

Education

- **University of Maryland, College Park** College Park, MD
Ph.D. in Computer Science; GPA:3.9 *Expected Fall 2015*
- **Johns Hopkins University** Baltimore, MD
M.S. in Security Informatics; GPA:3.9 *May 2008*
- **University of Iowa** Iowa City, IA
B.S. in Computer Science & Mathematics; GPA:3.85 *May 2006*

Experience

- **University of Maryland, College Park** College Park, MD
Research Assistant - Dynamic Software Updating Projects: *January 2012 – Present*
 - *Evolving NoSQL Databases Without Downtime:* Developed a solution to support the evolution of high-availability applications and their NoSQL data on-line, without excessive delays or interruptions to the connected users
 - *Dynamic Controller Upgrades for Software-Defined Networks:* Researched dynamically updating software-defined network controllers without losing any network application state or interrupting communications with switches
 - *C-Strider: Type-Aware Heap Traversal for C:* Developed a framework for custom automated type-aware heap traversals for C programs that allows programmers to tailor heap traversal actions with simple API calls
 - *Scalability in Dynamic Software Updating:* Enabled the Snort Intrusion Detection System and all dynamic plugins (~214K lines of code) to be dynamically updated from versions 2.9.2 - 2.9.2.3 in a few hundred milliseconds with no lost packets
 - *Dynamic Software Update Quiescence for Multithreaded Programs:* Demonstrated empirically that real-world, event-driven, multithreaded programs can be updated with minimal delay using only a small number of manually annotated update points
- **Google, Inc.** New York, NY
Software Engineering Intern *Summer 2014*
 - Worked with the network modeling group to implement generic end-to-end flow path modeling in Google's B4 software-defined network using C++ and protocol buffers
- **University of Maryland, College Park** College Park, MD
Teaching Assistant - Intro to Engineering Design *Fall 2010*
 - Assisted in teaching Arduino/C programming to 270 students across 6 lab sections
- **The Johns Hopkins University Applied Physics Laboratory** Laurel, MD
Computer Security Research Engineer *January 2008 – July 2010*
 - Designed algorithms and implemented prototypes for malware detection in Linux volatile memory images based on x86 architecture constructs
 - Modified a network interface card driver to implement security mechanisms for a custom Linux microkernel
 - Expanded GNU Radio code (C++ blocks and Python files) and created Wireshark plug-ins to assist in a wireless networks information assurance project
 - Reverse engineered an embedded protocol to detect vulnerabilities and implement a mediation strategy
 - Wrote proposals for internal and external funding and grants related to my research interests; awarded an internal research expansion and composition grant
 - Collaborated with a large team of engineers to meet sponsor requirements on a kernel-level software development project in C/x86

- **MITRE Corporation** Hanover, MD
Distributed/Embedded Systems Engineer Intern Summer 2007
 - Researched embedded systems running QNX
 - Reverse-engineered network equipment using IDAPro
- **University of Iowa** Iowa City, IA
Computer Science Honors Senior Research Project 2005-2006
 - Programmed a cell phone to communicate with sensor notes through Bluetooth using J2ME

Additional Internships:

- **National Security Agency** Ft. Meade, MD
Internship - Secure Software Development Summer 2005
- **State Farm Insurance** Bloomington, IL
Internship - Java/JUnit Testing Summer 2004
- **John Deere** Davenport, IA
Internship - Java/WebSphere Development Summer 2003
- **Rockwell Collins** Cedar Rapids, IA
Internship - Requirements for Flight Display Head Modules Summer 2002

Awards and Activities

Scholarships and Awards:

- NSF Graduate Research Fellowship: Honorable Mention 2011
- NSF Scholarship for Service 2006
- Callen Prize Recipient 2006
Awarded to one College of Liberal Arts & Sciences student at the University of Iowa
- Graduated with Honors and Distinction in Computer Science - University of Iowa 2006

Select Activities:

- CRA-W (Computer Research Association's Committee on the Status of Women in Computing Research) Graduate Cohort Workshop - Poster Presentation 2012
- Digital Forensics Research Workshop Challenge - 2nd Place 2008
with The Johns Hopkins University Applied Physics Laboratory

Select Publications

- [1] Christopher M. Hayden, Karla Saur, Edward K. Smith, Michael Hicks, and Jeffrey S. Foster. Kitsune: Efficient, general-purpose dynamic software updating for c. *ACM Trans. Program. Lang. Syst.*, 36(4): 13:1–13:38, October 2014. ISSN 0164-0925. URL <http://doi.acm.org/10.1145/2629460>.
- [2] Christopher M. Hayden, Karla Saur, Michael Hicks, and Jeffrey S. Foster. A study of dynamic software update quiescence for multithreaded programs. In *Proceedings of the Workshop on Hot Topics in Software Upgrades*, pages 6–10, June 2012.
- [3] Karla Saur and Julian B. Grizzard. Locating x86 paging structures in memory images. *Digital Investigation*, 7:28–37, 2010.