

M. Scott Doerrie

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Interests:

Formal Methods and Verification, Type Systems, Protection Mechanisms, Security Policies, Capability-based Systems and Run-times, and Robust Operating Systems.

Education:

Johns Hopkins University August 2015
Ph.D., Computer Science
Dissertation: *Confidence in Confinement: An Axiom-free, Mechanized Verification of Confinement in Capability-based Systems*
Advisor: Dr. Jonathan S. Shapiro

Gustavus Adolphus College May 2002
B.A., Computer Science

Technical Expertise:

Professional: Java, JDB, Perl, Python, SQL, C, C++, GDB, GNU Make, Bash, HTML, CSS, JavaScript, Linux kernel tracing, Linux VFS, Linux kernel modules, ACL2, Isabelle/HOL, TWELF, Coq, OCaml, SML, LaTeX, Git, Mercurial, SVN, CVS, QEMU, LotusScript, Lotus @Commands.
Personal: Haskell, Agda, Jekyll, Liquid, Sass, Arduino, Raspberry Pi, OpenSCAD.

Research and Work Experience:

Johns Hopkins University 2003-2015
Graduate Researcher, *Systems Research Laboratory*
Core Technologies: Coq, ACL2, TWELF, Isabelle/HOL, OCaml, SML, Perl, GNU Make, Latex, Mercurial, GIT.

- Conclusively demonstrated that capability-based systems can enforce confinement by leveraging mechanical verification using the Coq proof assistant.
- Increased confidence in the model and widened its future applicability by providing permission propagation theorems independent of any specific policy that are subsequently applied to the confinement problem.
- Hardened the model by providing a general implementation that can be refined to describe any capability system and completes the model for an axiom-free proof.
- Critically assessed multiple first-order and higher-order proof systems including ACL2, TWELF, Isabelle/HOL, and Coq.
- Ensured the Coyotos and BitC projects would be fit for future verification by providing continual feedback through their development.

Johns Hopkins University 2003-2006
Research Assistant, *Systems Research Laboratory*
Core Technologies: C, GNU Make, GDB, GIT, Mercurial, Linux kernel tracing, Linux VFS.

- Was a key participant in the coevolution of BitC and Coyotos.
- Reconciled the Intel paging mechanism with Coyotos' general-purpose guarded page tables.
- Motivated guarded page tables by simulating process behavior taken from traces in Linux and demonstrating that guarded page tables would not add substantial overhead.
- Guided early BitC language development through issues regarding formalization and verification.

Oracular Systems and Software 2002-2003
Software Consultant and System Administrator
Core Technologies: Java, HTML, JavaScript, CSS, LotusScript, Lotus @Commands, SQL, SVN.

- Improved corporate utility to clients by producing rapid prototypes of software services.
- Adapted to client software configurations when realizing prototypes into high-quality deliverables.
- Increased system uptime for clients and the company by diagnosing server and service issues.

Gustavus Adolphus College

2000-2002

Electronic Reserves Developer, *Folke Bernadotte Memorial Library*
Core Technologies: Perl, SQL, GNU Make, HTML, JavaScript.

- Worked within a self-directed and self-managed team to design and deploy the Gustavus Library Electronic Reserves system.
- Took personal responsibility for the system backend and data processing.

Teaching Experience:

Johns Hopkins University

2009

Teaching Assistant to Dr. Jonathan S. Shapiro, *Microkernels*
Core Technologies: C, C++, GNU Make, QEMU, GDB, GIT, Mercurial.

- Provided a constructive environment by assisting students with development and debugging in the Coyotos microkernel.
- Responded to student needs by offering lengthy mentoring sessions every night.

Johns Hopkins University

2006-2009

Instructor, *Operating Systems*
Core Technologies: C, GNU Make, QEMU, GDB, GIT, Mercurial, Linux kernel modules, Linux VFS.

- Responsible for all aspects of course execution.
- Provided an extremely practical, hands-on, and critical examination of operating system design reflecting both academic and practical perspectives.
- Improved the scope of the course by designing and presenting novel materials on 64-bit memory architectures, Linux kernel module development and in-kernel debugging, and capability-based systems.
- Prepared students professionally with advanced course material including the slab allocator, file-system implementations and Linux VFS, microkernels, and virtualization techniques.

Johns Hopkins University

2007

Lecturer, *TWELF Lecture series, Systems Research Laboratory*
Core Technologies: TWELF.

- Introduced the Systems Research Laboratory to verification techniques in TWELF by designing and presenting a half-semester lecture series.
- Communicated topics in advanced type theory and totality analysis and their relationship to mathematical proofs.

Publications:

M. S. Doerrie, *Confidence in Confinement: An Axiom-free, Mechanized Verification of Confinement in Capability-based Systems*, Ph. D. Dissertation, July 2015.

J. S. Shapiro, M. Scott Doerrie, E. Northup, S. Sridhar, and M. Miller, "Towards a Verified, General-Purpose Operating System Kernel", *Proc. 2004 NICTA Operating Systems Verification Workshop*, 2004.

J. S. Shapiro, S. Sridhar, S. Doerrie, M. Miller, E. Northup. *BitC Language Specification*, June 2006.

Honors and Awards:

1998 - 2001 Gustavus Dean's List

1998 - 2001 Trustee Scholarship

1998 - 2001 Norelius Service Award

1998 BSA Eagle Scout