

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"

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:

- 6/18- **Principal Engineer and Director, Emerging IoT Networks, Intel Next Generation & Standards**
Santa Clara, CA. Developing architectural building blocks to evolve the Internet toward a Data-centric Edge-to-Cloud continuum and Sustainable infrastructure. Responsible for setting technical and strategic direction for IoT standards, bridging upper layer IoT and lower layer networking. Focused on data stewardship, dynamic IoT Edge architecture, holistic QoS, and the automation of energy & sustainability reporting. Grounding in Industrial IoT and Video analytics use cases. Co-chairing the IETF Reliable & Available Wireless (RAW) working group to support L3 time sensitive networks and the Computing-in-the-Network (COIN) research group to examine the convergence of networking-compute-storage. Co-recipient of the 2020 IEEE Internet Award.
- 1/15-6/18 **Principal Engineer and Director of Research in Emerging Architectures, Intel Internet of Things Group**, Santa Clara, CA. Led pathfinding focused on the network, storage and data architecture required to evolve the Cloud toward Edge and Fog Computing, while supporting trusted analytics. Managed a technical team that worked on Real-time Visual Fog support for interactive and remote control of devices and data. Drove R&D on Reverse Content Distribution Networks (rCDNs) for aggregation of upstream IoT data flows, Smart Objects for semantic interoperability, Data life cycle management including privacy preservation, and Bootstrapping IoT trustworthiness in intermittently disconnected (mobile) contexts. Drove multi-year pathfinding that led to investment and launch of \$6.5M joint Intel-NSF ICN-WEN program (information-centric networking in wireless edge networks), serving on BoA.
- 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 an information-centric networking (ICN) 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. Targeted deployment pilot for 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 Inc.**, Menlo Park, CA. Performed 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 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 to solve the "Midnight Madness" problem (e.g., a million synchronous requests for the latest software release of the OS, browser, or other popular web-based content) and to support large-scale 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 (earliest known) 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

IEEE Internet Award, Co-recipient (2020)
 Intel "High-5 Award", Intel Patent Group, for 5 or more accepted patents / year (2018, 2019)
 Intel Division Recognition Award, Tech Symposium Chair, Womens PE & Fellows Forum (2018)
 Intel "Top 3 Inventor" Recognition, Internet of Things Group (IoT), 16 patents filed (2016)
 Intel Division Collaboration Award, IoT Group (2016)
 Intel Division Recognition Award, IoT Group, NIST Cyber-Physical Systems Architecture Framework (2016)
 Intel Achievement Award, ROAR program coach to retain senior technical women (2015)
 Intel Division Recognition Award, Intel Labs, Forbidden City Dataset (2007)
 Microsoft Graduate Fellowship (1997-1999)
 Caltech Earl C. Anthony Scholarship (1994-1995)
 American Association of University Women (AAUW), Educational Foundation Fellowship (1994-1995)
 George Tasic Science Scholarship (1979-1981)

RELATED ACCOMPLISHMENTS:

Intel: Patent Review Committees, Edge Networking & Applications (2018-), Automotive, Drones, & Robotics (2017-2018); Corporate Research Council (CRC), Emerging Ingredients Committee (2016-), grant sponsorship for research at Stanford, Northeastern, ACM ICN (2018-2020), ACM/IEEE SEC (2020), jointly with Next Generation and Standards BU; CRC Software and Systems, Center review committee (2017); IoT Group grant sponsorship of research at CMU, NDN Consortium, ACM ICN (2014-2017); Intel Environmental Excellent Awards Committee (2011, 2012); University Research Office grant sponsorship for research at MIT, CMU, UCB LoCal (2010-2013). Intel Research Council, Communications Committee, grant sponsorship for external research at MIT, Dartmouth, UC Davis, CAIDA/UCSD membership (2005-2009).

IETF/IRTF (Internet Engineering Task Force/Internet Research Task Force): Co-chair, Reliable & Available Wireless (RAW) working group (2/20-); Co-chair, Compute in the Network (COIN) research group (2/19-); Member, Internet of Things (IoT) Directorate (2017-); Co-founder and Co-chair, Multiparty, Multimedia Session Control (MMusic) working group (3/93-10/99); Co-founder and Co-chair, Conference Control (ConfCtrl) research group (1992); Member, Transport Area Directorate (1994-1997).

NSF (National Science Foundation): Board of Advisors, Intel-NSF 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).

Editorial Boards: Associate Editor, ACM Transactions on Internet Technology (ToIT) (2017-); Guest Editor, IEEE Network Magazine, Special issue on Computing in the Network (COIN) (to appear 2021), Guest Editor, ACM ToIT, Special issue on Evolution of IoT Networking, Vol.20, No.3 (Oct 2020); Reviewers Board, IEEE Network Magazine (2016); Guest Editor, IEEE Pervasive Computing, Special issue on Smart Energy Systems, Vol.10, No.1 (2011).

Technical Program Committees (TPCs) and other Leadership Positions: IEEE/ACM Symposium on Edge Computing (SEC'21, **Industry panel chair '20**); Dagstuhl Seminar on Compute-First Networking (**Co-organizer, 3/20**); IEEE Global Communications Conference (Globecom) Workshop on Information-Centric Edge Computing (ICEC **Steering committee '19**); IEEE International Conference on Fog & Mobile Emerging Networks (FMEC'18,'19); IEEE International Symposium on Local & Metropolitan Area Networks (LANMAN'18,'19,'20); ACM CoNext Workshop on Emerging in-Network Computing Paradigms (CoNext ENCP'19); ACM BuildSys'19, Workshop on Device-Free Human Sensing (BuildSys DFHS'19,'20); IEEE International Conference on Communications (ICC'18) Workshop on ICN Solutions for Real-world Applications (ICC ICN-SRA'18); Network and Distributed System Security Symposium (NDSS) Workshop on Decentralized IoT Security and Standards (NDSS DISS'17, '18); ACM International Conference on Information Centric Networking (ACM ICN'14,'16,'17,'18,'20, **Demo & Posters co-chair '15, Industry panel co-chair '19**); IEEE International Conference on Distributed Computing Systems (ICDCS'17,'18), Edge and Fog Computing track; IFIP Networking'17, Workshop on Information-Centric Fog Computing (Networking ICFC'17); EAI International Conference on Mobile Computing, Applications and Services (Mobicase'16,'18); Annual Mediterranean Ad Hoc Networking Workshop (MedHocNet, **Workshop co-chair '14**); IEEE Infocom Workshop on Name-Oriented Mobility: Architectures, Algorithms and Applications (Infocom NOM'14,'16,'17); NDN Community meeting (NDNComm'15,'17, **Industry panel chair '17**); ACM Workshop on Cyber-Physical System Security and Privacy (CPS-SPC'15); IEEE International Conference on Smart Grid Communication (SmartGridCom, **TPC co-chair '13**); ACM International Conference on Future Energy Systems (e-Energy'10 & '11, **Industry liaison '12**); IEEE International Symposium on a World of Wireless Mobile and Multimedia Networks (WoWMoM'09); IEEE Globecom (GCC'17) workshop on Named Data Networks for Challenged Communication Environments (NDN-CCE'17); IEEE Infocom Global Internet Symposium (GI'01); IEEE International Conference on Multimedia Computing Systems (ICMCS'99); ACM International Conference on Multimedia (MM'95); ACM 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 ICC ICN-SRA, IEEE Globecom, IEEE Globecom NDN-CCE, IEEE Global Internet Symposium, IEEE FMEC, ACM CoNext ENCP, ACM ICN, ACM Multimedia, ACM Mobisys (Demos), ACM BuildSys DFHS, IEEE ICMCS, IEEE ICDCS, IEEE LANMAN, ACM NOSSDAV, IEEE ComSoc Multimedia Workshop, ACM e-Energy, IEEE SmartGridComm, EAI MobiCase, IEEE Communication Magazine, Elsevier Computers & Security Journal, Elsevier Computer Networks Journal, NSF grant proposals and CAREER grants, SRC (Semiconductor Research Center) I3T (Innovation and Intelligent IoT) 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).

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

Volunteer: Anita Borg Institute, BRAID liaison (2020); Mentor, UPWARD U.N.I.T.E.S., Intel-University Santa Clara partnership; Grace Hopper Conference <<http://www.gracehopper.org>>: Career Panel, Girl-serving Organizations (GHC'20); Technical Panels, Partner Collaboration Forum (GHC'16, GHC'17, GHC'19); 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 Instructor, "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 (2014-2018); Instrumentalist, Internet distributed music performance, ACM MM '94 (10/94), DARTnet demo (12/92). 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 Carilloners. Member, Yale Glee Club ('80). Graduate, Manhattan School of Music, Preparatory Division, New York, NY, student in piano, music composition and music theory ('75-'79).

PUBLICATIONS:

Journals and Other Refereed Publications:

Rute C. Sofia, Eve M. Schooler, Dirk Kutscher, Chris Winkler, "Introduction to the Special Issue on Evolution of IoT Networking", *Transactions on Internet Technology (ToIT)*, Vol. 20, No.3 (Oct 2020).

M. Mirshekari, S. Pan, J. Pagert, E.M. Schooler, P. Zhang, H.Y. Noh, "Occupant Localization Using Footstep-Induced Structural Vibration", *Mechanical Systems and Signal Processing*, Vol.112, pp.77-97 (2018).

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).

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).

Eve M. Schooler, C. 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 *Proceedings IEEE 5th International Conference on Testbeds and Research Infrastructures for the Development of Networks and Communities* (TridentCom'09), *Proceedings 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., "Fcast Multicast File Distribution", *IEEE Network*, Vol.14, No.1, pp.58-68 (Jan/Feb 2000).

Gemmell, J., Schooler, E., and Kermod, 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", *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", *Multimedia Systems Journal*, **invited paper**, Vol.1, No.1, pp.2-9 (Jan 1993); Technical Report ISI/RS-93-360, USC/ISI, Marina del Rey, CA (Aug 1993); a shorter version appeared in the *Proceedings of the ACM 3rd International Workshop on Network and Operating System Support for Digital Audio and Video*, NOSSDAV'12, 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:

Eve M. Schooler, Dave Zage, Hassnaa Moustafa, Jeff Sedayao, "A Marauders Map for the IoT Edge", **invited paper**, *IEEE International Conference on Collaboration and Internet Computing*, CIC'19, Los Angeles, CA (Dec 2019).

Eve M. Schooler, Milan Milenkovic, Keith A. Ellis, Jessica McCarthy, Jeff Sedayo, Brian McCarson, "Rational Interoperability: A Pragmatic Path Toward a Data-Centric IoT", **invited paper**, *IEEE International Conference on Distributed Computing Systems*, ICDCS'18, pp.1139-1149 (Oct 2018).

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*, FWC'17 (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 International Conference on Distributed Computing Systems*, ICDCS'17, pp.1717-1728 (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 (2016).

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, pp. 725-730, 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, pp.217-222, 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, pp.1123-1130 (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 the 2nd IEEE International Symposium on Network Computing and Applications*, NCA'03, Cambridge, MA (Apr 2003); a longer version appeared as Technical Report, AT&T Labs-Research, Menlo Park, CA (Jan 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); a 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 MMTTC E-Letter, Vol.9, No.6, Special Issue on Big Data in 5G Networks (Nov 2014).

"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 Technical Report.

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

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 Technical Report.

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).

Schooler, E.M., "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).

In Preparation:

“Reliable and Available Wireless”, IEEE Communications Standards Magazine (to appear Dec 2020).

“Problem Statement of IoT integrated with Edge Computing”, Internet-draft, IETF Thing-to-Thing RG.

“Edge Data Discovery for COIN”, Internet-draft, IETF Computing-in-the-Network (COIN) RG.

Selected Patents:

“System to monitor and control sensor devices”, H. Moustafa, E.M. Schooler, G. Shen, T. Li, US Patent 10,791,177 (Sept 2020).

“Processing and caching in an information-centric network”, S. Schoenberg, A.S. Brown, S. Srikanteswara, J.C. McCarthy, E.M. Schooler, C. Maciocco, et al, US Patent 10,785,341 (Sept 2020).

“Configurable context aware sensors in IoT smart spaces”, H. Moustafa, S.K. Kamath, E.M. Schooler, US Patent 10,721,307 (July 2020).

“Automated semantic inference of visual features and scenes”, N.M. Smith, K.K. Bartfai-Walcott, E.M. Schooler, S.W. Yang, US Patent 10,719,744 (July 2020).

“Distributed computing resources in an information centric network”, S. Srikanteswara, H. Moustafa, J.C. McCarthy, J.C. Sedayao, E.M. Schooler, US Patent 10,681,167 (June 2020).

“Network coding in an information centric network”, J.R. Foerster, S. Srikanteswara, H. Moustafa, VS Somayazulu, N. Himayat, et al, US Patent 10,681,166 (June 2020).

“Ubiquitous visual computing witness”, S.W. Yang, E.M. Schooler, M.G. Hyde, H. Moustafa, K.K. Bartfal-Walcott, et al, US Patent 10,559,202 (Feb 2020).

“Data management in an information-centric network”, V.S. Somayazulu, E.M. Schooler, H. Moustafa, A.S. Brown, R. Vannithamby, S. Srikanteswara, et al, US Patent 10,356,197 (July 2019).

“Data management in an edge network”, H. Moustafa, E.M. Schooler, D.J. Zage, J.C. Sedayao, D.E. Cohen, S. Lee, US Patent, 10,244,071 (Mar 2019).

“Radio spectrum sharing”, S. Srikanteswara, D.E. Ott, E.M. Schooler, US Patent 10,225,743 (Mar 2019).

“Stochastic Method of Power Consumption by Computer Systems”, W.C. Wong, E.M. Schooler, S. Sud, US Patent 8,145,929 (Mar 2012).

“Method and System for Detecting and Reducing Botnet Activity”, J. Chandrashekar, E.M. Schooler, N. Taft, F. Giroire, US Patent 7,953,852 (May 2011).

Selected Patent Applications:

“Information centric network high definition map distribution”, H. Moustafa, E.M. Schooler, M.G. Hyde, J.C. Sedayao, N.M. Smith, S.M.I. Alam, et al, US Patent App 16/456,716 (Oct 2019).

“Information centric network interworking techniques”, S.M.I. Alam, S.C. Jha, K.C. Chen, Y. Zhang, V.N. Ekambaram, N.M. Smith, et al, US Patent App 16/456,687 (Oct 2019).

“Mission critical push notification in high-reliability information centric network”, S.C. Jha, S.M.I. Alam, Y. Zhang, E.M. Schooler, N.M. Smith, K. Sivanesean, et al, US Patent App 16/456,443 (Oct 2019).

“Data offload and time synchronization for ubiquitous visual computing witness”, E.M. Schooler, H. Moustafa, M.G. Hyde, N.M. Smith, US Patent App 16/456,410 (June 2019).

“Information-centric network data cache management”, N.M. Smith, S. Srikanteswara, K. Sivanesan, E.M. Schooler, S.C. Jha, et al, US Patent App 16/455,442 (June 2019).

“Converged Routing for Distributed Computing Systems”, E.M. Schooler, M.G. Hyde, H. Moustafa, US Patent App 16/236,474 (May 2019).

“Hybrid information-centric and host-oriented networks”, N. Himayat, S. Srikanteswara, C. Maciocco, H. Moustafa, E.M. Schooler, et al, US Patent App 15/638,092 (May 2018).

“Publisher control in an information centric network”, R. Balakrishnan, V.N. Ekambaram, S. Srikanteswara, J.C. McCarthy, et al, US Patent App 16/236,037 (May 2019).

M. Gupta Hyde, E.M. Schooler, S. Srikanteswara, H. Moustafa, J.C. Sedayao, “Information Centric Network Island Bridging”, US Patent App 15/487,808 (May 2018).

“Routing in an information-centric network”, R. Vannithamby, R. Wang, N. Himayat, E.M. Schooler, V.S. Somayazulu, et al, US Patent App 15/414,459 (2018).

“Trust-enhanced attribute-based encryption”, D.J. Zage, E.M. Schooler, M. Ambrosin, US Patent App 15/290,655 (2018).

Additional patent applications filed but pending. For the latest status updates, see Justia for further details: <http://patents.justia.com/inventor/eve-m-schooler>.

Book Chapters:

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

Selected Presentations:

“The Edge-ification of the Internet: Implications for the Wireless Edge”, *invited keynote*, ACM Hot Mobile Workshop, Austin, TX (Mar 2020).

“A Marauders Map for the IoT Edge”, *invited paper and panelist*, *IEEE International Conference on Collaboration and Internet Computing*, CIC'19, Los Angeles, CA (Dec 2019).

“Ubiquitous Witness & Reverse CDN”, IETF COINRG (Nov 2018).

“Ubiquitous Witness in the Visual Fog (aka Multi-dimensional Anomaly Reconstruction or 360-degree Blackbox)”, IETF ICNRC (July 2018).

“Networking for the Intelligent Edge: from a Data-Centric IoT to Ambient Intelligence”, *invited keynote*, IEEE LANMAN'18 (June 2018).

“When Everything is a Camera: Distributed Data Stewardship in the Internet of Things”, *invited talk and panelist*, Open IoT Day, ACM Mobisys'18 (June 2018).

“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, 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); a later version was presented to the Menlo-Atherton High School Women in Business and Technology (WOMBAT) club (Nov 2017).

"Content-Centric Privacy in ICN", CCNx Community Workshop, Xerox PARC, Palo Alto, CA (Sept 2013); extended version presented to the Network Seminar (CE 280N), Engineering Department, UCSC (Oct 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 MM & Graphics Seminar (Oct 1997).

"A Session Invitation Protocol (SIP)", IETF, MMUSIC Working Group, Los Angeles, CA (Mar 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 multimedia conferencing control application that provided skype-like VoIP functionality (for the multicast-capable portion of the Internet known as the Mbone). Release documentation, source code, Unix manual page available upon request (Oct 1993).

PhD Committees:

Mostafa Mirshekari, "Occupant Monitoring using Footstep-Induced Floor Vibrations", CMU (2019).

Roberto Morabito, "Lightweight Virtualization in Edge Computing for Internet of Things", Aalto University, Sweden (2018).

Xuan Zeng, "Towards Seamless Mobility in ICN: Connectivity, Security, and Reliability", Sorbonne, France (2018).

Mihaela Ion, "Security of Publish/Subscribe Systems", University Trento, Italy (2013).