

Jonathan S. Shapiro

The EROS Group, LLC
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Current Status

Managing Partner, The EROS Group, LLC.

Technical Interests

Operating systems, information security, virtual machines, and supporting tools, focusing primarily on secure operating system foundations and their underpinnings.

Education

University of Pennsylvania, Philadelphia, Pennsylvania.

Advisors: Jonathan M. Smith and David J. Farber

Ph.D. in Computer Science, 1999.

Stanford University, Stanford, California.

M.S. in Computer Science, 1989

Haverford College, Haverford, Pennsylvania.

B.S. in Computer Science, 1986

Employment

The EROS Group, LLC, Owings Mills, Maryland

January 2001-Present

Managing Director. The EROS Group was formed to provide technology transfer support for the EROS operating system, and has subsequently become a technology transfer and development vehicle for Dr. Shapiro's research. In this role, the company has received over \$750,000 in funding from Federal contracts totaling \$2M in value. The EROS Group has performed on several consulting engagements for several multinational corporations.

Assistant Research Professor, Dept. of Computer Science, Johns Hopkins University, Baltimore, Maryland

June 2007-Present

Dr. Shapiro continues to conduct research and support students in connection with the Computer Science Department. Currently active research areas include type systems and programming language design (BitC, with Swaroop Sridhar), formal verification (Scott

Doerrie) and operating systems (Viengoos, with Neal Walfield).

Assistant Professor, Dept. of Computer Science, Johns Hopkins University, Baltimore, Maryland

Summer 2000-June 2007

Responsible for establishing and managing a world class research program in operating systems and foundational security technology in such systems. Currently redesigning the basic and advanced Operating System courses to provide a more principle-driven focus for the course. Created a course on high-assurance software development, drawing from both theoretical and practical experience. Founding member of the Johns Hopkins University Information Security Institute (JHUISI). Current research includes secure operating systems (EROS) and secure, scalable configuration management (OpenCM).

Dr. Shapiro was on Sabbatical from July 2006 to June 2007.

IBM T.J. Watson Research Center, Hawthorne, New York

November 1998-March 2000

Research Staff Member, Pervasive Computing Research department. Research on high-performance capability systems and operating systems security. Formal verification of security policies. Participated in various internal security advisory activities within the company.

University of Pennsylvania, Philadelphia, Pennsylvania

September 1993 to 1999

Research on high-performance capability systems. EROS (Extremely Reliable Operating System) is designed to provide strong confinement for untrusted applications without compromising performance. On a practical note, the work has achieved a very fast capability system and demonstrated formally the correctness of the confinement architecture. On a more formal front, this work has resulted in a new and richer access model for capability systems and a formal proof of confinement for the EROS architecture. As a sidebar, we have shown that conventional protection mechanisms (access control lists) cannot be extended to provide equivalent protections.

Xanadu Operating Company, Inc., Palo Alto, California

July 1992 to November 1992

Chief Executive Officer. Negotiated the divestiture of the company from Autodesk, Inc. Built independent board of directors and resolved crippling impediments in corporate ownership structure, and managed the company to the point of having a demonstrable product. Stepped down in favor of a more experienced manager, who quickly formed an exclusive license for the company's assets with Memex Information Systems, Inc.

Synergistic Computing Associates, Menlo Park, California

August 1990-September 1993

Contract product development.

For Recht, Hausrath and Associates: Architected and developed FiscPac, a financial

modeling package for real-estate developments. System provides a way for county or city governments to model the costs and benefits of a particular development and evaluate the impact of changes in tax and services terms instantaneously.

For the Xanadu Operating Company: Produced technical documentation for the company's first commercial product. In the process worked with the architects to arrive at several simplifications in their repository and protection architecture.

ParcPlace Systems, Inc.: Member, Technical Advisory Board 1992-1993.

HaL Computer Systems, Inc., Campbell, California

August 1990 to August 1991

Co-founder. Manager, Software Design from August 1990 to January 1991, during which time I acted as the principle architect of the HaL Instruction Set Architecture and several parts of the HaL memory management subsystem. Transitioned in January to Manager of the Compiler Group, where I was responsible for staffing the early portions of the group and the delivery of the bootstrap cross compilation environment. Stepped down from this role in June to complete the bootstrap environment after hiring a better qualified manager to run the group.

Silicon Graphics, Inc. Mountain View, California

June 1989 to August 1990

Member of Technical Staff. Initially responsible as a consultant for establishing the push at SGI for an Application Binary Interface for the MIPS architecture. Established C++ as a key development language within the company, acting to some extent as an evangelist for the language. Joined the company in September/October to assist in the establishment of the SGI CASE department. Architected and led the development of the Silicon Graphics VIEW debugging and performance analysis tool suite. In addition, acted as driving architect for the overall structure of the next few generations of the VIEW product line. Held significant responsibility in identifying and hiring key members of the department. Continued further enhancement to the /proc(4) file system, including the invention of an efficient watchpoint mechanism.

AT&T Bell Laboratories, Summit, New Jersey

January 1988 to June 1989

Member of Technical Staff, Exploratory Programming Systems Group. Prototyped an incremental programming environment for C. Prototype resulted in a turnaround time of less than 2 seconds from compile to executable for typical program changes. Was personally responsible for the design of the user interface, the design of an incremental linker for the Extensible Linking Format (ELF), and a fast technique for reliably identifying text changes without reparsing. As part of the ELF linker work, implemented the first prototype of the COFF to ELF conversion utility for testing of this linker, which was modified and distributed through the development organization for testing of the new compilation system components. Helped to engineer the requirements and design the ELF object file format and associated access library.

AT&T Bell Laboratories, Summit, New Jersey

June 1986 to December 1988

Member of Technical Staff, C and Debugger Group. Architected, designed, and implemented debug(1), a debugger for distributed multiprocess applications. Debug was designed to handle multiple simultaneous processes which may be running across a heterogeneous network of machines. As of December 1988 it supported the IAPX/386, SPARC, and WE32x00 chip sets. Prototyped the STREAMS-based pseudo-terminal facility that was delivered in SVR3.2 and standardized in SVR4.0. Debug was the first commercial product ever developed in C++. As early users, the development team was actively involved in the evolution of the C++ language (smart pointer overloading was definitely our fault). Helped to test and design the System-V implementation of the /proc(4) debugging file system.

AT&T Bell Laboratories, Murray Hill, New Jersey

February 1982-January 1983

Research in natural languages processing for database query systems. Constructed a front end for relational database systems that accepted English language queries and returned the desired information from the database. The work demonstrated that in such a domain, simple keyword scanning and pattern matching techniques are sufficient for satisfactory real-world performance.

Publications

Refereed Conferences and Workshops

- [1] Swaroop Sridhar, Jonathan S. Shapiro, and Scott F. Smith. “Sound and Complete Type Inference for a Systems Programming Language.” *Proc. 6th ASIAN Symposium on Programming Languages and Systems* (APLAS 2008). Bangalore, India, Dec 9, 2008.
- [2] J. S. Shapiro. “Programming Language Challenges in Systems Codes (Why Systems Programmers Still Use C and What to Do About It).” *Proc. 3rd ECOOP Workshop on Programming Languages and Operating Systems* (PLOS 2006). San Jose, California, 2006.
- [3] Swaroop Sridhar and Jonathan S. Shapiro. “Type Inference for Unboxed Types and First Class Mutability.” *Proc. 3rd ECOOP Workshop on Programming Languages and Operating Systems*. San Jose, California, USA, 2006
- [4] Swaroop Sridhar, Jonathan S. Shapiro, Eric S. Northup, and Prashanth P, Bungale. “HDTrans: An Open Source, Low-Level Dynamic Instrumentation System.”, *Proc. 2nd International Conference on Virtual Execution Environments*, Ottawa, Canada, June 14-16, 2006.

- [5] Swaroop Sridhar, Jonathan S. Shapiro, and Prashanth P, Bungale. “HDTrans: A Low-Overhead Dynamic Translator.”, *Proc. 2005 Workshop on Binary Instrumentation and Applications*. St. Louis, MO, September 18, 2005. (2 external citations)
- [6] Mark S. Miller, E. Dean Tribble, and Jonathan S. Shapiro. “Concurrency Among Strangers: Programming in E as Plan Coordination” *Proc. 2005 Symposium on Trustworthy Global Computing*, (European Joint Conference on Theory and Practice of Software 2005 (Invited Paper). Published as *Lecture Notes in Computer Science*, vol. 3705, Springer-Verlag, pp. 195-229.
- [7] Jonathan S. Shapiro, M.S. Doerrie, E. Northup, S. Sridhar, and M. Miller. *Towards a Verified, General-Purpose Operating System Kernel*, NICTA Invitational Workshop on Operating System Verification, University of New South Wales, Sydney, Australia, October 2004 (Invited Paper, 8 external citations)
- [8] Mark S. Miller, Bill Tulloh, and Jonathan S. Shapiro. “The Structure of Authority: Why Security is Not a Separable Concern.” *Proc 2nd International Conference on Multiparadigm Programming in Mozart/OZ (MOZ/2004)*, pp. 2-20. Charleroi Belgium, October 2004 (Invited Paper, 4 external citations). Published as *Lecture Notes in Computer Science*, vol. 3389, Springer-Verlag,.
- [9] Hao Chen and Jonathan S. Shapiro. “Using Build-Integrated Static Checking to Preserve Correctness Invariants,” *Proc. 11th ACM Conference on Computer and Communications Security*, pp. 288-297. Washington D.C., 2004 (3 external citations)
- [10] Michael Hohmuth, Hermann Hartig, and Jonathan S. Shapiro, “Reducing TCB Size by Using Untrusted Components – Small Kernels Versus Virtual Machine Monitors,” *Proc. 11th ACM SIGOPS European Workshop*, Leuven Belgium, 2004 (6 external citations)
- [11] Jonathan S. Shapiro, John Vanderburgh, Eric Northup, and David Chizmadia, “Design of the EROS Trusted Window System,” *Proc. 2004 USENIX Security Conference*, pp. 165-178. San Diego CA, 2004 (10 external citations)
- [12] Anshumal Sinha, Sandeep Sarat, and Jonathan S. Shapiro, “Network Subsystems Reloaded: A High-Performance, Defensible Network Subsystem,” *Proc. 2004 USENIX Annual Technical Conference*, pp. 213-226. Boston MA, 2004
- [13] Jonathan S. Shapiro, “Creating Assurance That Works,” *Computing Research Association Conference on Grand Challenges in Information Security and Assurance*, Warrenton, Va, November 16-19 2003. (Invitational Conference)
- [14] Mark Miller and Jonathan S. Shapiro, “Paradigm Regained: Abstraction Mechanisms for Access Control,” *Eighth Asian Computing Science Conference (ASIAN '03)*, pp. 224-242. Tala Institute of Fundamental Research, Mumbai India, December 10-13 2003. (Invited Paper, 17 external citations)
- [15] Jonathan S. Shapiro, “Vulnerabilities in Synchronous IPC Designs,” *2003 IEEE Symposium on Security and Privacy (Oakland)*, pp. 251-262. 2003. (6 external citations)

- [16] Jonathan S. Shapiro, John Vanderburgh, and Jack Lloyd, “OpenCM: Early Experiences and Lessons Learned,” *Proc. 2003 USENIX Annual Technical Conference, FreeNIX Track*, Monterey, CA, 2003 (2 external citations)
- [17] Jonathan S. Shapiro and John Vanderburgh, “CPCMS: A Configuration Management System Based on Cryptographic Names,” *Proc. 2002 USENIX Annual Technical Conference, FreeNIX Track*, pp. 207-220. Monterey, CA, 2002 (Best Paper, 12 external citations)
- [18] Jonathan S. Shapiro and John Vanderburgh. “Access and Integrity Control in a Public-Access, High-Assurance Configuration Management System,” *Proc. 11th USENIX Security Symposium*, pp. 109-120. 2002, San Francisco, CA, 2002. (6 external citations)
- [19] J. S. Shapiro and Jonathan Adams. “Design Evolution of the EROS Single-Level Store,” *2002 USENIX Annual Technical Conference*, pp. 59-72. Monterey CA, 2002. (1 external citation)
- [20] J. S. Shapiro, S. Weber. “Verifying the EROS Confinement Mechanism.” *2000 IEEE Symposium on Security and Privacy*, pp. 166-176. Oakland, CA, 2000. (9 external citations)
- [21] J. S. Shapiro, Jonathan M. Smith, and David J. Farber. “EROS: A Fast Capability System.” *Proc. 17th ACM Symposium on Operating Systems Principles*. pp. 170-185. Charleston, SC. 1999 (105 external citations)
- [22] Jonathan S. Shapiro, David J. Farber, and Jonathan M. Smith. “The Measured Performance of a Fast Local IPC.” *Proc. 5th International Workshop on Object Orientation in Operating Systems*, pp. 89-94. Seattle, Washington. 1996. (13 external citations)
- [23] Jonathan S. Shapiro, David J. Farber, and Jonathan M. Smith. “State Caching in the EROS Kernel – Implementing Efficient Orthogonal Persistence in a Pure Capability System,” *Proc. 7th International Workshop on Persistent Object Systems*, pp. 88-100. Cape May, N.J. 1996 (6 external citations)
- [24] Alan C. Bomberger, A. Peri Frantz, William S. Frantz, Ann C. Hardy, Norman R. Hardy, Charles Landau, Jonathan Shapiro. “The KeyKOS NanoKernel Architecture.” *Proc. USENIX Workshop on Micro-Kernels and Other Kernel Architectures*. USENIX Association. April 1992. pp. 95-112. ([Principle Author](#), 33 external citations).

Articles in Refereed Journals

- [1] J. S. Shapiro, “Understanding the Windows EAL4 Evaluation,” *IEEE Computer*, February 2003, pp. 103-105. (6 external citations)

Excerpted in testimony by Prof. Eugene H. Spafford, to the US Congressional Committee on House Government Reform, Subcommittee on Technology, Information Policy, Intergovernmental Relations, and Census, September 17, 2003

Excerpted in testimony by Prof. William Caelli before the Australian Congress
[verbally confirmed with Prof. Caelli; detailed citation forthcoming]

- [2] J. S. Shapiro. "EROS: A Principle-Driven Operating System from the Ground Up," *2001 IEEE Software*, Jan/Feb 2001, pp. 26-33. (17 external citations)

Specifications

- [1] J. S. Shapiro, S. Sridhar, S. Doerrie, and E. Northup. Coyotos Microkernel Specification, version 0.2, February 2006.

The successor to the EROS system, Coyotos was originally intended to be a cleanup pass on EROS. This changed rapidly as the system picked up early adopters, and discussions revealed that a more radical departure from the EROS architecture was required. Coyotos now provides an entirely new asynchronous IPC mechanism that should merge the IPC performance of EROS and L4 with a much more flexible communications model.

Coyotos is also expected to see rapid commercial deployment It is now being used in two SBIR contracts (DARPA, DHS) and is currently the preferred platform for a new generation of surgical instruments.

- [2] J. S. Shapiro, S. Sridhar, S. Doerrie, M. Miller, and E. Northup. BitC Language Specification, version 0.9+, February 2006. (1 external citation)

BitC is a programming language that straddles the requirements of verifiability and low-level systems code development. It adapts the Hindley-Milner type inference mechanism (extended with type classes) to a systems programming language providing direct control over data representation and strong support for stateful programming idioms. BitC also incorporates a logic language that is currently being defined. As of this update, the prototype compiler is operational and work on the verification environment is beginning.

- [3] J. S. Shapiro, M. Miller CapIDL Language Specification, version 0.1 February 2006.

CapIDL is a new interface definition language that is specialized for the needs of capability-based systems. It incorporates the notion of "interfaces as types" and adds interface single inheritance to the traditional IDL approach exemplified by CORBA.

Books

- [1] Jonathan S. Shapiro, *A C++ Toolkit*, Prentice Hall, 1990. (6 external citations)
- [2] J. S. Shapiro, *EROS: A Capability System*, 1999 (Dissertation, 36 external citations)

Technical Reports and Notes

- [1] J. S. Shapiro, S. Sridhar, and M. S. Doerrie. "The Origins of the BitC Programming Language." SRL-TR-2008-04, Department of Computer Science, Johns Hopkins University

- [2] J. S. Shapiro. “Managing Capabilities by Dynamic Single Assignment.” SRL-TR-2000-04, Department of Computer Science, Johns Hopkins University
- [3] J. S. Shapiro. “First-Class Flexpage-Based Address Spaces.” SRL-TR-2000-03, Department of Computer Science, Johns Hopkins University
- [4] J. S. Shapiro. “Operating System Requirements for Liquid Software.” SRL-TR-2000-02, Department of Computer Science, Johns Hopkins University (2 external citations)
- [5] J. S. Shapiro “The Practical Application of a Decidable Access Model.” SRL-TR-2000-01, Department of Computer Science, Johns Hopkins University
- [6] J. S. Shapiro, S. Weber, *Constructing a Language for Security and Safe Execution*. Unnumbered Technical Note, IBM T.J. Watson Research Center
- [7] J. S. Shapiro, S. Weber, *A Family of Securable Protection Systems*, Department of Computer and Information Science Technical Report MS-CIS-98-18, University of Pennsylvania
- [8] J. S. Shapiro, S. Weber, *Verifying Operating System Security*, Department of Computer and Information Science Technical Report MS-CIS-97-26, University of Pennsylvania (7 external citations)
- [9] J. S. Shapiro, S. J. Muir, J. M. Smith, and D. J. Farber. *Operating System Support for Active Networks*. Department of Computer and Information Science Technical Report MS-CIS-97-03, University of Pennsylvania
- [10] J. S. Shapiro. *EROS: A Capability System*. Department of Computer and Information Science Technical Report MS-CIS-97-04, University of Pennsylvania (31 external citations)

Talks and Presentations

- [1] Panelist, *Verified Software, Theories, Tools, and Experiments*. Toronto, Canada, October 2008. Members were Rod Chapman, Tony Hoare, Rustan Leino, Wolfgang Paul, and myself.
- [2] “Towards Engineerable Assurance” *2006 German-American Frontiers of Engineering Symposium*, (co-hosted by the U.S. National Academy of Engineering and the Alexander von Humboldt Foundation) May 4-6 2006, Murray Hill, New Jersey
- [3] “A Look at the EROS Operating System.” *2005 Libre Software Meeting*, July 2005, Dijon, France.
- [4] “From EROS to Coyotos/BitC.” *2005 Libre Software Meeting*, July 2005, Dijon, France.
- [5] *EROS: Lessons Learned*, Department of Computer Science, U. Copenhagen, February 2004

- [6] *EROS Tutorial*, Computer Science Laboratory, University of Cambridge, Cambridge England, February 2004
- [7] *An EROS Tutorial*, Department of Computer Science, Dresden University of Technology, Dresden, Germany, January 2004
- [8] Invited Panelist, *Accelerated Trustworthy Internetworking Workshop*, Security Architectures session, January 2004
- [9] Invited attendee, *Computing Research Association workshop on Grand Challenges in Information Assurance and Information Security*, Arlie House, Warrenton VA, November 2003
- [10] *Revision Control Panel*, CodeCon 2.0, San Francisco, California, 2003
- [11] Jonathan S. Shapiro and David Chizmadia. *An Introduction to the Application Service Provider Operating System (ASP OS) Protection Profile*. Information Assurance Technical Framework Forum, March 2003
- [12] An Overview of the Hopkins information Security Lab, for Richard Clark, Homeland Defense Agency.
- [13] An Overview of the EROS System, University of Syracuse, Syracuse, New York, 2002
- [14] *Confinement in a Pure Capability System*. HP Laboratories, Palo Alto, 1998
- [15] *Experiences Optimizing A Capability System on the Pentium Family* First Workshop on PC-Based System Performance and Analysis, San Jose, California, 1998
- [16] *Implications of Superscalar Processors*, Stanford University, Stanford, California, 1991
- [17] *Debug: The Next Generation UNIX Debugger*, Stanford University, Stanford, California, 1989
- [18] *EROS: A Capability System*. IBM T. J. Watson Research Center, Hawthorne, New York, June 1988
- [19] *The Internet Worm*, Stanford University, Stanford, California, 1988

Other

- [1] J. S. Shapiro. *The Coyotos Web Site* (<http://www.coyotos.org>)
- [2] J. S. Shapiro, S. Sridhar. *The BitC Web Site* (<http://www.bitc-lang.org>)
- [3] J. S. Shapiro. *The OpenCM Web Site* (<http://www.opencm.org>)

Software Artifacts

- [1] *The Coyotos Operating System*. A successor to the EROS project. Other successors include L4.sec (Herman Hartig, Technical University of Dresden) and CapROS (Charlie Landau, commercial effort). Like EROS, Coyotos resolves some architectural issues in EROS, and will in due course seek high-assurance evaluation. (*in progress*, 4,223 lines, 0.91 Person Years, Development cost \$122,615)¹
- [2] *The CapIDL Compiler*. A compiler that translates CapIDL interface specifications to declarations, definitions, and stub implementations in several target languages. (22,468 lines, 5.25 Person Years, Development cost \$1,386,043)
- [3] *The BitC Compiler*. BitC is described above under “Specifications.” The bootstrap compiler is a joint effort between myself and Swaroop Sridhar. It is now sufficiently reliable that work on the BitC runtime library is now beginning, and it will be possible to implement much of the runtime system in BitC itself. (38,418 lines, 9.22 Person Years, Development cost \$1,245,670)
- [4] *The EROS Operating System*. The first implementation of a high-performance capability-based operating system, rearchitected between 2001 and 2003 as a pure microkernel. EROS is an “open source” system, readily available for use by other researchers and educators. As of 2/20/2003, Google reports 342 distinct sites that link to the EROS site, and it has been an active topic of discussion among the Linux community and Slashdot audiences. Various EROS papers have been cited as sources of influence on many later research operating systems, but most notably on L4.sec. (229,675 lines, 60.28 Person Years, Development cost \$17,361,686)

EROS has now spawned two derivatives: Coyotos and CapROS. CapROS is a commercial derivative derived from the EROS research code base. Coyotos is our own successor system, but is also being deployed in three commercial efforts.
- [5] *The OpenCM Configuration Management System*. An open source configuration management system providing high-integrity and high-assurance storage of software development data for the creation of highly secure software. OpenCM is now cited by all of the major pages that reference configuration management tools on the web. (26,605 lines, 6.27 Person Years, Development cost \$846,941)

Grants and Contracts

- [1] *Panasonic Research Collaboration Agreement*, Panasonic Information and Networking Technology Laboratory, \$40,000. Contract completed 2002.

¹ Line counts, person years, and development cost estimates generated using David A. Wheeler's “SLOCCount” tool. SLOCCount is widely accepted as the preferred tool for line count estimation. It's estimates of development time and cost are derived using the Basic COCOMO model assuming typical developers. They are provided as an independent means to calibrate the level of effort involved. Actual development times for these artifacts was about half of the SLOCCount estimates. SLOCCount was directed to use an annual salary assumption of \$110,000, which is typical for systems programmers performing this type of development. All figures *exclude* externally authored subsystems that have been integrated into the distributions.

- [2] *EROS-Based Confined Capability Client*, DARPA, \$852,596 Contract completed 2003.
- [3] *Secure Development Environment*, Air Force, \$795,848. Contract completed 2003.

Commercial Deployments

- [1] *FOESA: Framework for Open, Exploratory Static Analysis*, OSD/NAVY Phase I SBIR contract effective 1 June 2008. This contract is preparing groundwork for later static analysis of BitC programs. Phase I award \$99,740.
- [2] *SHARP: Secure Hypervisor with Autonomic Recovery*. OSD/USAF Phase I SBIR contract FA8650-07-M-1235 contract effective 25 September 2007. This contract adapts the work for HSARPA to operate hosted in a virtual machine monitor. Phase I award \$99,917.
- [3] *Hardware Assisted System Security Monitor* (subcontract). HSARPA Phase-I SBIR contract NBCHC060046 effective Jan 15, 2006. This contract uses the Coyotos operating system as an embedded runtime platform for a plug-in card to perform host-based security monitoring. Overall phase 1 award \$98,227.

A Phase-II contract NBCHC070061 for was awarded in February 2007 in the amount of \$749,000.

- [4] *Embedded Capability-Based Operating System* (subcontract), DARPA Phase-I SBIR contract W31P4Q-06-C-0034 effective Dec 15, 2005. This contract seeks commercial demonstration of capability-based operating system technology in embedded applications. **All awardees based their proposals on systems derived from the EROS operating system.** The *other* awardee is the commercial developer of the CapROS system, which is an EROS derivative. Overall phase 1 award \$98,839.

Both our effort and the CapROS effort were awarded Phase-II contracts on September 14, 2006, bringing the total investment by DARPA to \$1,7M.

- [5] *Radio-Frequency Knife*. Coyotos is now the preferred software platform for a new medical device, the “radio frequency knife.” The RF knife uses a rapidly oscillating field to cut more cleanly in surgical applications. EROS/Coyotos is being used as the software control platform because of its robustness.

Service and Teaching

Reviewing

Reviewer, 2008 Networking and Distributed Systems

Reviewer, 2007 Software Practice and Experience

Reviewer, 2007 Journal of Computer Security

Reviewer, 2007 Operating Systems Review special issue on Secure Small-Kernel Systems

Reviewer, 2006 IEEE Transactions on Dependable and Secure Computing

Reviewer, 2006 Journal of Computer Security

Reviewer, 2004 Operating System Design and Implementation
Reviewer, 2004 Topics on Computing Systems (TOCS)
Reviewer, 2003 IEEE Symposium on Security and Privacy
Reviewer, 2003 Symposium on Operating Systems Principles
Reviewer, 2002 USENIX Annual Technical Conference

Conference Committees

2008 15th Annual Network & Distributed System Security Symposium. San Diego, CA, February 2008 (NDSS 2008)
2007 14th Annual Network & Distributed System Security Symposium. San Diego, CA, February 2007 (NDSS 2007)
2007 First International Workshop on MicroKernels for Embedded Systems. Sydney, Australia, Jan 2007 (MIKES 2007)
2006 Workshop on Linguistic Support for Modern Operating Systems (PLOS 2006)
2004 IEEE Symposium on Security and Privacy
2004 ACM Conference on Computer and Communications Security
2004 USENIX Conference, FREENIX Track
1990 CompCON Compilers Track session chair

Teaching

600.318/600.418, *Operating Systems*, Spring 2000-01, 74 students.
600.318/600.418, *Operating Systems*, Spring 2001-02, est. 42 students.
600.318/600.418, *Operating Systems*, Spring 2002-03, est. 40 students.
600.318/600.418, *Operating Systems*, Spring 2004-05, est. 25 students.
600.318/600.418, *Operating Systems*, Spring 2005-06, est. 21 students.
600.438, *Advanced Topics in Operating Systems*, Fall 2000-01, 5 students.
600.438, *Advanced Topics in Operating Systems*, Fall 2004-05, 10 students.
600.438, *Advanced Topics in Operating Systems*, Fall 2005-06, 10 students.
600.436, *High Assurance Systems*, Fall 2001-02, 30 students.
600.328/600.428, *Compilers and Program Analysis*, Fall 2003-04, est. 16 students.

Current Students

Michael (Scott) Doerrie, PhD student (advisee, completion expected May 2009)
Swaroop Sridhar, PhD student (advisee, completion expected Dec 2009)
Neal Walfield, Ph.D. candidate (advisee, completion expected May Dec 2009)

Completed Students

Mark Miller, PhD 2006. Dissertation: *Robust Composition: Towards a Unified Approach to Access Control and Concurrency Control*, Johns Hopkins University, May 2006
Anya Kanevsky, MS/CS, Jan 2003
Sandeep Ranade, MS/CS, Jan 2003
Sidney Chen, MS/CS, May 2003 (expected)
Ryan Goltry, MS/CS May 2003

Krister Johansen, BS May 2003
Dan Kalowsky, MS/CS, Dec 2003
Peter Sargent, MS/CS, May 2004
Prashanth Bungale, MS/CS May 2004 – entered PhD program at Harvard
Abhishek Chitlangia, MS/CS May 2004
Sandeep Sarat, PhD student (transferred to Andreas Terzis)
Marc Seaborn, MS/CS, Dec 2004
Anshumal Sinha, MS/CS, Dec 2004

Administrative Service

Member, Faculty Search Committee, 2001-2002
Member, CER Fellowship Committee, 2001-2007
Member, Computer Science Graduate Admissions Committee, 2002-2003, 2004-2005
Member, Computer Science Curriculum Committee, 2002-2003
Member, Computer Engineering Curriculum Committee, 2003-2004
Member, WSE committee on Intellectual Property, 2003-2007
Member, Licensing and Technology Development Advisory Group, 2004-05
Member, Johns Hopkins Technology Transfer Advisory Group, 2005-2007