

Eve Meryl Schooler

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EDUCATION:

Ph.D. Computer Science, California Institute of Technology, Pasadena, CA.

Ph.D. Thesis: "Why Multicast Protocols (Don't) Scale:

An Analysis of Multipoint Algorithms for Scalable Group Communication"

M.S. Thesis: "A Multicast User Directory Service for Synchronous Rendezvous" (1996)

Advisor: K. Mani Chandy

M.S. Computer Science, University of California, Los Angeles, CA.

Thesis: "Distributed Debugging in a Loosely-Coupled Processing System"

Advisor: Leonard Kleinrock

B.S. Computer Science, Yale University, New Haven, CT.

Thesis: "Peep-hole Optimization for the "T" Compiler"

Advisor: Joseph Fisher

WORK EXPERIENCE:

- 1/15- **Principal Engineer and Director of Research in Emerging Architectures, Intel Internet of Things (IoT) Group**, Technology, Standards & Pathfinding team, Santa Clara, CA. Leading pathfinding for the network, storage and data architecture required to evolve the Cloud toward Edge and Fog Computing while supporting trusted analytics. Focused on: Reverse Content Distribution Networks (rCDNs) for aggregation of upstream IoT data flows; Smart Objects for semantic interoperability; Data stewardship, economy and privacy preservation over the data lifecycle; Bootstrapping IoT trustworthiness in intermittently or fully disconnected contexts; Real-time Fog support for interactive and remote control of devices and data; Data-centric IoT architecture that comprehends and migrates computation and storage throughout the Fog architecture.
- 1/14-12/14 **Principal Engineer and Senior Architect, Intel Software & Services Group**, IoT Device Services, Santa Clara, CA. Evaluated suitability of data-centric networking and privacy-preserving encryption on energy-constrained mobile devices. Drove development of trusted data management solutions, reputation services, an observation- and measurement-based IoT trust calculus, leading to business unit adoption of information-centric networking (ICN) into publish-subscribe middleware solution.
- 10/10-12/13 **Principal Engineer and Project Lead, Intel Labs**, Energy & Sustainability Lab, Santa Clara, CA. Led the Trusted Personal Cloud project to architect and to build the trusted communication infrastructure for the Smart home and Smart city. Innovated at the Smart Grid edge by combining information-centric networking (ICN) with attribute-based encryption (ABE) to enable self-securing data with high availability. Led research team that delivered scalable data privacy and visualization solutions, quantified energy savings from presence detection in the Smart home, implemented middleware-agnostic privacy and security library, demonstrated inference-based personal cloud formation and showcased privacy-preservation in neighborhood-coordinated Electric Vehicle Charging use case. Designed deployment pilot for roll-out in DoE-funded Pecan Street smart neighborhood trials.
- 4/08-10/10 **Principal Engineer and Project Lead, Intel Research**
1/05-4/08 **Senior Research Scientist and Project Lead, Intel Research**, Distributed Detection & Inference project, Communication Technology Lab, Corporate Technology Group, Santa Clara, CA. Led team of researchers focused on collaborative network anomaly detection in large-scale Enterprise networks, combining machine learning with distributed networking techniques using a fully distributed end-host architecture. Targeting zero-day attacks, algorithms reduced false positives (1000x), detected two orders of magnitude stealthier malware, with nearly 95% reduction in the percentage of the network infected at time of detection. Drove the collection of a unique dataset derived from mobile end-host user network traffic traces that led to insights into malware and botnet behavior, and demonstrated data as a service (Division Recognition Award). Improved performance further through biased

messaging, real-time adaptation, and clustering. Matured system into proof of concept in year-long trial deployment with British Telecom, a major European service provider.

- 6/04-12/04 **Consultant, Pollere LLC**, Menlo Park, CA. Performed an extensive comparative analysis of network simulation tools to support the Transformation Communications Satellite (TSAT) system. Resultant white paper and recommendations contributed to Lockheed-Martin winning \$40M DARPA funding due to superior risk analysis compared to competitors.
- 9/01-7/03 **Principal Technical Staff Member, AT&T Labs-Research**, Internetworking Research Department, Menlo Park, CA. Designed an aggregation architecture for efficient feedback in large N-to-1 communication systems. Augmented Real-time Transport Control Protocol (RTCP) to improve scaling techniques and to support operation in constrained topologies, such as source-specific multicast (SSM) and satellite networks, and subsequently applied to contexts such as wide-area network monitoring and sensor networks. Widely deployed in IPTV distribution systems, the extensions were adopted as a proposed standard in the IETF (RFC 5760). Implemented passive end-system monitoring of peer-to-peer (p2p) traffic for improved network provisioning. Derived preliminary workloads by tracking p2p client signaling protocol activity in Internet-scale experiments.
- 9/94-7/01 **Research Assistant, Computer Science Department, Caltech**, Pasadena, CA, Infosphere Project. Focused on issues in scalable distributed control, network performance analysis, resource discovery, multicast and Web-based telecollaboration, session agreement protocols and media synchronization (9/94-12/00). Teaching Assistant for CS128 Algorithms, core class on sequential, distributed and parallel algorithms ('95-'96, '98). Advisor, Caltech Summer Research Program in Parallel Computing for Undergraduate Women and Minorities, supervising visiting undergraduates. Implemented a distributed network monitoring application for computer theft detection, a multicast dynamic LDAP (light-weight directory access protocol) directory service, an accompanying user interface, and a fault tolerant collaborative Web browser (Summers '95, '98, '99).
- 5/97- 8/97 **Summer Intern, Microsoft Research**, Telepresence Research Group, Bay Area Research Center, San Francisco, CA. Developed a multicast forward error correction (FEC) protocol for scalable Web file distribution and one-to-many telepresentations. Demonstrated in multicast version of the Powerpoint application.
- 5/96- 8/96 **Summer Intern, Hewlett-Packard Laboratories**, Broadband Information Systems Lab, Palo Alto, CA. Investigated Quality of Service (QoS) in the Internet and its impact on the design of a hybrid fiber coax (HFC) system to the home. Created an experimental testbed for protocol analysis.
- 3/88-12/95 **Member Technical Staff, USC/Information Sciences Institute**, Multimedia Conferencing Project, Networking Division, Marina del Rey, CA. Drove the design of a session control protocol for operation over wide area packet networks that supported multiway conference establishment, propagated quality of service information, negotiated heterogeneous site configurations, and resynchronized state as needed. Led to co-authorship of IETF Session Initiation Protocol (SIP), widely used standard for VoIP (RFCs 2543 and 3261). Pioneered and implemented evolving protocol in early workstation-based teleconferencing tool over experimental Internet (Mbone), combining real-time voice and video with shared computer workspaces. Publicly released software to Internet community. Demonstrated results in one of, if not the first Internet-wide distributed music performances, to showcase synchronization algorithms.
- 9/85-2/88 **Research Assistant, Computer Science Department, UCLA**, Los Angeles, CA, Advanced Teleprocessing Group. Developed the Benevolent Bandit Laboratory, a loosely-coupled testbed for distributed algorithms that took advantage of idle CPUs in a local area network of microcomputers and provided fault tolerance through redundancy. Thesis work created a distributed debugger and monitor to examine the impact of interprocess communication (1/87-2/88). Sysadmin in Artificial Intelligence Lab maintaining network of Apollo workstations (9/85-12/86).
- 8/83-7/85 **Software Engineer, Apollo Computer**, Operating Systems Group, R&D, Chelmsford, MA. Ported and integrated non-kernel Unix functions into Apollo's Aegis distributed operating system. Member of the design team that implemented a co-resident version of Berkeley 4.2 and Bell System V Unix. Responsible for portions of the process fault manager and global libraries. Co-composer, "A Long Ray's Journey into Light", SIGGRAPH'05 animation, which synthesized the accompanying graphics and music using spare cycles across the network.

HONORS

“Top 3 Inventor” Recognition, Internet of Things Group, 16 patents filed (2016)
Intel Division Collaboration Award (2016)
Intel Division Recognition Award, NIST Cyber-Physical Systems Framework (2016)
Intel Achievement Award (2015), ROAR program coach (to retain senior technical women) (2015)
Intel Division Recognition Award, Forbidden City Dataset (2007)
Microsoft Graduate Fellowship (1997-1999)
Caltech Earl C. Anthony Scholarship (1994-1995)
American Association of University Women, Educational Foundation Fellowship (1994-1995)
George Tasic Science Scholarship (1979-1981)

RELATED ACCOMPLISHMENTS:

Intel: Patent Review Committee, Automotive, Drones, Robotics (2017-); Corporate Research Council, Emerging Ingredients Committee (2016-), grant sponsorship for UCB Software Defined Buildings; IoT Group grant sponsorship of research at CMU, NDN Consortium, ACM ICN (2014-); Intel Environmental Excellent Awards Committee (2011, 2012); University Research Office grant sponsorship for research at MIT, CMU, UCB LoCal (2010-2013). Intel Research Council, Communication Committee, grant sponsorship for external research at MIT, Dartmouth, UC Davis, CAIDA/UCSD membership (2005-2009).

IETF (Internet Engineering Task Force): Member, IETF Internet of Things (IoT) Directorate (2017-); Co-founder and Co-chair, working group on Multiparty, Multimedia Session Control (MMusic) (3/93-10/99); Member, IETF Transport Area Directorate (1994-1997).

NSF (National Science Foundation): Board of Advisors, NSF-Intel joint program on Information-Centric Networking in Wireless Edge Networks (ICN-WEN) (2017-); Industry panelist, Role of Information Sciences and Engineering in Sustainability (RISES) workshop (2011); Technical Advisor, Wireless Nano-Bio-Info Sensors and Systems Program (2008-2009); Reviewer, Aware Networking (ANET) program area (2008); Member, Committee of Visitors for CISE/ANIR (2003).

NIST (National Institute of Standards): Co-chair, Data Interoperability working group, Cyber-Physical Systems Initiative (2014-2016).

OpenFog Consortium: Co-chair SW Infrastructure WG’s Task Group on Smart Objects for Fog Computing (2017).

TPCs (Technical Program Committees): NDSS Workshop on Decentralized IoT Security and Standards (NDSS DISS’17); ACM International Conference on Information Centric Networking (ACM ICN’14,’16,’17, Demo & Posters co-chair ’15); IEEE International Conference on Distributed Computing Systems (ICDCS’17), Edge and Fog Computing track; IFIP Networking ’17, Workshop on Information-Centric Fog Computing; EAI International Conference on Mobile Computing, Applications and Services (Mobicase’16, ’18); Annual Mediterranean Ad Hoc Networking Workshop (MedHocNet’14, Workshop co-chair); IEEE Infocom Workshop on Name-Oriented Mobility: Architectures, Algorithms and Applications (NOM’14,’16); ACM Workshop on Cyber-Physical System Security and Privacy (CPS-SPC’15); IEEE International Conference on Smart Grid Communication (SmartGridCom’13, TPC co-chair); International Conference on Future Energy Systems (e-Energy’10 & ’11, TPC member; ’12 Industry liaison); IEEE International Symposium on a World of Wireless Mobile and Multimedia Networks (WoWMoM’09); Global Internet Symposium (Globecom ’01); IEEE International Conference on Multimedia Computing Systems (ICMCS ’99); ACM International Conference on Multimedia (MM ’95); 5th International Workshop on Networking and OS Support for Digital Audio and Video (NOSSDAV ’94).

Reviewer: IEEE/ACM Transactions on Networking, Journal of Internetworking, ACM Transactions on Internet Technology, IEEE Transactions on Mobile Computing, IEEE Computer, IEEE Parallel and Distributed Technology, IEEE Internet Computing, Cluster Computing, IEEE Multimedia Journal, ACM SIGCOMM, IEEE INFOCOM, IEEE GLOBECOM, ACM Multimedia, IEEE ICMCS, IEEE ICDCS, NOSSDAV, IEEE ComSoc Multimedia Workshop, IEEE e-Energy, IEEE SmartGridComm, IEEE MobiCase, Elsevier Computers & Security Journal, Elsevier Computer Networks Journal, NSF grant proposals, I3T SRC proposals, DoE PSERC whitepapers.

Expert Witness on VoIP (Voice over IP): Pragmatus vs Yahoo! (2/13-5/14); Tandberg vs Collaboration Properties Inc/Avistar (12/06-2/07).

Member: Sigma Xi Scientific Research Honors Society; Association for Computing Machinery (ACM); Institute of Electrical and Electronics Engineers (IEEE).

Volunteer: Grace Hopper Conference <<http://www.gracehopper.org>>: Technical Panels, Partner Collaboration Forum (GHC'16, GHC'17); New Investigators Committee (GHC'08); Co-Chair, Invited Technical Talks Committee (GHC'07); Publications Chair (GHC'05), Web Designer and Host for resume database (GHC'02). Mentor, MentorNet ('02-'04); Workshop Developer, "Music and Computer Networks: Friends or Foes?", Sally Ride Science Festival for Middle School Girls, Stanford, CA; Web Designer and e-mail sysadmin, Children's Center at Caltech, "<http://www.its.caltech.edu/~ccenter>" (10/98-09/01); Tutor, California Literacy Project ('89-'91).

Musician: Board member, Ragazzi Boys Chorus (2014-); Instrumentalist, Internet distributed music performance, ACM MM '95. Collaborator, cyber music composition for the BodySynth, an alternate I/O device that creates sound through movement (6/93). Summer student, Center for Computer Research in Music and Acoustics (CCRMA), Stanford University, session on Synthesis and Composition on Small Advanced Systems (7/86). Co-composer, SIGGRAPH '85 animation "A Long Ray's Journey into Light", synthesized the accompanying music score with UC San Diego CMUSIC computer-based software. Performer and musical arranger, Yale acappella singing groups, Whim 'n Rhythm ('83) and Something Extra ('80-'82). Co-chairperson ('83) and Member ('79-'83), Yale Guild of Carillonners. Member, Yale Glee Club ('80). Graduate, Manhattan School of Music, Preparatory Division, New York, NY, student in piano, music composition and music theory ('74-'79).

PUBLICATIONS:

Journals and Other Refereed Publications:

Eve M. Schooler, Jianqing Zhang, Adedamola Omotosho, Jessica McCarthy, Meiyuan Zhao, Qinghua Li, "The Trusted Personal Energy Cloud for the Smart Home", *Intel Technology Journal*, Special Issue on Sustainable Intelligent Systems, Vol.16, No.3, pp.14-26 (July 2012).

Joseph A. Paradiso, Prabal Dutta, Hans Gellersen, Eve M. Schooler, "Guest Editors' Introduction: Smart Energy Systems", *IEEE Pervasive Computing*, Vol. 10, No.1 (2011).

Eve M. Schooler, Carl Livadas, J. Kim, P. Gandhi, P.R. Passera, J. Chandrashekar, S. Orrin, M. Koyabe, F. El-Moussa, G. Dabibi, "Collaborative Defense as a Pervasive Service: Architectural Insights and Validation Methodologies of a Trial Deployment", *International Journal of Sensor Networks*, Vol.8, No.2, pp.65-76 (2010). A shorter version appeared in IEEE 5th International Conference on Testbeds and Research Infrastructures for the Development of Networks and Communities (TridentCom'09), *Proceedings The First International Workshop on Pervasive Computing Systems and Infrastructures*, (PCSI'09), Washington, DC (April 2009).

John Mark Agosta, Jaideep Chandrashekar, Denver Dash, Manish Dave, David Durham, Hormuzd Khosravi, Hong Li, Stacy Purcell, Sanjay Rungta, Ravi Sahita, Uday Savagaonkar, Eve M. Schooler, "Autonomic Enterprise Security: Distributed Detection, Self-Defending Platforms and Adaptive Feedback", *Intel Technical Journal*, volume 10, number 4 (Nov 2006).

Gemmell, J., Schooler, E., and Gray, J., "An Architecture for Multicast Telepresentations", *IEEE Network*, Vol. 14, No. 1, pp. 58-68 (Jan/Feb 2000).

Gemmell, J., Schooler, E., and Kermodé, R., "An Architecture for Multicast Telepresentations", *Journal of Computing and Information Technology*, Vol. 6, No. 3, pp. 255-272 (July 1998).

Chandy, K.M., Rifkin, A., Schooler, E.M., "Using Announce-Listen with Global Events to Develop Distributed Control Systems", *Concurrency: Practice and Experience*, Vol. 10, No. 11-13, pp. 1021-1027 (Sept-Nov 1998); also appeared in *Proceedings of the ACM Workshop on High Performance Java Network Computing*, Palo Alto, CA (Feb 1998).

Schooler, E.M., "Conferencing and Collaborative Computing", *ACM Multimedia Systems Journal*, Vol. 4, No. 5, pp. 210-225 (Oct 1996); also invited white paper, *Proceedings of Dagstuhl International Workshop on Fundamentals and Perspectives on Multimedia Systems*, pp. 175-208, Dagstuhl, Germany (July 1994).

Schooler, E.M., "The Impact of Scaling on a Multimedia Connection Architecture", *ACM Multimedia Systems Journal*, Vol. 1, No. 1, pp.2-9 (1993); Technical Report ISI/RS-93-360, USC/ISI, Marina del Rey, CA (Aug 1993); a shorter version appeared in the *Proceedings of the 3rd International Workshop on Network and Operating System Support for Digital Audio and Video*, San Diego, CA (Nov 1992).

Schooler, E.M., "Case Study: Multimedia Conference Control in a Packet-switched Teleconferencing System", *Journal of Internetworking: Research and Experience*, Vol. 4, No. 2, pp. 99-120 (Jun 1993), superseded by *IEEE/ACM Trans. on Networking*; Technical Report ISI/RS-93-359, USC/ISI, Marina del Rey, CA (Aug 1993).

Schooler, E.M., Casner, S.L., "An Architecture for Multimedia Connection Management", *ACM SIGCOMM Computer Communication Review*, Vol. 22, No. 3 (July 1992); *Proceedings of the 4th IEEE ComSoc International Workshop on Multimedia Communications*, Monterey, CA, (Apr 1992); Technical Report ISI/RS-92-294, USC/ISI, Marina del Rey, CA (Apr 1992).

Felderman, R.E., Schooler, E.M., Kleinrock, L., "The Benevolent Bandit Laboratory: A Testbed for Distributed Algorithms", *IEEE Journal on Selected Areas in Communications*, Vol. 7, No. 2, pp. 303-311 (Feb 1989).

Conferences and Workshops:

Hassnaa Moustafa, Eve M. Schooler, Jessica McCarthy, "rCDN for Fog Computing: The Data Lifecycle of Video in Connected and Autonomous Vehicles", invited paper, *Fog World Congress* (Oct 2017).

Eve M. Schooler, David Zage, Jeff Sedayao, Hassnaa Moustafa, Andrew Brown, Moreno Ambrosin, "An Architectural Vision for a Data-Centric IoT: Rethinking Things, Trust and Clouds", invited paper, *IEEE ICDCS'17* (June 2017).

Hassnaa Moustafa, Eve M. Schooler, Geng Shen, Sanjana Kamath, "Remote Monitoring and Medical Devices Control in eHealth", *12th IEEE International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob'16), Workshop on e-Health Pervasive Wireless Applications and Services (eHPWAS'16)*.

Xinlei Wang, Jianqing Zhang, Eve M. Schooler, Mihaela Ion, "Performance Evaluation of Attribute-based Encryption: Toward Privacy in the IoT", *IEEE International Conference on Communications, ICC'14*, Sydney, Australia (Aug 2014).

Mihaela Ion, Jianqing Zhang, Eve M. Schooler, "Toward Content-Centric Privacy in ICN: Attribute-based Encryption and Routing", *ACM SIGCOMM'13 and SIGCOMM ICN'13 Workshop*, extended abstract, Hong Kong (Aug 2013).

Jianqing Zhang, Qinghua Li, Eve M. Schooler, "iHEMS: An Information-Centric Approach to Secure Home Energy Management", *IEEE 3rd International Conference on Smart Grid Communications, SmartGridComm'12*, Tainan City, Taiwan (Nov 2012).

David Zage, Carl Livadas, Eve Schooler, "A Network-Aware Distributed Membership Protocol for Collaborative Defense", *12th IEEE International Conference on Computational Science and Engineering (CSE'09), Workshop on Leveraging Social Patterns for Security, Privacy and Networks SP4SPNA'09, pp1123-1130 (August 2009)*.

Frederic Giroire, Jaideep Chandrashekar, Nina Taft, Eve M. Schooler, Dina Papagiannaki, "Exploiting Temporal Persistence to Detect Covert Botnet Channels", *Recent Advances in Intrusion Detection, RAID'09*, pp.326-345 (Sept 2009).

F. Giroire, J. Chandrashekar, G. Iannaccone, K. Papagiannaki, E. Schooler and N. Taft, "The Cubicle vs. The Coffee Shop: Behavioral Modes in Enterprise End-Users", *Proceedings Passive and Active Measurement Workshop, PAM'08*, pp.202-211 (April 2008).

Sentil Cheetancheri, John-Mark Agosta, Jaideep Chandrashekar, Denver Dash, Karl Levitt, Jeff Rowe, Eve Schooler, "A Distributed Host-based Worm Detection System", ACM SIGCOMM, *Proceedings Workshop on Large Scale Attack Defense, LSAD'06* (Sept 2006).

Denver Dash, Branislav Kveton, John Mark Agosta, Eve Schooler, Jaideep Chandrashekar, Abraham Bachrach, Alex Newman, "When Gossip is Good: Distributed Probabilistic Inference for Detection of Slow Network Intrusions", *Proceedings Twenty-First National Conference on Artificial Intelligence, AAAI'06*, pp. 1115-1122 (July 2006).

Denver Dash, John Mark Agosta, Jaideep Chandrashekar, Eve Schooler, "Detecting weak network anomalies with Bayesian models", Twenty-Third International Conference on Machine Learning, ICML'06, *Workshop on Machine Learning Algorithms for Surveillance and Event Detection* (June 2006).

J.M. Agosta, A. Bachrach, D. Dash, B. Kveton, A. Newman, E. Schooler, "Distributed Detection and Inference in Enterprise Networks", *Proceedings Intelligence Beyond The Desktop Workshop, NIPS'05* (Dec 2005).

Denver Dash, John Mark Agosta, Abraham Bachrach, Branislav Kveton, Alex Newman, Eve Schooler, "Learning robust generative models for distributed anomaly detection", *Proceedings Intelligence Beyond the Desktop Workshop, NIPS'05* (Dec 2005).

J.M. Agosta, A. Bachrach, D. Dash, B. Kveton, A. Newman, E. Schooler, "Distributed Inference to Detect a Network Attack", *Proceedings 4th Adaptive and Resilient Computing Security Workshop, ARCS'05, Santa Fe, NM* (Nov 2005)

D. Dash, J.M. Agosta, E. Schooler, B. Kveton, "Population-based Modeling for Distributed Detection of Network Anomalies", *Proceedings Intel Research Conference, IRCON'05, Portland, OR* (Aug 2005).

Chesterfield, J., Schooler, E.M., "An Extensible RTCP Control Framework for Large Multimedia Distributions", *Proceedings of the 2nd IEEE International Symposium on Network Computing and Applications, NCA'03, Cambridge, MA* (Apr 2003).

Gemmell, J., Schooler, E., Gray, J., "Fcast Multicast File Distribution: Tune in, Download, and Drop out", *Proceedings of the IASTED International Conference on Internet and Multimedia Systems and Applications, IMSA'99, Nassau, Bahamas*, pp.371-377 (Oct 1999).

Chandy, M., Ginis, R., Schooler, E., "A General Distributed Event Model", *Proceedings of the IEEE Fifth International Conference on High Performance Computing, HiPC'98*, pp.119-123, Madras, India (Dec 1998).

Gemmell, J., Schooler, E., Kermode, R., "A Scalable Multicast Architecture for One-to-Many Telepresentations", *Proceedings of the IEEE International Conference on Multimedia Computing Systems, ICMCS'98, Austin, TX*, pp. 128-139 (Jun 1998).

Chandy, K.M., Schooler, E.M., "Designing Directories in Distributed Systems: A Systematic Framework", *Proceedings of the Workshop on Multimedia and Collaborative Environments, High Performance Distributed Computing Conference, Syracuse, NY*, pp. 318-328 (Aug 1996); also available as technical report CS-TR-96-19, Department of Computer Science, Caltech, Pasadena, CA (Aug 1996).

Shenker, S., Weinrib, A., Schooler, E.M., "Managing Shared Ephemeral State: Policy and Mechanism", *Proceedings International Workshop on Multimedia Transport and Teleservices, COST237, Vienna, Austria* (Nov 1994); republished as *Springer-Verlag Lecture Notes in Computer Science*, Vol. 882, pp. 69-88 (1994); a later version appears as Internet Draft "ietf-mmusic-agree-00.txt", IETF MMusic Working Group.

Schooler, E.M., "Abstractions for Packet Teleconferencing: A Wide-Area Distributed Multimedia Application", panel member, Abstractions for Coordination and Control session, extended abstract in *Proceedings of the Workshop on Programming Abstractions for Distributed Multimedia Applications, ACM Multimedia '93, Anaheim, CA, MM'93* (Aug 1993).

Schooler, E.M., Casner, S.L., Postel, J., "Multimedia Conferencing: Has it come of age?", invited paper, Collaboratory Projects Panel, *Proceedings of the 24th Hawaii International Conference on Systems Sciences*, Vol. 3, pp. 707-716, HICSS'91 (Jan 1991); Technical Report ISI/RS-91-286, USC/ISI, Marina del Rey, CA (Aug 1991).

Schooler, E.M., "Telecollaboration: Conferencing From Afar", panel member, Collaborative Design Session, extended abstract in *Proceedings of the International Conference on Systems, Man and Cybernetics*, Universal City, CA (Nov 1990).

Schooler, E.M., Casner, S.L., "Multimedia Conferencing in the Internet: the Effect of Long Distances on Groupware Design", *Proceedings of the Groupware Technology Workshop*, IFIP Working Group 8.4, Palo Alto, CA (Aug 1989).

Technical Reports and Other Manuscripts:

B. Karlin, E. Schooler, S. Schrecker, L. Wigle, M. Dickman, "Enhancing National Cybersecurity for a Safer World", white paper (Dec 2016); shorter version presented as position statement to the Presidential Commission on Enhancing Cybersecurity, delivered by B. McCarson (Aug 2016).

David E. Cohen, Eve M. Schooler, "Data Inversion and SDN Peering: Harbingers of Edge Cloud Migration", *IEEE ComSoc MMTC E-Letter*, Vol.9, No.6, Special Issue on Big Data in 5G Networks (Nov 2014).

R. Want, E. Schooler, L. Jelinke, J. Jung, D. Dahle, U. Sengupta, "Ensemble Computing: Opportunities and Challenges", *Intel Technology Journal* (Oct 2010).

Jaideep Chandrashekar, Carl Livadas, Steve Orrin, Eve M. Schooler, "The Dark Cloud: Understanding and Defending against Botnets and Stealthy Malware", *Intel Technology Journal*, Vol.13, No.2 (2009). *Excerpt appeared on Harvard Business Review web site* (June 2009).

"On Multi-core Systems for Networking and Vice Versa", Michael Kounavis, Nina Taft, Annie Foong, Jingwen Jin, Eve Schooler, John Vicente, Jesse Walker, Intel Research TR.

F. Giroire, J. Chandrashekar, N. Taft, G. Iannaccone, T. Karagiannis, K. Papagiannaki, E. Schooler, "The Case For Personalizing End-Host Detectors", Intel Research TR.

F. Giroire, J. Chandrashekar, G. Iannaccone, T. Karagiannis, K. Papagiannaki, E. Schooler, N. Taft, "Inside the Forbidden City: A look at End-Host Traffic inside a Modern Enterprise", Intel Research TR.

Chesterfield, J., Schooler, E.M., "An Extensible RTCP Control Framework for Large Multimedia Distributions", Technical Report, AT&T Labs-Research, Menlo Park, CA (Jan 2003); a shorter version appeared in *Proceedings of the 2nd International Symposium on Network Computing and Applications*, NCA'03, Cambridge, MA (Apr 2003).

Schooler, E.M., Manohar, R., Chandy, K.M., "An Analysis of Leader Election for Multicast Groups", Technical Report, AT&T Labs-Research, Menlo Park, CA (Feb 2002).

Schooler, E.M., Manohar, R., Chandy, K.M., "An Analysis of Suppression for Group Communication in Lossy Networks", Technical Report, AT&T Labs-Research, Menlo Park, CA (Nov 2001).

Schooler, E.M., "Why Multicast Protocols (Don't) Scale: An Analysis of Multipoint Algorithms for Scalable Group Communication", *PhD Dissertation* (Defended Sept 2000), Technical Report CS-TR-01-03, Department of Computer Science, Caltech, Pasadena, CA (2001).

Gemmell, J., Schooler, E., Gray, J., "Fcast Scalable Multicast File Distribution: Caching and Parameter Optimizations", Technical Report MSR-TR-99-14, Bay Area Research Center, Microsoft Research, San Francisco, CA (Jun 1999).

Schooler, E., Gemmell, J., "Using Multicast FEC to Solve the Midnight Madness Problem", Technical Report MSR-TR-97-25, Bay Area Research Center, Microsoft Research, San Francisco, CA (Sept 1997).

Schooler, E.M., "QoS in the Internet: An Overview", White Paper, Broadband Information Systems Lab, Hewlett-Packard Laboratories, Palo Alto, CA (Aug 1996).

Schooler, E.M., "A Multicast-based User Directory Service for Synchronous Rendezvous", *Master's Thesis*, Technical Report CS-TR-96-18, Department of Computer Science, Caltech, Pasadena, CA (Aug 1996).

Mates, N., Nystrom, M., Schooler, E., "The Web meets MOOs, IRC and the Mbone", CS138 Final Report, "<http://www.cs.caltech.edu/~schooler/overview.html>", Department of Computer Science, Caltech, Pasadena, CA (Jun 1995).

Schooler, E.M., "Connection Control Protocol (CCP): Architecture", USC/ISI, Marina del Rey, CA (Jan 1992); and companion document, "Connection Control Protocol (CCP): Specification", USC/ISI, Marina del Rey, CA (Dec 1991).

Schooler, E.M., "A Distributed Architecture for Multimedia Conference Control", Technical Report ISI/RR-91-289, USC/ISI, Marina del Rey, CA (Nov 1991).

Schooler, E.M., Casner, S.L., "A Packet-switched Multimedia Conferencing System", *ACM SIGOIS Bulletin*, Vol. 10, No. 1, pp. 12-22 (Jan 1989).

Schooler, E.M., Felderman, R.E., Kleinrock L., "The Benevolent Bandit Laboratory: A Testbed for Distributed Algorithms Using PCs on an Ethernet", Technical Report 880016, Computer Science Department, UCLA (Mar 1988).

Schooler, E.M., "Distributed Debugging in a Loosely-Coupled Processing System", *Master's Thesis*, Department of Computer Science, University of California, Los Angeles (Feb 1988).

Schooler, E.M., Gray, T., "Case Study: Performance of an Aegis-Unix Remote File System Bridge", Technical Report 870063, Computer Science Department, University of California, Los Angeles (Jun 1987).

Standards Documents:

"NIST Framework for Cyber-Physical Systems (CPS)", Release 1.0, Public CPS Working Group, contributions to Data Interoperability and Cybersecurity chapters (May 2016).

Ott, J., Chesterfield, J., Schooler, E., "RTCP Extensions for Single-Source Multicast Sessions with Unicast Feedback", **RFC 5760**, Proposed Standard, IETF Audio Video Transport (AVT) Working Group (Feb 2010).

Rosenberg, J., Schulzrinne, H., Camarillo, G., Johnston, A., Peterson, J., Sparks, R., Handley, M., Schooler, E., "SIP: Session Initiation Protocol (SIP)", **RFC 3261**, Proposed Standard, IETF SIP Working Group (Jun 2002).

Handley, M., Schulzrinne, H., Schooler, E., Rosenberg, J., "Session Initiation Protocol (SIP)", **RFC 2543**, Proposed Standard, IETF Multiparty Multimedia Session Control (MMusic) Working Group (Mar 1999).

Under Submission:

Mostafa Mirshekari, Eve M. Schooler, Pei Zhang, Hae Young Noh, "Occupant Localization Using Footstep-induced Structural Vibration", under submission (Oct 2017).

Eve M. Schooler, Milan Milenkovic, Brian McCaron, "Rational Interoperability for IoT: On Pragmatic Device, Data and Meta-Data Interactions", Invited vision paper, IEEE ICDCS'18, under submission (Feb 2018).

Eve M. Schooler et al, Invited vision paper, Proceedings IEEE, special issue on Information Centric Networking.

Patents:

W. Wong, E.M. Schooler, S. Sud, "Stochastic Method of Power Consumption by Computer Systems", US Patent #8145929 (Mar 2012).

J. Chandrashekar, E.M. Schooler, N. Taft, F. Giroire, "Method and System for Detecting and Reducing Botnet Activity", US Patent #20110202997 A1 (May 2011).

>20 additional patent applications filed, but pending.

Book Chapters:

"Conferencing and Collaborative Computing", Handbook of Internet and Multimedia: Systems and Applications, Ed. Borko Furht, CRC Press (Dec 1998).

Selected Presentations:

"Information-Centric Networking in Wireless Edge Networks (ICN-WEN) and Beyond", invited keynote, Information-Centric Fog Computing workshop, IFIP Networking 2017 (June 2017).

"An Architectural Vision for Data-Centric IoT: Rethinking Things, Trust and Clouds", invited paper and panelist, Vision Track, IEEE ICDCS'17 (June 2017)

"Data-centric Networking for a Data-centric IoT: A User's Perspective", invited keynote, NIST Workshop on Named Data Networking, invited speaker, Gaithersburg, MD (June 2016).

"Why Those in the Arts can be Great Role Models for Those in STEM: How a Computer Scientist Found Inspiration from Her Opera Singer Mother", invited keynote, M-BEST program for Girls in STEM, Menlo School, Menlo Park, CA (March 2014).

"Content-Centric Privacy in ICN", CCNx Community Workshop, Xerox PARC, Palo Alto, CA (September 2013); extended version presented to the Network Seminar (CE 280N), Engineering Department, UC Santa Cruz (October 2013).

"An Attribute-based Trust Framework for the Internet of Things: Perspectives from the Smart Grid edge", Security Seminar, Computer Science Department, University Trento, Trento, Italy (Apr 2013).

"Empowering CSE-driven Sustainability", Industry panel, NSF Role of Information Sciences and Engineering in Sustainability (RISES) workshop, Washington, DC (Feb 2011).

"Collaborative Defense as a Pervasive Service: Architectural Insights and Validation Methodologies of a Trial Deployment", PCSI'09/TridentCom'09, Washington, DC (Apr 2009).

"Inside the Forbidden City: A look at end-host traffic inside a modern enterprise", MIT Communications Futures Program, Cisco, San Jose, CA (Jan 2008).

"Collaborative Measurement and Inferencing Infrastructure for the Green House", Digital Home Group, Intel Corporation, Hillsboro, OR (Sept 2007).

"When Gossip is Good: Distributed Inference for Network Intrusion Detection", ICOMM (Apr 2007).

"An RTCP Control Framework for Large Multimedia Sessions", AT&T Labs-Research, Florham Park, NJ (Apr 2002).

"Why Multicast Protocols (Don't) Scale", Bell Labs, Holmdel, NJ (Dec 2000).

"A Scalable Multicast Architecture for One-to-many Telepresentations", IEEE International Conference on Multimedia Computing and Systems, Austin, TX (Jun 1998).

"Using Multicast FEC to Solve the Midnight Madness Problem", Computer Science Department, Caltech (Dec 1997).

"A Multicast User Directory for Synchronous Rendezvous", Berkeley Multimedia & Graphics Seminar (Oct 1997).

"A Session Invitation Protocol (SIP)", IETF, MMusic Working Group, Los Angeles, CA (March 1996).

"Middleware for Remote Collaboration", panel member, ACM SIGCOMM, Middleware Workshop, Cambridge, MA (Aug 1995).

"Distributed Music: A Foray into Networked Performance", International Network Music Festival, Santa Monica, CA (Sept 1993).

Software:

Schooler, E.M., Touch, J., "mmcc", Public release of an early X-based **m**ultimedia **c**onferencing **c**ontrol application that provided skype-like VoIP functionality (for the multicast-capable portion of the Internet known as the MBone). Release documentation, source code and Unix manual page available upon request (Oct 1993).

Last updated: 2018-03-01