

Dorothy E. Denning VITA

I. BIOGRAPHICAL INFORMATION

1. Demographic Information

Dorothy E. Denning
Emeritus Distinguished Professor
Department of Defense Analysis
Naval Postgraduate School
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2. Education

Purdue University, PhD in Computer Science, 1972-1975
Thesis: Secure Information Flow in Computer Systems, supervised by Herbert Schwetman
IBM Fellowship

University of Michigan, MA in Mathematics, 1967-1969

University of Michigan, BA in Mathematics, 1963-1969
Regents Alumni Scholarship; Zeta Tau Alpha Scholarship

3. Professional History

Naval Postgraduate School, Department of Defense Analysis, Monterey CA, 2002-

Emeritus Distinguished Professor, 2017-; Distinguished Professor, 2009-16; Professor, 2002-09.

Developed courses in conflict and cyberspace; computer network attacks and defense; trust, influence, and networks; and terrorist financing, primarily for students in special operations and information operations. Conducted research and published papers relating to cyber conflict and cyber security. Received funding from the Department of Defense. Advised masters students on theses.

Chair, DA Department Evaluation Committee (DEC), 2003-

Chaired ten departmental promotions and tenure evaluation committees.

Associate Chair, Cyber Academic Group, 2011-2015.

Assisted with creation and management of new cyber curriculum at NPS.

NPS committee memberships

Faculty Council (DA Rep), 2014-
GSOIS Dean Reappointment Committee, 2008
Faculty Recruitment and Retention, 2007
Sustaining Faculty Excellence, 2006

Georgetown University, Computer Science Department, Washington DC, 1991-2002

Patricia and Patrick Callahan Family Professor of Computer Science, 2001-2002; Professor of Computer Science, 1991-2002.

Developed courses in information warfare, codes and ciphers, networks and society, data communications, and introduction to computers and networks for a broad spectrum of graduate and undergraduate students in the university. Taught existing courses in introductory computer science. Conducted research and published papers in the areas of cyber crime and information warfare; activism, hacktivism, and cyber terrorism on the Internet; location-based encryption and authentication; the impact of encryption and other concealment technologies on crime and law enforcement; encryption policy; key recovery systems; and wiretapping.

Director, Georgetown Institute for Information Assurance, 2000-2002.

Formed a new interdisciplinary institute for information assurance involving the main campus, law center, and medical center.

Co-Chair, Technology Oversight Committee, 1999-2000.

Reviewed technology issues on campus and made recommendations for change.

Member, Faculty Advisory Board for Communication, Culture, and Technology, 1996-.

Helped create CCT program, served on advisory board for CCT, supervised CCT masters theses, advised students, and taught CS courses jointly listed with CCT.

Member, Field Committee for Science and Technology in International Affairs, 1997-.

Served on faculty committee for STIA program, mentored STIA students, supervised senior theses, and taught CS courses jointly listed with STIA.

Member, Information Security Policy committee, 1999.

Helped write an information security policy for the university.

Chair, Computer Science Department, 1991-1994.

Managed a department of five full-time faculty, two adjunct faculty, and about twenty undergraduate majors.

Chair, Computing and Networking Task Force, 1991-92.

Led university-wide effort to develop a strategic plan for academic use of information technology.

Digital Equipment Corporation, Systems Research Center, Palo Alto, CA, 1987-91

Principal Software Engineer, 1987-91.

Managed an international, collaborative research program that involved making SRC's computing environment available to colleagues at eight universities, four of which were outside the United States. Handled budgets, proposals, licenses, and an annual conference. Conducted a research study on young computer hackers who break into computer systems.

SRI International, Computer Science Lab, Menlo Park, CA, 1983-1987

Senior Staff Scientist, 1987; Senior Computer Scientist, 1984-87; Computer Scientist, 1983-84.

Principle developer of SRI model of a real-time intrusion-detection expert system (IDES) aimed at detecting break-ins and other forms of computer misuse. Led effort to build prototype. Principle investigator and project leader of SeaView project, a joint effort by SRI and Gemini Computers to model and design a multilevel-secure database system at class A1. Developed techniques for handling inference problems in multilevel databases. Led SRI project to assess the vulnerabilities in a major computer system and recommend a security plan. Participated in other security evaluations. Developed a prototype user interface on an IBM PC for SRI's verification system. Received funding from the U.S. Air Force, the U.S. Navy, the U.S. Army, NSF, NASA, and the private sector.

Purdue University, Computer Science Department, W. Lafayette, IN, 1972-1983

Associate Professor, 1981-83; Assistant Professor, 1975-81; Ph.D. Fellowship: 1974-75; Instructor, 1972-74.

Developed and taught a course in cryptography and data security. Taught existing courses in database systems, data structures, programming languages, and introductory programming. Conducted research and published papers in the area of information security. Developed the lattice model of secure information flow, techniques for protecting sensitive data released as summary statistics, and cryptographic protocols and techniques for networks and databases. Developed a prototype tool that displays graphically the data structures of a program as they evolve during program execution. Received funding from NSF. Supervised the Ph.D. studies of Matt Bishop and served on several other Ph.D. committees.

University of Rochester, Rochester, NY, 1969-72

Systems Programmer, Computing Center, 1969-72.

Performed systems programming tasks on an IBM System 360. Designed and implemented an interpreter for the Easy Control Language (ECL), which translated ECL

into the Job Control Language (JCL) of the System 360. The interpreter was installed and used at Rochester and the Stanford Linear Accelerator Center.

Instructor, Electrical Engineering, 1971-72; School of Business, 1971.

Developed and taught courses in data structures, programming languages, and compiler design.

University of Michigan, Ann Arbor, MI, 1967-72

Teaching and Research Assistant, Computing Center, 1969

Taught a lab section of the introductory course in computer science under Bernard Galler, assisted users in the computing center, and evaluated software for the computing center.

Assistant Research Mathematician, Radio Astronomy, 1967-69.

Developed a program that simulates the path of a satellite, using ray tracing techniques to plot when the satellite could receive signals from various sources. Wrote three reports.

4. Academic concentrations and research interests

Cyber security

Cyber crime and cyber conflict

Terrorism and cyberspace

Information operations

Trust, influence, and networks

II. PUBLICATIONS

(i) Books

1. Denning, D. E., *Information Warfare and Security*, Addison-Wesley, December 1998. (Chapter 1, "Gulf War – Infowar," reprinted as Chapter 7 in *Perceptions Are Reality: Historical Case Studies of Information Operations in Large-Scale Combat Operations*, (Col. M. D. Vertuli and Lt. Col. B. S. Loudon eds.), with Introduction and Notes by R. M. Hill, Army University Press, 2018.)
2. Denning, D. E. and Denning, P. J., eds., *Internet Besieged: Countering Cyberspace Scofflaws*, ACM Press, Addison-Wesley, 1997.
3. Denning, D. E. and Lin, H., eds., *Rights and Responsibilities of Participants in Networked Communities*, Computer Science and Telecommunications Board, National Research Council, National Academy Press, 1994.
4. Denning, D. E., *Cryptography and Data Security*, Addison-Wesley, May 1982. (This book, now out of print, was selected by ACM for distribution on ACM's website.)

(ii) Chapters in books

5. Denning, D. E., "Assessing Cyber War," in *Assessing War* (L. J. Blanken, H. Rothstein, and J. J. Lepore eds.), Georgetown University Press, 2015, pp. 266-284.

6. Denning, D. E. and Strawser, B. J., "Active Cyber Defense: Applying Air Defense to the Cyber Domain," in *Cyber Analogies* (E. O. Goldman and J. Arquilla, eds.), Technical Report NPS-DA-14-001, 2014. Revised version in *Understanding Cyber Conflict: Fourteen Analogies* (G. Perkovich and A.E. Levite, eds.), Georgetown University Press, 2017, Chapter 12.
7. Denning, D. E. and Strawser, B. J., "Moral Cyber Weapons," in *The Ethics of Information Warfare* (M. Taddeo and L. Floridi, eds.), Springer, 2014, pp. 85-103.
8. Denning, D. E., "Power Over Information Flow," *The Global Flow of Information: Legal, Social and Cultural Perspectives* (Ramesh Subramanian and Eddan Katz, eds.), New York University Press, 2011, pp. 217-231.
9. Denning, D. E., "Cyber Conflict as an Emergent Social Phenomenon," *Corporate Hacking and Technology-Driven Crime: Social Dynamics and Implications* (T. Hold and B. Schell eds.), IGI Global, 2011, pp. 170-186.
10. Denning, D. E., "Terror's Web: How the Internet is Transforming Terrorism," *Handbook on Internet Crime* (Y. Jewkes and M. Yar, eds.), Willan Publishing, 2010.
11. Denning, D. E., "The Internet and the Iraq Conflict," in *The Three Circles of War: Understanding the Dynamics of Conflict in Iraq*, edited by Heather S. Gregg, Hy S. Rothstein, and John Arquilla, Washington DC: Potomac, 2010.
12. Denning, D. E., "Terror's Web: How the Internet is Transforming Terrorism," to appear in *Handbook on Internet Crime* (Y. Jewkes and M. Yar, eds.), Willan Publishing, 2009.
13. Denning, D. E., "The Ethics of Cyber Conflict," Chapter 17 in *The Handbook of Information and Computer Ethics* (K. E. Himma and H. T. Tavani eds.), Wiley, 2008, pp. 407-428.
14. Denning, D. E., "Assessing the CNO Threat of Foreign Countries," in *Information Strategy and Warfare* (J. Arquilla and D. Borer eds.), Routledge, 2007, pp. 187-210.
15. Kinniburgh, J. and Denning, D. E., "Blogs and Military Information Strategy," in *Information Strategy and Warfare* (J. Arquilla and D. Borer eds.), Routledge, 2007, pp. 211-232.
16. Denning, D. E., "A View of Cyberterrorism Five Years Later," Chapter 7 in *Readings in Internet Security: Hacking, Counterhacking, and Society* (K. Himma ed.), Jones and Bartlett Publishers, Boston, 2006, pp. 123-139.
17. Denning, D. E., "Cyber Security as an Emergent Infrastructure," in *Bombs and Bandwidth: The Emerging Relationship between IT and Security* (Robert Latham ed.), The New Press, 2003.
18. Denning, D. E., "Information Technology and Security," in *Grave New World: Global Dangers in the 21st Century* (Michael Brown ed.), Georgetown Press, 2003.
19. Denning, D. E., "Is Cyber Terror Next?" in *Understanding September 11* (Craig Calhoun, Paul Price, and Ashley Timmer eds.), The New Press, 2002; also placed on SSRC website November 2001.

20. Roberts, S. E. and Denning, D. E., "Protecting a Borderless World: Recognizing and Understanding Security Threats to E-Commerce," in *E-Business Handbook*, eds. Lowry, Cherrington, and Watson, St. Lucie Press, 2002, pp. 339-352.
21. Denning, D. E. and Baugh, W. E., Jr., "Hiding Crimes in Cyberspace," in *Crypto Anarchy, Cyberstates, and Pirate Utopias*, P. Ludlow, ed., The MIT Press, 2001, pp. 115-142; reprinted from article in *Information, Communication and Society*.
22. Denning, D. E., "Activism, Hacktivism, and Cyberterrorism: The Internet as a Tool for Influencing Foreign Policy," In *Networks and Netwars : The Future of Terror, Crime, and Militancy*, J. Arquilla and D. F. Ronfeldt (eds), 2001, pp. 239-288.
23. Denning, D. E., "Encryption Policy: Global Challenges and Directions," in *The Information Revolution and International Security*, R. Henry and C. E. Peartree, eds., CSIS Press, July 1998.
24. Denning, D. E. and Baugh, W. E. Jr., "Encryption in Crime and Terrorism," in *Cyberwar 2.0*, A. D. Campen and D. H. Dearth eds., AFCEA Press, 1998.
25. Denning, D. E. and Branstad, D. K., "A Taxonomy for Key Recovery Encryption," in *Internet Besieged*, 1997. Revised from earlier paper, "A Taxonomy for Key Escrow Encryption."
26. Denning, D. E., "Cyberspace Attacks and Countermeasures," in *Internet Besieged*, 1997. Also published as a monograph by the Computer Security Institute.
27. Denning, D. E., "Encryption Policy and Market Trends," in *Internet Besieged*, 1997. Also presented at the International Cryptography Institute 1996, National Intellectual Property Law Institute, October 25-26, 1996.
28. Denning, D. E. and MacDoran, P. F., "Grounding Cyberspace in the Physical World," in *Cyberwar: Security, Strategy and Conflict in the Information Age*, A. D. Campen, D. H. Dearth, and R. T. Goodden, eds., AFCEA International Press, 1996, pp. 119-126.
29. Denning, D. E. and Baugh, W., "Key Escrow Encryption Policies and Technologies," *Handbook of Information Security Management, 1996-97 Yearbook*, Z. Ruthberg and H. Tipton, eds., Auerbach, pp. S267-275.
30. Denning, D. E., "The Future of Cryptography," In *The Governance of Cyberspace*, B. Loader, ed., Routledge, 1996. Also in *Crypto Anarchy, Cyberstates, and Pirate Utopias*, P. Ludlow, ed., The MIT Press, 2001, pp. 85-103.
31. Denning, D. E., "International Key Escrow Encryption: Proposed Objectives and Options," In *Building in Big Brother*, Hoffman, L. ed., Springer-Verlag, 1995, pp. 208-225.
32. Denning, D. E., "Cryptography and Escrowed Encryption," *Handbook of Information Security Management, 1994-95 Yearbook*, Z. Ruthberg and H. Tipton, eds., Auerbach, pp. S217-235.
33. Denning, D. E., "Interview of Frank Drake," in *Computers Under Attack*, ed. P. J. Denning, ACM Press, 1990.

34. Denning, D. E., "Database Security," *Annual Review of Computer Science*, Annual Reviews, Inc., Palo Alto, CA, Vol. 3, 1988.
35. Denning, D. E., "A Review of Research on Statistical Data Base Security," *Foundations of Secure Computation*, (ed. DeMillo et al), Academic Press, 1978, pp 15-26 (presented at workshop on Foundations of Secure Computation in Atlanta).

(iii) Refereed journal articles

36. Denning, D. E., "Tags, Tweets, and Tethers," *Combating Terrorism Exchange*, Vol. 4, No. 1, Feb. 2014, pp. 27-36.
37. Denning, D. E., "Stuxnet: What Has Changed?" *Future Internet*. 2012; 4(3):672-687.
38. Denning, D. E., "Barriers to Entry: Are They Lower for Cyber Warfare?" *IO Journal*, April 2009.
39. Yuill, J., Denning, D., and Feer, F., "Using Deception to Hide Things from Hackers," *Journal of Information Warfare*, Vol. 5, No. 3, 2006, pp. 26-40.
40. Denning, D. E. and Baugh, W. E., Jr., "Hiding Crimes in Cyberspace," *Information, Communication and Society*, Vol. 2, No. 3, 1999.
41. Denning, D. E. and Branstad, D. K., "A Taxonomy for Key Escrow Encryption," *Comm. ACM*, Vol. 39, No. 3, March 1996, pp. 34-40.
42. Long, J. and Denning, D. E., "Ultra-Structure: A Design Theory for Complex Systems and Processes," *Comm. ACM*, Vol. 38, No. 1, Jan. 1995, pp. 103-120.
43. Denning, D. E. and Smid, M., "Key Escrowing Today," *IEEE Communications*, Sept. 1994.
44. Denning, D. E., "To Tap or Not to Tap," *Comm. of the ACM*, Vol. 36, No. 3, pp 24-33, 42-44, March 1993.
45. Denning, D. E., "The United States vs. Craig Neidorf: A Viewpoint on Electronic Publishing, Constitutional Rights, and Hacking," *Comm. of the ACM*, Vol. 34, No. 3, pp 24-32, 42-43, March 1991.
46. Lunt, T. F., Denning, D. E., Schell, R. R., Heckman, M., and Shockley, W.R., "The SeaView Security Model," *IEEE Trans. on Software Engineering*, Vol. 16, No. 1, pp. 593-607, IEEE Computer Society, June 1990. (Republished from conference paper)
47. Denning, D. E., Akl, S. G., Heckman, M., Lunt, T. F., Morgenstern, M., Neumann, P. G., and Schell, R. R., "Views for Multilevel Database Security," *IEEE Trans. on Software Eng.*, Vol. SE-13, No. 2, Feb. 1987, pp 129-140. (Republished from conference paper.)
48. Denning, D. E., "An Intrusion-Detection Model," *IEEE Trans. on Software Eng.*, Vol. SE-13, No. 2, Feb. 1987, pp 222-232. (Republished from conference paper.)
49. Denning, D. E., "Digital Signatures with RSA and Other Public-Key Cryptosystems," *Comm. ACM*

27, 4, April 1984, pp 388-392.

50. Denning, D. E. and Schlörner, J., "Inference Controls for Statistical Databases," *IEEE Computer* 16, 7, July 1983, pp 69-82.
51. Denning, D. E., "Protecting Public Keys and Signature Keys," *IEEE Computer* Vol. 16, No. 2, Feb. 1983, pp 27-35.
52. Dalenius, T. and Denning, D. E., "A Hybrid Scheme for Release of Statistics," *Statistik Tidskrift*, No. 2, 1982, pp 97-102.
53. Denning, D. E., Meijer, H., and Schneider, F. B., "More on Master Keys for Group Sharing," *Information Processing Letters*, Vol. 13, No. 3, Dec. 13 1981, pp 125-126.
54. Denning, D. E. and Sacco, G. M., "Timestamps in Key Distribution Protocols," *Comm. ACM*, Vol. 24, No. 8, Aug. 1981, pp 533-536.
55. Denning, D. E. and Schneider, F. B., "Master Keys for Group Sharing," *Information Processing Letters*, Vol. 12, No. 1, Feb. 1981, pp 23-25.
56. Denning, D. E., "Secure Statistical Database with Random Sample Queries," *ACM Trans. on Database Sys.*, Vol. 5, No. 3, Sept. 1980, pp 291-315.
57. Denning, D. E. and Schlörner, J., "A Fast Procedure for Finding a Tracker in a Statistical Database," *ACM Trans. on Database Sys.*, Vol. 5, No. 1, March 1980, 88-102.
58. Denning, D. E. and Denning, P. J., "Data Security," *Computing Surveys*, Vol. 11, No. 3, Sept. 1979, pp 227-249.
59. Denning, D. E., "Secure Personal Computing in an Insecure Network," *Comm. ACM*, Vol. 22, No. 8, Aug. 1979, pp 476-482.
60. Schwartz, M. D., Denning, D. E., and Denning, P. J., "Linear Queries in Data Bases," *ACM Trans. on Database Sys.*, Vol. 4, No. 2, June 1979, pp 476-482.
61. Denning, D. E., Denning, P. J., and Schwartz, M. D., "The Tracker: A Threat to Statistical Database Security," *ACM Trans. on Database Sys.*, Vol. 4, No. 1, March 1979, pp 76-96.
62. Denning, D. E. and Denning, P. J., "Certification of Programs for Secure Information Flow," *Comm. ACM*, Vol. 20, No. 7, July 1977, pp 504-513.
63. Denning, D. E., "A Lattice Model of Secure Information Flow," *Comm. ACM*, Vol. 19, No. 5, May 1976, pp 236-243 (presented at the Fifth Symp. on Operating Systems Principles, Austin, Nov. 1975.)

(iv) Refereed conference papers

64. Chen, H., Denning, D., Roberts, N., Larson, C., Yu, X., and Huang, C., "The Dark Web Forum Portal: From Multi-lingual to Video," *Proceedings of 2011 IEEE International Conference on Intelligence and Security Informatics*, ISI 2011, Beijing, China, July 2011.

65. Zhang, D., Zeng, S., Huang, C-N, Fan, L., Yu, X., Dang, Y., Larson, C., Denning, D., Roberts, N., Chen, H., "Developing a Dark Web Collection and Infrastructure for Computational and Social Sciences," *Proc. of the 2010 IEEE International Conference on Intelligence and Security Informatics (ISI 2010)*.
66. Yuill, J., Freer, F., and Denning, D., "Designing Deception Operations for Computer Security Defense," *DoD Cybercrime Conference 2005*, January 2005.
67. Yuill, J., Zappe, M., Denning, D., and Freer, F., "Honeyfiles: Deceptive Files for Intrusion Detection," *Proc. IEEE Workshop on Information Assurance*, U.S. Military Academy, West Point, NY, June 2004.
68. Scott, L. and Denning, D. E., "Location Based Encryption and its Role in Digital Cinema Distribution," *Proc. ION GPS/GNSS 2003*, September 9-12, Portland, OR.
69. Scott, L. and Denning, D. E., "A Location Based Encryption Technique and Some of Its Applications," Institute of Navigation National Technical Meeting, January 22-24, 2003, Anaheim, CA.
70. Denning, D. E., "Critical Factors of Key Escrow Encryption Systems," *Proc. 18th National Information Systems Security Conf.*, Oct. 1995, pp. 384-394.
71. Denning, D. E., "A New Paradigm for Trusted Systems," *Proc. New Security Paradigms Workshop*, 1992-1993, pp 36-41. Also in *Proc. 15th National Computer Security Conf.*, Oct. 1992.
72. Denning, D. E., "Hacker Ethics," *Proc. National Conference on Computing and Values*, New Haven, Aug. 1991.
73. Denning, D. E., "Responsibility and Blame in Computer Security," *Proc. National Conference on Computing and Values*, New Haven, Aug. 1991.
74. Denning, D. E., "Concerning Hackers Who Break into Computer Systems," *Proc. 13th National Computer Security Conf.*, pp. 653-664, Oct. 1990.
75. Lunt, T. F., Denning, D. E., Schell, R. R., Heckman, M., and Shockley, W.R., "The SeaView Security Model," *Proc. 1988 Symp. on Security and Privacy*, pp. 218-233, IEEE Computer Society, 1988.
76. Denning, D. E., Neumann, P. G., and Parker, D. B., "Social Aspects of Computer Security," *Proc. 10th National Computer Security Conference*, Sept. 1987.
77. Denning, D. E., Lunt, T. F., Schell, R. R., Heckman, M., and Shockley, W., "A Multilevel Relational Data Model," *Proc. of the 1987 Symp. on Security and Privacy*, IEEE Computer Society, April 1987 (award for best paper) .
78. Akl, S. G. and Denning, D. E., "Checking Classification Constraints for Consistency and Completeness," *Proc. of the 1987 Symp. on Security and Privacy*, IEEE Computer Society, April 1987.

79. Schell, R. R. and Denning, D. E., "Integrity in Trusted Database Systems," *Proc. of the 9th National Computer Security Conf.*, Sept. 1986.
80. Denning, D. E., Akl, S. G., Heckman, M., Lunt, T. F., Morgenstern, M., Neumann, P. G., and Schell, R. R., "Views for Multilevel Database Security," *Proc. of the 1986 Symp. on Security and Privacy*, IEEE Computer Society, April 1986, pp 156-172.
81. Denning, D. E., "An Intrusion-Detection Model," *Proc. of the 1986 Symp. on Security and Privacy*, IEEE Computer Society, April 1986, pp 118-131.
82. Denning, D. E., "Commutative Filters for Reducing Inference Threats in Multilevel Database Systems," *Proc. 1985 Symp. on Security and Privacy*, April 1985, pp 52-61.
83. Denning, D. E., "Cryptographic Checksums for Multilevel Database Security," *Proc. 1984 Symp. on Security and Privacy*, April 1984, pp 52-61.
84. Denning, D. E., "Field Encryption and Authentication," *Advances in Cryptology: Proc. CRYPTO 83*, Plenum Press, Aug. 1983.
85. Denning, D. E., "The Many-Time Pad: Theme and Variations," *Proc. 1983 Symp. on Security and Privacy*, April 1983.
86. Schlörner, J. and Denning, D. E., "Protecting Query Based Statistical Output in Multipurpose Database Systems," *Proc. IFIP Security Conf.*, Stockholm, Sweden, May 1983.
87. Denning, D. E., Schlörner, J., and Wehrle, E., "Memoryless Inference Controls for Statistical Databases: Extended Abstract," *Proc. 1982 Symp. on Security and Privacy*, April 1982, pp 38-43.
88. Denning, D. E., "Restricting Queries That Might Lead to Compromise," *Proc. 1981 Symp. on Security and Privacy*, April 1981, pp 33-40.
89. Denning, D. E. and Schneider, F. B., "The Master Key Problem," *Proc. 1980 Symp. on Security and Privacy*, April 1980, pp 103-107.
90. Denning, D. E., "Complexity Results Relating to Statistical Confidentiality," *Proc. Computer Science and Statistics: 12th Annual Symp. on the Interface*, Waterloo, May 1979, pp 252-256.
91. Denning, D. E., "A Method for Maintaining Routing Data in Automated Record Keeping Systems," *Proc. IEEE COMPSAC*, 1978, pp 215-219.
92. Denning, D. E., "Are Statistical Data Bases Secure," *AFIPS Conf. Proc. 47, 1978 NCC*, pp 525-530.
93. Schwartz, M. D., Denning, D. E., and Denning, P. J., "Securing Data Bases Under Linear Queries," *Proc. IFIP Congress 77, 1977*, pp 395-398.

(v) Book reviews

Records not kept.

(vi) Published computer programs

None

(vi) Patents

94. Denning, D. E., Glick, B. J., Karpf, R. S., and Seiler, M. E., U.S. Patent No. 10,715,316, “System and method for delivering information in a communication network using location identity,” July 14, 2020. <http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO1&Sect2=HITOFF&d=PALL&p=1&u=%2Fnetahtml%2FPTO%2Fsrchnum.htm&r=1&f=G&l=50&s1=10715316.PN.&OS=PN/10715316&RS=PN/10715316>
95. Denning, D. E., Glick, B. J., Karpf, R. S., and Seiler, M. E., U.S. Patent No. 7,143,289, “System and method for delivering encrypted information in a communication network using location identity and key tables,” November 28, 2006.
96. MacDoran, P. F., Mathews, M. B., Ziel, F. A., Gold, K. L., Anderson, S. M., Coffey, M. A., Denning, D. E., U.S. Patent No. 5,757,916, “Method and Apparatus for Authenticating the Location of Remote Users of Networked Computing Systems,” May 26, 1998.

(vii) Other publications

Congressional testimony

97. Denning, D. E., “Cyberterrorism,” Testimony Before the Special Oversight Panel on Terrorism, Committee on Armed Services, U.S. House of Representatives, May 23, 2000.
98. Denning, D. E., Statement Before the Subcommittee on Courts and Intellectual Property Committee on the Judiciary, U.S. House of Representatives, March 4, 1999.
99. Denning, D. E. and Baugh, W. E. Jr., Testimony Before the Senate Committee on the Judiciary, Subcommittee on Technology, Terrorism, and Government Information, September 3, 1997.
100. Denning, D. E., “The Role of the Government in Encryption Policy,” Testimony Before the House Science Committee, Subcommittee on Technology, November 26, 1996.
101. Denning, D. E., Testimony Before the Subcommittee on Aviation of the Committee on Transportation and Infrastructure, U.S. House of Representatives, June 8, 1995.
102. Denning, D. E., Testimony Before the Subcommittee on Technology, Environment, and Aviation of the Committee on Science, Space, and Technology, U.S. House of Representatives, May 3, 1994.
103. Denning, D. E., Testimony Before the Subcommittee on Telecommunications and Finance, U.S. House of Representatives, June 9, 1993.

Non-refereed journal articles

104. Denning, P. J. and Denning, D. E., “Dilemmas of Artificial Intelligence,” *Comm. of the ACM*, Vol. 63, No. 3, March 2020, pp. 22-24.

105. Denning, P. J. and Denning, D. E., "Cybersecurity Is Harder Than Building Bridges," *American Scientist*, May-June 2016, 154-157.
106. Denning, D. E., "The Rise of Hacktivism," *Georgetown Journal of International Affairs*, September 8, 2015. At <http://journal.georgetown.edu/the-rise-of-hacktivism/>.
107. Denning, D. E., "Towards More Secure Software," *Comm. of the ACM*, 58(4), April 2015, 24-26.
108. Denning, D. E., "Rethinking the Cyber Domain and Deterrence," *Joint Forces Quarterly* 77, 2nd Quarter, April 2015, 8-15.
109. Denning, D. E., "Framework and Principles for Active Cyber Defense," *Computers & Security*, February 2014, 27-36. DOI: 10.1016/j.cose.2013.11.004.
110. Berson, T. A. and Denning, D. E., "Cyberwarfare," guest editor's introduction to special issue on cyberwarfare, *IEEE Security & Privacy*, Vol. 9, No. 5, September/October 2011, pp. 13-15.
111. Denning, D. E., "Comments on Responsibility of and Trust in ISPs," *Knowledge, Technology & Policy*, Vol. 23, No. 3 (2010), pp. 399-401.
112. Denning, P. J. and Denning, D. E., "Discussing Cyber Attack," *Communications of the ACM*, Vol. 53, No. 9, Sept. 2010, pp. 29-31.
113. Massey, D. and Denning, D. E., "Securing the Domain Name System," guest editors' introduction to special issue on DNS, *IEEE Security & Privacy*, Vol. 7, No. 5, September/October 2009, pp. 11-13.
114. Denning, D. E., "The Web Ushers In New Weapons of War and Terrorism," *Scientific American*, August 18, 2008. (published on website)
115. Denning, D. E., "The Lesson of Estonia," *Information Security*, September 2007.
116. Kinniburgh, J. and Denning, D. E., "Blogs and Military Information Strategy," *IO Sphere*, Joint Information Operations Center, Summer 2006, pp. 5-13. Also issued as JSOU Report 06-05, Joint Special Operations University, June 2006.
117. Denning, P.J. and Denning, D. E., "Artificial Stupidity," *Comm. ACM*, Vol. 47, No. 5, May 2004, p. 112.
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120. Denning, D. E., "Key Concerns," *Information Security*, Vol. 4, No. 11, November 2001, p. 120.
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129. Denning, D. E., "Activism, Hacktivism, and Cyberterrorism: The Internet as a Tool for Influencing Foreign Policy," *The Computer Security Journal*, Vol. XVI, No. 3, Summer 2000, pp. 15-35.
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131. Denning, D. E., "Who's Stealing Your Information," *Information Security*, Vol. 2, No. 4, April 1999, pp. 22-29; reprinted in *The OPSEC Journal*, Fifth Ed., 2002, pp. 3-9.
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Non-refereed conference papers

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171. Denning, D. E., "Towards Network Security for Accountability," *Proc. of the Dept. of Defense Computer Security Workshop on Computer Network Security*, March 1985.
172. Denning, D. E., "Report from the Accountability Group," *Proc. of the Dept. of Defense Computer Security Workshop on Computer Network Security*, March 1985.

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Other

177. Denning, D., "Russian Cyberthreat Extends to Coronavirus Vaccine Research," [*The Conversation*](#), July 21, 2020.
178. Denning, D., "How Iran's Military Outsources its Cyberthreat Forces," [*The Conversation*](#), January 22, 2020.
179. Denning, D., "Is Quantum Computing a Cybersecurity Threat" [*The Conversation*](#), December 20, 2018. Reprinted in *American Scientist*, March-April 2019, pp. 83-85.
180. Denning, D., "VPNs are Powerful but Risky," [*The Globe Post*](#), December 4, 2018.
181. Denning, D., "North Korea's Growing Criminal Cyberthreat," [*The Conversation*](#), February 20, 2018.
182. Denning, D., "Following the Developing Iranian Cyberthreat," [*The Conversation*](#), December 11, 2017. Republished by [*Fifth Domain*](#), December 12, 2017.
183. Denning, D., "How the Chinese Cyberthreat Has Evolved," [*The Conversation*](#), October 4, 2017. Republished by [*Newsweek*](#), October 5, 2017.
184. Denning, D., "Tracing the Sources of Today's Russian Cyberthreat," [*The Conversation*](#), August 15, 2017.
185. Denning, D. E., "Social Power and Cyberspace," Presented at Cyber Power Workshop, Naval Postgraduate School, February 16-17, 2017.
186. Denning, D., "Cybersecurity's Next Phase: Cyber-Deterrence," [*The Conversation*](#), December 13, 2016.
187. Denning, D. E., "Why Is It So Hard to Find a Wife?" in *Four Lives: A Celebration of Raymond Smullyan*, Jason Rosenhouse ed., (Mineola, NY: Dover Publications), 2014, pp. 15-16.
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192. Denning, D. E., Forward to *Machine Learning and Data Mining for Computer Security* (Marcus A. Maloof, ed.), Springer, 2005.
193. Yuill, J, Freer, F., Denning, D., and Bell, B., Deception for Computer Security Defense, prepared for Office of Net Assessment, Office of the Secretary of Defense, The Pentagon, January 2004.
194. Denning, D. E., "Is Cyber Terrorism Coming?" The George C. Marshall Institute, May 2, 2002, <http://www.marshall.org/article.php?id=58> .
195. Denning, D. E., "Geo-Encryption," July 1, 2002.
196. Denning, D. E., "Information Technology Trends and Information Assurance," Information Assurance Advisory Council Symposium, October 11-12, 2000.
197. Denning, D. E., "TriStrata Integrates PKI Authentication," TriStrata, Inc., December 2000.
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199. Denning, D. E. and Baugh, W. E. Jr., "Easy Guide to Encryption Export Controls," September 1999.
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201. Denning, D. E., "Export Controls, Encryption Software, and Speech," presented at the RSA Data Security Conference, January 28, 1997.
202. Denning, D. E., "Is Encryption Speech? A Cryptographer's Perspective," Feb. 12, 1995.
203. Denning, D. E., "Key Escrow Encryption: Does it Protect or Compromise User Interests?," prepared for National Research Council Study Panel on Encryption Policy, Jan. 1995.
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207. Denning, D. E., Lunt, T. F., Schell, R. R., Heckman, M., and Shockley, W. R., "Secure Distributed Data Views (SeaView): The SeaView Formal Security Policy Model," Computer Science Lab, SRI International, 1987.
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210. Denning, D. E. and Neumann, P. G., "Requirements and Model for IDDES -- a Real-Time Intrusion Detection System," SRI International, Computer Science Lab, 1985.
211. Denning, D. E., Schlörner, J., and Wehrle, E., "Memoryless Inference Controls for Statistical Databases," Rev. March 1984.
212. Denning, D. E. and Denning, P. J., Eight short papers: "Overhead," "program Status Words and State Vectors," "System Generation," "System Nucleus," "Task," "Thrashing," "Throughput," "Working Set," in *Encyclopedia of Computer Science* (A. Ralston and C. L. Meek, ed.), Petrocelli/Charter, 1976, revised 1980.
213. Denning, D. E., "A Prototype Program Understanding Tool," Purdue Univ., November, 1979.
214. Sacco, G. M. and Denning, D. E., "Handshakes Are Shaky," CSD TR 322, Purdue University, November 1979.
215. Denning, D. E., Denning, P. J., Garland, S. J., Harrison, M. A., and Ruzzo, W. L., "Proving Protection Systems Safe," Feb. 1978.
216. Denning, D. E., "A Programming Contest in an Introductory Course," Purdue Univ., May 1978.
217. Denning, D. E., "On the Derivation of Lattice Structured Information Flow Policies," Purdue Univ., CSD TR 180, March 1976.
218. Denning, D. E., "Secure Information Flow in Computer Systems," Ph.D. Thesis, Purdue University, CSD TR 145, May 1975.
219. Davis, D. E., "The Easy Control Language," *Proceedings SHARE "XIX*, 1972.
220. Arcuri, F. W. and Davis, D. E., "The Easy Control Language Reference Manual," The Univ. of Rochester, Feb. 1972.
221. Robling, D. E., "Further Study of Celestial Radio Source Occultation from the NASA OGO Satellites," UM/RAO Report No. 68-7, July 1968.
222. Robling, D. E., "Occultation of Celestial Radio Sources Viewed from an Earth Satellite," UM/RAO

Report No. 68-4, Feb. 1968.

223. Robling, D. E., "Ray Tracing in the Earth's Outer Ionosphere," Univ. of Michigan Radio Astronomy Obs., UM/RAO Report No. 68-3, Jan. 1968.

III. RESEARCH FUNDING

At NPS (2002-present)

Department of Defense (DOD) Supply Chain Risk Management (SCRM) Threat Analysis Center (TAC) Collaboration Project with Naval Postgraduate School (NPS), \$150K, 2011. Supervised students who identified and analyzed known cyber supply chain malware incidents, which included 183 unclassified cases and an additional set of classified ones.

Department of Defense, Assessing the Computer Network Operations (CNO) Threat of Foreign Countries, \$54K, 2004-2005. Supervised students who developed a methodology for assessing the state cyber threat and applied the methodology to Iran and North Korea.

At SRI International (1983-1987)

National Science Foundation, Multilevel Database Security, \$100K (est), 1983-85. Developed cryptographic techniques for protecting multilevel databases.

US Air Force RADC, Multilevel Database Security, \$1M (est), 1985-88. Led SRI/Gemini SeaView project to model and design a multilevel-secure database system at class A1.

US Navy SPAWAR, Two grants on Intrusion Detection, \$500K (est), 1984-87. Developed SRI model of an Intrusion Detection Expert System (IDES) and led effort to develop prototype.

US Army CECOM, Military Database Technology Study, \$100K (est). Developed techniques for addressing inference problems.

At Purdue University (1975-1983)

National Science Foundation: Research in Secure Computer Systems, 1977-79; Data Security, 1981-85; Multilevel Database Security, 1983-85.

IV. INTERNAL NPS ACTIVITIES

a. Course and laboratory development

I developed 4 courses as follows:

DA 3104, Computer Network Attack and Defense. This course introduces the basic principles of attacking and defending computer networks, as well as basic networking concepts. The course includes some hands-on work in a lab with hacking and security technologies. Kristen Tsolis developed the lab materials under my supervision.

DA 3105, Conflict and Cyberspace. This course examines how cyberspace, particularly the Internet, can serve as a tool, target, and source of conflict for both state and non-state actors. Topics include: power in

cyberspace, methods and technologies of cyber conflict, cyber-based information operations, domestic and international laws governing cyber operations, cybercrime, cyber activism and hacktivism, terrorists and jihadists in cyberspace, cyberwarfare, cyber surveillance, critical infrastructure protection, and cyber conflict strategy and challenges.

DA 4601, Terrorist Financing. This course examines how terrorists fund their activities and the role of that funding in counterterrorism. It covers sources and methods of terrorist financing, methods of moving and storing money, and the underground economy and nexus between crime and terrorism. It covers national and international structures, laws, regulations, tools, and efforts to identify, track, capture, and eliminate terrorists and their financial support through their financial transactions.

SO 4106, Trust, Influence and Networks. This course examines the underlying nature of trust, influence, and networks, and how they relate to each other. Students are given a theoretical foundation for these concepts and shown how they apply to a broad spectrum of activity, including irregular warfare, terrorism and counterterrorism, information and influence operations, and intelligence operations; how trust and influence are established, maintained, exploited, and lost; and the functions they serve for individuals, organizations, and societies.

b. DoN/DoD applications

None

c. Teaching techniques developed

None

d. Major administrative appointments

None

V. EXTERNAL PROFESSIONAL AND SERVICE ACTIVITIES

a. Navy/DoD Activity

Member, Independent Strategic Assessment Group, Computer Network Defense/Computer Network Attack, advising the Commander in Chief of SPACECOM, 2000-2002.

Member, DoD Messaging Advisory Board, Department of Defense, 1996.

Invited reviewer, Escrowed Encryption System (Clipper Chip), NSA/NIST, 1993-94.

Chair, Workshop on Computer Security Curriculum, National Computer Security Center (NCSC), 1987.

Group leader, Workshop on Computer Network Security, NCSC, 1985.

Member, Steering Committee, Air Force Summer Study on Multilevel Secure Database Management, 1982.

Member, Steering Committee, US Army Automation Security Workshop, 1978.

b. External Professional Activities

International Association for Cryptologic Research

President, 1983-86 (served 2 terms as first president).

Director, 1986-90.

Program committee member for several CRYPTO and EUROCRYPT conferences.

ACM

Chair, Special Interest Group on Operating Systems Principles (SIGOPS), 1980-83; Secretary-Treasurer, 1977-80.
Member, Program Committee for ACM Workshop on Scientific Aspects of Cyber Terrorism (SACT), 2002.
Member, Advisory Committee on Security and Privacy (ACSP), 2001.
Member, ACM Panel on Cryptography Policy, 1993-94.
Co-Chair, ACM Conference on Computer and Communications Security, 1993, 1994.
ACM Representative on Board of Directors, Computing Research Association, 1991-95.
Associate Editor, *Transactions on Computer Systems*, 1982-90.
Chair, Grace Murray Hopper Awards Committee, 1981; member, 1979-82.
Member, ACM Computing Reviews Category Revision Committee, 1979-81
Program committee member for several SIGOPS conferences.

IEEE Computer Society

Editorial Board, *IEEE Security and Privacy*, 2003-2015.
Program Co-Chair, IEEE Symposium on Security and Privacy, 1983, 1984.
Newsletter Editor, IEEE Technical Committee on Security and Privacy, 1978-79.
IEEE Distinguished Visitor, 1978-80.

National Academy of Sciences

Member, Panel on Information Technology, Board of Assessment of NIST Programs, 1993-1998.
Chair, Forum on Rights and Responsibilities of Participants in Networked Communities, Computer Science and Technology Board, 1992-1993.
Member, Panel on Evaluation of Statistical Software, 1982-83.

Government

Co-Chair, Standards and Certification Working Group, Electronic Crimes Partnership Initiative, 2001-2002.
Member, Independent Strategic Assessment Group, Computer Network Defense/Computer Network Attack, advising the Commander in Chief of SPACECOM, 2000-2002.
Member, National Cybercrime Training Partnership portfolio on Industry and Academia, 2000-2002.
Member, President's Export Council Subcommittee on Encryption, 1998-2001.
Member, Technical Advisory Committee to Develop a Federal Information Processing Standard for the Federal Key Management Infrastructure, 1996-98.
Member, DoD Messaging Advisory Board, Department of Defense, 1996.
Information Technology Advisor, Federal Bureau of Investigation, 1993-95.
Invited reviewer, Escrowed Encryption System (Clipper Chip), 1993-1994.
Chair, Workshop on Computer Security Curriculum, National Computer Security Center, 1987.
Group leader, Workshop on Computer Network Security, National Computer Security Center, 1987.
Member, Steering Committee, Air Force Summer Study on Multilevel Secure Database Management, 1982.
Member, Steering Committee, U.S. Army Automation Security Workshop, 1978.

Advisory and Editorial Boards for Journals and Institutes (recent)

Military Cyber Professional Association, 2017-
Middle East Media Research Institute (MEMRI), 2015-
PeerJ Computer Science, 2015-
International Journal of Cyber Crimes and Criminal Justice (IJCCCJ), 2006-
International Journal of Critical Infrastructure Protection, 2008-2017.
International Journal of Information and Computer Security, 2004-2017.
Security and Privacy, IEEE Computer Society, 2003-2015.
Ethics and Information Technology, 1999-2016.
Information, Communication & Society, 1997-2016.
Secure Business Quarterly, 2001.

Other Conferences and Committees

Member, Program Committee, Conference on Cyber Conflict, NATO Cooperative Cyber Defence Center of Excellence (CCDCOE), 2010-
Member, Program Committee, International Conference on Cyber Warfare and Security (ICWS), 2008-
Member, Program Committee, International Symposium on Human Aspects of Information Security & Assurance (HAISA), 2007-2016.
Member, Program Committee, Workshop on Ethics of Cyber Conflict, NATO CCD COE, 2013.
Member, Program Committee, Workshop on Ethics in Computer Security Research (WECSR), 2009.
Chair, Second International Conference on Information Warfare and Security (ICIW), 2007.
Member, Review Committee, Colloquium for Information Systems Security Education (CISSE), 2006-2009.
Member, Steering Committee, Workshop on Cyber Conflict, International Cooperation, and Deterrence, 2007.
Member, Program Committee, International Conference on Communication, Network, and Information Security, 2006-
Member, Program Committee, the European Conference on Information Warfare, 2005-2006.
Member, Program Committee, the International Conference on Information Warfare, 2006-2008.
Co-editor, Special NPS Issue of the *Journal of Information Warfare*, 2004.
Member of Advisory Board for The Strategic Implications of Advances in the Field of Information Technology, International Institute for Strategic Studies, 2001-2002.
Member, Committee on Information Technology, International Cooperation and Global Security, Social Science Research Council, 2001-2002.
Member, ICSA Security Certification Oversight Board, 2001.
Member, Board of Directors, G2-Forward, 1999-
Member, Task Force on Cyber Threats for the Future, Homeland Defense, Center for Strategic and International Studies, 2000.
Member, Board of Directors, National Colloquium for Information Systems Security Education, 1998-
Chair, International Cryptography Institute, National Intellectual Property Law Institute, 1994, 1995; member, steering committee, 1998-99.
Member, US Working Group on Global Organized Crime, National Strategy Information Center, 1996-1999.

Member, Information Warfare Working Group, Center for Strategic and International Studies, 1996-97.
Member, Information Technology Security Task Force, Global Organized Crime, Center for Strategic and International Studies, 1995-98.
Member, Steering Committee, Conference on Computers, Freedom, and Privacy, 1991-93, 96.
Member, Advisory Board, *Who's Who in Frontier Science and Technology*, 1982.
Member, Advisory Board, *Computer Security Journal*, 1978-82.
Manager, Command Languages Project of SHARE, 1972.

Business and consulting

Member, GeoCodex, LLC, 2001-.
Consultant, Piper, Marbury, Rudnick & Wolfe, 2001-2002.
Consultant, Bircham Dyson Bell, 2001-2002.
Consultant, Oblon, Spivak, McClelland, Maier, and Neustadt, 2001-2002.
Consultant, Finnegan, Henderson, Farabow, Garrett & Dunner, 2001-2002.
Member, Technical Advisory Board and Editorial Review Board for *Secure Business Quarterly*, @Stake, 2000-2004.
Member, Technical Advisory Board, LUX Capital Group, 2000-2002.
Member, Technical Advisory Board, RIPTech, Inc., 2000-2002 (bought by Symantec).
Consultant and technical advisor, TriStrata Security Inc., 1998-2001.
Consultant, Danu Industries, Ireland, 1999-2000.
Member, Board of Directors, Centrax Corporation, 1998-99 (bought by CyberSafe).
Consultant, Wilson Sonsini Goodrich & Rosati, 1998-99.
Consultant, Science Applications International Center, 1997-1999.
Consultant, International Series Research Inc, 1995-97.
Program Chair and Co-Sponsor, Encrypting Voice and Data, Telestrategies Conference, 1993, 1994.

VI. APPENDIX

Honors and Awards

Test of Time Award, IEEE Technical Committee on Security and Privacy, 2019.
Navy Meritorious Civilian Service Award, Department of the Navy, 2016.
Kristian Beckman Award, IFIP TC-11, 2013.
Distinguished Women Scholars, Purdue University, 2013.
National Cybersecurity Hall of Fame, 2012.
Distinguished Fellow, ISSA, 2010.
Outstanding Innovation Award, ACM Special Interest Group on Security, Audit and Control (SIGSAC), 2008.
Fellow of (ISC)², International Information Systems Security Certification Consortium, 2008.
Security 7 Award, *Information Security Magazine*, 2006.
Distinguished Science Alumnus, Purdue University School of Science, 2006.
Harold F. Tipton Award, International Information Systems Security Certification Consortium, 2005.
ISSA Hall of Fame, 2003.
COMPASS Award, *CSO Magazine*, 2003.
Women of Vision Award, *Information Security Magazine*, 2003.

Honorary Certified Information Systems Security Professional (CISSP), International Information Systems Security Certification Consortium, 2003 (replaced by Fellow of (ISC)² in 2008).
Honorary Certified Information Security Manager (CISM), Information Systems Audit and Control Association, 2003
Award for Excellence in Information Security, George Washington University, 2002.
Augusta Ada Lovelace Award, Association for Women in Computing, 2001.
TechnoSecurity Professional of the Year Award, 2000.
National Computer Systems Security Award, 1999.
ACM Fellow, 1995.
ACM Recognition of Service Award, 1985, 1987, 1989, 1994, 1995.
Distinguished Lecturer in Computer Security Award, Aerospace, 1990.
Best Paper Award, Symposium on Security and Privacy, 1987.
Exceptional Achievement Award, SRI International, 1986.
Outstanding Teacher in the School of Science, Purdue University, 1980-81.
Sigma Xi, 1976.
IBM Fellowship, 1974-75.

Other Recognition

Center named after me

Dr. Dorothy E. Denning Center of Academic Excellence in Information Assurance Education, Professional Security Studies Department, New Jersey City University, 2009.

Articles and book chapters about me

R. A. Grimes, "Profile: Dr. Dorothy E. Denning," Ch. 15 in *Hacking the Hacker*, Wiley, 2017.
K. A. Stewart, "Distinguished NPS Professor Discusses the Ethics of Cyber Warfare," *Update NPS*, June, 2013.
D. Amorosi, "Interview: Dorothy Denning," *Infosecurity Magazine*, Apr. 30, 2013.
A. D. Stein, "DA Professor Selected for Cyber Hall of Fame," *Update NPS*, Nov. 2012.
A. Stent and P. Lewis, "Dorothy Denning: Wrote the Book on Computer Security," Sec. 5.2 in *The Princess at the Keyboard: Why Girls Should Become Computer Scientists*, Lulu.com, 2009, pp. 44-45.
M. Savage, "Highest Honors," *Information Security*, Oct. 2006.
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