Arlo Luca Albelli | Curriculum Vitae

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GitHub

Skills

- **Architectures:** x86, ARM, RISC-V
- **Languages:** C (Proficient), Python (Familiar), C++ (Familiar), SQL (Beginner)
- **Systems & Tools:** Linux, Research Operating Systems, Open-Source Development Tools (gdb, git, gcc, etc.), Docker, Virtualization Tools (qemu, libvirt)

Education

Boston University
2021 - ongoing
Ph. D. - Computer Science
Boston, MA
Advisor: Jonathan Appavoo

Research Focus: Understanding and exploiting relationships between hardware and low-level, device-specific software to develop systems with the ability to introspect and self-optimize.

Boston University
2016 - 2020
BS - Neuroscience, Minor - Computer Science
Boston, MA

Projects

Porting and Generalizing Dynamic Privilege in Linux 2021 - present
Porting Dynamic Privilege across architectures to lay the foundation for a Linux infrastructure both for gathering and conducting performance studies in an architecturally independent way, and uncover opportunities for optimization.

- Implemented the necessary primitives to enable Dynamic Privilege for the ARM architecture, and explored various approaches to supporting the dynamic privilege runtime model with respect to the ARM memory protection scheme and page tables
- Integrated x86 and ARM implementations to a single code base with careful separation of common and architecture-specific paths
- Introduced a potential RISC-V implementation of Dynamic Privilege inspired by the port to ARM
- Carried out detailed cross-architectural comparison of how both existing kernel code and specifics of the hardware architecture intersect to shape the implementation of Dynamic Privilege
- Explored the use of Dynamic Privilege to enable the creation of a Linux process-caching infrastructure for use in deploying optimizations that have been explored in specialized systems in the past

SymbiOS 2020 - present

Promoting app threads to kernel privilege, advancing the state of the art in how operating systems can evolve or incorporate new functionality.

- Ported x86 prototype of the project to the ARM infrastructure by introducing a syscall to allow a thread to switch from EL0 to EL1
- Developed various tools for the x86 prototype including: a library for leveraging our kElevate syscall to perform shallow and deep shortcuts on read and write system call paths, a tool for interposing on or replacing a given system call handler on x86 Linux, a tool for copying, modifying, and installing a core's Interrupt Descriptor Table on x86 Linux, and a tool to interpose on shared library symbol resolution using ld_preload to transparently shortcut write system calls for a given binary
- Automated setup and configuration of TFTP server to bootstrap hardware nodes for running experiments

Foundations in Open Source Education May 2022 - Feb 2023

In the current technological landscape, knowledge of how computer systems work, and access to this knowledge, is attendant to creating an educated populace. OPE combines open hardware and open source software to enable authoring, publishing, and collaborating on high quality computer science educational material, and making such material accessible to anyone with a web browser.

- Helped lead the effort to develop a rich environment for authoring and deploying high quality, open source educational materials
- Provided detailed statements of goals and priorities to structure the collaboration between BU and Red Hat Research on this project
- Served as a mentor for Red Hat interns involved with OPE
- Acted as editor for a Computer Systems textbook, UCSLS, that serves as an example of what can be achieved using the OPE environment, and is used in the instruction of a large Computer Systems course at BU

Programmable Smart Machines Lab (PSML) 2019 - present

Exploring aggressive approaches to future computer systems that combine biologically-inspired learning techniques with the core operation of the classic Von Neumann architecture.

- Explored a vast body of literature on cortical function and cortex-based algorithms, such as Hierarchical Temporal Memory (HTM) and Cortical Network Simulator (CNS)
- Explored the use of succinct data structures such as compressed suffix trees for storing and evaluating trace data
- Used the SDSL library for succinct data structures to store and analyze temporal trace data
- Worked cooperatively with data science team to ensure proper structures used for data storage and manipulation

Posters and Talks

Poster • **Stellux: Exploring Fine-Grain Privilege Access in a Clean-Slate Kernel, SOSP 2024**
Albert Slepak, Arlo Albelli, Thomas Unger, Jonathan Appavoo

Talk • **Porting and Generalizing Dynamic Privilege in Linux, DevConf 2024**
Arlo Albelli

Poster • **Introducing the Chrono-kernel: Kernel Privilege for the People**
Thomas Unger, Arlo Albelli, Ryan Sullivan, Orran Krieger, Jonathan Appavoo, Larry Woodman, Ulrich Drepper, Richard Jones, Daniel Bristol de Olivera

Poster • **Open Source Education: From Philosophy to Reality**
Arlo Albelli, Orran Krieger, Jonathan Appavoo, Heidi Dempsey, Larry Woodman

Talk • **New Sheriff in Town: Deputizing Application Threads to Kernel Privilege for Performance, Profit, ...and Safety???**
Thomas Unger, Arlo Albelli, Ryan Sullivan, Ali Raza, Eric Munson, Daniel Bristol de Oliveira, Larry Woodman, Ulrich Drepper, Richard Jones, Orran Krieger, Jonathan Appavoo

Talk • **Abstraction, Programmability, & Optimization: The Sandbox and the Sanctuary**
Thomas Unger, Ali Raza, James Cadden, Arlo Albelli, Amos Waterland, Jonathan Appavoo, Orran Krieger

Teaching Experience

My teaching philosophy centers the notion that connecting a low-level understanding of a system with the abstractions we build from system primitives is vital to any Computer Science education, and is the foundation for deep and lasting understanding. I aim to support students through guided and structured self-exploration, rather than prescriptive recipes, to build a conceptual framework that will serve them far beyond their time in the course.

Course Manager • CS210 Computer Systems • Boston University Fall 2022
- Helped design and develop a container image for a novel use of RHODES on OpenShift - both in production and experimental platforms (AWS, NERC), and oversaw its deployment for a class of 250 students
- Developed textbook and lab material to deepen students understanding of UNIX concepts, bash, assembly programming, the C language, and advanced gdb techniques
- Coordinated Teaching Fellows and Course Assistants to facilitate content creation, testing, and distribution

Teaching Fellow • CS210 Computer Systems • Boston University Spring 2022
- Managed troubleshooting bootstrapping and deployment of open source education infrastructure for a class of 250 students
- Built, edited, and deployed textbook and assignment material in the cloud server environment provided for the students
- Taught weekly discussion sections on technical details of computer systems to support deeper understanding
- Directed a team of 12 staff members to coordinate meetings, grading, and various administrative tasks

Teaching Assistant • CS210 Computer Systems • Boston University Spring & Fall 2020
- Taught several discussion sections weekly and prepared lessons to deepen students' understanding of lecture concept
- Cooperated in the building of the virtual environment used for instruction and student assignments
- Developed and facilitated in-class lab activities to get students familiar with the infrastructure

Awards and Grants

"Towards Open Source Education"
Red Hat Collaboratory Student Research Award
Arlo Albelli, Jonathan Appavoo
Summer 2022