

Henry F. Korth

Address

- Department of Computer Science and Engineering
Lehigh University
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Education

- B.A., Williams College, Williamstown, MA (1977), (Phi Beta Kappa, Magna Cum Laude), Mathematics
- M.A., Princeton University, Princeton, NJ (1979), Computer Science
- M.S.E., Princeton University, Princeton, NJ (1979), Computer Science
- Ph.D., Princeton University, Princeton, NJ (1981), Computer Science. Dissertation title, “Locking Protocols: General Lock Classes and Deadlock Freedom.” Advisor: Jeffrey D. Ullman

Professional Societies

- Fellow, Association for Computing Machinery
- Fellow, IEEE
- Sigma Xi

Professional Awards

- “Most Influential Paper from Proceedings of Ten Years Ago,” *21st International Conference on Very Large Data Bases*, Zürich, Switzerland, awarded for the paper, “A Model of CAD Transactions,” which appeared in *Proc. 11th International Conference on Very Large Data Bases* (VLDB), and was co-authored with F. Bancilhon and W. Kim
- “Best Paper,” “Multithreaded Architectures and the Sort Benchmark,” *International Workshop on Data Management on New Hardware*, held in association with the 2005 ACM SIGMOD International Conference on the Management of Data. Co-authored with P. Garcia.

Employment History

- Jan 2003 - present:

Lehigh University, Bethlehem, PA 18015

- Professor, Department of Computer Science and Engineering, Jan 2003 - present
- Chair, Department of Computer Science and Engineering, Jan 2003 - June 2009
- Co-Director, Program in Computer Science and Business, (appointed, term to begin June 2012)
- Activities:
 - * Served as department chair during a period of rapid growth and change in the department. During my terms as chair, three quarters of the faculty were hired or promoted in rank, four junior faculty won NSF CAREER Awards, curricula were updated, and the quantity and breadth of departmental research increased. Major renovations were made to the undergraduate computing laboratories to facilitate innovative lab-based teaching in several courses.
 - * Research in numerous areas of database systems, especially architecture-aware database processing, real-time systems, and graph-based database systems.
 - * Taught undergraduate courses in database systems, introduction to computer science, and technical presentation.
 - * Taught graduate courses in database systems, real-time systems, database theory, and several independent study courses.
 - * Graduated 3 Masters thesis students.
 - * Served on 5 Ph.D. dissertation committees.
 - * Co-leader in the creation of an approximately \$1million research project in document analysis and exploitation.
 - * University service: service and leadership roles in a variety of areas including faculty recruiting, promotion, mentoring, work-life balance, facilities and equipment, deputy-provost selection, and inter-college relationships; details documented below.
 - * Professional service: extensive service and leadership roles documented below.

- Aug 1995 - Dec 2002:

Bell Laboratories, Lucent Technologies Inc., (formerly AT&T Bell Laboratories), 600 Mountain Avenue, Murray Hill, NJ 07974

- Positions Held:

- * Director, Database Principles Research, Jun 1997 - Dec 2003
- * Director, Technology Assessment, Lucent Software Products Group, Aug 2000 - March 2001
- * Leadership Team, Joint Development and Delivery Center, Lucent Software Products Group (formerly Kenan Systems), July 1999 - Sep 2000
- * Product manager: DataBlitz Main-Memory Database System, Feb 1998 - Aug 1999.
- * Acting Head, Fundamentals of Computing Research Department Dec 1997 - May 1998
- * Acting Head, Database Principles Research Department, Jan 1997 - Jun 1997

- * Member of Technical Staff, Information Sciences Research Center, Aug 1995 - Jun 1997
- Activities:
 - * Leading a team of Ph.D. researchers in Bell Labs performing research and development in various aspects of database systems, information systems and distributed systems, including XML data management, web-based data, exploiting processor architecture (cache and other features) for information management systems, main-memory database systems, real-time systems, parallel systems, data warehousing, data mining, data replication, mobile computing, billing systems, electronic commerce, and operation support systems.
 - * Leading research-business cooperation between Bell Labs and the Billing and Customer Care product group. Personally performing research in database systems and distributed systems, with focus on applications in real-time systems, billing systems, web-based information systems (including XML), electronic commerce systems, operations support systems, and data warehouses.
 - * Founding member of the Joint Development and Delivery Center (JDDC), an organization set up within Lucent's Kenan Systems subsidiary (later Lucent Software Products Group) to enable the rapid transition of Bell Labs research prototypes into products in the marketplace. By combining expertise in research, development, and business, the JDDC successfully transitioned 6 projects into products with paying customers in its first year. I served as a member of the JDDC leadership team during this time, overseeing strategy and operations, with a focus on managing the relationship between the JDDC and Bell Labs Research.
 - * Member of the Software Products Group Technology Assessment Team charged with seeking out and evaluating external technologies to meet current and projected business needs.
- Awards:
 - * Member of team winning Bell Labs President's Silver Award, 1998 (QTM Real-time Event Processing Engine)
 - * Member of team winning Bell Labs President's Silver Award, 1999 (DataBlitz Main-Memory Storage Manager).
- Co-inventor on eight U.S. patents.
- Sep 1991 - Aug 1995:

Matsushita Information Technology Laboratory, Panasonic Technologies, Inc., 2 Research Way, Princeton, NJ 08540-6628

 - Positions Held
 - * Vice President and Director (Oct 1992 to Aug 1995),
 - * Associate Director (Jan 1992 to Sep 1992),
 - * Senior Scientist (Sep 1991 to Jan 1992),
 - Activities
 - * The Matsushita Information Technology Laboratory (MITL) was formed in 1991 to serve as the leading computer systems research laboratory for Matsushita Electric Industrial (better known by its brand names: Panasonic, Technics, and Quasar). I

joined MITL in a senior research position and was promoted to Associate Director and, later, Director. The promotion to Director included appointment as a Vice President of Panasonic Technologies, Inc., Matsushita's research and development corporation in the United States.

- * Personally conducted research in multidatabase systems, mobile computing, database user interfaces, and multimedia information systems.
- * Co-inventor on three U.S. patents.
- * Managed groups conducting research in the above topics, plus full-text indexing, multimedia indexing, optical character recognition, video servers, operating systems, and distributed computing.
- * Management responsibilities included research direction for the laboratory (which grew from a staff of 15 when I became Director to 23), budgeting, legal issues (patents, licensing, export control, etc.), and interaction with MITL's sponsors in Japan.

- Aug 1983 - Aug 1992:

Department of Computer Sciences, The University of Texas at Austin, Austin TX 78712-1188.

- Associate Professor (with tenure), Sep 1989 - Aug 1992 (on leave 91-92 academic year).
- Assistant Professor, Aug 1983 - Aug 1989.
- Holder of a Computer Science Faculty Fellowship, Sep 1987 - Aug 1991
- Research in numerous areas of database systems, including transaction processing, object-oriented systems, real-time database systems, nested relational databases, multidatabases, and distributed database systems
- Graduated 7 Ph.D. students, and 8 Masters thesis students
- Supervised 6 undergraduate honors projects
- Taught graduate courses in database systems, analysis of algorithms, transaction processing, object-oriented systems, and relational database theory
- Taught undergraduate courses in database systems and C programming
- Taught university-sponsored industrial short courses in database systems

- Jun 1981 - Aug 1983:

IBM T.J. Watson Research Center, Yorktown Heights, NY 10598.

- Research Staff Member
- Research and development in office automation and distributed database systems.

Professional Activities

- Associate Editor, *Proceedings of the VLDB Endowment* 2011-2012
- Associate Editor, *ACM Transactions on Database Systems*, 2004 - 2011
- Associate Editor, *VLDB Journal*, 1995 - 2003
- Associate Editor, *Journal on Cooperative Information Systems*, 1995-2005

- Associate Editor, *SIGMOD Record* (1990 - 1993)
- Council Member, Computing Community Consortium (CCC), 2010 - 2013.
 The CCC is a group within the Computing Research Association, funded by the National Science Foundation, and addressing issues of long-term research agendas in computing. Details on the CCC can be found at www.cra.org/ccc
 - During 3-year term, participated in bi-weekly council conference calls and thrice-yearly face-to-face council meetings
 - Personally led creation of a series of “challenges and visions” sessions at various computer-science conferences, using CCC-funded best-paper/presentation awards to attract visionary position papers with the long-term goal of stimulating new research directions in computing.
- National Science Foundation (NSF) Proposal Review Panels, 1991, 1998, 2005, 2007, 2010
- Invited Participant: ACM Workshop on Strategic Directions in Computing Research, June 1996, MIT, Cambridge, MA.
- ACM SIGMOD Advisory Board, 2001 - 2005.
- ACM SIGMOD Industrial Advisory Board, 1999 - 2006.
- ACM SIGMOD Jim Gray Doctoral Dissertation Award Committee, 2009, 2010, 2011, 2012
- Computing Research Association Outstanding Undergraduate Research Award Committee, 2004, 2010
- Computing Innovation Fellows Selection Committee, 2010
 The Computing Innovation Fellows Program is an activity of the Computing Community Consortium and Computing Research Association that provides postdoctoral opportunities for recent Ph.D. graduates.
- Program Committee Co-Chair:
 - International Conference on Parallel and Distributed Information Systems (PDIS), 1994
- Program Committee Associate Chair:
 - ACM SIGMOD International Conference on the Management of Data, 1997
- Program Committee Vice Chair:
 - IEEE International Conference on Data Engineering (ICDE), 2000
- Track Chair (Outrageous Ideas and Visions Track):
 - Conference on Innovative Data Systems Research (CIDR), 2011
- Research Track Co-Chair / Associate Editor:

- International Conference on Very Large Data Bases, 2012 / Proceedings of the VLDB Endowment Volume 5

The VLDB Conference has embarked on a new system of paper review and publication that merges the concepts of journal and conference. During a year-round process, papers are submitted, reviewed, and possibly revised for a second round of review. Accepted papers appear in the online journal *Proceedings of the VLDB Endowment* (PVLDB). The research presentations at the VLDB Conference are for those papers accepted in the past year to PVLDB.

Unlike a normal conference process, VLDB reviews a batch of submissions on a monthly cycle. As a co-chair, my responsibilities include co-leading this activity and participating in the design and evaluation of this new system and evaluating how well it is meeting our goal of improving the research publication process.

- Program Committee Member:

- ACM SIGMOD International Conference on the Management of Data, 1987, 1988, 1989, 1990, 1995, 1997, 2003, 2005, 2007, 2008, 2009, 2012
- ACM SIGMOD Ph.D. Workshop (for recent Ph.D.s), 2012
- ACM SIGACT-SIGMOD-SIGART Symposium on the Principles of Database Systems (PODS), 1987, 1991
- COMAD International Conference on the Management of Data, 1995
- Conference on Information and Knowledge Management (CIKM), 1993, 2011
- Conference on Innovative Data Systems Research, 2011 (Track co-chair)
- Extending Data Base Technology (EDBT) Conference, 1990, 2002
- IEEE International Conference on Data Engineering (ICDE), 1993, 1996, 1998, 2000, 2001, 2003, 2010
- IEEE Workshop on Research Issues in Data Engineering, 1996
- International Conference on Parallel and Distributed Information Systems (PDIS), 1993, 1994
- ACM/IEEE Mobicom, 1999
- International Conference on Very Large Data Bases (VLDB), 1995, 2001, 2002, 2004, 2005, 2006, 2010, 2011, 2012
- International Symposium on Databases for Parallel and Distributed Systems, 1988
- International Symposium on Database Systems for Advanced Applications (DASFAA), 1993, 1995, 1997
- International Workshop on Satellite-based Information Services, 1996, 1997
- International Workshop on Data Engineering for Wireless and Mobile Access (MobiDE), 1999, 2001
- International Workshop on the Web and Databases (WebDB), 2006

- Workshops Organized

- XP 7.52 Workshop on Database Theory, Austin, Texas, 1986.

- MOBIDATA: NSF Workshop on Mobile and Wireless Information Systems, Rutgers University, New Brunswick, NJ, 1994 (co-organized with T. Imielinski)
- Tutorial Chair: International Conference on Parallel and Distributed Information Systems (PDIS), 1996
- Tutorial Chair: ACM SIGMOD International Conference on the Management of Data, 2004
- Organizing Committee: Computing Research Association Conference, 2008
- Visiting Committee: Williams College Department of Mathematical Sciences, 1986.
- Instructor: ACM/MAA Institute for Retraining in Computer Science 1984 - 1986
Taught database systems and compilers to college mathematics faculty retraining in computer science
- Instructor, IBM Technical Education Program, 1988 - 1990
Taught undergraduate-level courses in database systems and operating systems at IBM facilities in Austin TX, Boca Raton FL, Rochester MN, Rockville MD, Tokyo Japan
- Consultancies (while on faculty of University of Texas)
 - IBM T. J. Watson Research Center
 - IBM Austin
 - Microelectronics and Computer Technology Corporation
 - Matsushita Information Technology Laboratory of Panasonic Technologies, Inc.
- Referee/reviewer for numerous journals, conferences, and funding agencies.

University Research Funding

- At University of Texas:
 - University of Texas Research Institute grant, summer 1984
Principal Investigator: H. F. Korth
 - IBM Faculty Development Award, 1984-1986
Principal Investigator: H. F. Korth
 - IBM Research Grant, “Distributed Algorithms for Circuit-Switched LANs,” 1984-1987
Principal Investigators: H. F. Korth and M. K. Molloy
 - NSF Grant, “Theory of Non-First Normal Form Relations,” 1985-1987
Principal Investigators: H. F. Korth and A. Silberschatz
 - IBM Research Grant, “Query Processing in Object-Oriented and Nested Relational Databases” 1987-1991.
Principal Investigator: H. F. Korth
 - State of Texas Advanced Research Program, “Concurrency Control and Reliability in a Multidatabase Environment,” 1988-1990
Principal Investigators: H. F. Korth and A. Silberschatz

- NEC America, Inc. Research Grant, “Real-Time Database Systems,” 1991-1992
Principal Investigators: H. F. Korth and A. Silberschatz
- At Lehigh University
 - Pittsburgh Digital Greenhouse, “Cyber Security Grant Agreement,” 2005-2008
 - Pennsylvania Keystone Alliance, “Keystone Alliance for Homeland Security,” 2005-2006
 - BBN Technologies, Inc., “Document Analysis and Exploitation,” 2009-2010 (with H. Baird and D. Lopresti)

University Service Activities at University of Texas

- Served on numerous departmental committees, including: Industrial Liaison (1983-1984), Computing Research Review (1984-1986, 1988-1990), Salary and Evaluation Committee (1984-1985), Graduate Admissions Committee (1985-1987, chairman 1986-1987), Graduate Studies Committee (1983-1991), Undergraduate Studies Committee (1987-1988), Space and Housing Committee (1987-1988), Frontiers of Computer Science Lecture Series (1988-1991), Laboratory and Equipment Committee (1988-1990), Industrial Associates Program (1989-1990)
- Served on the committee that developed and organized the University of Texas Management Institute. The Institute offers a nine-month program for technical managers and is sponsored by the Department of Computer Sciences, the College of Engineering, and the College of Business Administration
- Served as advisor for the creation of an on-line database for departmental student records
- Served as faculty sponsor of the Ultimate Frisbee Club (1986-1991)

University Service Activities at Lehigh University

- Sloane-sponsored project on faculty work/life balance that led to major changes in leave and tenure policy for family-related and other life events (2007-2009)
- Curriculum committee whose activities included major revisions to the undergraduate program (09-present)
- Recruiting committee (*ex-officio* during terms as department chair, served as committee chair for the one search conducted following my terms as department chair (2009-2010)
- Equipment committee (*ex-officio* during terms as department chair), served as regular member (2009-present) chaired committee twice afterwards (2009-2010, 2011-2012)
- University-level faculty mentoring committee (2009-present)
- College promotion committee (2007-present)
- Engineering college representative to College of Arts and Sciences (2009-2010)
- Selection committee for deputy provost for faculty affairs (2010)
- Faculty advisor for minor in computer science (2011-present)

- Faculty advisor for students majoring in computer science through the College of Arts and Sciences (2011-present)

- Co-Director Program in Computer Science and Business (starting 2012)

Lehigh offers a unique B.S. degree in Computer Science and Business. It is a full degree in computer science that in addition provides skills and training in business. It is the *only* degree to be accredited both by ABET (for computer science) and by the Association to Advance Collegiate Schools of Business.

The program has two co-directors: one from computer science and one from business. Their role is to manage the operation of the program in all aspects, including budget, curriculum, capstone projects, internships, and study abroad opportunities.

Ph.D. Students

- Lt.Col. Mark A. Roth, 1986

“Theory of Non-First Normal Form Relational Databases”

Current employment: Science and Technology Director, Command Control, Communications, and Intelligent Systems Directorate, U.S. Strategic Command, Offut Air Force Base, Nebraska

- Hyoung-Joo Kim, 1988

“Issues in Object-Oriented Database Schemas”

Current employment: Professor and Head, School of Computer Science and Engineering, Seoul National University, Korea.

- Gregory Speegle, 1990

“The NT/PV Model: A New Representation for Long-Duration Transaction”

Current employment: Professor, Baylor University, Waco, Texas

- Eliezer Levy, 1991

“Semantics-Based Recovery in Transaction Management Systems”

Current employment: Technical Director at SAP Research, Israel

- Nandit Soparkar, 1993

“Time-Constrained Transaction Management”

Current employment: CEO at Ubiquiti, Inc, Ann Arbor, MI..

- Sharad Mehrotra, 1993 “Failure-Resilient Transaction Management in Multidatabase Systems”

Current employment: Professor, University of California, Irvine.

- Rajeev Rastogi, 1993

“Concurrency Control in Multidatabases”

Current employment: Vice President, Yahoo! Labs, Bangalore, India

Masters thesis students:

- Lehigh University
 - Fabiana F. Prabhakar, 2008
“Using Prefetch Instructions to Improve Hash Join Algorithms for Database Systems”
 - Chris Creswell, 2005
“The Graph Database Prototype: Building a Peer-to-Peer Information Sharing Network Composed of Distributed, Heterogeneous Databases”
 - Philip Garcia, 2005
“Optimizing Database Algorithms for Modern Computer Architectures”
- University of Texas at Austin
 - H. Ramananda Kedlaya, 1985
“Relational Operating System Interface System Utilities”
 - Hyoung-Joo Kim, 1985
“Graphical Environments for Query Processing”
 - Kit Hung Lou, 1985
“Hypergraph Algorithms to Support a User-Friendly Graphical Interface for Database Applications”
 - Ramakrishnan Srinivasen, 1986
“Design and Implementation of a Translator for SQL/NF with Role Joins”
 - Richard Cohen, 1987
“NSALAN: General Purpose Servers on a Circuit-Switched Network”
 - Emilia Villarreal, 1987
“Evaluation of an $O(N^2)$ Method for Database Query Optimization”
 - Jeanne A. Kamman, 1989
“Set-Oriented Queries in Object-Oriented Databases”
 - Sheryl Walsh, 1990
“Extensible and Incremental Statistics Maintenance for Nested Relational Databases”

Undergraduate Honors Project Students:

- Edward C. Bueché, 1987
“Oonix: An Object-Oriented Unix Shell”
- Maurice T. Franklin, 1987
“Oonix: An Object-Oriented Unix Shell”
- Gene C. Sheppard, 1987
“Oonix: An Object-Oriented Unix Shell”
- Edward R. Holley, 1988
“A Compiler and a Browser for the Oonix Project”

- Michael J. Hall, 1989
“Expanding the Oonix Project”
- Pow-Hwee Tan, 1990
“The Oonix-2 Project”

Patents Granted

- “Computer-Implemented Method and Apparatus for Fulfilling a Request for Information Content with a User-Selectable Version of a File Containing that Information Content,” U.S. Patent 7243122, Issued July 10, 2007 (with S. Acharya and V. Poosala)
- “Computer-Implemented Method and Apparatus for Providing a Logical Point of Access to One or More Files,” U.S. Patent 7047483, Issued May 16, 2006 (with S. Acharya and V. Poosala)
- “Computer-Implemented Method and Apparatus for Fulfilling a Request for Information Content with a User-Selectable Version of a File Containing that Information Content,” U.S. Patent 6826593, Issued November 30, 2004 (with S. Acharya and V. Poosala)
- “Real-Time Event Processing System for Telecommunications and Other Applications,” U.S. Patent 6496831, Issued December 17, 2002 (with G. D. Baulier, S. M. Blott, B. L. Branch, T. M. Cliff, Jr., J. E. Polito, A. Silberschatz, S. L. Speicher)
- “Computer Implemented Method And Apparatus For Enhancing Access To A File,” U.S. Patent 6408296, Issued June 18, 2002 (with S. Acharya and V. Poosala)
- “A Serial Protocol For Transaction Execution In Main-Memory Database Systems,” U.S. Patent 6341285, Issued January 22, 2002. (with S.M. Blott).
- “Concurrency-Control Protocols for Management of Replicated Data Items in a Distributed Database System,” U.S. Patent 5999931, Issued December 7, 1999. (with Y. Breitbart and A. Silberschatz)
- “Method and System for Managing Replicated Data With Enhanced Consistency and Concurrency,” U.S. Patent 5864851, Issued January 26, 1999. (with Y. Breitbart).
- “Certifiable Optical Character Recognition,” U.S. Patent 5703971, Issued Apr. 1997. (with R. J. Lipton, D. P. Lopresti, and J. Sandberg).
- “Certifiable Optical Character Recognition,” U.S. Patent 5703972, Issued Dec. 1997. (with R. J. Lipton, D. P. Lopresti, and J. Sandberg).
- “Method and Apparatus for Storage and Retrieval of Handwritten Information,” U.S. Patent 5524240, Issued June 4, 1996. (with D. Barbará)

Publications

Books

- *Database System Concepts*, McGraw-Hill, (1986), (with A. Silberschatz).
- *Database System Concepts – Second Edition*, McGraw-Hill, (1991), (with A. Silberschatz).
- *Database System Concepts – Third Edition*, McGraw-Hill, (1997), (with A. Silberschatz and S. Sudarshan).
- *Database System Concepts – Fourth Edition*, McGraw-Hill, (2002), (with A. Silberschatz and S. Sudarshan).
- *Database System Concepts – Fifth Edition*, McGraw-Hill, (2006), (with A. Silberschatz and S. Sudarshan).
- *Database System Concepts – Sixth Edition*, McGraw-Hill, (2011), (with A. Silberschatz and S. Sudarshan).
- *Time-Constrained Transaction Management: Real-Time Constraints in Database Transaction Systems*, Kluwer Academic Publishers, (1996), (with N. Soparkar and A. Silberschatz).

Edited Book

- *Mobile Computing*, Kluwer Academic Publishers, (1996), (with T. Imielinski)

Book Chapters

- “An Optimistic Concurrency Control Protocol for Replicated Databases,” in *Fundamental Problems in Computing*, S.S. Ravi and S. K. Shukla, eds. (2009) (with Y. Breitbart and A. Silberschatz).
- “Data Models,” in *The Computer Science Handbook, second edition*, CRC Press. (2004) (with A. Silberschatz and S. Sudarshan)
- “Database Systems,” in *Information Systems Encyclopedia*, Academic Press (2002) (with A. Silberschatz and S. Sudarshan).
- “Database Management Systems,” in *McGraw Hill Encyclopedia of Science and Technology, 9th Edition*, McGraw Hill (2000) (with A. Silberschatz and S. Sudarshan).
- “Distributed Databases,” in *Encyclopedia of Electrical and Electronics Engineering*, John Wiley & Sons. (1998) (with Y. Breitbart, A. Silberschatz, and S. Sudarshan)
- “Data Models,” in *The Computer Science and Engineering Handbook*, CRC Press, Chapter 42, pages 979–994. (1997) (with A. Silberschatz and S. Sudarshan)
- “Autonomous Transaction Managers in Responsive Computing,” in *Responsive Computer Systems: Toward Integration of Fault-tolerance and Real-time*, D. Fussell, ed., Kluwer Academic Publishers, (1994), (with N. Soparkar and A. Silberschatz).

- “Triggered Real-Time Transactions with Consistency Constraints,” in *Advances in Real-Time Systems*, J. A. Stankovic and K. Ramamritham, eds., IEEE Computer Society Press, 1992, pp. 674-698. (reprint of conference paper listed below) (with N. Soparkar and A. Silberschatz)
- “Oonix: An Object-Oriented Unix Shell,” in *Object-Oriented Databases*, Nahouraii and Petry, eds., IEEE Computer Society Press (1991), (reprint of conference paper listed below) (with E. C. Bueché, M. T. Franklin, E. R. Holley, and G. C. Sheppard).
- “Principles of Database Systems,” in *Encyclopedia of Computer Science and Technology*, Marcel Dekker Inc., 1989, also in *Encyclopedia of Microcomputers*, Marcel Dekker Inc., 1989, (with A. Silberschatz).
- “Query Languages for Nested Relational Databases,” *Nested Relations and Complex Objects in Databases*, Lecture Notes in Computer Science 361, pp. 190-205, Springer-Verlag, 1989, (with M.A. Roth).
- “On Long Duration CAD Transactions.” in *Readings in Object-Oriented Databases*, Zdonik and Maier, eds., Morgan-Kaufmann, (1989), (reprint of *Information Sciences* journal article listed below, (with W. Kim and F. Bancilhon).

Journal Publications

- “The Claremont Report on Database Research.” *C. ACM*, 37(3): 56-65 (2009), (with Rakesh Agrawal, Anastasia Ailamaki, Philip A. Bernstein, Eric A. Brewer, Michael J. Carey, Surajit Chaudhuri, AnHai Doan, Daniela Florescu, Michael J. Franklin, Hector Garcia-Molina, Johannes Gehrke, Le Gruenwald, Laura M. Haas, Alon Y. Halevy, Joseph M. Hellerstein, Yannis E. Ioannidis, Donald Kossmann, Samuel Madden, Roger Magoulas, Beng Chin Ooi, Tim O’Reilly, Raghu Ramakrishnan, Sumita Sarawagi, Michael Stonebraker, Alexander S. Szalay, Gerhard Weikum). Initial version appeared in *ACM SIGMOD Record*, 37(3): 9-19 (2008).
- “Overcoming Heterogeneity and Automony in Multidatabase Systems,” *Information and Computation*, 167, pp. 132-172 (2001). with S. Mehrotra, R. Rastogi, Y. Breitbart and A. Silberschatz)
- “User-Level Billing and Accounting in IP Networks,” *Bell Labs Technical Journal*, Vol. 4, No. 4., pp. 237–251. (1999) (with S. M. Blott, C. Martin, Y. Breitbart, J. Brustoloni, T. R. Gramaglia, D. M. Kristol, R. H. Liao, E. L. Scanlon, A. Silberschatz)
- “Replication and Consistency in a Distributed Environment,” *J. Computer and System Sciences*, Vol. 59, pp. 29-69, (1999) (with Y. Breitbart).
- “Sunrise: A Real-Time Event-Processing System,” *Bell Labs Technical Journal*, pp. 3-18, Winter 1998. (with J. Baulier, S. Blott, and A. Silberschatz).
- “Ensuring Consistency in Multidatabases by Preserving Two-Level Serializability,” *ACM Transactions on Database Systems*, Vol. 23, No. 2, pp. 199-230 June 1998. (with S. Mehrotra, R. Rastogi, and A. Silberschatz).
- “On Correctness of Non-Serializable Executions,” *J. Computer and System Sciences*, Vol. 56, No. 1, pp. 68-82 (February 1998) (with S. Mehrotra, R. Rastogi, Y. Breitbart, and A. Silberschatz).

- “Database Research Faces the Information Explosion,” *C. ACM*, Vol. 40, No. 2, pp. 139–142 (February 1997). (with A. Silberschatz)
- “Concurrency Control in Hierarchical Multidatabase Systems,” *VLDB Journal*, Vol. 6, No. 2, pp. 152-172 1997. (with S. Mehrotra and A. Silberschatz)
- “Databases with Deadline and Contingency Constraints,” *IEEE Transactions on Knowledge and Data Engineering*, Vol. 7, No. 6, pp. 552-565, (Aug 1995), (with N. Soparkar and A. Silberschatz)
- “Data Models,” *ACM Computing Surveys*, Vol. 28, No. 1, pp. 105–108 (March 1996). (with A. Silberschatz and S. Sudarshan)
- “Formal Aspects of Concurrency Control in Long-Duration Transaction Systems Using the NT/PV Model,” *ACM Transactions on Database Systems* **19:3**, pp. 492–535. (Sep 1994), (with G. Speegle)
- “Failure-Resilient Transaction Management in Multidatabases,” *IEEE Computer*, **24:12**, pp. 28-37 (December 1991), (with N. Soparkar and A. Silberschatz).
- “Performance Analysis of Two Concurrency Control Schemes for Design Environments,” *Information Sciences*, **49**, pp. 3-33 (1989) (with S.-W. Yeh, C. Ellis, and A. Ege).
- “Null Values in non1NF Relational Databases,” *Acta Informatica*, **26**, pp. 615-642 (1989) (with M.A. Roth and A. Silberschatz).
- “Extended Algebra and Calculus for non-1NF Relational Databases”, *ACM Transactions on Database Systems* **13:4**, pp. 389-417. (December 1988) (with M.A. Roth, and A. Silberschatz).
- “PICASSO: A Graphical Query Language for Universal Relation Databases,” *Software Practice and Experience*, **18:3**, pp. 169-203 (March 1988) (with H.-J. Kim and A. Silberschatz).
- “Computer Science in Liberal Arts Colleges,” *Journal of Computer Science Education*, **1:1**, (1988) (with R. L. Scot Drysdale and Allen Tucker).
- “On Long Duration CAD Transactions.” *Information Sciences*, **46**, p. 73-107, (October 1988) (with W. Kim and F. Bancilhon).
- “SQL/NF: A Query Language for non-1NF Relational Databases,” *Information Systems*, **12:1** p. 99-114 (1987) (with M.A. Roth and D.S. Batory).
- “Extending the Scope of Relational Languages,” *IEEE Software*, **3:1**, pp. 19-28 (January 1986).
- “System/U: A Database System Based on the Universal Relation Assumption,” *ACM Transactions on Database Systems* **9:3**, pp. 331-347. (September 1984) (with G.M. Kuper, J. Feigenbaum, A. Van Gelder, and J.D. Ullman)
- “Locking Primitives in a Database System,” *J. ACM* **30:1**, pp. 55-79. (Jan 1983).
- “Deadlock Freedom Using Edge Locks,” *ACM Transactions on Database Systems* **7:4**, pp. 632-652. (December 1982).

Conference Publications

- “How Carefully Designed Open Resource Sharing Can Help to Expand Document Analysis Research,” *Proc. Document Recognition and Retrieval Conference*, 2011. (with B. Lamiroy, D. Lopresti, and J. Heflin)
- “Database Hash-Join Algorithms on Multithreaded Computer Architectures,” *Proc. ACM Computing Frontiers Conference*, pp. 254-260, 2006 (with P. Garcia)
- “Composing XSL Transformations with XML Publishing Views,” *Proc. ACM Sigmod International Conference on the Management of Data*, pp. 515-526, 2003. (with C. Li, P. Bohannon, P.P.S. Narayan)
- “An Almost-Serial Protocol for Transaction Execution in Main-Memory Database Systems,” *Proc. International Conference on Very Large Data Bases*, pp. 706-717, 2002 (with S. Blott)
- “Optimizing View Queries in ROLEX to Support Navigable Result Trees,” *Proc. International Conference on Very Large Data Bases*, pp. 119-130, 2002 (with P. Bohannon, S. Ganguly, P.P.S. Narayan, P. Shenoy)
- “Covering Indexes for Branching Path Expression Queries,” *Proc. Sigmod International Conference on the Management of Data*, pp. TBA, 2002. (with R. Kaushik, P. Bohannon, and J. F. Naughton)
- “Systematic Multiresolution and its Application to the World Wide Web,” *Proc. International Conference on Data Engineering*, pp. 40-49, Sydney, March 1999. (with S. Acharya and V. Poosala)
- “Replication, Consistency, and Practicality: Are These Mutually Exclusive?” *Proc. Sigmod International Conference on the Management of Data*, pp. 484-495, 1998. (with T. Anderson, Y. Breitbart, and A. Wool)
- “Data Logging: A Method for Efficient Data Updates in Constantly Active RAIDs,” *Proc. 14 IEEE International Conference on Data Engineering*, pp. 144-153, 1998, (with E. Gabber).
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- “Adaptive Commitment for Distributed Real-Time Transactions,” *Proc. 3rd International Conference on Information and Knowledge Management*, Gaithersburg, MD (1994) (with E. Levy, N. Soparkar, and A. Silberschatz).
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- “Efficient Global Transaction Management in Multidatabase Systems,” *Proc. Third International Symposium on Database Systems for Advanced Applications*, pp. 29-36, Daejeon, Korea. (1993) (with S. Mehrotra, R. Rastogi, Y. Breitbart, and A. Silberschatz).
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- “Non-Serializable Executions in Heterogeneous Distributed Database Systems,” *Proc. International Conference on Parallel and Distributed Information Systems*, pp. 245-252. (1991) (with S. Mehrotra, R. Rastogi, and A. Silberschatz)
- “A Theory of Relaxed Atomicity,” *Proc. ACM Symposium on the Principles of Distributed Computing*, pp. 95-109, (1991) (with E. Levy and A. Silberschatz).
- “An Optimistic Commit Protocol for Distributed Transaction Management,” *Proc. SIGMOD '91 International Conference on the Management of Data*, pp. 88-97, (1991) (with E. Levy and A. Silberschatz).
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- “Triggered Real-Time Databases with Consistency Constraints,” *Proc. International Conference on Very Large Data Bases*, pp. 71-82, Brisbane, Queensland, Australia. (1990) (with N. Soparkar and A. Silberschatz).
- “Formal Approach to Recovery by Compensating Transactions,” *Proc. International Conference on Very Large Data Bases*, pp. 95-106, Brisbane, Queensland, Australia. (1990) (with E. Levy and A. Silberschatz).
- “Query Processing Issues in Knowledge Bases,” *Proc. Conference on Artificial Intelligence in Petroleum Exploration and Production*, (1990) (with X. Peltier).
- “Long-Duration Transactions in Software Design Projects,” *Proc. 6 IEEE International Conference on Data Engineering*, pp. 568-574. (1990) (with G. Speegle).
- “Oonix: An Object-Oriented Unix Shell,” *Proc. 22 Hawaii International Conference on System Sciences*, (1989), (with E. C. Bueché, M. T. Franklin, E. R. Holley, and G. C. Sheppard).
- “Formal Model of Correctness without Serializability,” *Proc. SIGMOD '88 International Conference on the Management of Data*, pp. 379-386. (1988) (with G. Speegle).
- “Psycho: A Graphical Language for Supporting Schema Evolution in Object-Oriented Databases,” *Proc. 3rd User System Interface Conference*, (1988) (with H.-J. Kim).

- “Semantics and Implementation of Schema Evolution in Object-Oriented Databases,” *Proc. SIGMOD '87 International Conference on the Management of Data*, pp. 311-322. (1987) (with J. Banerjee, H.-J. Kim, and W. Kim).
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- “Extending the Scope of Relational Languages,” *Proc. 19 Hawaii International Conference on System Sciences*, (1986).
- “A Model of CAD Transactions,” *Proc. International Conference on Very Large Data Bases*, p. 25–33, (1985) (with F. Bancilhon and W. Kim).
- “ROSI: A User-Friendly Operating System Interface Based on the Relational Data Model,” *Proc. International Symposium on New Directions in Computing*, (1985) (with A. Silber-schatz).
- “Transactions and Concurrency Control in CAD Databases,” *Proc. IEEE International Conference on Computer Design: VLSI in Computers*, pp. 86-90. Stockholm, Sweden, (1985) (with F. Bancilhon and W. Kim).
- “A Framework for Understanding Distributed (Deadlock Detection) Algorithms,” *Proc. 2 ACM Sigact/Sigmod Symposium on the Principles of Database Systems*, pp. 192-202. (with R. Krishnamurthy, A. Nigam, and J.T. Robinson.) (1983)
- “Design of a Document Filing and Retrieval Service,” *Proc. SIGMOD '83 Database Week: Databases for Business and Office Applications*, pp. 96-101, (1983) (with B.E. Willner and R.P. King).
- “An Experimental Distributed Database System,” *Proc. SIGMOD '83 Database Week: Databases for Business and Office Applications*, pp. 2-7. (1983) (with B.T. Hailpern)
- “Edge Locks and Deadlock Avoidance in Distributed Systems,” *Proc. 1 ACM Sigact/Sigops Symposium on the Principles of Distributed Computing*, pp. 173-182. (1982)
- “Compatible Attributes in a Universal Relation,” *Proc. 1 ACM Sigact/Sigmod Symposium on the Principles of Database Systems*, pp. 55-62. (1982) (with C. Beeri)
- “A Deadlock-Free, Variable Granularity Locking Protocol,” *Proc. 5 Berkeley Workshop on Distributed Data Management and Computer Networks*, pp. 105-121. (1981).

Workshop Publications

- “Pipelined Hash-Join on Multithreaded Architectures,” *Third International Workshop on Data Management on New Hardware*, held in association with the 2007 ACM SIGMOD International Conference on the Management of Data. (with P. Garcia)
- “Multithreaded Architectures and the Sort Benchmark,” *International Workshop on Data Management on New Hardware*, held in association with the 2005 ACM SIGMOD International Conference on the Management of Data. (with P. Garcia)

- “The Table and the Tree: On-Line Access to Relational Data through Virtual XML Documents,” *Proc. Fourth International Workshop on the Web and Databases*, Santa Barbara, CA, (2001) (with P. Bohannon and P.P.S. Narayan)
- “Time-Constrained Transaction Scheduling,” *Proc. Third International Workshop on Responsive Computer Systems* (1993) (with N. Soparkar and A. Silberschatz).
- “Multimedia Research at MITL,” *IEEE Workshop on Multimedia Computing*, Pittsburgh (Mar 1993) (with D. Barbará and D. P. Lopresti).
- “A Database Interface for Mobile Computers,” *Proc. 1992 Globecom Workshop on Networking of Personal Communication Applications*, Orlando, FL. (1992) (with R. Alonso and E. Haber)
- “A Mobile Computer Interface for Heterogeneous Databases,” *Proc. 3rd International Workshop on Research Issues on Data Engineering: Interoperability in Multidatabase Systems*, Vienna. (1993) (with R. Alonso and E. Haber)
- “Interoperability with Unstructured Data and Services,” *Proc. 3rd International Workshop on Research Issues on Data Engineering: Interoperability in Multidatabase Systems*, Vienna. (1993) (with D. Barbará, Y. Breitbart, H. Garcia-Molina, and S. Mehrotra)
- “Relaxing Serializability in Heterogeneous Distributed Database Systems,” *Proc. 2nd International Workshop on Research Issues on Data Engineering: Transaction and Query Processing*, Phoenix, AZ, pp. 205-212, (1992) (with S. Mehrotra, R. Rastogi, and A. Silberschatz).
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- “Encapsulation of Transaction Management in Object Databases,” *Proc. ECOOP/OOPSLA ’90 Workshop on Transactions and Objects*, (1990) (with G. Speegle).
- “Query Algebra for Object-Oriented Databases,” *Proc. Schlumberger Software Conference*, (1990) (with X. Peltier).
- “Optimization of Object-Retrieval Queries,” *Proc. 2 International Workshop on Object-Oriented Database Systems, Lecture Notes in Computer Science 334*, K.R. Dittrich, ed., pp. 352-357, Springer-Verlag (1988).
- “Using Nested Relations in the Design of Object Databases,” *Proc. International Workshop on the Theory and Applications of Nested Relations and Complex Objects*, (1987).
- “Schema Evolution in Object-Oriented Persistent Databases,” *Proc. XP 7.52 Workshop on Database Theory*, (1986) (with J. Banerjee, H.-J. Kim, and W. Kim).
- “Non-1NF Relations: Theory and Application,” *Proc. XP 7.52 Workshop on Database Theory*, (1986).
- “System/U: A Progress Report,” *Proc. XP/2 Workshop on Relational Database Theory*, (1981).
- “System/U: A Database System Based on the Universal Relation Assumption,” *Proc. XP/1 Workshop on Relational Database Theory*, (1980) (with J.D. Ullman)

Other Publications

- “Metadata for Structured Document Datasets,” *International Workshop on Document Analysis Systems*, 2010. (short paper and poster) (with D. Song and J. Hefflin)
- Paper and Proposal Reviews: is the Process Flawed?” *ACM SIGMOD Record* 37(3): 36-39 (2008), (with Philip A. Bernstein, Mary F. Fernandez, Le Gruenwald, Phokion G. Kolaitis, Kathryn S. McKinley, M. Tamer Ozsu)
- “Diffusing Queries: A Framework for Opportunistic Intelligence Sharing,” *Working Together: R&D Partnerships in Homeland Security*, U.S. Department of Homeland Security, April 2005, (Poster Paper), (with C. Creswell and C. Hogg)
- “The Atomic Manifesto: a Story in Four Quarks,” *ACM SIGMOD Record*, March 2005, and *ACM SIGOPS Operating Systems Review*, 39(2): 41–46 April 2005, and *ACM SIGMOD Record* 34(1): 63–69, 2005 and *Journal of Universal Computer Science*, Vol. 11, No. 5, pp. 636-650, May 2005. (with C. Jones, D. Lomet, A. Romanovsky, G. Weikum, A. Fekete, M-C. Gaudel, R. de Lemos, J. E. B. Moss, R. Rajwar, K. Ramamritham, B. Randell, L. Rogrigues)
- “ROLEX: Relational On-Line Exchange with XML.” *Proc. ACM SIGMOD International Conference on the Management of Data*, San Diego, CA., pp. 673, June 2003. (Demo Paper) (with P. Bohannon, X. Dong, S. Ganguly, C. Li, P. P. S. Narayan, P. Shenoy)
- “Approaching Zero Latency: When Throughput Isn’t Enough,” *The Future of Software*, Fawcette Technical Publications, Vol. 1, No. 1, Winter 2000/2001, pp. 18-21.
- “Data Replication Gains Popularity,” interview in *IEEE Concurrency*, S. Jajodia, ed., pp. 4-5, April-June 1999. (with Y. Breitbart).
- “DataBlitz Storage Manager: Main Memory Database Performance for Critical Applications,” *Proc. ACM SIGMOD International Conference on the Management of Data*, Philadelphia, PA, pp. 519-520, (June 1999) (Industrial Track Paper) (with J. Baulier, P. Bohannon, S. Gogate, C. Gupta, S. Haldar, S. Joshi, A. Khivesera, P. McIlroy, J. Miller, P.P.S. Narayan, M. Nemeth, R. Rastogi, S. Seshadri, A. Silberschatz, S. Sudarshan, M. Wilder, C. Wei).
- “The DataBlitz Main-Memory Storage Manager: Architecture, Performance, and Experience,” *Proc. Third Annual Fedlab Symposium Advanced Telecommunications and Information Distribution Consortium*, U.S. Army Research Laboratory, College Park, MD., (Feb. 1999) (with J. D. Baulier, P. Bohannon, A. Khivesara, R. Rastogi, A. Silberschatz, S. Sudarshan, and B. Sayrs).
- “A Database System for Real-Time Event Aggregation in Telecommunication,” *Proc. 24th International Conference on Very Large Data Bases (VLDB)*, New York, NY, Aug 1998, pp. 680-684(Industrial Track Paper) (with J. Baulier, S. Blott, and A. Silberschatz)
- “DataBlitz: A High Performance Main-Memory Storage Manager,” *Proc. 24th International Conference on Very Large Data Bases (VLDB)*, New York, NY, Aug 1998, pp. 701 (Exhibit Track Paper) (with J. Baulier, P. Bohannon, S. Gogate, S. Joshi, C. Gupta, A. Khivesera, P. McIlroy, J. Miller, P.P.S. Narayan, M. Nemeth, R. Rastogi, A. Silberschatz, S. Sudarshan)
- “New Focal Points for Research in Database Systems,” *ACM Computing Surveys*, Vol. 28A, 1997.

- “Database System Architecture for Time-Constrained Applications,” invited presentation, *Workshop on Databases: Active and Real-Time*, Rockville, MD, Nov 1996.
- “The Transaction Abstraction: Fundamental Principle and Evolving System Concept,” *Proc. 21st International Conference on Very Large Data Bases (VLDB)*, pp. 2-6, Zürich, Switzerland, Sep 1995 (invited paper and talk)
- “Transcending the Serializability Requirement,” *Bulletin of the IEEE Technical Committee on Data Engineering*, Vol. 16, No. 2, pp. 8-11 (June 1993), (with R. Rastogi, S. Mehrotra, and A. Silberschatz).
- “Locking Protocols: General Lock Classes and Deadlock Freedom,” Ph.D. Thesis, Princeton University, Princeton, NJ. (1981)
- “A Straw Man Analysis of the Probability of Waiting and Deadlock,” RJ3066 IBM Research Laboratory, San Jose, CA. (1981) (with J.N. Gray, P. Homan and R. Obermarck), also oral presentation, *5 Berkeley Workshop on Distributed Databases and Computer Networks*.

Conference Panels

- “Paper and proposal reviews: is the process flawed?,” CRA Conference at Snowbird, 2008, (Panel chair)
- “Database Kernel Research: What, if anything, is left to do?”” *IEEE International Conference on Data Engineering*, Boston, MA, March 2004
- “Information, Communication, and Money: For What Can We Charge and How Can We Meter It?,” (panel co-chair) *24th International Conference on Very Large Data Bases*, New York, NY, Aug. 1998.
- “Research Directions in Databases,” Fourteenth International Conference on Data Engineering, Orlando, FL, February 1998.
- “Mobile Computing and Communications,” 22nd ACM Annual Computer Science Conference, Phoenix, AZ, March 1994.
- “Mobile Computing - Fertile Research Area or Black Hole?” (panel co-chair), Nineteenth International Conference on Very Large Data Bases, Dublin, Ireland, 1993.