

## Bruce MacDowell Maggs

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### Research Interests

Networks for parallel and distributed computer systems.

### Employment

#### *Duke University*

Pelham Wilder Professor of Computer Science, July 2011–present.  
Professor of Computer Science, January 2010–July 2011.  
Visiting Professor of Computer Science, September 2007–August 2008,  
July 2009–January 2010.

#### *Carnegie Mellon University*

Adjunct Professor of Computer Science, July 2009–July 2010.  
Professor of Computer Science, July 2004–July 2009.  
Professor of Electrical and Computer Engineering (by courtesy), July 2004–July 2009.  
Associate Professor of Computer Science, with tenure, July 1999–July 2004.  
Associate Professor of Computer Science, July 1997–July 1999.  
Assistant Professor of Computer Science, January 1994–July 1997.

#### *Akamai Technologies, Inc.*

Vice President for Research, January 1, 2000–present.  
Vice President for Research and Development, April 1, 1999–December 31, 1999.  
Senior Research Scientist, January 15, 1999–March 31, 1999.

#### *Massachusetts Institute of Technology*

Visiting Associate Professor of Computer Science, September 1998–January 1999.

#### *NEC Research Institute, Inc.*

Research Scientist (Permanent Status), October 1993–January 1994.  
Research Scientist (Provisional Status), September 1990–October 1993.

#### *Massachusetts Institute of Technology*

Postdoctoral Associate, September 1989–September 1990.

### Education

#### *Massachusetts Institute of Technology*

Ph.D., Computer Science, September 1989.  
Thesis title: *Locality in Parallel Computation*  
Thesis supervisor: Charles E. Leiserson  
S.M., Electrical Engineering and Computer Science, June 1986.  
Thesis title: *Communication-Efficient Parallel Graph Algorithms*  
S.B., Computer Science and Engineering, June 1985.  
Thesis title: *Computing Minimum Spanning Trees on a Fat-Tree Architecture*

#### *University of Illinois at Urbana-Champaign*

September 1981–May 1983.

## II. Publications

### Chapters in Books

- [1] “Parallel algorithms,” G. E. Blelloch and B. M. Maggs. In M. J. Atallah, editor, *Handbook of Algorithms and Theory of Computation*, CRC Press, Boca Raton, FL, November 1998, chapter 47.
- [2] “Parallel algorithms,” G. E. Blelloch and B. M. Maggs. In A. B. Tucker, Jr., editor, *The Computer Science and Engineering Handbook*, CRC Press, Boca Raton, FL, 1997, pp. 277–315.

### Refereed Journal Papers

- [1] “Enabling Content-Aware Traffic Engineering,” I. Poese, B. Frank, G. Smaragdakis, S. Uhlig, A. Feldmann, and B. Maggs. *ACM SIGCOMM Computer Communication Review*, Vol. 42, No. 5, October 2012.
- [2] “Posit: A Lightweight Approach for IP Geolocation,” B. Eriksson, P. Barford, B. Maggs, and R. Nowak, *SIGMETRICS Performance Evaluation Review*, Vol. 40, No. 2, September 2012, pp. 2–11.
- [3] “Simultaneous Source Location,” K. Andreev, C. Garrod, D. Golovin, B. Maggs, and A. Meyerson. *ACM Transactions on Algorithms*, Vol. 6, No. 1, December 2009.  
Originally appeared in the *Proceedings of the 7th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems (APPROX)*, August, 2004.
- [4] “On the Performance Benefits of Multihoming Route Control,” A. Akella, B. M. Maggs, S. Seshan, A. Shaikh, and R. Sitaraman. *IEEE/ACM Transactions on Networking*, Vol. 16, No. 1, February 2008, pp. 91–104.  
Originally appeared as “A measurement-based analysis of multihoming,” in the *Proceedings of the ACM SIGCOMM 2003 Conference on Applications, Technologies, Architectures, and Protocols for Computer Communication (SIGCOMM)*, August, 2003.
- [5] “Globally distributed content delivery,” J. Dille, B. Maggs, J. Parikh, H. Prokop, R. Sitaraman, and B. Weihl. *IEEE Internet Computing*, September/October 2002, pp. 50–58.
- [6] “Protocols for asymmetric communication channels,” M. Adler and B. M. Maggs. *Journal of Computer and Systems Sciences*, Vol. 63, No. 4, December 2001, pp. 573–596.  
Originally appeared in the *Proceedings of the 39th Annual Symposium on Foundations of Computer Science (FOCS)*, October 1998, pp. 522–533.
- [7] “On the bisection width and expansion of butterfly networks,” C. F. Bornstein, A. Litman, B. M. Maggs, R. K. Sitaraman, and T. Yatzkar. *Theory of Computing Systems*, Vol. 34, No. 6, November 2001, pp. 491–518.  
Originally appeared in the *Proceedings of the 12th International Parallel Processing Symposium (IPPS)*, March 1998, pp. 144–150.
- [8] “On the benefit of supporting virtual channels in wormhole routers,” R. J. Cole, B. M. Maggs, and R. K. Sitaraman. *Journal of Computer and System Sciences*, Vol. 62, No. 1, February 2001, pp. 152–177.  
Originally appeared in the *Proceedings of the 8th ACM Symposium on Parallel Algorithms and Architectures (SPAA)*, June 1996, pp. 131–141.
- [9] “Improved routing and sorting on multibutterflies,” B. M. Maggs and B. Vöcking. *Algorithmica*, Vol. 28, No. 4, 2000, pp. 438–464.

Originally appeared in the *Proceedings of the 28th Annual ACM Symposium on the Theory of Computing* (STOC), May 1997, pp. 517–530.

- [10] “Sorting-based selection algorithms for hypercubic networks,” P. Berthomé, A. Ferreira, B. M. Maggs, S. Perennes, and C. G. Plaxton. *Algorithmica*, Vol. 26, No. 2, 2000, pp. 237–254. Originally appeared in the *Proceedings of the 7th International Parallel Processing Symposium* (IPPS), April 1993, pp. 89–95.
- [11] “Fast algorithms for finding  $O(\text{congestion} + \text{dilation})$  packet routing schedules,” F. T. Leighton, B. M. Maggs, and A. W. Richa. *Combinatorica*, Vol. 19, No. 3, 1999, pp. 375–401. Originally appeared in the *Proceedings of the 28th Hawaii International Conference on System Sciences* (HICSS), Volume 2, January, 1995, pp. 555–563.
- [12] “Simple algorithms for routing on butterfly networks with bounded queues,” B. M. Maggs and R. K. Sitaraman. *SIAM Journal on Computing*, Vol. 28, No. 3, June 1999, pp. 984–1003. Originally appeared in the *Proceedings of the 24th Annual ACM Symposium on the Theory of Computing* (STOC), May 1992, pp. 150–161.
- [13] “Tight analyses of two local load balancing algorithms,” B. Ghosh, F. T. Leighton, B. M. Maggs, S. Muthukrishnan, C. G. Plaxton, R. Rajaraman, A. W. Richa, R. E. Tarjan, and D. Zuckerman. *SIAM Journal on Computing*, Vol. 29, No. 1, February 1999, pp. 29–64. Originally appeared in the *Proceedings of the 27th Annual ACM Symposium on the Theory of Computing* (STOC), May 1995, pp. 548–558.
- [14] “On the fault tolerance of some popular bounded-degree networks,” F. T. Leighton, B. M. Maggs, and R. K. Sitaraman. *SIAM Journal on Computing*, Vol. 27, No. 5, October 1998, pp. 1303–1333. Originally appeared in the *Proceedings of the 33rd Annual Symposium on Foundations of Computer Science* (FOCS), October 1992, pp. 542–552.
- [15] “An experimental analysis of parallel sorting algorithms,” G. E. Blelloch, C. E. Leiserson, B. M. Maggs, C. G. Plaxton, S. Smith, and M. Zagha. *Theory of Computing Systems*, Vol. 31, No. 2, March/April 1998, pp. 135–167. Originally appeared as “A comparison of sorting algorithms for the Connection Machine CM-2,” in the *Proceedings of the 3rd Annual ACM Symposium on Parallel Algorithms and Architectures* (SPAA), July 1991, pp. 3–16.
- [16] “Reconfiguring arrays with faults part I: worst-case faults,” R. J. Cole, B. M. Maggs, and R. K. Sitaraman. *SIAM Journal on Computing*, Vol. 26, No. 6, December 1997, pp. 1581–1611. Originally appeared as “Multi-scale emulation: A technique for reconfiguring arrays with faults,” in the *Proceedings of the 25th Annual ACM Symposium on the Theory of Computing* (STOC), May 1993, pp. 561–572.
- [17] “Work-preserving emulations of fixed-connection networks,” R. R. Koch, F. T. Leighton, B. M. Maggs, S. B. Rao, A. L. Rosenberg, and E. J. Schwabe. *Journal of the ACM*, Vol. 44, No. 1, January 1997, pp. 104–147. Originally appeared in the *Proceedings of the 21st Annual ACM Symposium on Theory of Computing* (STOC), May 1989, pp. 227–240.
- [18] “On-line algorithms for path selection in a nonblocking network,” S. Arora, F. T. Leighton, and B. M. Maggs. *SIAM Journal on Computing*, Vol. 25, No. 3, June 1996, pp. 600–625. Originally appeared in the *Proceedings of the 22nd Annual ACM Symposium on Theory of Computing* (STOC), May 1990, pp. 149–158.

- [19] “A maximum likelihood stereo algorithm,” I. J. Cox, S. L. Hingorani, B. M. Maggs, S. B. Rao. *Computer Vision and Image Understanding*, Vol. 63, No. 3, May 1996, pp. 542–567. Originally appeared as “Stereo without disparity gradient smoothing: a Bayesian sensor fusion solution,” in D. Hogg and R. Boyle, ed., *Proceedings of the British Machine Vision Conference*, Springer-Verlag, September 1992, pp. 337–346.
- [20] “Randomized routing and sorting on fixed-connection networks,” F. T. Leighton, B. M. Maggs, S. B. Rao, and A. G. Ranade. *Journal of Algorithms*, Vol. 17, No. 1, July 1994, pp. 157–205. Originally appeared as “Universal packet routing algorithms,” T. Leighton, B. Maggs, and S. Rao. *Proceedings of the 29th Annual Symposium on Foundations of Computer Science (FOCS)*, October 1988, pp. 256–271. Note: this conference paper was later broken into two journal papers.
- [21] “Packet routing and job-shop scheduling in  $O(\text{congestion} + \text{dilation})$  steps,” F. T. Leighton, B. M. Maggs, S. B. Rao. *Combinatorica*, Vol. 14, No. 2, 1994, pp. 167–180. Originally appeared as “Universal packet routing algorithms,” T. Leighton, B. Maggs, and S. Rao. *Proceedings of the 29th Annual Symposium on Foundations of Computer Science (FOCS)*, October 1988, pp. 256–271. Note: this conference paper was later broken into two journal papers.
- [22] “A parallel algorithm for reconfiguring a multibutterfly network with faulty switches,” A. V. Goldberg, B. M. Maggs, and S. A. Plotkin. *IEEE Transactions on Computers*, Vol. 43, No. 3, March 1994, pp. 321–326.
- [23] “Fast algorithms for routing around faults in multibutterflies and randomly-wired splitter networks,” F. T. Leighton and B. M. Maggs. *IEEE Transactions on Computers*, Vol. 41, No. 5, May 1992, pp. 578–587. Originally appeared as “Expanders might be practical: fast algorithms for routing around faults on multibutterflies,” in the *Proceedings of the 30th Annual Symposium on Foundations of Computer Science (FOCS)*, October 1989, pp. 384–389.
- [24] “Fast algorithms for bit-serial routing on a hypercube,” W. A. Aiello, F. T. Leighton, B. M. Maggs, and M. Newman. *Mathematical Systems Theory*, Vol. 24, No. 4, 1991, pp. 253–271. Originally appeared in the *Proceedings of the 2nd Annual ACM Symposium on Parallel Algorithms and Architectures (SPAA)*, July 1990, pp. 55–64.
- [25] “Communication-efficient parallel algorithms for distributed random-access machines,” C. E. Leiserson and B. M. Maggs. *Algorithmica*, Vol. 3, No. 1, 1988, pp. 53–77. Originally appeared in the *Proceedings of the 1986 International Conference on Parallel Processing (ICPP)*, August 1986, pp. 861–868.
- [26] “Minimum-cost spanning tree as a path-finding problem,” B. M. Maggs and S. A. Plotkin. *Information Processing Letters*, Vol. 26, No. 6, January 1988, pp. 291–293.

### Submitted for Journal Publication

- [1] “Designing overlay multicast networks for streaming”, K. Andreev, B. Maggs, A. Meyerson, and R. Sitaraman. Originally appeared in *Proceedings of the Fifteenth Annual ACM Symposium on Parallel Algorithms and Architectures (SPAA)*, June 2003.
- [2] “On hierarchical routing in doubling metrics,” H. T-H. Chan, A. Gupta, B. M. Maggs, and S. Zhou.

Originally appeared in *Proceedings of the 16th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA)*, January 2005.

## Refereed Conference and Workshop Papers Not Also Appearing in or Submitted to Journals

- [1] “Less pain, most of the gain: incrementally deployable ICN,” S. Fayazbaksh, Y. Lin, A. Tootonchian, A. Ghodsi, T. Koponen, B. Maggs, K.-C. Ng, V. Sekar, and S. Shenker, *Proceedings of the ACM SIGCOMM 2013 Conference (SIGCOMM)*, August, 2013, to appear.
- [2] “Reliable content-distribution networks,” P. Aditya, M. Zhao, Y. Lin, A. Haeberlen, P. Druschel, B. Maggs, and B. Wishon, *Proceedings of the 9th USENIX Symposium on Networked Systems Design and Implementation (NSDI)*, April 2012.
- [3] “Cutting the electrical bill for Internet-scale systems,” A. Qureshi, R. Weber, H. Balakrishnan, J. Guttag, and B. Maggs, *Proceedings of the ACM SIGCOMM 2009 Conference (SIGCOMM)*, August, 2009.
- [4] “Holistic query transformations for dynamic Web applications,” A. Manjhi, C. Garrod, B. M. Maggs, T. C. Mowry, and A. Tomasic, *Proceedings of the 2009 IEEE 25th International Conference on Data Engineering (ICDE)*, April 2009.
- [5] “Holistic application analysis for update-independence,” C. Garrod, A. Manjhi, B. Maggs, T. Mowry, and A. Tomasic, *Proceedings of the Second IEEE Workshop on Hot Topics in Web Systems and Technologies (HotWeb 2008)*, October, 2008, pp. 1–6.
- [6] “Scalable query result caching for Web applications,” C. Garrod, A. Manji, A. Ailamaki, B. Maggs, T. Mowry, C. Olston, and A. Tomasic. *Proceedings of the 34th International Conference on Very Large Databases (VLDB)*, August 2008.
- [7] “On the impact of route monitor selection,” Y. Zhang, Z. Zhang, Z. M. Mao, Y. C. Hu, and B. M. Maggs, *Proceedings of the Internet Measurement Conference 2007 (IMC)*, October 2007.
- [8] “Portcullis: protecting connection setup from denial-of-capability attacks,” B. Parno, D. Wendlandt, E. Shi, A. Perrig, B. Maggs, and Y.-C. Hu, *Proceedings of the ACM SIGCOMM 2007 Conference (SIGCOMM)*, August, 2007.
- [9] “R-BGP: staying connected in a connected world,” N. Kushman, S. Kandula, D. Katabi, and B. M. Maggs, *Proceedings of the 4th USENIX Symposium on Networked Systems Design & Implementation (NSDI)*, April 2007.
- [10] “Invalidation clues for database scalability services,” A. Manjhi, P. B. Gibbons, A. Ailamaki, B. M. Maggs, T. C. Mowry, C. Olston, A. Tomasic, and H. Yu. *Proceedings of the 2007 IEEE 23rd International Conference on Data Engineering (ICDE)*, April 2007.
- [11] “Quorum placement in networks: minimizing network congestion,” D. Golovin, A. Gupta, B. M. Maggs, F. Oprea, and M. Reiter, *Proceedings of the 18th Annual ACM SIGACT-SIGOPS Symposium on Principles of Distributed Computing (PODC)*, July, 2006.
- [12] “Simultaneous scalability and security for data-intensive Web applications,” A. Manjhi, A. Ailamaki, B. M. Maggs, T. C. Mowry, C. Olston, and A. Tomasic. *Proceedings of ACM SIGMOD 2006 (SIGMOD)*, June, 2006.
- [13] “Finding effective support-tree preconditioners,” B. M. Maggs, G. L. Miller, O. Parekh, R. Ravi, and S. L. M. Woo. *Proceedings of the 17th Annual ACM Symposium on Parallel Algorithms and Architectures (SPAA)*, July 2005.



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