

FARNAM JAHANIAN

Computer Science and Engineering Division
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Farnam Jahanian is Professor, Chair for [Computer Science and Engineering](#) at the [University of Michigan](#), and co-founder of [Arbor Networks, Inc.](#) Prior to joining academia, he was a Research Staff Member at the IBM T.J. Watson Research Center in New York. Farnam's research is aimed at the study of scalability, dependability and security of networked systems and applications. His interests include distributed computing, network security, and network protocols and architectures. Farnam's research at the University of Michigan has been funded by the National Science Foundation, US Department of Homeland Security, DARPA, National Security Agency, ONR, Cisco, Intel, Hitachi, Hewlett-Packard and IBM.

Farnam has led several research efforts aimed at developing new protocols and architectures for ensuring dependability of network infrastructures in the presence of security attacks, hardware and software failures, and operational faults. In the mid 90's, Farnam launched the Internet Performance Measurement and Analysis (IPMA) project, a joint research effort of the University of Michigan and Merit Network, aimed at studying the growth and scalability of the Internet backbone routing infrastructure. This work, sponsored by the National Science Foundation, was motivated by the explosive growth in size and topological complexity of the Internet and the increasing strain on the underlying infrastructure. The project deployed the first backbone routing probes across the major Internet public exchange points in 1995. The analysis of inter-domain routing behavior based on this data led to the discovery of BGP routing instability and inter-domain delayed convergence. This research on routing stability and convergence properties has been highly influential within both the network research community and the Internet operational community. It served as a catalyst for significant changes in commercial Internet routing software implementation and impacted routing policies employed by Internet Service Providers throughout the world. Furthermore, this work was the first research to uncover the fragility of the Internet routing infrastructure, and led to a body of work that has been built on by numerous networking infrastructure researchers over the last decade. This work was recently recognized with an ACM SIGCOMM Test of Time Award in 2008.

In early 2000, Farnam led a research effort (the Lighthouse Project, sponsored in part by DARPA and Cisco Systems) aimed at developing a flow-based system for detecting, backtracing and resolving network-wide anomalies such as distributed denial-of-service (DDoS) attacks and routing exploits. Working from a granular understanding of normal network traffic flows, the anomaly detection technique introduced by this effort can rapidly spot distributed attacks, closing a costly gap between detection of a threat and its resolution. This approach does not require any changes to the existing Internet routing infrastructure and has changed how large-scale network security attacks are addressed by today's Internet Service Providers.

These breakthroughs were the pillars on which Farnam co-founded [Arbor Networks](#) with former UM graduate student G. Robert Malan. During a two-year leave, serving as Arbor's President, Farnam led the management team of the company and raised over \$33 million in two rounds of funding from venture capital firms and strategic investors. The Internet security solutions based

on this work have been widely deployed by more than 200 Internet Service Providers, cable operators, content providers, and numerous mission-critical networks around the globe, and have won numerous [awards](#) in recent years. As one illustration of the impact of this research in practice, more than 70% of the Internet transit traffic in 2007 was protected against DDoS attacks by this technology. As Chairman of Arbor Networks, he is responsible for setting the strategic direction of the company and working with the company's board of directors.

Farnam is currently leading the Internet Motion Sensor Project, a collaborative research project (with Merit Network) aimed at observing and characterizing security threats on a global scale. The key idea is that by monitoring unused IP addresses (dark spaces), one could gain a network-wide understanding of cyber threats and their impact globally. The current IMS deployment consists of more than 60 distinct monitored blocks at 18+ organizations across the Internet, monitoring over 17 million unique IP addresses corresponding to more than 1.25% of all routed IPv4 space. The IMS system is being used by the ISP operational community as a reconnaissance tool, serving as an early warning system for brewing attacks. The data from the IMS project has been used to gain new insights into subtle characteristics of several recent Internet attacks and their impact on the underlying global infrastructure. With a significant grant from DHS, Farnam's group is currently involved in a research effort in developing a framework and tools for *"Understanding, Detecting, and Disrupting Botnets."*

The author of over 80 published research papers, Farnam has served on dozens of advisory boards and government panels in recent years, including Internet2's External Relations Advisory Council, National Advisory Board for UM Office of Technology Transfer, and the SparkZone Advisory Board. He is the recipient of a National Science Foundation CAREER Award, the Amoco Teaching Award, the University of Michigan College of Engineering Teaching Excellence Award, the EECS Outstanding Faculty Achievement Award, the EECS Department Teaching Excellence Award, the IBM Faculty Development Award, an IEEE Service Award, the Eta Kappa Nu Professor of the Year Award, and an IBM Outstanding Technical Innovation Award. He has been an active advocate for regional economic development efforts over the last decade, working with entrepreneurs, frequently lecturing on the topic and serving on numerous advisory boards. He was the 2005 recipient of the Governor's University Award for Commercialization Excellence. He was an associate editor of IEEE Transactions on Computers from 1995-99, and is serving on the editorial board of the International Journal of Time-Critical Computing Systems. Farnam holds a master's degree and a Ph.D. in Computer Science from the University of Texas at Austin.

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TECHNICAL INTERESTS

Distributed Computing; Network Security; Network Protocols and Architectures.

EDUCATION

UNIVERSITY OF TEXAS AT AUSTIN

Doctor of Philosophy degree in Computer Science, 1989.

Master of Science in Computer Science, Minor in Electrical Engineering, 1987.

UNIVERSITY OF TEXAS AT SAN ANTONIO

Bachelor of Science in Mathematics, Computer Science, and System Design, May 1982,
Summa cum Laude.

PROFESSIONAL EXPERIENCE

UNIVERSITY OF MICHIGAN

Chair, Computer Science and Engineering (July 2007–Present)

Professor, EECS Department (2001–Present)

Director, Software Systems Research Lab (1997–2000)

Associate Professor, EECS Department (1995–2001)

Assistant Professor, EECS Department (1993–1995)

ARBOR NETWORKS

Chairman of the Board, 2005 – Present

Chief Scientist, 2003 – 2005

Founder and President, 2000 – 2002 (on leave from UM)

IBM T.J. WATSON RESEARCH CENTER

Senior Manager, Research Division, 1991-1993.

Research Staff Member, 1989-1991

UNIVERSITY OF TEXAS AT AUSTIN (1984 - 1989)

Research Assistant with the Real-Time Systems Group.

MICROSOFTWARE DEVELOPMENT ASSOCIATES, INC. (1982 - 1983)

Systems analyst responsible for design and development of application software.

HONORS AND AWARDS

- ACM SIGCOMM Test of Time Award, 2008.
- Governor's University Award for Commercialization Excellence (U-ACE), 2005.
- EECS Outstanding Faculty Achievement Award, 2005.
- Ernst & Young Entrepreneur of the Year Finalist, 2003.
- Amoco Faculty Teaching Award, University of Michigan, 2000.
- IBM Faculty Development Award, 2000.
- DARPA Innovation Award, Fault-Tolerant Networking Program, 2000.
- College of Engineering Teaching Excellence Award, University of Michigan, 1998.
- The Smithsonian-ComputerWorld Innovation Awards: UARC project, 1998.
- IBM University Partnership Program Research Award, 1998.
- ACM SIGCOMM Best Student Paper Award (Craig Labovitz), 1997.
- EECS Department Teaching Excellence Award, University of Michigan, 1996.
- National Science Foundation CAREER Award, 1995.
- Eta Kappa Nu Honor Society EECS Professor of the Year, 1995.
- IEEE Service Award, 1993.
- IBM Research Division Award, 1992.
- IBM Outstanding Technical Innovation Group Award, 1992.
- Elected vice president of UTSA chapter of Upsilon Pi Epsilon honor society, 1981-1982.
- Elected to Eta Kappa Nu, Phi Kappa Phi and Alpha Chi honor societies.
- More than 20 [company and innovation awards](#) granted to Arbor Networks since 2001 including *Techworld Award for Security Product Of The Year*, *Information Security Product Award*, and *Inc 500 Award*.

RESEARCH PROJECTS

- “*Virtual Center for Network and Security Data*,” Department of Homeland Security, Farnam Jahanian (PI), Michael Bailey, Morley Mao (UM); Paul Barford (U. Wisconsin); Nick Femster (Georgia Tech); Internet2; Manish Karir (Merit Network), 2005-2008.
- “*Topology-Aware Internet Threat Detection Using Pervasive Darknets*,” National Science Foundation, Farnam Jahanian (PI) and Jignesh Patel, 2006-2009.
- “*New Frameworks for Detecting and Minimizing Information Leakage in Anonymized Network Data*,” Department of Homeland Security, Fabian Monrose (PI) Johns Hopkins University; Farnam Jahanian and Michael Bailey (UM); and Mike Reiter (CMU), 2008-2010.
- “*Collaborative Research: Enabling Security and Network management Research for Future Networks*,” National Science Foundation, Morley Mao (PI), Farnam Jahanian (UM); Wenke Lee and Nick Femster (Georgia Tech); Manish Karir (Merit Network); Southern Crossroads, 2008-2011.
- “*Detecting and Dismantling Botnet Command and Control Infrastructure using Behavioral Profilers and Bot Informants*,” Department of Homeland Security, Farnam Jahanian (PI), Morley Mao (UM); Greg Travis (Indiana University); Manish Karir (Merit Network), 2006-2008..
- “*Internet Motion Sensor*,” Gift from Intel Corporation, Farnam Jahanian (PI), 2006-present.
- “*Internet Motion Sensor*,” Gift from Cisco Systems, Farnam Jahanian (PI), 2006.
- “*Distributed Systems Instructional Infrastructure*,” Intel Corporation Equipment Grant, 2004. Farnam Jahanian (PI).
- “*Multi-Tiered Distributed Indication, Warning and Defense System*,” Sponsored by ARDA, Farnam Jahanian (PI) and Peter Chen, 2003-2004.
- “*Lighthouse Project: Detecting and Surviving Large-Scale Network Infrastructure Attacks*,” Sponsored by DARPA, Farnam Jahanian (PI) and Paul Howell (Merit Network)., 1999-2003.
- “*Internet Infrastructure Scalability and Stability*,” Intel Corporation, 1999-2000. Farnam Jahanian (PI).
- “*IPMA Project: Internet Performance Measurement & Analysis*,” National Science Foundation, Craig Labovitz (Merit Network) and Farnam Jahanian (Co-PI), 1997-2000.
- “*Experimentation with Multi-Threaded, Distributed Routing Technology in the Internet*,” National Science Foundation, Farnam Jahanian (PI) and Craig Labovitz (Merit Network), 1997-2000.

- “*Development of Ultra High Speed Next Generation Internet Technology,*” Sponsored by Hitachi Corporation, Farnam Jahanian (PI); Craig Labovitz and Hirabaru Masaki (Merit Network), 1999-2000..
- “*Middleware Services for Collaboratives on Wide-Area Networks,*” Sponsored by Intel Corporation, 1997-2000. Farnam Jahanian (PI).
- “*The SPARC Project: Collaborative Knowledge-Work Environments for Team Science,*” National Science Foundation KDI Initiative, Dan Atkins (PI), Gary Olson, Farnam Jahanian, Tim Killeen and Atul Prakash, 1998 – 2001.
- Network Infrastructure Equipment Gift, CISCO Systems, 1999.
- “*IBM UPP: Networking Support for Adaptive Internet-based Applications,*” IBM, Farnam Jahanian and Brian Noble, 1998.
- “*ARMADA Project: Building Scalable Real-Time Fault-Tolerant Systems for Embedded Applications,*” Sponsored by DARPA, Kang Shin (PI), Farnam Jahanian and Peter Chen, 1995-99.
- National Science Foundation *CAREER Award*, 1995-1999. Farnam Jahanian.
- “*End-to-End Performance Studies of Web-Based Groupware and Collaborative Applications over the Internet,*” Sponsored by Hewlett-Packard Company, Farnam Jahanian (PI) and Sugih Jamin, 1997-1998.
- “*Integrated Execution Simulation and Monitoring Environment for the Modechart Toolset,*” Naval Research Laboratories, 1996 - 1998, Farnam Jahanian (PI).
- “*Enabling Multimedia-Based Collaboration over Computer networks,*” Sponsored by the AT&T Foundation, Atul Prakash (PI) and Farnam Jahanian.
- “*Probing and fault Injection of Distributed Real-Time Protocols,*” Office of Naval Research, 1994-1997, Farnam Jahanian (PI).

DOCTORAL COMMITTEES CHAIRED

- Wu-chi Feng – August 96
“Video-on-Demand services: Efficient Transportation and Decompression of Variable Bit Rate Video”
- Scott Dawson – December 97
“Message Level Fault Injection in Distributed Systems”
- Monica Brockmeyer – May 99
“Monitoring, Testing, and Abstractions of Real-Time Specifications”
- Craig Labovitz – August 99
“Scalability of Internet Backbone Routing Infrastructure”
- Hengming Zou – December 99
“Dynamic Active-Passive Replication”
- G. Robert Malan – December 99
“Transparent Measurement and Manipulation of Internet Protocols”
- Scott Johnson – December 2001
“Scalable Group Composition”
- David Watson – May 2004
“Measurement and Analysis of Routing Protocol Behavior on Production Networks”
- Junghee Han – December 2004
“Enhancing End-to-end Availability and Performance by Leveraging Internet Redundancy”
- Michael D. Bailey – May 2006
“A Scalable Hybrid Network Monitoring Architecture for Measuring, Characterizing, and Tracking Internet Threat Dynamics”
- Evan Cooke – May 2007
“Exposing Internet Address Use to Enhance Network Security”
- 25+ doctoral dissertation committees (1993-2007)

TEACHING ASSIGNMENTS

Term	EECS Course	Enrollment	Class Score	Instructor Score
Fall 93	682: Special Topic	28	4.71	4.89
Winter 94	582: Adv. OS	22	4.28	4.80
Fall 94	482: Intro OS	89	4.70	4.84
Winter 95	482: Intro OS	108	4.60	4.86
Fall 95	682: Special Topic	26	4.42	4.78
Winter 96	380: Data Structures	76	4.38	4.87
Fall 96	682: Distributed Syst	27	4.65	4.89
Winter 97	482: Intro OS	83	4.40	4.90
Fall 97	591: Distributed Syst	41	4.21	4.70
Winter 98	482: Intro OS	125	4.33	4.69
Fall 98	591: Distributed Syst	38	4.18	4.46
Winter 99	482: Intro OS	125	4.57	4.85
Fall 00	591: Distributed Syst	40	4.40	4.64
Fall 01	281: Data Structures	54	4.16	4.64
Winter 03	591: Distributed Syst	34	4.25	4.65
Fall 03	498: Intro Dist Syst	14	4.78	4.96
Winter 04	591: Distributed Syst	26	4.63	4.80
Fall 04	281: Data Structures	54	4.25	4.82
Winter 05	591: Distributed Syst	22	4.00	4.77
Fall 05	498: Intro Dist Syst	21	4.83	4.96
Winter 06	591: Distributed Syst	22	4.55	4.77
Fall 06	496: Major Design	132	3.95	4.74
Winter 07	591: Distributed Syst	23	4.67	4.88
Fall 07	496: Major Design	128	4.22	4.71

- Supervised 20+ undergraduates in my research group since joining UM.

REPRESENTATIVE PROFESSIONAL ACTIVITIES AND SERVICES

Recent Broad Memberships and Advisory Committees:

- Arbor Networks, Chairman of the Board, 2001 – present.
- Internet2 External Relations Advisory Council (ERAC), Member, 2007 – present.
- UM Center for Entrepreneurship, Advisory Board, 2008 – present.
- External Review Panel, Office of Naval Research, Information Technology Division, 2002 and 2007.
- Worldwide Observatory of Malicious Behaviors and Attack Threats (WOMBAT), European Community Project, Advisory Board, 2007-present.
- National Advisory Board, UM Office of Technology Transfer, 2006 – present.
- WSU, Computer Science Department Advisory Committee Member, 2005 – present.
- Ann Arbor IT Zone, Board Member, 2004 – 2008.
- Dartmouth Inst. of Security Technology Studies, Advisory Committee, 2004 –2006.
- Member of NSF Working Group on “Future Scenarios for Networking Research and Associated Infrastructure Support.”

Significant Editorship and Technical Committees:

- General Chair, 40th IEEE Int. Conf. on Dependable Systems and Networks (DSN).
- Student Forum Chair, IEEE Int. Conf. on Dependable Systems and Networks, 2007.
- Program Chair, ACM Workshop on Recurring Malcode (WORM), 2006.
- Chair, IFIP Workshop on "Infrastructure Security and Operational Challenges of Service Provider Networks," June 2006.
- Co-chair, 2nd EU-US Workshop on "Cyber Trust: System Dependability and Security," April 2006.
- Program Chair, IEEE Int. Conf. on Dependable Systems and Networks (DSN), 2002.
- Program Committee Vice Chair, Fault-Tolerance Track, 21st ICDCS, 2000.
- Publicity Chair, IEEE Int. Conf. On Dependable Systems and Networks, 2000.
- Elected member of IFIP Working Group 10.4 on Dependable Computing, 1998.
- Editor, IEEE Transactions on Computer, 1995-99.
- Associate Editor, Real-Time Systems Journal, 1997-present.
- Chair, DARPA Working Group on Integrated High-Conf. Computing, 1998-99.
- Program Committee Vice-Chair, Distributed Real-Time Systems, 16th ICDCS, 1996.
- General Chair - 15th IEEE Real-Time Systems Symposium, 1994.
- Program Chair - 14th IEEE Real-Time Systems Symposium, 1993.
- Over 30 program committees of technical conferences and symposia, including:
 - 2009 ACM/Usenix Symposium on Networked Systems Design and Implementation.
 - 2009 IEEE Symposium on Security and Privacy.
 - 2008 ACM Computer and Communications Security Conference.
 - 2007 IEEE Internet Measurement Conference.
 - 2001, 2002, 2003, 2005, 2007, 2008, 2009 IEEE International Conf. on Dependable Systems and Networks.
 - 2005-2008 International Symposium Recent Advances in Intrusion Detection (RAID).

National Science Foundation Review Panels, 2000-2007:

- CAREER Panel, NSF CISE Directorate.
- Site Visit Member, Research Infrastructure, CISE Directorate.
- Site Visit Member, Science and Technology Center.
- SBIR Panel, CISE Directorate.
- NSF Infrastructure Panel, CISE Directorate.
- Combined Research-Curriculum Development Panel, Engineering Directorate.

- Operating Systems and Compiler Panel, CISE Directorate.
- Cyber Security ITR, CISE Directorate.
- NeTS Networking of Sensor Systems, CISE Directorate.
- CyberTrust Program, CISE Directorate.
- FIND Panel, NSF CISE Directorate.
- Site Visit Member, TRUST, CISE Directorate.

MAJOR UNIVERSITY COMMITTEE ASSIGNMENTS

College and University-level Assignments:

- OVPR Committee on UM Research Cyber Infrastructure, 2007.
- OVPR Committee on Enhancing Industry Relationships: Faculty Advisory Group on Industry and Technology Transfer, 2006–2007.
- Search Committee, CoE/Office of Technology Transfer and Commercialization, 2007–present.
- UM Office of Technology Transfer National Advisory Board, 2006–present.
 - Chair, Committee on “Business Engagement Center,” Fall 2007
- Chair, EECS Internal Review Committee, Chair, 2004.
- University IT Security Council, 2004 – present.
- University Digital Strategies Council, 2003–2005
- Faculty Advisory Board, CoE Technology Transfer and Commercialization, 2002–2004.
- President’s Commission on Information Revolution, 2000–2001.
 - Chair, subcommittee on IT Infrastructure.
 - Co-chair with John Laird, subcommittee on Research.
- CAEN/College of Engineering IT Advisory Committee, 2003–2005.
- Cisco Systems Merit Scholarship Selection Committee, 2003.
- Faculty Associate to OVPR, IBM Relationship, 1997–2000.
- Rackham Panel on Life Beyond Graduate School. 1999.
- CoE Capital Campaign Retreat, 1999.
- College of Engineering Information Technology Advisory Committee, 1996–1997.
- Member, EECS Departmental Review Committee, 1996–1997.

Department-level Assignments:

- Chair, CSE Division, 2007–present.
- Chair, Executive Committee, CSE Division, 2007–present.
- EECS Awards and Honors Committee, 2007–present.
- Faculty Search Committee, CSE Division, 2005–present.
- Executive Committee, Computer Science and Engineer, 2003–05.
- Faculty Advisor, Eta Kappa Nu Honor Society, 1995-1999, 2005-present.
- Director of Software Systems Lab, 1997-2000.
- Faculty Search Committee, CSE Division, 1997-2000.
- Fellowships and Financial-aid Chair, Computer Science & Engineering, 1994-98.
- Graduate Admissions Committee, 1994-98.
- EECS Department Graduate Affairs Committee, 1994-98.

RECENT KEYNOTES AND INVITED TALKS (2003-present)

- “A Case for Security Services in the Network Cloud,” Invited Talk, Department of Computer Science, University of Toronto, March 2008.
- “The Evolution of Internet Threats,” Invited Talk, RSA Conference, Tokyo, Japan, April 2007.
- “A Perspective-Aware Approach to Internet Security in the Botnet Era,” ITI Distinguished Lecture, University of Illinois, January 2007.
- “A Perspective-Aware Approach to Internet Security in the Botnet Era,” Invited Talk, Computer Science Colloquium Series, Cornell University, November 2006.
- “The Evolution of Internet Threats,” Invited Talk, Johns Hopkins Information Security Institute, November 2006.
- “Measuring, Characterizing, and Tracking Internet Threats,” Invited Talk, Intel Network Monitoring and Security Workshop, Hillsboro, Oregon, November 2006.
- NSF Invitational Workshop on Future Directions for the CyberTrust Program, Pittsburgh, PA, October 2006.
- “University & Industry Technology Commercialization Strategies: The Secrets to Success” Presentations and Panel with Howard Bell, Steve Forrest and Rangaramanujam Kannan, Michigan Technology Conference, September 2006.
- “Enter the Botnet: An Introduction to the Post-Worm Era,” ARO-DARPA-DHS Invitational Workshop on Botnets, Washington, DC, June 2006.
- “Emerging Technologies,” Michigan Growth Capital Symposium, Ann Arbor, MI, May 2006.
- “The Changing Internet Ecology: Confronting Security and Operational Challenges by Mining Network Data,” Keynote Presentation, ACM Workshop on mining network data (MineNet), September 2005.
- “Backbone Attack Detection and Mitigation Methodologies” Tutorial, ACM SIGCOMM Conference, Philadelphia, PA, Sept. 2005.
- “Internet Motion Sensor,” Invited Talk, Intel FM Innovation Centre, June 2005.
- “Worm research and Internet Motion Sensors,” Colloquium for Information System Security Education, Georgia Tech University, June 2005.
- “Measuring, Characterizing, and Tracking Internet Threat Dynamics,” US–Japan Critical Information Infrastructure Protection Workshop, Sponsored by National Science Foundation and Japan Science and Technology Agency, Washington, DC, September 2004.

- “Entrepreneurship: Building a Successful Venture,” Presentation and Panel, Entrepalooza 2004: Expanding the Horizons of Entrepreneurship, Sept. 2004.
- “The Changing Internet Ecology: New Threats to Infrastructure Security,” Invited Talk, Trans-European Research and Education Networking Association, Rhodes, Greece, May 2004.
- “The Changing Internet Ecology: New Threats to Infrastructure Security,” Invited Talk, Computer Science Department, Yale University, April 2004.
- "Research Solutions for the Practitioner," Invited Talk, Cyber Conflict Studies Association, National Defense University, Washington DC, March 2004.
- “eBarbarians at the Gate -The State of Network Security,” Panel Chair, FuturTech Conference, University of Michigan Business School, January 2004.
- “The Changing Internet Ecology: New Threats to Infrastructure Security,” Keynote Address, National Science Foundation Cyber Trust PI Meeting, Washington DC, August 2003.
- “UM's Role in Technology and Economic Development,” Presentations and Panel at the ITZone Forum with Mary Sue Coleman, Rick Snyder and Mike Klein, June 2003.
- “Network Engineering Case Study: Advanced Network Security Solutions,” Internet2 Member Meeting, Indianapolis, IN, October 2003.
- “Distributed Denial-of-Service Attacks,” Invited Talk, Internet2 Technical Meeting, Miami, FL, February 2003.
- DARPA CoNE Program, “Fleet Battle Experiment and Joint Warrior Interoperability,” Invited Presentation and Demonstration, July 2003.

REPRESENTATIVE MEDIA EXPOSURE

- **MIT Technology Review.** August 26, 2008. “[Moving Security to the Cloud](#)”
An article on recent Cloud-AV research.
- **Virtualization.com.** March 24, 2008. Article covering recent research result from our group on virtual machine migration vulnerability.
<http://virtualization.com/news/2008/03/24/live-virtual-machine-migration-vulnerability/>
- **CNN.com,** March 7, 2008. Article quoting data from Arbor Networks that peer-to-peer traffic accounts for about a third of all Internet traffic.
<http://www.cnn.com/2008/TECH/03/27/comcast.bittorrent/index.html>
- **Ann Arbor Business Review.** March 27, 2008. Article on UM/CoE Entrepreneurial Opportunities Day.
http://blog.mlive.com/ann_arbor_business_review/2008/03/entrepreneurship_jobs_event_dr.html
- **SC Magazine.** “[Two vulnerabilities found in VMware virtualization products,](#)”
Interview with my student Jon Oberheide on our new result on virtual machine vulnerability. Feb. 25, 2008.
- **ACM TechNews.** April 10, 2006. “Thinking Beyond the Box” based on article published on April 6, 2006 in Michigan Daily.
- **The Wall Street Journal,** May 29, 2005. Article on confronting large-scale denial-of-service attacks. <http://online.wsj.com/article/SB111196539614190462.html>
- **USA Today.** October 17, 2005. Article discusses federal (research) funding and its long-lasting impact to the private sector.
http://www.usatoday.com/money/smallbusiness/2005-10-17-fed-contractors-usat_x.htm
- **The Wall Street Journal.** March 28, 2005. “[Firms Join Forces Against Hackers](#)”
- **eWEEK.** March 28, 2005. An article on how ISPs across the world formed an alliance to automate the way real-time data on cyber-attacks.
<http://www.eweek.com/c/a/Security/Vendors-Join-Forces-to-Fingerprint-Hacker-Attacks/>
- **Inc Technology.** 2004. Inc. 500 Interview on Internet Security Threats.
<http://technology.inc.com/security/articles/200608/arbor.html>
- **www.chinaview.cn,** March 29, 2005. “[Communication firms join forces to confront hacker attacks](#)”
- **Detroit News.** April 18, 2004. “Arbor Networks software keeps hackers at bay.”
- **Business Wire.** July 15, 2003. “Arbor Networks Strengthens Network Security Portfolio with Eight New Pending Patents.”
- **Crain's Detroit Business.** July 8, 2002. Article on Internet2 consortium.
http://www.accessmylibrary.com/coms2/summary_0286-25607822_ITM

SELECTED REFEREED PUBLICATIONS 1994-2008

- Jon Oberheide, Evan Cooke, and Farnam Jahanian, "[CloudAV: N-Version Antivirus in the Network Cloud](#)," Proc. of the 17th USENIX Security Symposium, July 2008.
- Jon Oberheide, Kaushik Veeraraghavan, Evan Cooke, Jason Flinn, and Farnam Jahanian, "[Virtualized In-Cloud Security Services for Mobile Devices](#)," Workshop on Virtualization in Mobile Computing (MobiVirt'08), June 2008.
- Jon Oberheide, Evan Cooke, and Farnam Jahanian, "[Exploiting Live Virtual Machine Migration](#)," Black Hat DC, Washington DC, February 2008.
- Michael Bailey, Jon Oberheide, Jon Andersen, Z. Morley Mao, Farnam Jahanian, and Jose Nazario, "[Automated Classification and Analysis of Internet Malware](#)," 10th International Symposium Recent Advances in Intrusion Detection (RAID), Queensland, Australia, Sept. 2007.
- Jon Oberheide, Evan Cooke, and Farnam Jahanian, "[Rethinking Antivirus: Executable Analysis in the Network Cloud](#)," 2nd USENIX Workshop on Hot Topics in Security (HotSec), Boston, MA, August 2007.
- Sushant Sinha, Michael Bailey, and Farnam Jahanian, "[Shedding Light on the Configuration of Dark Addresses](#)," Network and Distributed System Security Symposium (NDSS), San Diego, California, February 28-March 2, 2007.
- Evan Cooke, Andrew Myrick, David Rusek, and Farnam Jahanian, "[Resource-Aware Multi-Format Network Security Data Storage](#)," Proc. of the SIGCOMM Workshop on Large Scale Attack Defense (LSAD'06), September 2006.
- Sushant Sinha, Farnam Jahanian, and Jignesh Patel, "WIND: Workload-aware Intrusion Detection," 9th International Symposium on Recent Advances in Intrusion Detection (RAID), Hamburg, Germany, Sept. 2006.
- Evan Cooke, Z. Morley Mao, and Farnam Jahanian, "[Hotspots: The Root Causes of Non-Uniformity in Self-Propagating Malware](#)," International Conference on Dependable Systems and Networks (DSN 2006), Philadelphia, PA, pp. 179-188, June 2006.
- By Junghee Han, David Watson, Farnam Jahanian, "[An Experimental Study of Internet Path Diversity](#)," [IEEE Transactions on Dependable and Secure Computing](#), vol. 3, no. 4, pp. 273-288, Oct-Dec, 2006.
- Evan Cooke, Michael Bailey, Farnam Jahanian, and Richard Mortier, "[The Dark Oracle: Perspective-Aware Unused and Unreachable Address Discovery](#)," 3rd Symposium on Networked Systems Design and Implementation (NSDI06), San Jose, CA, May 2006.
- Michael Bailey, Evan Cooke, Farnam Jahanian, Niels Provos, Karl Rosaen, and David Watson, "[Data Reduction for the Scalable Automated Analysis of Distributed Darknet Traffic](#)," Internet Measurement Conference (IMC 2005), Oct. 2005.
- Michael Bailey, Evan Cooke, Farnam Jahanian, Jose Nazario, and David Watson, "[The Blaster Worm: Then and Now](#)," IEEE Security & Privacy Magazine, volume 3, issue 4, pp. 26- 31, July-Aug. 2005.
- Evan Cooke, Farnam Jahanian, and Danny McPherson, "[The Zombie Roundup: Understanding, Detecting, and Disrupting Botnets](#)," Usenix Workshop on Steps to Reducing Unwanted Traffic on the Internet (SRUTI 2005), pp. 39-44, Cambridge, MA, July 2005.

- Junghee Han, David Watson, and Farnam Jahanian, "[Topology Aware Overlay Networks](#)," IEEE Infocom, Miami, FL, March 2005.
- Michael Bailey, Evan Cooke, Farnam Jahanian, Jose Nazario, and David Watson, "[The Internet Motion Sensor: A Distributed Blackhole Monitoring System](#)," Proceedings of the 12th Annual Network and Distributed System Security Symposium (NDSS), San Diego, CA, Feb. 2005.
- Evan Cooke, Michael Bailey, Z. Morley Mao, David Watson, Farnam Jahanian, and Danny McPherson, "[Toward Understanding Distributed Blackhole Placement](#)," WORM'04, Washington, DC, pp. 56-64, October 2004.
- Junghee Han and Farnam Jahanian, "[Impact of Path Diversity on Multi-homed and Overlay Networks](#)," IEEE International Conference on Dependable Systems and Networks (DSN-2004), Florence, Italy, pp. 22-31, June 2004.
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