

David K. Lowenthal

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Education

Ph.D. in Computer Science, The University of Arizona, May 1996.

Thesis advisor: Greg Andrews.

Dissertation: *Fine-Grain Parallelism and Run-Time Decision Making*.

M.S. in Computer Science, The University of Arizona, May 1992.

B.S. in Computer Science, The University of California, Davis, June 1990.

Research and Teaching Interests

Parallel and distributed computing, power-aware computing, operating systems, compilers, networking.

Professional Experience

Professor, The University of Arizona, Department of Computer Science, January 2009 to present (also Associate Head, 2012-present).

Professor, The University of Georgia, Department of Computer Science, August 2007 to December 2008.

Associate Professor, The University of Georgia, Department of Computer Science, August 2002 to July 2007.

Research Fellow, Princeton University, Department of Computer Science, September 2004 to January 2005.

Assistant Professor, The University of Georgia, Department of Computer Science, September 1996 to July 2002.

Research Assistant, The University of Arizona, Department of Computer Science, August 1992 to May 1996.

Refereed Journal Publications

- Zheng Gu, Matthew Small, Xin Yuan, and David K. Lowenthal. Protocol Customization for Improving MPI Performance on RDMA-enabled Clusters. *International Journal of Parallel Programming*, February 2013.
- Barry Rountree, Todd Gamblin, Bronis R. de Supinski, Martin Schulz, David K. Lowenthal, Guy Cobb, and Henry Tufo. Parallelizing heavyweight debugging tools with MPIecho. *Parallel Computing*, 39(3): 156-166 (2013)
- Min Yeol Lim, Vincent W. Freeh, David K. Lowenthal. Adaptive, Transparent CPU Scaling Algorithms Leveraging Inter-Node MPI Communication Regions. *Parallel Computing*, 37(10-11): 667-683 (2011).
- Nandani Kappiah, Vincent W. Freeh, and David K. Lowenthal. Just-in-Time Dynamic Voltage Scaling: Exploiting Inter-Node Slack to Save Energy in MPI Programs. *Journal of Parallel and Distributed Computing*, 68(9): 1175-1185 (2008).
- Vincent W. Freeh, David K. Lowenthal, Feng Pan, Robert Springer, Nandani Kappiah, Barry Rountree, and Mark Femal. Analyzing the Energy-Time Tradeoff in High Performance Computing Applications. *IEEE Transactions on Parallel and Distributed Systems*, 18(6):835-848 (2007).
- Chris Bentley, Scott A. Watterson, David K. Lowenthal, and Barry Rountree. Implicit Array Bounds Checking on 64-bit Architectures. *ACM Transactions on Architecture and Code Optimization*, 3(4):502-527 (2006).
- Haijin Yan, Rupa Krishnan, Scott A. Watterson, David K. Lowenthal, Kang Li, and Larry L. Peterson. Client-Centered, Energy-Efficient Wireless Communication on IEEE 802.11b Networks. *IEEE Transactions on Mobile Computing*, 5(11): 1575–1590 (2006).
- D. Brent Weatherly, David K. Lowenthal, Mario Nakazawa, and Franklin Lowenthal. Dyn-MPI: Supporting MPI on a Nondedicated Cluster of Workstations. *Journal of Parallel and Distributed Computing*, 66(6):822–838 (2006).
- Amit Karwande, Xin Yuan, and David K. Lowenthal. CC-MPI: A Compiled Communication Capable MPI Prototype for Ethernet Switched Clusters. *Journal of Parallel and Distributed Computing*, 65(10):1123–1133 (2005).
- Gregory W. Price and David K. Lowenthal. A Comparative Analysis of Fine-Grain Threads Packages. *Journal of Parallel and Distributed Computing*, 63(11):1050–1063 (2003).
- David K. Lowenthal and Ragavan Subramanian. HyFi: Architecture-Independent Parallelism on Networks of Multiprocessors. *International Journal of Parallel and Distributed Systems and Networks*, 25(4):272–282 (2003).

- Karthik Balasubramanian and David K. Lowenthal. Efficient Support for Pipelining in Distributed Shared Memory Systems. *Parallel and Distributed Computing Practices*, 4(2) (2001).
- Peter Hauschildt, David K. Lowenthal, and Eddie Baron. Parallel Implementation of the PHOENIX Generalized Stellar Atmosphere Program. *Astrophysical Journal*, 134:323–329 (2001).
- David K. Lowenthal. Accurately Selecting Block Size at Run-Time in Pipelined Parallel Programs. *International Journal of Parallel Programming*, 28(3):245–274 (2000).
- David K. Lowenthal and Vincent W. Freeh. Architecture-Independent Parallelism for Both Shared- and Distributed-Memory Machines Using the Filaments Package. *Parallel Computing*, 26:1297–1323 (2000).
- David K. Lowenthal, Vincent W. Freeh, and Gregory R. Andrews. Efficient Fine-Grain Parallelism on Shared-Memory Multiprocessors. *Concurrency—Practice and Experience*, 10(3):157–173 (1998).
- David K. Lowenthal, Vincent W. Freeh, and Gregory R. Andrews. Using Fine-Grain Threads and Run-Time Decision Making in Parallel Computing. *Journal of Parallel and Distributed Computing*, 37, 41–54 (1996).

Refereed Conference and Workshop Publications

- Aniruddha Marathe, Rachel Harris, David K. Lowenthal, Bronis de Supinski, Barry Rountree, and Martin Schulz. A Comparative Study of High-Performance Computing on the Cloud. *22nd ACM Symposium on High-Performance Parallel Distributed Computing (HPDC)*, June 2013.
- Tapasya Patki, David K. Lowenthal, Barry Rountree, Martin Schulz, and Bronis de Supinski. Exploring Hardware Overprovisioning in Power-Constrained High Performance Computing. *27th ACM International Conference on Supercomputing (ICS)*, June 2013.
- Jianxia Chen, Laksmish Ramaswamy, David K. Lowenthal, and Shivkumar Kalyanaraman. Comet: Decentralized Complex Event Detection in Mobile Delay Tolerant Networks. *13th IEEE International Conference on Mobile Data Management*, July 2012.
- Barry Rountree, Dong Ahn, Bronis de Supinski, David K. Lowenthal, and Martin Schulz. Beyond DVFS: A First Look at Performance Under a Hardware-Enforced Power Bound. *8th Workshop on High-Performance, Power-Aware Computing*, May 2012.
- Peter E. Bailey, Tapasya Patki, Gregory M. Striemer, Ali Akoglu, David K. Lowenthal, Peter Bradbury, Matt Vaughn, Liya Wang, and Stephen Goff. Quantitative Trait Locus Analysis Using a Partitioned Linear Model on a GPU Cluster. *11th Workshop on High-Performance Computational Molecular Biology*, May 2012.

- Barry Rountree, David K. Lowenthal, Martin Schulz, and Bronis R. de Supinski. Practical Performance Prediction Under Dynamic Voltage Frequency Scaling. *2nd International Green Computing Conference*, July 2011.
- Jianxia Chen, Lakshmesh Ramaswamy, and David K. Lowenthal. CAEVA: A Customizable and Adaptive Event Aggregation Framework for Collaborative Broker Overlays. *6th International Conference on Collaborative Computing*, October 2010.
- Brad Barnes, Jeonifer Garren, David K. Lowenthal, Jaxk Reeves, Bronis de Supinski, Martin Schulz, and Barry Rountree. Using Focused Regression for Accurate Time-Constrained Scaling of Scientific Applications. *23rd IEEE/ACM International Parallel and Distributed Processing Symposium (IPDPS)*, April 2010.
- Jianxia Chen, Lakshmesh Ramaswamy, and David K. Lowenthal. Towards efficient event aggregation in a decentralized publish-subscribe system. *3rd ACM International Conference on Distributed Event-Based Systems (DEBS)*, July 2009.
- Barry Rountree, David K. Lowenthal, Bronis de Supinski, Martin Schulz, Vincent W. Freeh, and Tyler Bletsch. Adagio: Making DVS Practical for Complex HPC Applications. *23rd ACM International Conference on Supercomputing (ICS)*, June 2009.
- Brad Barnes, Barry Rountree, David K. Lowenthal, Jaxk Reeves, Bronis R. de Supinski, and Martin Schulz. A Regression-Based Approach to Scalability Prediction. *20th ACM International Conference on Supercomputing (ICS)*, June 2008.
- Barry Rountree, David K. Lowenthal, Shelby H. Funk, Vincent W. Freeh, Bronis R. de Supinski, and Martin Schulz. Bounding Energy Consumption in Large-Scale MPI Programs. *IEEE/ACM Supercomputing 2007 (SC '07)*, November 2007.
- Min Yeol Lim, Vincent W. Freeh, and David K. Lowenthal. Adaptive, Transparent Frequency and Voltage Scaling of Communication Phases in MPI Programs. *IEEE/ACM Supercomputing 2006 (SC '06)*, November 2006.
- Wenduo Zhou and David K. Lowenthal. A Parallel, Out-of-Core Algorithm for RNA Secondary Structure Prediction. *35th IEEE International Conference on Parallel Processing (ICPP)*, August 2006.
- Ahmad Faraj, Xin Yuan, and David K. Lowenthal. STAR-MPI: Self Tuned Adaptive Routines for MPI Collective Operations. *20th ACM International Conference on Supercomputing (ICS)*, June 2006.
- Rob Springer, David K. Lowenthal, Barry Rountree, and Vincent W. Freeh. Minimizing Execution Time in MPI Programs on an Energy-Constrained, Power-Scalable Cluster. *11th ACM Symposium on Principles and Practice of Parallel Programming (PPOPP)*, March 2006.
- Nandani Kappiah, Vincent W. Freeh, and David K. Lowenthal. Just In Time Dynamic Voltage Scaling: Exploiting Inter-Node Slack to Save Energy in MPI Programs. *IEEE/ACM Supercomputing 2005 (SC '05)*, November 2005.

- Mario Nakazawa, David K. Lowenthal, and Wenduo Zhou. The MHETA Execution Model for Heterogeneous Clusters. *IEEE/ACM Supercomputing 2005 (SC '05)*, November 2005.
- Haijin Yan, David K. Lowenthal, and Kang Li. ACE: An Active, Client-Directed Technique for Reducing WNIC Energy During Web Browsing. *15th ACM Workshop on Networks and Operating System Support for Digital Audio and Video (NOSSDAV)*, June 2005.
- Vincent W. Freeh, Feng Pan, David K. Lowenthal, and Nandani Kappiah. Using Multiple Energy Gears in MPI Programs on a Power-Scalable Cluster. *10th ACM Symposium on Principles and Practice of Parallel Programming (PPOPP)*, June 2005.
- Vincent W. Freeh, David K. Lowenthal, Robert Springer, Feng Pan, and Nandani Kappiah. Exploring the Energy-Time Tradeoff in MPI Programs. *19th IEEE/ACM International Parallel and Distributed Processing Symposium (IPDPS)*, April 2005.
- Bryan Veal, Kang Li, and David K. Lowenthal. New Methods for Passive Estimation of Round-Trip Times Using TCP Timestamps. *6th Workshop on Passive and Active Measurement (PAM)*, March 2005.
- Haijin Yan and David K. Lowenthal. Towards Cooperation Fairness in Mobile Ad Hoc Networks. *6th IEEE Wireless Computing and Networking Conference (WCNC)*, March 2005.
- Doug McCreary, Kang Li, Scott A. Watterson, and David K. Lowenthal. TCP-RC: A Receiver-Centered TCP Protocol for Delay-Sensitive Applications. *12th SPIE/ACM Multimedia Computing and Networking Conference (MMCN)*, January 2005.
- Michael Gundlach, Sarah Doster, Haijin Yan, David K. Lowenthal, Scott A. Watterson, and Surendar Chandra. Dynamic, Power-Aware Scheduling for Mobile Clients Using a Transparent Proxy. *33rd International Conference on Parallel Processing (ICPP)*, August 2004.
- Chris Bentley, Scott A. Watterson, David K. Lowenthal, and Barry Rountree. Implicit Java Array Bounds Checking on 64-bit Architectures. *18th ACM International Conference on Supercomputing (ICS)*, June 2004.
- Haijin Yan, Rupa Krishnan, Scott A. Watterson, and David K. Lowenthal. Client-Centered Energy Savings for Concurrent HTTP Connections. *14th ACM Workshop on Networks and Operating System Support for Digital Audio and Video (NOSSDAV)*, June 2004.
- Haijin Yan, Rupa Krishnan, Scott A. Watterson, David K. Lowenthal, Kang Li, and Larry L. Peterson. Client-Centered Energy and Delay Analysis for TCP Downloads. *12th IEEE International Workshop on Quality of Service (IWQoS)*, June 2004.
- D. Brent Weatherly, David K. Lowenthal, Mario Nakazawa, and Franklin Lowenthal. Dyn-MPI: Supporting MPI on a Nondedicated Cluster of Workstations. *IEEE/ACM Supercomputing 2003 (SC '03)*, November 2003.

- Mario Nakazawa and David K. Lowenthal. I/O-Aware Gang Scheduling. *16th International Conference on Parallel and Distributed Computing Systems (PDCS)*, August 2003.
- Haijin Yan and David K. Lowenthal. Popularity-Aware Cache Replacement in Streaming Environments. *16th International Conference on Parallel and Distributed Computing Systems (PDCS)*, August 2003.
- Amit Karwande, Xin Yuan, and David K. Lowenthal. CC-MPI: A Compiled Communication Capable MPI Prototype for Ethernet Switched Clusters. *9th ACM Symposium on Principles and Practice of Parallel Programming (PPOPP)*, p. 95–106, June 2003.
- David K. Lowenthal, Vincent W. Freeh, and David W. Miller. Efficient Support for Two-Dimensional Data Distributions in Distributed Shared Memory Systems. *16th IEEE/ACM International Parallel and Distributed Processing Symposium (IPDPS)*, April 2002.
- Donald G. Morris and David K. Lowenthal. Accurate Data Redistribution Cost Estimation in Distributed Shared Memory Systems. *8th ACM Symposium on Principles and Practice of Parallel Programming (PPOPP)*, p. 62–71, June 2001.
- Gregory M.S. Howard and David K. Lowenthal. An Integrated Compiler/Run-Time System for Global Data Distribution in Distributed Shared Memory Systems. *2nd Workshop on Software Distributed Shared Memory*, May 2000.
- David K. Lowenthal and Michael James. Run-Time Selection of Block Size in Pipelined Parallel Programs. *13th IEEE/ACM International Parallel Processing Symposium (IPPS)*, p. 82-87, April 1999.
- David K. Lowenthal and Gregory R. Andrews. Adaptive Data Placement for Distributed-Memory Machines. *10th IEEE/ACM International Parallel Processing Symposium (IPPS)*, p. 349-353, April 1996.
- Vincent W. Freeh, David K. Lowenthal, and Gregory R. Andrews. Distributed Filaments: Efficient Fine-Grain Parallelism on a Cluster of Workstations. *1st USENIX Symposium on Operating Systems Design and Implementation (OSDI)*, p. 201-213, November 1994.

Technical Reports

- John Hatcher and David K. Lowenthal. *monpp*: Monitors in Nachos. Technical Report 99-07, The University of Georgia, August 1999.
- David K. Lowenthal and Vincent W. Freeh. Filaments Programmers Manual. Technical Report 98-03, The University of Georgia, June 1998.

Software

David K. Lowenthal and Vincent W. Freeh. *The Filaments Package for Implementing Efficient, Fine-Grain, Shared-Memory Parallel Programs*.

Grants

National Science Foundation Computer Systems Research Program (CSR), “Conductor: A Run-Time System for Exascale Computing” September 2013–August 2016, \$400,000

National Science Foundation Computer Systems Research Program (CSR), “MPI-PPA: Improving Efficiency of Large-Scale Clusters Through Statistical Performance Prediction” (PI; co-PI Jaxk Reeves, UGA Statistics), September 2008–August 2013, \$320,000.

National Science Foundation iPlant Collaborative, “GPU Support for Generalized Linear Modeling”, January 2010–January 2013, \$240,000.

National Science Foundation Computing Processes and Artifacts (CPA), “Detecting and Alleviating Sources of Scalability Problems” (collaborative proposal with Frank Mueller, NC State), September 2004—August 2007, \$160,000.

National Science Foundation Advanced Computational Research Program (ACR), “HC-MPI: A System for Out-of-Core, Heterogeneous Data Distributions”, Computer and Communications Research Grant, July 2003—June 2005, \$150,000 (additionally, \$12,000 on REU supplements).

State of Georgia *Yamacraw* Research Program, “An Integrated, Scalable Client-Server System for Energy-Aware Computing” (PI with Surendar Chandra; co-PIs: Ben Bishop, Scott Watterson, Suchendra Bhandarkar), October 2000–August 2004, \$472,000.

National Science Foundation Information Technology Research Program, “ITR/ACS: Stochastic Summation of High-Order Feynman Graph Expansions” (co-PI; PI: Bernd Schuttler, Dept. of Physics and Astronomy), September 2000–August 2003, \$487,000

National Science Foundation Research Instrumentation Grant, “Instrumentation Grant for Research in Parallel and Distributed Computing”, (PI; co-PIs: Eileen Kraemer and Suchendra Bhandarkar), Experimental and Integrative Activities, March 2000–February 2003, \$114,000 (includes matching from the University of Georgia Research Foundation).

National Science Foundation CAREER Award, “An Integrated Compiler/Run-Time System for Global Data Distribution”, Computer and Communications Research Grant, July 1998–June 2002, \$200,000 (additionally, \$7,500 on REU supplements).

National Science Foundation Research Instrumentation Grant, “Acquisition of a Symmetric Multiprocessor Scientific Computer System”, (co-PI; PI: David Landau, Dept. of Physics and Astronomy) September 1997–August 1999, \$420,000.

UGA Faculty Research Grant, “Improving Server Performance for the World-Wide Web”,
University of Georgia Research Foundation, January 1997–December 1997, \$4,770.

Courses Taught

Parallel and distributed computing

Graduate introductory programming

Graduate operating systems

Undergraduate/Graduate [co-convened] operating systems

C++ and Systems Programming

Program Design and Development

Selected Professional Activities

Area Chair, Performance, SC 2012; Area Co-Chair, Performance and Modeling, ICPP 2011

General Chair, International Conference on Supercomputing, 2011

Program Co-Chair, IEEE International Conference on Green Computing, 2010

National Science Foundation Grant Review Panel Member, 1999, 2002, 2003, 2004, 2010.

Co-Chair, Workshop on High-Performance, Power-Aware Computing (2005, 2006).

Tutorial and Workshops Chair, PPOPP 2008

Program Committee Member, PACT (2009), ICPP (2007, 2008), PPOPP (2007), SC (2006, 2009, 2011, 2013), IPDPS (2006, 2011), HiPC (2004, 2005), HIPS (2002, 2003, 2005), CLADE (2005, 2006, 2007), WNDA (2004), LCR (2002), RTSPP (1998, 1999)

Referee for *Network Systems Design and Implementation (NSDI)*, *Journal of Parallel and Distributed Computing (JPDC)*, *Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, *Transactions on Computer Systems (TOCS)*, *Symposium on Operating Systems Principles (SOSP)*, *Operating Systems Design and Implementation (OSDI)*, *Transactions on Parallel and Distributed Systems (TPDS)*, *Principles and Practice of Parallel Programming (PPOPP)*, *International Conference on Supercomputing (ICS)*.

Member of the ACM, SIGPLAN, and SIGOPS.

Students

| Name | Degree | Status | Title or Topic | First Position |
|---------------------|--------|-------------|--|-------------------------------|
| Aniruddha Marathe | Ph.D | 4th year | Cloud computing | — |
| Tapasya Patki | Ph.D | 3rd year | Power-constrained supercomputing | — |
| Peter Bailey | Ph.D | 3rd year | Power-constrained supercomputing | — |
| Brad Barnes | Ph.D | Aug 2011 | A Regression Based System for Accurate Scalability Prediction on Large-Scale Machines | Asst. Prof Muskingum Univ. |
| Barry Rountree | Ph.D | May 2010 | Theory and Practice of Dynamic Voltage/Frequency Scaling in the High Performance Computing Environment | LLNL |
| Mario Nakazawa | Ph.D | May 2005 | I/O Considerations in Efficient Heterogeneous Data Distributions | Asst. Prof. Berea College |
| Haijin Yan | Ph.D | May 2005 | Network Support for Energy Efficient, Wireless Communication | Motorola |
| Matt Cleveland | M.S. | May 2011 | A distributed system for track discovery | IBM |
| Michael Moore | M.S. | August 2006 | Exo-TCP | Omaha M.U.D. |
| Rob Springer | M.S. | Aug. 2005 | Minimizing Exec. Time in MPI Progs. on an Energy-Constrained, Power-Scalable Cluster | Phillips Electronics |
| Wenduo Zhou | M.S. | Dec. 2004 | A Parallel, Out-of-Core Algorithm for RNA Secondary Structure Prediction | Postdoc Mich. St. Physics |
| Rupa Krishnan | M.S. | Aug. 2004 | A Model of TCP over IEEE 802.11b Power-Save Mode | Ph.D student Stonybrook CS |
| Ed Cashin | M.S. | Aug. 2004 | Automated Control of Hardware and Software Fault Isolation | BORF Research |
| Chris Bentley | M.S. | May 2003 | OS Support for Low Cost Array Bounds Checking on 64-bit Architectures | Access Communications |
| Michael Gundlach | M.S. | Dec. 2002 | A Power-Aware Scheduler for Streaming Multimedia Clients | Google |
| Brent Weatherly | M.S. | July 2002 | A-MPI: Supporting MPI on a Nondedicated Assignments in Task/Data Parallel Programs | Res. Scientist UGA |
| Greg Price | M.S. | Nov. 2000 | A Comparative Analysis of Fine-Grain Threads Packages | Clarke County |
| Don Morris | M.S. | Aug. 2000 | Accurate Data Redistribution Cost Estimation in DSM Systems | HP |
| Bala Narasimhan | M.S. | June 2000 | Twaritha: A Fast, User-Level Simulator for Virtual Memory Systems | Veritas |
| Ragavan Subramanian | M.S. | Aug. 1999 | HyFi: Architecture-Independent Parallelism on a Network of Multiprocessors | Yahoo |
| Kar Balasubramanian | M.S. | Aug. 1999 | Efficient Support for Pipelining in Distributed-Shared Memory Systems | NexGenix |
| Greg Howard | M.S. | Aug. 1998 | An Integrated Compiler/RTS for Global Data Distribution in DSM Systems | SGI |

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|---------------|------|-----------|---|--------------------|
| Michael James | M.S. | Mar. 1998 | Run-Time Selection of Block Size in Pipelined Parallel Programs | General Electric |
| Doug McCreary | B.S. | Aug. 2004 | Low-latency TCP for multimedia | Guidewire Software |
| David Mayo | B.S. | Aug. 2004 | Energy-aware video sensing | Motorola |
| Sarah Doster | B.S. | Aug. 2003 | Streaming multimedia for mobile clients | Ph.D Arizona CS |
| Graham Greene | B.S. | Unknown | Efficient fine-grain parallelism | Radiant Systems |