Rajmohan Rajaraman

Professor
College of Computer and Information Science
Northeastern University
Boston, MA 02115

Phone: (617) 373–2075
Fax: (617) 373–5121
Email: `rraj@ccs.neu.edu`
`http://www.ccs.neu.edu/home/rraj`

Professional Background

- Professor, *Northeastern University*, Boston, MA; July 2008 to present; Associate Professor, July 2003 to June 2008; Assistant Professor, September 1998 to June 2003.

- Postdoctoral Fellow at *DIMACS*, *Rutgers University* and *Bell Laboratories, Lucent Technologies*, NJ; October 1997 to August 1998.

- Visiting positions:

    - *Adverplex*, Research Consultant, May-September 2007 and June-July 2008.
    - *Akamai Technologies*, Senior Research Scientist, December 2005 to September 2006, and December 1999 to May 2001.
    - *MIT CSAIL*, Visiting Scientist, September 2005 to December 2005.
    - *Cornell University*, Visiting Assistant Professor, September 2002.
    - *Sandia National Laboratories*, Consultant, June 1996 to August 1996.

- Ph.D., Computer Science, December 1997.
  University of Texas at Austin.
  Title of dissertation: "Sharing Resources in Distributed Systems".
  Supervisor: Greg Plaxton.

- M.S., Computer Science, May 1993. *University of Texas at Austin.*

- B.Tech., Computer Science and Engineering, June 1991. *Indian Institute of Technology, Kanpur, India.*

Honors and Awards

- Co-author of ACM WiSec 2011 Best Paper Award winner.

- Co-author of IEEE ICDCS 2006 Best Paper Award winner.

- NSF Faculty Early Career Development Award (CAREER), June 2000 to May 2004.

Research Grants

- Co-PI, with Agnes Chan, Guevara Noubir, and Ravi Sundaram (PI) on BAE subcontract on mitigating DoS attacks in wireless ad hoc networks. September 2011 to August 2013, $600K.

- Co-PI, NSF NeTS grant "A Game-Theoretic Framework for Agile and Resilient Wireless Systems", with Guevara Noubir (PI), September 2009 to August 2012, $400K.

- PI, NSF grant "How Blissful is Ignorance? The Role of Obliviousness in Network Optimization", Theoretical Foundations Cluster, with Ravi Sundaram, September 2006 to August 2009, $200K.

- Co-PI, DARPA grant, "SPREAD: Second-Generation Wireless Protocol Resiliency Enabled by Adaptive Diversification", with Agnes Chan, Guevara Noubir (PI), and Ravi Sundaram (PI). September 2005 to August 2007, $380K.

- Co-PI, National Science Foundation (NSF) grant IIS–0330201, "SENSORS: Data Driven Sensor Networks". PI Johannes Gehrke (Cornell). Award amount $500,000 for the period September 2003 to August 2006. Northeastern's share is $170K.

- PI, National Science Foundation (NSF) *Faculty Early Career Development Award* CCR–9983901, "CAREER: Algorithms for Organizing and Scheduling Distributed Resources". Award amount $213K for the period June 2000 to May 2004.

Journal Articles

- G. Lin, C. Nagarajan, R. Rajaraman, and D. Williamson, "A general framework for incremental approximation and clustering", *SIAM Journal on Computing*, vol 39, November 2010.

- G. Lin and R. Rajaraman, "Approximation Algorithms for Multiprocessor Scheduling under Uncertainty", *Theory of Computing Systems*, vol 47, 2010. Special issue on selected papers from SPAA 2007.

- Ivan D. Baev, R. Rajaraman, and Chaitanya Swamy, "Approximation Algorithms for Data Placement Problems", *SIAM J. Comput.* 38(4): 1411-1429, 2008.

- K. Laing and R. Rajaraman, "A Space Lower Bound for Name-Independent Compact Routing in Trees", *Journal of Interconnection Networks*, volume 8, September 2007.

- J. Chen, R. Kleinberg, L. Lovasz, R. Rajaraman, R. Sundaram, and A. Vetta, "(Almost) Tight Bounds and Existence Theorems for Single-Commodity Confluent Flows", *Journal of the ACM*, volume 54, 2007.

- A. Trigoni, Y. Yao, A. Demers, J. Gehrke, and R. Rajaraman, "Wave Scheduling and Routing in Sensor Networks", *ACM Transactions on Sensor Networks*, volume 3, March 2007.

- M. Arias, L. Cowen, K. Laing, R. Rajaraman, and O. Taka, "Compact Routing with Name Independence", *SIAM Journal on Discrete Mathematics*, volume 20, pages 705–726, 2006.

- J. Chen, R. Rajaraman, and R. Sundaram, "Meet and Merge: Approximation Algorithms for Confluent Flows", *Journal of Computer and System Sciences*, 72(3): 468-489 (2006). Special issue devoted to selected papers in network algorithms.

- M. Bender, S. Muthukrishnan, and R. Rajaraman, "Improved Algorithms for Stretch Scheduling", *Journal of Scheduling* 7(3): 195-222 (2004).

- J. Gehrke, S. Muthukrishnan, R. Rajaraman, and A. Shaheen, "Online Scheduling to Minimize Average Stretch". *SIAM Journal on Computing*, 34(2): 433-452 (2004).

- V. Guruswami, S. Khanna, R. Rajaraman, B. Shepherd, and M. Yannakakis, "Near-Optimal Hardness Results and Approximation Algorithms for Edge-Disjoint Paths and Related Problems". *Journal of Computer and System Sciences*, 67(3), 473-496, 2003.

- M. Adler, S. Khanna, R. Rajaraman, and A. Rosén, "Time-Constrained Scheduling of Weighted Packets on Trees and Meshes", *Algorithmica*, 36(2): 123–152, 2003.

- L. Jia, R. Rajaraman, and T. Suel, "An Efficient Distributed Algorithm for Constructing Small Dominating Sets". *Distributed Computing* 15:193-205, 2002. Special issue devoted to selected papers from ACM PODC 2001.

- R. Rajaraman and S. Muthukrishnan, "An Adversarial Model for Distributed Dynamic Load Balancing". *Journal of Interconnection Networks* 3:35–47, 2002.

- M. Mitzenmacher and R. Rajaraman, "Towards More Complete Models for TCP Latency and Throughput". *Journal of Supercomputing* 20:137–160, 2001. Special issue on transport protocols.

- M. Korupolu and C. G. Plaxton, R. Rajaraman, "Placement Algorithms for Hierarchical Cooperative Caching". *Journal of Algorithms* 38:260–302, 2001. Special issue devoted to selected papers from SODA 1999.

- M. Korupolu, C. G. Plaxton, and R. Rajaraman, "Analysis of a Local Search Heuristic for Facility Location Problems". *Journal of Algorithms* 37:146–188, 2000. Special issue devoted to selected papers from SODA 1998.

- J. E. Gehrke, R. Rajaraman, and C. G. Plaxton, "Rapid Convergence of a Local Load Balancing Algorithm for Asynchronous Rings". *Theoretical Computer Science* 220(1):247-265, 1999. Special issue devoted to selected papers from WDAG 1997.

- C. G. Plaxton, R. Rajaraman, and A. W. Richa, "Accessing Nearby Copies of Replicated Objects in a Distributed Environment". *Theory of Computing Systems* 32:241–280, 1999. Special issue devoted to selected papers from SPAA 1997.

- B. Ghosh, F. T. Leighton, B. M. Maggs, S. Muthukrishnan, C. G. Plaxton, R. Rajaraman, A. W. Richa, R. E. Tarjan, and D. Zuckerman, "Tight Analyses of Two Local Load Balancing Algorithms". *SIAM Journal on Computing* 29(1):29–64, 1999.

- P. D. Mackenzie, C. G. Plaxton, and R. Rajaraman, "On Contention Resolution Protocols and Associated Probabilistic Phenomena" . *Journal of the ACM* 45(2): 324–378, March 1998.

- R. Rajaraman and D. F. Wong, "Optimum Clustering for Delay Minimization" . *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, 14:1490–1495, December 1995.

Conference Papers
(full versions of some papers are also listed under journal articles)

- B. Haeupler, G. Pandurangan, D. Peleg, and Z. Sun, " Discovery Through Gossip", *ACM SPAA*, June 2012.

- R. Gopalakrishnan, D. Kanoulas, N. Karuturi, C. Pandu Rangan, R. Rajaraman, and R. Sundaram, "Cache me if you can: Capacitated Selfish Replication Games", *LATIN*, April 2012.

- G. Noubir, R. Rajaraman, B. Sheng, and B. Thapa, "On the robustness of IEEE 802.11 rate adaptation algorithms against smart jamming", *ACM WISEC 2011.* Winner of **best paper award**.

- L. Poplawski and R. Rajaraman, "Multicommodity Facility Location under Group Steiner Access Cost", *ACM-SIAM SODA*, January 2011.

- A. Kumar, Z. Sun, R. Rajaraman, and R.Sundaram, "Existence Theorems and Approximation Algorithms for Generalized Network Security Games", *IEEE ICDCS*, June 2010.

- S. Kintali, L. Poplawski, R. Rajaraman, R. Sundaram, and S. Teng, "Reducibility among Fractional Stability Problems", *IEEE FOCS*, November 2009.

- A. Chan, R. Rajaraman, Z. Sun, and F. Zhu, "Approximation Algorithms for Key Management in Secure Multicast", *COCOON*, February 2009.

- N. Laoutaris, L. Poplawski, R. Rajaraman, R. Sundaram, and S.-H. Teng, "Bounded Budget Connection Games, or How to Make Friends and Influence People, on a Budget", *ACM PODC*, August 2008.

- E. Bayrataroglu, C. King, X. Liu, G. Noubir, R. Rajaraman, and B. Thapa, "On the Performance of IEEE 802.11 under Jamming", in *Infocom 2008*.

- G. Lin and R. Rajaraman, "Approximation Algorithms for Multiprocessor Scheduling under Uncertainty", in *ACM SPAA 2007*, pages 25–34. Invited to appear in a special issue of *Theory of Computing Systems* on SPAA 2007.

- R. Chakinala, A. Kumarasubramanian, K. Laing, R. Manokaran, C. P. Rangan, and R. Rajaraman, "Playing Push vs Pull: Models and Algorithms for Disseminating Dynamic Data in Networks", *ACM SPAA*, July 2006, pages 244–253.

- J. Chen, M. Marathe, R. Rajaraman, and R. Sundaram, "On the Confluent Capacity of the Internet: Congestion and Dilation", *Proceedings of the IEEE ICDCS*, July 2006. **Winner of the best paper award**.

- L. Jia, G. Noubir, R. Rajaraman, and R. Sundaram, "Group-Independent Spanning Trees for Data Aggregation in Sensor Networks", *IEEE DCOSS*, June 2006.

- G. Lin, C. Nagarajan, R. Rajaraman, and D. Williamson, "A general framework for incremental approximation and clustering", *ACM-SIAM SODA*, January 2006.

- N. Trigoni, Y. Yao, A. Demers, J. Gehrke, and R. Rajaraman, "Multi-Query Optimization for Sensor Networks", *IEEE DCOSS*, June 2005.

- L. Jia, G. Lin, G. Noubir, R. Rajaraman, and R. Sundaram, "Universal approximations for TSP, Steiner tree, and set cover", *ACM STOC 2005*, pages 386-395, May 2005.

- L. Jia, X. Liu, R. Rajaraman, and G. Noubir, "Transmission Power Control for Ad Hoc Wireless Networks: Throughput, Energy and Fairness", *IEEE WCNC*, March 2005.

- A. Trigoni, Y. Yao, A. Demers, J. Gehrke, and R. Rajaraman, "Hybrid Push-Pull Query Processing for Sensor Networks", *GI-Conference Informatik Workshop on Sensor Networks 2004*, Berlin, Germany, September 2004.

- A. Trigoni, Y. Yao, A. Demers, J. Gehrke, and R. Rajaraman, "WaveScheduling: Energy-Efficient Data Dissemination for Sensor Networks", *VLDB Workshop on Data Management for Sensor Networks (DMSN 2004)*.

- J. Chen, R. Kleinberg, L. Lovasz, R. Rajaraman, R. Sundaram, and A. Vetta, "(Almost) Tight Bounds and Existence Theorems for Confluent Flows", *ACM STOC*, June 2004.

- G. Lin, G. Noubir, and R. Rajaraman, "Mobility Models for Ad Hoc Networks", *IEEE INFOCOM*, March 2004.

- L. Jia, R. Rajaraman, and C. Scheideler, "On Local Algorithms for Topology Control and Routing in Ad hoc Networks", *ACM SPAA*, pages 220-229, June 2003

- M. Arias, L. Cowen, K. Laing, R. Rajaraman, and O. Taka, "Compact Routing with Name Independence", *ACM SPAA*, pages 184-192, June 2003.

- J. Chen, R. Rajaraman, and R. Sundaram, "Meet and Merge: Approximation Algorithms for Confluent Flows". *ACM STOC*, pages 373-382, June 2003.

- M. Bender, S. Muthukrishnan, and R. Rajaraman, "Improved Algorithms for Stretch Scheduling". In *ACM-SIAM SODA*, pages 762–771, January 2002.

- L. Jia, R. Rajaraman, and T. Suel, "An Efficient Distributed Algorithm for Constructing Small Dominating Sets". In *ACM PODC*, pages 33–42, August 2001. Winner of the best student paper for doctoral student Lujun Jia.

- R. Rajaraman, A. Richa, B. Vöcking, and G. Vuppuluri, "A Data Tracking Scheme for General Networks". In *ACM SPAA*, pages 247–254, July 2001.

- I. Baev and R. Rajaraman, "Approximation Algorithms for Data Placement in Arbitrary Networks". In *ACM-SIAM SODA*, pages 661–670, January 2001.

- J. Gehrke, S. Muthukrishnan, R. Rajaraman, and A. Shaheen, "Scheduling to Minimize Average Stretch". In *IEEE FOCS*, pages 433–442, November 1999.

- M. Adler, S. Khanna, R. Rajaraman, and A. Rosén, "Time-Constrained Scheduling of Weighted Packets on Trees and Meshes". In *ACM SPAA*, pages 1–12, June 1999.

- M. Rabinovich, I. Rabinovich, R. Rajaraman, and A. Aggarwal, "Dynamic Object Replication and Migration Algorithms for an Internet Hosting Service". In *IEEE/ACM ICDCS*, pages 101-113, May 1999.

- V. Guruswami, S. Khanna, R. Rajaraman, B. Shepherd, and M. Yannakakis, "Near-Optimal Hardness Results and Approximation Algorithms for Edge-Disjoint Paths and Related Problems", *ACM STOC*, pages 19–28, May 1999.

- J. E. Gehrke, C. G. Plaxton, and R. Rajaraman, "Rapid Convergence of a Local Load Balancing Algorithm for Asynchronous Rings", in *Proceedings of the 11th International Workshop on Distributed Algorithms*, pages 81–95, September 1997.

- M. Korupolu and C. G. Plaxton, R. Rajaraman, "Placement Algorithms for Hierarchical Cooperative Caching", *ACM-SIAM SODA*, pages 586–595, January 1999.

- R. Rajaraman and S. Muthukrishnan, "An Adversarial Model for Distributed Dynamic Load Balancing", *ACM SPAA*, pages 47–54, June 1998.

- M. Korupolu, C. G. Plaxton, and R. Rajaraman, "Analysis of a Local Search Heuristic for Facility Location Problems", *ACM-SIAM SODA*, pages 1–10, January 1998.

- C. G. Plaxton, R. Rajaraman, and A. W. Richa, "Accessing Nearby Copies of Replicated Objects in a Distributed Environment", *ACM SPAA*, pages 311–320, June 1997.

- C. G. Plaxton and R. Rajaraman, "Fast Fault-Tolerant Concurrent Access to Shared Objects", *IEEE FOCS*, pages 570–579, October 1996.

- B. Ghosh, F. T. Leighton, B. M. Maggs, S. Muthukrishnan, C. G. Plaxton, R. Rajaraman, A. W. Richa, R. E. Tarjan, and D. Zuckerman, "Tight Analyses of Two Local Load Balancing Algorithms", *ACM STOC*, pages 548–558, May 1995.

- P. D. Mackenzie, C. G. Plaxton, and R. Rajaraman, "On Contention Resolution Protocols and Associated Probabilistic Phenomena", *ACM STOC*, pages 153–162, May 1994.

- R. Rajaraman and D. F. Wong, "Optimum Clustering for Delay Minimization", *Proceedings of the 30th Annual Design Automation Conference*, pages 309–314, June 1993.

Invited Articles

- "Randomized Rounding", article for *Encyclopaedia of Algorithms*, 2008, editor M.-Y. Kao.

- "Performance Driven Clustering", article for *Encyclopaedia of Algorithms*, 2008, editor M.-Y. Kao.

- "The Cougar Project: A Work-In-Progress Report", with A. Demers, J. Gehrke, N. Trigoni, and Y. Yao *Sigmod Record*, 34(4), December 2003.

- "Topology Control and Routing in Ad Hoc Networks: A Survey", *ACM SIGACT News* 33:60-73, June 2002.

PhD Students Supervised

- Zhifeng Sun, "Diffusion in Networks", expected graduation April 2012. Currently in Microsoft's Bing Search team.

- Laura Poplawski, "Decentralized Network Design", August 2009. Research Scientist at Raytheon.

- Guolong Lin, "New paradigms for combinatorial optimization with uncertain inputs", April 2006. Senior Software Engineer at Akamai Technologies, Cambridge, MA.

- Lujun Jia, "Distributed Structures in Mobile Ad-hoc Networks", December 2005. Distinguished Member of Technical Staff at Verizon Technological Organization, Waltham, MA.

- Jiangzhuo Chen, "Confluent flows", September 2005. Research Scientist at Virginia Bioinformatics Institute, Virgina Tech. Co-advised with Ravi Sundaram.

Tutorials and Invited Talks

- "Universal Approximations", Princeton/DIMACS workshop Approximation Algorithms: The Last Decade and the Next, June 2011.

- "Games Ad Hoc Networks Play", Keynote Speaker, ACM SIGACT/SIGMOBILE International Workshop on Foundations of Mobile Computing DIALM-POMC, September 2010.

- "Algorithms for Dissemination of Dynamic Data in Sensor Networks", Keynote Speaker, International Workshop on Interconnections of Wireless Sensor Networks, part of DCOSS 2010, June 2010.

- "Reducibility among Fractional Stability Problems", Bellairs Workshop on Approximation Algorithms, Barbados, March 2010.

- "On the Performance Analysis of 802.11 Under Jamming", Bertinoro Workshop on Wireless Networks and Algorithms, Bertinoro, Italy, August 2007.

- "Playing Push vs Pull: Models and Algorithms for Disseminating Dynamic Data in Networks", Bertinoro Workshop on Flexible Network Design, Bertinoro, Italy, October 2006.

- "Introduction to Dynamic Networks: Models, Algorithms, and Analysis", Summer School on Dynamic Networks, Lisboa, Portugal, June 2006.

- "Scheduling under Uncertainty", CIRM Workshop on Scheduling, Marseille-Luminy, France, May 2006.

- Tutorial "Algorithmic Foundations of Ad Hoc Networks", Summer School at ETH Zurich, July 2004.

- Tutorial "Maintaining Distributed Structures in Multihop Networks", Cornell University, September 2002; an earlier version was presented at the *Summer School on Foundations of Wireless Networks and Applications*, DIMACS Special Year on Next Generation Network Technologies and Applications, August 2000.

Professional Service

- Associate Editor, Theory of Computing Systems, 2011-present.

- Program Chair, ACM Symposium on Parallelism in Algorithms and Architectures, 2011.

- Program Chair, IEEE Conference on Distributed Computing over Sensor Systems (DCOSS), 2010.

- Program Vice-Chair, Algorithms Track, IEEE Parallel and Distributed Processing Symposium (IPDPS) 2010.

- Guest editor, special issue of *SIAM Journal on Computing* devoted to selected papers from FOCS 2006; special issue of *Theory of Computing Systems* devoted to selected papers from SPAA 2002.

- Program Committee Member: SSS 2012, GameNets 2011, SODA 2010, PODC 2009, SPAA 2008, IPDPS 2008, PODC 2007, IPTPS 2007, DCOSS 2007, DIALM-POMC 2006, FOCS 2006, MobiHoc 2005, HiPC 2005, DIALM-POMC 2005, ISPAN 2005, DIALM-POMC 2004, APPROX 2004, DIALM 2003, PODC 2003, SODA 2003, SPAA 2002, CNDS 2002, HiPC 2001, PDCS 1999.

- SPAA Treasurer, January 2003 to 2008.

- Co-organizer, *Workshop on Resource Management and Scheduling in Next Generation Networks*, DIMACS, Special Year on Next Generation Network Technologies and Applications, March 2001.