books

- B1. S. Keshav, An Engineering Approach to Computer Networking, *Addison-Wesley*, May 1997. (660 pages)
- B2. S. Keshav, Mathematical Foundations of Computer Networking, *Addison-Wesley*, April 2012. (475 pages). Chinese Translation published by Tsinghua Press in 2015.
- B3. O. Ardakanian, S. Keshav, C. Rosenberg, Integration of Renewable Generation and Elastic Loads into Distribution Grids, *Springer*, July 2016. (80 pages)

Refereed Journals

- J1. M. Jain, R. Kalaimani, S. Keshav, and C. Rosenberg, "Using Personal Environmental Comfort Systems to Mitigate the Impact of Occupancy Prediction Errors on HVAC Performance," *Energy Informatics*, 2018 1:60, <https://doi.org/10.1186/s42162-018-0064-9>, December 2018.
- J2. F. Kazhamiaka, S. Keshav, C. Rosenberg, and K.-H. Pettinger, "Simple Spec-Based Modelling of Lithium-Ion Batteries," *IEEE Transactions on Energy Conversion*, Vol 33, No. 4, December 2018. (9 pages)
- J3. R. Kalaimani, M. Jain, S. Keshav, and C. Rosenberg, "On the Interaction between Personal Comfort Systems and Centralized HVAC Systems in Office Buildings," *J.*

Advances in Building Energy Research, August 2018, V7:p.1-29. (29 pages)

- J4. A. Adepetu, A. Alyousef, S.Keshav, and H. de Meer, "Comparing Solar Photovoltaic and battery adoption in Ontario and Germany: an agent-based approach," *Energy Informatics*, 1(1), p.6, 2018. (22 pages)
- J5. S. Edge, J. Dean, M. Cuomo, and S. Keshav, "Exploring e-bikes as a mode of sustainable transport: a temporal qualitative study of the perspectives of a sample of novice riders in a Canadian city," *Canadian Geographer/Le Geographe Canadien*, April 2018.
- J6. G. Tang, S. Keshav, L. Golab, and K. Wu, "Bikeshare Pool Sizing for Bike-And-Ride Multimodal Transit," *IEEE Transactions on Intelligent Transportation Systems*, 19(7), p. 2279-2289, 2018. (13 pages)
- J7. S. Keshav, Paradoxes of Internet Architecture, Invited paper, *IEEE Internet Computing*, January/February 2018. (4 pages)
- J8. F. Kazhamiaka, P. Jochem, S. Keshav, and C. Rosenberg, "PV-Storage System Profitability in Multiple Jurisdictions," *Energy Policy*, Vol. 109, Oct. 2017. (13 pages)
- J9. C. Gorenflo, I. Rios, L. Golab, S. Keshav, "Usage Patterns of Electric Bicycles: An Analysis of the WeBike Project," *Journal of Advanced Transportation*, vol. 2017, Article ID 3739505, 2017. <https://doi.org/10.1155/2017/3739505>. (15 pages)
- J8. F. Kazhamiaka, C. Rosenberg, S. Keshav, "Practical Strategies for Storage Operation in Energy Systems: Design and Evaluation," *IEEE Transactions on Sustainable Energy*, Vol. 7, no. 4, pp. 1602-1610, Oct. 2016. (10 pages)
- J9. R. P. Singh, B. Cassell, S. Keshav, T. Brecht, "TussleOS: Managing Privacy Versus Functionality Trade-Offs on IoT Devices," *SIGCOMM Computer Communication Review*, July 2016. (6 pages)
- J10. A. Adepetu, V. Arya, and S. Keshav, "An Agent-Based Electric Vehicle Ecosystem Model: San Francisco Case Study," *Transport Policy*, 46 (2016): 109-122.
- J11. Y. Ghiassi-Farrokhfal, C. Rosenberg, S. Keshav, and M.-B. Adjaho, "Optimal Operation and Design of Hybrid Energy Storage Systems," *IEEE Journal on Selected Areas in Communication*, Vol. 34, No. 3, March 2016.
- J12. Y. Ghiassi-Farrokhfal, F. Kazhamiaka, C. Rosenberg, and S. Keshav, "Optimal Design of Solar PV Farms with Storage," *IEEE Transactions on Sustainable Energy*, Vol. 6, No. 5, October 2015.
- J13. A. Adepetu and S. Keshav, "The Relative Importance of Price and Driving Range on Electric Vehicle Adoption: Los Angeles Case Study," *Transportation*, August 2015 pp. 1-21.
- J14. Y. Ghiassi-Farrokhfal, S. Keshav, and C. Rosenberg, "Towards a Realistic Performance Analysis of Storage Systems in Smart Grids," *IEEE Trans on Smart Grids*, Vol 6, No. 1, January 2015, pp. 402-410.

- J15. Y. Ghiassi-Farrokhfal, S. Keshav, C. Rosenberg, and F. Ciucu, "Solar Power Shaping: An Analytical Approach," *IEEE Transactions on Sustainable Energy*, Vol 6, No. 1, Jan. 2015.
- J16. S. Singla, Y. Ghiassi-Farrokhfal, and S. Keshav, "Using Storage to Minimize Carbon Footprint of Diesel Generators for Unreliable Grids," *IEEE Transactions on Sustainable Energy*, Vol. 5, No. 4, pp. 1270-1277, 2014.
- J17. O. Ardakanian, S. Keshav, and C. Rosenberg, "Real-Time Distributed Control for Smart Electric Vehicle Chargers: From a Static to a Dynamic Study," *IEEE Transactions on Smart Grid*, vol.5, no.5, pp.2295,2305, Sept. 2014.
- J18. R.P. Singh, T. Brecht, and S. Keshav, "IP address multiplexing for VEEs," *ACM SIGCOMM Computer Communication Review*, April 2014.
- J19. T. Carpenter, S. Keshav, and J.W. Wong, "Sizing Finite Population Vehicle Pools," *IEEE Trans. on Intelligent Transportation Systems*, Volume PP issue 99, Jan 2014.
- J20. S. Singla, Y. Ghiassi-Farrokhfal, and S. Keshav, "Battery Provisioning and Scheduling For a Hybrid Battery-Diesel Generator System," *ACM Performance Evaluation Review*, December 2013.
- J21. T. Carpenter, A. R. Curtis, and S. Keshav, "The Return On Investment For Taxi Companies Transitioning To Electric Vehicles," *Transportation*, June 2013.
- J22. H. Zarkoob, S. Keshav, and C. Rosenberg, "Optimal Contracts For Providing Load-Side Frequency Regulation Service Using Fleets of Electric Vehicles," *J. Power Sources*, 2013. (22 pages)
- J23. S. Guo, M. Derakhshani, M.H. Falaki, U. Ismail, R. Luk, E.A. Oliver, S. Ur Rahman, A. Seth, M.A. Zaharia, S. Keshav, "Design and implementation of the KioskNet system *Computer Networks*," 55(1):264-281, January 2011 pp. (18 pages)
- J24. M.A. Zaharia and S. Keshav, "Gossip-Based Algorithms for Efficient Search Selection," *Journal of Concurrency and Computation: Practice and Experience*, 2008 (14 pages)
- J25. S. Guo, M.H. Falaki, E.A. Oliver, S. Ur Rahman, A. Seth, M.A. Zaharia, and S. Keshav, "Very Low-Cost Internet Access Using KioskNet," *ACM SIGCOMM Computer Communication Review*, 37(5):95-100, October 2007. (6 pages)
- J26. L. Qiu, Y. Zhang, and S. Keshav, "Understanding the Performance of Many TCP Flows," *Computer Networks*, 37(3-4):277-306, November 2001. (29 pages)
- J27. M. Grossglauser*, S. Keshav, and D. Tse, "RCBR: A Simple and Efficient Service for Multiple TimeScale Traffic," *IEEE/ACM Transactions on Networking*, 5(6):741-755, December 1997. (15 pages)
- J28. A.E. Kaplan, S. Keshav, N.L. Schryer, and J.H. Venutolo, "An Internet-accessible Telepresence," *ACM Multimedia Systems Journal*, 5(3):140-144, Summer 1997. (5 pages)
- J29. C.R. Kalmanek, S. Keshav, W.T. Marshall, S.P. Morgan, and R.C. Restrck, "Xunet 2:

Lessons from an Early WideArea ATM Testbed," *IEEE/ACM Transactions on Networking*, 5(1):40-55 April 1997. (16 pages)

- J30. R. Ahuja, S. Keshav, and H. Saran, "Design, Implementation, and Performance of a Native-Mode ATM Transport Protocol," *IEEE/ACM Transactions on Networking*, 4(4): 502-515, August 1996. (14 pages)
- J31. S. Keshav, C. Lund, S. Phillips, N. Reingold, and H. Saran, "An Empirical Evaluation of Virtual Circuit Holding Time Policies in IOverATM Networks," *IEEE Journal on Selected Areas in Communication*, 13(8):1371-1382 October 1995. (12 pages)
- J32. S. Keshav, "A Control-Theoretic Approach to Flow Control," *ACM SIGCOMM Computer Communication Review*, January 1995. **Appeared in the 25th Anniversary Special Issue on the "most important papers that have appeared in *Computer Communication Review* over the past 25 years."** (12 pages)
- J33. A. Demers, S. Keshav and S. Shenker, "Analysis and Simulation of a Fair Queueing Algorithm," *ACM SIGCOMM Computer Communication Review*, January 1995. **Appeared in the 25th Anniversary Special Issue on the "most important papers that have appeared in *Computer Communication Review* over the past 25 years."** (12 pages)
- J34. H. Saran, S. Keshav, and C.R. Kalmanek, "A Scheduling Discipline and Admission Control Policy for Xunet 2," *ACM Multimedia Systems Journal*, 2(3):89-101, September 1994. (13 pages)
- J35. S. Keshav, "On the Efficient Implementation of Fair Queueing," *Journal of Internetworking: Research and Experience*, 2(3):157-173, September 1991. (17 pages)
- J36. A. Demers, S. Keshav, and S. Shenker, "Analysis and Simulation of a Fair Queueing Algorithm," *Journal of Internetworking Research and Experience*, 1(1):3-26, September 1990. (24 pages)

Refereed Conferences and Workshops

- C1. J. Wang, O. Abari, and S. Keshav, RFID Hacking for Fun and Profit, *Proc. ACM MOBICOM*, October 2018.
- C2. F. Kazhamiaka, S. Keshav, and C. Rosenberg, "Robust and Practical Approaches for Solar PV and Storage Sizing," *Proc. ACM eEnergy 2018*, June 2018.
- C3. S. Sun, S. Keshav, C. Rosenberg, M. Peloso, "Optimal Matching of Stochastic Solar Generators to Stochastic Loads," *Proc. ACM eEnergy 2018*, June 2018.
- C4. M. Doroshenko, S. Keshav, C. Rosenberg, "Poster: Flattening the Duck Curve Using Grid-friendly Solar Panel Orientation," *Proc. ACM eEnergy 2018*, June 2018.
- C5. S. Rizvi, B. Wong, and S. Keshav, "Canopus: A Scalable and Massively Parallel Consensus Protocol," *Proc. ACM CoNEXT 2017*, December 2017.
- C6. C. Gorenflo, L. Golab, S. Keshav, "Managing Sensor Data Streams: Lessons Learned

from the WeBike Project," *Proc. SSDBM 2017*, 1:1-1:11, May 2017.

- C7. A. Rabbani and S. Keshav, "The SPOT* Personal Thermal Comfort System," *Proc. ACM BuildSys'16*, November 2016.
- C8. F. Kazhamiaka, C. Rosenberg, S. Keshav, "Li-Ion Storage Models for Energy System Optimization: The Accuracy-Tractability Tradeoff," *Proc. ACM e-Energy*, 2016.
- C9. A. Adepetu and S. Keshav, "Understanding Solar PV and Battery Adoption in Ontario: An Agent-Based Approach," *Proc. ACM e-Energy*, 2016.
- C10. L. Gebhard, L. Golab, S. Keshav, and H. de Meer, "Range prediction for electric bicycles," *Proc. ACM e-Energy*, 2016.
- C11. R. Kalaimani, S. Keshav, and C. Rosenberg, "Multiple Time-scale Model Predictive Control for Thermal Comfort in Buildings," *Poster in ACM e-Energy*, 2016.
- C12. I. Rios, L. Golab, and S. Keshav, "Analyzing the Usage Patterns of Electric Bicycles," *Proc. EV-SYS Workshop at ACM e-Energy*, 2016.
- C13. A. Pat, K. Larson, and S. Keshav, "Big-Data Mechanisms and Energy-Policy Design," *Proc. AAAI*, 2016.
- C14. X. Gao, L. Golab, S. Keshav, "What's wrong with my solar panels: a data-driven approach," *Proc. Workshop on Energy Data Management*, March 2015, pp. 86-93.
- C15. R. P. Singh, T. Brecht, and S. Keshav, "Towards VM Consolidation Using a Hierarchy of Idle States," *Proc. ACM SIGPLAN/SIGOPS International Conference on Virtual Execution Environments (VEE)*, March 2015.
- C16. O. Ardakanian, C. Rosenberg and, S. Keshav, "Quantifying the Benefits of Extending Electric Vehicle Charging Deadlines with Solar Generation," *Proc. IEEE Smart Grid Communications*, November 2014.
- C17. Y.J. Liu, P.X. Gao, B. Wong, and S. Keshav, "Quartz: A New Design Element for Low-Latency DCNs," *Proc. ACM SIGCOMM*, August 2014.
- C18. Y. Ghiassi-Farrokhfal, S. Keshav, and Catherine Rosenberg, "An EROI-Based Analysis of Renewable Energy Farms with Storage," *Proc. ACM e-Energy 2014*, June 2014.
- C19. O. Ardakanian, N. Koochakzadeh, R. P. Singh, L. Golab, S. Keshav, "Computing Electricity Consumption Profiles from Household Smart Meter Data," *3rd Workshop on Energy Data Management*, 2014
- C20. P.X. Gao and S. Keshav, Optimal Personal Comfort Management Using SPOT+, "*Proc. BuildSys Workshop*," 2013. **Best Student Paper Award.**
- C21. A. Adepetu, E. Rezaei, D. Lizotte, and S. Keshav, "Critiquing Time-Of-Use Pricing in Ontario," *Proc. IEEE SmartGridComm Symposium 2013*, Vancouver, October 2013.
- C22. K Kogan, S. Nikolenko, S. Keshav, and A. Lopez-Ortiz, "Efficient Demand Assignment in Multi-Connected Microgrids, Extended Abstract," *Proc. SustainIT*, October 2013.

- C23. S. Alamdari, T. Biedl, T. M. Chan, E. Grant, K.R Jampani, S. Keshav, A. Lubiw and V. Pathak, "Smart-grid Electricity Allocation via Strip Packing with Slicing," *Proc. WADS 2013*, August 2013.
- C24. S. Singla, Y. Ghiassi-Farrokhfal, and S. Keshav, "Near-Optimal Scheduling for a Hybrid Battery-Diesel Generator for Off-Grid Locations," *Proc. GreenMetrics Workshop*, June 2013.
- C25. Y. Ghiassi-Farrokhfal, S. Keshav, and C. Rosenberg, "Firming Solar Power, Extended Abstract/Poster," *Proc. ACM SIGMETRICS*, June 2013.
- C26. O. Ardakanian, C. Rosenberg, and S. Keshav, Distributed Control of Electric Vehicle Charging, *Proc. ACM e-Energy 2013*," May 2013. **Best Paper award**
- C27. R.P. Singh, S. Keshav, and T. Brecht, "A Cloud-Based Consumer-Centric Architecture for Energy Data Analytics," *Proc. ACM e-Energy 2013*, May 2013.
- C28. P. X. Gao and S. Keshav, "Personalized Smart Thermal Control System," *Proc. ACM e-Energy 2013*, May 2013.
- C29. K. Kogan, S. Nikolenko, S. Keshav, and A. Lopez-Ortiz, "Efficient Demand Assignment in Multi-Connected Microgrids," *Proc. e-Energy 2013*, May 2013. (Poster)
- C30. S. Alamdari, T. Biedl, T. M. Chan, E. Grant, K.R. Jampani, S. Keshav, A. Lubiw and V. Pathak, "Smart-grid Electricity Allocation via Strip Packing with Slicing," *Proc. EuroCG*, March 2013.
- C31. P. Srikantha, S. Keshav, C. Rosenberg, "Distributed Control for Reducing Carbon Footprint in the Residential Sector," *Proc. IEEE SmartGridComm*, November 2012. (6 pages)
- C32. S. Singla, S. Keshav, "Demand Response through a Temperature Setpoint Market in Ontario," *Proc. IEEE SmartGridComm*, November 2012. (6 pages).
- C33. X.Gao, A.R. Curtis, B. Wong, and S. Keshav, "It's Not Easy Being Green," *Proc. ACM SIGCOMM*, August 2012. (12 pages)
- C34. O. Ardakanian, C. Rosenberg, and S. Keshav, "Real Time Distributed Congestion Control for Electrical Vehicle Charging (invited paper)," *Proc. ACM SIGMETRICS Greenmetrics Workshop*, June 2012. (6 pages)
- C35. O. Ardakanian, C. Rosenberg, and S. Keshav, "On the Impact of Storage in Residential Power Distribution Systems," *Proc. ACM SIGMETRICS Greenmetrics Workshop*, June 2012. (6 pages)
- C36. P. Srikantha, C. Rosenberg, and S. Keshav, "An Analysis of Peak Demand Reductions due to Elasticity of Domestic Appliances," *Proc. e-Energy*, May 2012. (10 pages)
- C37. T. Carpenter, S. Singla, P. Azimzadeh, and S. Keshav, "The Impact of Electricity Pricing Schemes on Storage Integration In Ontario," *Proc. e-Energy*, May 2012. (10 pages)
- C38. O. Ardakanian, S. Keshav, and C. Rosenberg, "On the Use of Teletraffic Theory in Power Distribution Systems," *Proc. e-Energy*, May 2012. (10 pages)

- C39. A. R. Curtis, T. Carpenter, M. Elsheikh, A. López-Ortiz and S. Keshav. "REWIRE: An Optimization-based Framework for Unstructured Data Center Network Design," *Proc. INFOCOM*, March 2012. (8 pages)
- C40. E. Oliver and S. Keshav, "An Empirical Approach to Smartphone Energy Level Prediction," *Proc. ACM UbiComp 2011*, September 2011. (10 pages)
- C41. O. Ardakanian, S. Keshav, and C. Rosenberg, "Markovian Models for Home Electricity Consumption," *Proc. ACM SIGCOMM Green Networking Workshop*, August 2011. (6 pages)
- C42. N. Ahmed, S. Keshav, and K. Papagiannaki, "OmniVoice: A Mobile Voice Solution for Small-scale Enterprises," *Proc. MobiHoc*, May 2011. (11 pages)
- C43. A. Curtis, S. Keshav and A. Lopez-Ortiz, "LEGUP: Using Heterogeneity to Reduce the Cost of Data Center Network Upgrades," *Proc. ACM CoNEXT*, December 2010. (12 pages)
- C44. S. Keshav and C. Rosenberg, "How Internet Concepts and Technologies Can Help Green and Smarten the Electrical Grid," *Proc. ACM SIGCOMM Green Networking Workshop*, August 2010. Selected as **one of the best papers** in the workshop and republished in ACM SIGCOMM CCR, January 2011 (6 pages)
- C45. S. Keshav, "Design Principles for Robust Opportunistic Communication," *Proc. of ACM SIGCOMM Workshop on Networked Systems for Developing Regions (NSDR 2010)*, June 2010. (6 pages)
- C46. O. Ardakanian and S. Keshav, "Using Decision Making to Improve Energy Efficiency of Buildings," *POMDP Practitioner's Workshop*, May 2010. (3 pages)
- C47. V. Shrivastava, N. Ahmed, S. Rayanchu, S. Banerjee, S. Keshav, K. Papagiannaki, A. Mishra. "CENTAUR: Realizing the Full Potential of Centralized WLANs using a Hybrid Data Path," *ACM MobiCom*, Beijing, September 2009 (14 pages). **Best paper award**
- C48. N. Ahmed, U. Ismail, S. Keshav, and K. Papagiannaki, "Online Estimation of RF Interference," *Proc. ACM Conext*, Madrid, December 2008. (12 pages)
- C49. E. Oliver and S. Keshav, "Design Principles for Opportunistic Communication in Constrained Computing Environments," *Proc. MobiCom Workshop on Wireless Networks and Systems for Developing Regions (WiNS-DR)*, San Francisco, September 2008. (6 pages)
- C50. S. Ur Rahman, U. Hengartner, U. Ismail and S. Keshav, "Practical Security for Rural Internet," *Proc. of ACM SIGCOMM Workshop on Networked Systems for Developing Regions (NSDR 2008)*, Seattle WA, August 2008. (6 pages)
- C51. J. Crowcroft, S. Keshav, and N. McKeown, "Scaling Internet Research Publication Processes to Internet Scale," *Proc. Workshop on Organizing Workshops, Conferences, and Symposia in Computer Systems*, April 2008. (6 pages).

- C52. S. Guo and S. Keshav, "Fair and Efficient Scheduling in Data Ferrying Networks," *Proc. ACM CoNEXT 2007*, December 2007. (10 pages)
- C53. S. Guo, M.H. Falaki, E.A. Oliver, S. Ur Rahman, A. Seth, M.A. Zaharia, U. Ismail, and S. Keshav, "Design and Implementation of the KioskNet System," *Proc. International Conference on Information Technologies and Development*, December 2007. (12 pages)
- C54. N. Ahmed, V. Shrivastava, A. Mishra, S. Banerjee, S. Keshav, K. Papagiannaki, "Interference Mitigation in Enterprise WLANs through Speculative Scheduling (Extended Abstract)," *Proc. ACM Mobicom 2007*, September 2007. (6 pages)
- C55. M. Karsten, S. Keshav, S. Prasad, and O. Beg, "An Axiomatic Basis for Communication," *Proc. ACM SIGCOMM*, August 2007. (12 pages)
- C56. D. Hadaller, S. Keshav, T. Brecht, S. Agarwal, "Vehicular Opportunistic Communication Under the Microscope," *Proc. ACM Mobisys*, June 2007. (14 pages)
- C57. M. Zaharia, A. Chandel, S. Saroiu, and S. Keshav, "Finding Content in File-Sharing Networks When You Can't Even Spell," *Proc. ACM International Peer-to-Peer Symposium 2007*, Feb 2007. (8 pages)
- C58. M. Thomas, A. Gupta, and S. Keshav, "Group Based Routing in Disconnected Ad Hoc Networks," *Proc. 13th Annual IEEE International Conference on High Performance Computing*, December 2006. (12 pages)
- C59. N. Ahmed and S. Keshav, "SMARTA: Self-Management Architecture for Thin Access Points," *Proc. ACM CoNEXT*, December 2006. (12 pages)
- C60. M. Karsten, S. Keshav, and S. Prasad, "An Axiomatic Basis for Communication," *Proc. ACM HOTNETS V*, November 2006. (6 pages)
- C61. N. Ahmed, D. Hadaller, and S. Keshav, "GUESS: Gossiping Updates for Efficient Spectrum Sensing," *Proc. ACM MobiShare- 1st International Workshop on Decentralized Resource Sharing in Mobile Computing and Networking*, September 2006. (6 pages)
- C62. D. Hadaller, S. Keshav, and T. Brecht, "MV-MAX: Improving Wireless Infrastructure Access for Multi-Vehicular Communication," *Proc. SIGCOMM 2006 Workshop on Challenged Networks*, September 2006. (8 pages)
- C63. A. Seth, D. Kroeker, M. Zaharia, S. Guo, S. Keshav, "Low-cost Communication for Rural Internet Kiosks Using Mechanical Backhaul," *Proc. ACM MOBICOM 2006*, September 2006. (12 pages)
- C64. S. Guo, M. Ghaderi, A. Seth, S. Keshav, "Opportunistic Scheduling in Ferry-Based Networks," *Proc. IEEE Workshop on Network Protocols for Transportation 2006*, August 2006. (6 pages)
- C65. N. Ahmed and S. Keshav, "A Successive Refinement Approach to Wireless Infrastructure Network Deployment," *Proc. IEEE Wireless Communication and Networking Conference*, April 2006. (9 pages)
- C66. H.J. Pan and S. Keshav, "Detection and Repair of Faulty Access Points," *Proc. IEEE*

Wireless Communication and Networking Conference, April 2006. (8 pages)

- C67. M.A. Zaharia and S. Keshav, "Gossip-Based Algorithms for Efficient Search Selection," *Proc. ACM International Peer-to-Peer Symposium 2006, Feb 2006. (8 pages)*
- C68. A. Seth and S. Keshav, "Practical Security for Disconnected Nodes," *Proc. First Workshop on Secure Network Protocols (NPSEC), November 2005. (6 pages)*
- C69. M. Ghaderi and S. Keshav, "Multimedia Messaging Service: System Description and Performance Analysis," *Proc. Wireless Internet Conference, July 2005. (8 pages)*
- C70. J. Wang, Y. Zhang, and S. Keshav, "Understanding End-to-End Performance: Testbed and Preliminary Results," *Proc. of IEEE Global Internet Symposium, November 2001. (5 pages)*
- C71. Y. Zhang, L. Qiu, and S. Keshav, "Speeding Up Short Data Transfers: Theory, Architectural Support, and Simulation Results," *Proc. NOSSDAV'2000, Chapel Hill, NC, June 2000. (11 pages)*
- C72. S. Keshav and S. Paul, "Centralized Multicast," *Proc. International Conference on Network Protocols '99, October 1999. (10 pages)*
- C73. L. Qiu, Y. Zhang, and S. Keshav, "On the Performance of Individual and Aggregated TCP Connections," *Proc. International Conference on Network Protocols '99, October 1999. (10 pages)*
- C74. J. Wang and S. Keshav, "Efficient and Accurate Ethernet Simulation," *Proc. Local Computer Networks '99, October 1999. (10 pages)*
- C75. X.W.Huang, R. Sharma, and S. Keshav, "The Entrapid Protocol Development Environment," *Proc. INFOCOM '99, March 1999. (9 pages)*
- C76. S. Keshav and R. Sharma, "Achieving Quality of Service through Network Performance Management," *Proc. NOSSDAV '98, July 1998. (8 pages)*
- C77. R. Sharma, S. Keshav, M. Wu, and L. Wu, "Environments for Active Networks," *Proc. NOSSDAV '97, May 1997. (8 pages)*
- C78. S. Keshav and S.P. Morgan, "SMART: Retransmission: Performance with Random Losses and Overload," *Proc. INFOCOM '97, April 1997. (9 pages)*
- C79. A. Jain and S. Keshav, "Native-mode ATM in FreeBSD: Experience and Performance," *Proc. NOSSDAV '96, April 1996. (8 pages)*
- C80. R. Ahuja, S. Keshav, and H. Saran, Design, "Implementation, and Performance of a Native-Mode ATM Transport Protocol," *Proc. INFOCOM'96, March 1996. **Selected as one of the top ten papers of the approximately 500 submitted to the conference.** (12 pages)*
- C81. M. Grossglauser and S. Keshav, "On CBR Service," *Proc. INFOCOM'96, March 1996. (8 pages)*

- C82. M. Grossglauser, S. Keshav, and D. Tse, "RCBR: A Simple and Efficient Service for Multiple TimeScale Traffic," *Proc. ACM SIGCOMM'95*, August 1995. (12 pages)
- C83. M. Grossglauser, S. Keshav, D. Tse, "The Case Against VBR," *Proc. NOSSDAV '95*, April 1995. (4 pages)
- C84. R. Sharma and S. Keshav, "Signaling and Operating System Support for Native-Mode ATM Applications," *Proc. ACM SIGCOMM'94*, September 1994. (12 pages)
- C85. H. Saran and S. Keshav, "An Empirical Evaluation of Virtual Circuit Holding Times in IP-over-ATM Networks," *Proc. INFOCOM '94*, June 1994. (8 pages)
- C86. S. Keshav, "Experience with Large Videoconferences in Xunet 2," *Proc. INET'94*, June 1994. (5 pages)
- C87. H. Saran, S. Keshav, and C.R. Kalmanek, "A Scheduling Discipline and Admission Control Policy for Xunet 2," *Proc. NOSSDAV '93*, November 1993. (8 pages)
- C88. A. Banerjea and S. Keshav, "Queueing Delays in Rate-Controlled Networks," *Proc. INFOCOM '93*, March 1993. (8 pages)
- C89. S. Keshav, "Flow Control in High-Speed Networks with Long Delays," *Proceedings of INET '92*, Kobe, Japan, June 1992. (8 pages)
- C90. P.S. Khedkar and S. Keshav, "Fuzzy Prediction of Timeseries," *Proc. IEEE Conference on Fuzzy Systems, FUZZ-IEEE*, March 1992. (8 pages)
- C91. S. Keshav, "A Control-theoretic Approach to Flow Control," *Proc. ACM SIGCOMM '91*, September 1991. **Winner of the Best Student Paper Award.** (12 pages)
- C92. H. Zhang and S. Keshav, "Comparison of Rate-Based Service Disciplines," *Proc. ACM SIGCOMM '91*, September 1991. (12 pages)
- C93. C.R. Kalmanek, H. Kanakia, and S. Keshav, "Rate-Controlled Servers for Very High-Speed Networks," *Proc. GLOBECOM '90*, San Diego, December 1990. (9 pages)
- C94. A. Demers, S. Keshav and S. Shenker, "Analysis and Simulation of a Fair Queueing Algorithm," *Proc. ACM SIGCOMM '89*, September 1989. (12 pages)
- C95. S. Keshav and D.P. Anderson, "A Workload Model for Large Distributed File Systems," *Proc. 19th Annual Pittsburgh Conference on Simulation and Modeling*, May 1988. (8 pages)

Magazine Articles

- M1. S. Keshav, "Paradoxes of Internet Architecture," Invited paper, *IEEE Internet Computing*, January/February 2018.
- M2. S. Keshav, "How blockchain can democratize green power," *The Conversation*, January 2018.

- M3. S. Keshav, "Technical Perspective: The power of Wi-Fi to deliver power," *Communications of the ACM*, 60(3), March 2017 (1 page).
- M4. S. Keshav, "Technical Perspective: The chemistry of software-defined batteries." *Communications of the ACM*, 59(12), December 2016 (1 page).
- M5. J. Crowcroft, S. Keshav, and N. McKeown, "Scaling the Academic Publication Process to Internet Scale," *Communications of the ACM*, January 2009 (3 pages).
- M6. S. Keshav, "How to Read a Paper", *ACM SIGCOMM Computer Communication Review*, 37(3):83-84, July 2007. (2 pages)
- M7. S. Keshav, "Efficient and Decentralized Computation of Approximate Global State," *ACM SIGCOMM Computer Communication Review*, 36(1):69-74, Jan. 2006. (6 pages)
- M8. S. Keshav, "Why Cell Phones Will Dominate the Future Internet," *ACM SIGCOMM Computer Communication Review*, 35(2):83-86, April 2005. (4 pages)
- M9. S. Keshav, "Blueprints for Web Hosting," *Web Hosting Magazine*, April 2001. (8 pages)
- M10. D. Bergmark and S. Keshav, "Building Blocks for Internet Telephony," *IEEE Communications Magazine*, 37(4): 88-94, April 2000. (7 pages)
- M11. S. Keshav and R. Sharma, "Issues and Trends in Router Design," *IEEE Communications Magazine*, 36(5):144-151, May 1998. (8 pages)
- M12. A. Berenbaum, M.J. Dixon, A. Iyengar, and S. Keshav, "A Flexible ATM Host-Interface for Xunet 2," *IEEE Network Magazine*, 7(4):18-23, July 1993. (6 pages)
- M13. S. Keshav, "Report on Workshop on Quality of Service Issues in High Speed Networks," *ACM SIGCOMM Computer Communication Review*, 22(5):74-85 October 1992. (10 pages)

Software

REAL: An early packet level public-domain network simulator that provided extensive support for research in flow and congestion control. 1989.

XUNET II: The first wide area ATM network. 1993.

IDLInet: The first Personal-Computer based ATM LAN. 1995.

ITX: A Java-based computer telephony platform. 1999.

KioskNet/VLink: KioskNet and VLink are comprehensive systems for low-cost internet access from rural kiosks using mechanical backhaul. 2010.

US Patents

I am a co-inventor of 30 US/EU patents on a wide variety of systems issues.

8,422,988 Controlling activity levels and reducing infrastructure data transmission costs for wireless mobile devices

8,412,101 Optimally controlling short-range wireless communication on mobile communication devices

8,351,449 Scheduling data communication for mobile communication devices with multiple wireless network interfaces associated with differing costs

8,238,913 Wireless network augmentation using other wireless networks

8,190,088 Optimally controlling short-range wireless communication on mobile communication devices

7,769,887 Opportunistic data transfer over heterogeneous wireless networks

7,219,354 Virtualizing super-user privileges for multiple virtual processes

7,143,024 Associating identifiers with virtual processes

6,985,937 Dynamically modifying the resources of a virtual server

6,976,258 Providing quality of service guarantees to virtual hosts

6,909,691 Fairly partitioning resources while limiting the maximum fair share

6,907,421 Regulating file access rates according to file type

6,754,716 Restricting communication between network devices on a common network

6,732,211 Intercepting I/O multiplexing operations involving cross-domain file descriptor sets

6,393,581 Reliable time delay-constrained cluster computing

6,363,483 Methods and systems for performing article authentication

5,864,605 Voice menu optimization method and system

5,835,595 Method and apparatus for cryptographically protecting data

5,793,768 Method and apparatus for collapsing TCP ACKs on asymmetrical connections

5,761,289 800 number callback

5,627,970 Methods and apparatus for achieving and maintaining optimum transmission rates and preventing data loss in a processing system network

5,623,605 Methods and systems for interprocess communication and inter-network data transfer

5,604,731 Renegotiated bit-rate service system and method

5,559,798 Data segmentation within a renegotiated bit-rate service transmission system

5,272,697 Apparatus and method for time multiplexing a resource among a plurality of entities

STUDENTS

Postdoctoral fellows (doctoral degree)

- Ju Wang (Northeast University, China) 2018-
- Liqiong Chang (Northeast University, China) 2018-
- Sun Sun (Toronto) 2017-
- Ansis Rosmanis (Waterloo) 2016
- Rachel Kalaimani (IIT Bombay) 2015-16
- Yashar Ghiassi-Farrokhfal (U. Toronto) 2012-15
- Kirill Kogan (Ben Gurion) 2011-2012
- Weihong Wang (Toronto) 2010-2011
- Andre Allavena (Cornell) 2004-2005

Graduated PhD students (first position)

- *Adedamola Adepetu*: 2012-2016, Waterloo. Thesis: An Agent-Based Modeling Framework for Energy Policies (CIBC Bank)

- *Rayman Preet Singh*: 2011-2015, Waterloo. Thesis: Personal Data Management in the Internet of Things (MTS at Samsung Research)
- *Omid Ardakanian*: 2009-2015, Waterloo. Thesis: On the Control of Active End-nodes in the Smart Grid (Postdoc at UC Berkeley) Currently Assistant Professor, U. Alberta
- *Tommy Carpenter*: 2010-2015, Waterloo. Thesis: Measuring & Mitigating Electric Vehicle Adoption Barriers (MTS at AT&T Research)
- *Earl Oliver*: 2006-2012, Waterloo. Thesis: Censorship Tolerant Networking (Founder, Brio Mobile)
- *Andy Curtis*: 2008-2012, Waterloo. Thesis: Reducing the cost of Operating a Datacenter Network (Nicera Inc.)
- *Nabeel Ahmed*: 2004-2009, Waterloo. Thesis: Interference Management in Dense 802.11 Networks (Post-doc at MIT)
- *Aaditeshwar Seth*: 2004-2008, Waterloo, Co-supervised by Prof. R. Cohen. Thesis: Design of a Recommender System for Participatory Media Built on a Tetherless Communication Infrastructure (IBM Research, India)
- *Majid Ghaderi*: 2004-2006, Waterloo, Co-supervised by Prof. R. Boutaba. Thesis: Resource management in heterogeneous wireless networks (PostDoc at U. Mass. Amherst)
- *Rosen Sharma*: 1996-99, Cornell. Thesis: 'Internet TV' (CEO at Ensim Inc.)

Graduated Master's students

- 2016: A. Pat, A. Rabbani, M. Doroshenko
- 2015: I. Rios
- 2014: E. Rezaei, X. Gao
- 2013: P.X. Gao, S. Singla, P. Srikantha
- 2012: B. Hu, R. Case
- 2011: O. Ardakanian
- 2009: U. Ismail
- 2008: H. Falaki, S. Ur Rahman, D. Hadaller
- 2007: S. Guo, O. Beg, E. Oliver
- 2005: N. Ahmed
- 1999: Y. Xu, N. Sastry, J. Wann, P. Singh, A. Singh, M. Ranjan, W. Ng, J. Howes
- 1998: K. Lee, R. Schwager, R. Siamwalla
- 1997: D. Balakrishna, K. Chan, B. Nicks, J. Teo, M. Wu, L. Wu, H. Jamjoom
- 1995: M. Grossglauser

SELECTED RECENT PROFESSIONAL ACTIVITIES (Since 2010)

Professional Societies

Member of ACM, ACM SIGCOMM, IEEE
 2008-present: Member, Executive Committee, ACM SIGCOMM
 2013-2017: Elected Chair, ACM SIGCOMM
 2013-2017: Member of ACM SIG Governing Board

Editorial positions

2016 - present: Member, Steering Committee, ACM SIGMETRICS PACM Series
 2009-2013: Member/Chair, Steering Committee, IEEE/ACM Transactions on Networking
 2008- 2012: Editor-in-chief, ACM SIGCOMM Computer Communication Review
 2004-2006: Editor, ACM SIGCOMM Computer Communication Review
 1997-1999: Editor, ACM SIGCOMM Computer Communication Review
 1997-1999: Editor, IEEE/ACM Transactions on Networking

1997-1999: Editor, Journal of High Speed Networks

Recent conference organization

2016 General Chair, ACM eEnergy
2013- Member Steering Committee, ACM e-Energy
2013 TPC Co-Chair, ACM eEnergy
2011 General Co-Chair, ACM SIGCOMM
2010 TPC Co-Chair, ACM Mobisys

Recent selected program committee memberships

2018 ACM COMPASS
2013-2018 ACM eEnergy
2017 ACM NetEcon Workshop
2014, 2016-18 USENIX NSDI
2016 IEEE SmartGridComm
2015 ACM ICDCS
2015 ACM CoNEXT
2013-2017 ACM BuildSys
2008-2010 ACM SIGCOMM
2014 ACM APSys Workshop
2014, 17 ACM GreenMetrics Workshop
2013 IEEE SmartGridComm
2013 ACM COMSNETS
2011 ACM NSDR
2010 ACM ICTD (International Conference on ICT for Development)
2010-12 ACM ExtremeCom Workshop
2010 International Teletraffic Congress

Program review

External Review Committee Member, Department of Computer Science, University of British Columbia, 2014.

External examiner

Chien-Ming Tseng, Masdar Institute, Abu Dhabi, 2017
Mauricio Restrepo, Dept. of ECE, U. Waterloo, 2017
Nafeesa Mehboob, Dept. of ECE, U. Waterloo, 2016
Jelmer Kuiper, U. Twente, 2015
Alfredo Vaccaro, Dept. of ECE, U. Waterloo, 2015
Abbas Mehrabian, Department of Combinatorics and Optimization, U. Waterloo, 2014
ACM India Dissertation Award Committee 2014-16
Mikko Pervilä, U. Helsinki, 2013
Jing Su, U. Toronto, 2010

Summer Schools/Tutorial

"Research Methods in Networks and Systems," Summer School, Sharif University, **Teheran**, Iran, August 2018

"Communication Technologies for Energy Informatics," Summer School, University of Passau, **Passau**, Germany, September 2017

"How Internet Technologies Can Green the Grid," Tutorial at ACM SIGCOMM, **Helsinki**, Finland, August 2012

"Game Theory," U. Alberta Summer School, **Banff**, Canada, 2011

Keynotes/Invited talks/Conference presentations

"Blockchain: Foundations and Applications", **Keynote** at IEEE Kitchener-Waterloo Section Annual General Meeting, **Waterloo**, November 2018.

"Scalable BFT Consensus using RCanopus," Invited presentation, Oasis Labs, **Berkeley**, August 2018; IIT **Delhi**, October 2018; IIT **Madras**, November 2018; UPMC/Sorbonne, **Paris**, November 2018; U. Waterloo, **Waterloo**, December 2018.

"Canopus: a Scalable and Massively Parallel Consensus Protocol," Dept. of Computer Science, University of Washington, **Seattle**, August 2018.

"On Trustworthy Cyber-physical Gateways for Blockchains", Keynote at ACM Open IoT Day, **Munich**, June 2018

"Solar + Storage + IoT + LED = \$30 trillion," Invited Lecture, Karlsruhe Institute of Technology, **Karlsruhe**, June 2018

"Optimal Matching of Stochastic Solar Generators to Stochastic Loads," Presentation at ACM eEnergy conference, **Karlsruhe**, June 2018.

"Canopus: a Scalable and Massively Parallel Consensus Protocol," Dept. of Computer Science, University of Texas at Austin, **Austin**, February 2018

"Scalable Blockchains for Transactive Energy," Invited Lecture, Alan Turing Institute, **London**, July 2017

"Solar + Storage + IoT = \$30 Trillion," Invited Lecture, King's College, **London**, July 2017

"Paradoxes in Internet Architecture," **Distinguished Lecture**, Queen Mary University of **London**, July 2017

"Paradoxes in Internet Architecture," Invited Lecture, Microsoft Research, **Cambridge**, UK, July 2017

"Paradoxes in Internet Architecture," Keynote at ACM TUR-C conference, **Shanghai**, May 2017

"Solar + Storage + IoT = \$30 Trillion," Invited Lecture, SouthEast University, **Nanjing**, May 2017

"Solar + Storage + IoT = \$30 Trillion," Invited Lecture, NorthWest University, **Xi'an**, May 2017

"Paradoxes in Internet Architecture," Invited Lecture, Tsinghua University, **Beijing**, July 2017

"Solar + Storage + IoT = \$30 Trillion," Invited Lecture, Cyber Physical Institute Seminar Series, U. **Toronto**, April 2017

"Solar + Storage + IoT + LED = \$30 trillion," Public Lecture, Waterloo Institute for Sustainable Energy, University of **Waterloo**, April 2017

"Optimal Lighting Control with Pervasive Sensing," Invited Lecture, South West Ontario OR Day, **Waterloo**, April 2017

"Solar + Storage + IoT + LED = \$30 trillion," Invited Lecture, McGill University, **Montreal**, June 2016

"Solar + Storage + IoT + LED = \$30 Trillion," Keynote at Erasmus Energy Day, Erasmus University, **Rotterdam**, Netherlands, May 2016

"The WeBike Project," presentation at the University of Twente, **Twente**, Netherlands, May 2016

"What is Smart Now?" Round-table discussion at WORKSHOP Design Center, **Toronto**, November 2014

"Smart Grid: Status and Challenges," Keynote at Communications and Control for Smart Energy Systems Workshop, IEEE INFOCOM, **Toronto**, April 2014

"The Challenge of Deployment," Keynote at Workshop on Lowest Cost Networking for Universal Access, ACM MOBICOM, **Miami**, Florida, 2013

"The Consumer-centric Smart Grid," WISE Advisory Council, **Waterloo**, May 2012

"Optimal Contracts for Providing Frequency Regulation Service Using Fleets of Electric Vehicles," Smart Grid Day Workshop, **Waterloo**, May 2012

"A Networking Approach to the Smart Grid," Invited Lecture, Cornell University, **Ithaca**, July 2012

"A Networking Approach to the Smart Grid," Invited Lecture, McMaster University, **Hamilton**, Feb. 2012

"A Networking Approach to the Smart Grid," Invited Lecture, ETH **Zurich**, Jan. 2012

"How the Internet can Green the Grid," Distinguished Lecture, University of North Carolina, **Chapel Hill**, November 2010

"How the Internet can Green the Grid," presentation made to Google **Waterloo**, April 2010.

"Cloud computing: Good, Bad, and Ugly," First Mysore Park Workshop on Cloud Computing, **Mysore**, India, January 2010.