Paul Crews

ptcrews.jr@gmail.com | 253-740-4160 | Website: https://ptcrews.github.io | GitHub: https://github.com/ptcrews

EDUCATION

Stanford University   Stanford, CA

- *Master of Science in Computer Science; GPA: 4.039*   *Jan. 2018 - June 2019*
  Bachelor of Science in Computer Science; GPA: 3.809   *Sept. 2014 - June 2018*
  - **Relevant Courses**: Operating systems, computer security, cryptography, advanced cryptography, networking, advanced networking, compilers, secure compilation, and distributed systems.

Stanford Center for Professional Development   Stanford, CA
Non-Degree Option; GPA: 4.0   *Sept. 2021 - Dec. 2021*
  - **Relevant Courses**: Cloud computing.

EXPERIENCE

Google   Mountain View, CA
Software Engineer, Security Foundation Team   *September 2019 - Present*

- **Measured Boot**: Currently leading a project which validates the root filesystem at boot-time for production machines at Google. Improved validation reliability by $> 95\%$, and designed a solution to eliminate all failures. Implemented and rolled out the project to $> 50\%$ of production machines in audit mode. Designed and proposed improvements to the project's security guarantees using Linux kernel features (fs-verity, eBPF). Responsible for implementing and maintaining project testing, monitoring, and alerting infrastructure.
- **Security Research**: I started and am currently leading a research project focused on how to design applications to handle a compromise. Formally defined what it means for an application to recover from a compromise (*recoverability*) and what security properties can be recovered, and encoded these definitions in Isabelle/HOL. Currently working on implementing a security-critical application then formally proving it is recoverable. Presented this research at the YArch Workshop at ASPLOS 2022, as a poster at USENIX Security 2022, and as a talk at NESVD 2022.

AT&T Foundry   Palo Alto, CA
Software Engineering Intern   *June 2018 - Aug 2018*

- **Network Proxy**: Developed a network proxy for the Hyper Precise Positioning Project which broadcasts GPS correction data over AT&T's cellular network, improving positioning accuracy by two orders of magnitude.
- **Efficiency**: Defined and implemented a custom compression algorithm and queuing system that reduced the overall message size by more than 35% and reduced the total message count by about 40%.
- **Security**: Implemented a security overlay to restrict who can receive the correction data, while also providing message authentication and support for periodic key rotations. Submitted a patent to AT&T's patent team.

Stanford University   Stanford, CA
Undergraduate Researcher, TockOS Project   *March 2017 - June 2018*

- **6LoWPAN**: Implemented 6LoWPAN compression, decompression, and fragmentation, bringing IPv6 networking over low-power wireless links to the Tock platform, substantially increasing the viability of the system.
- **Wireless Updating**: Implemented the Deluge protocol for sending binary updates over low-power wireless networks, allowing userland programs to be updated remotely on the Tock platform.
- **SPI**: Extended the existing Serial Peripheral Interface (SPI) codebase to support running Tock as an SPI Slave device, enabling the use of Tock with peripherals that operate only in SPI Master mode.

The Raytheon Company   Melbourne, FL
Reverse Engineering Intern   *June 2016 - Sept 2016*

- **Hypervisor Vulnerability Analysis**: Performed static and dynamic analysis on a widely used commercial hypervisor, using industry-standard reversing tools along with custom kernel drivers for dynamic analysis and fuzzing.

Extracurricular Organizations

- **Applied Cybersecurity Club** Stanford, CA
  Club President, Project Team Lead *Oct 2015 - June 2019*
    - **Leadership**: Responsible for organizing and leading workshops, technical demonstrations, and competition trainings. Focused on teaching both high-level security concepts and analyzing real-world security vulnerabilities.
    - **Projects**: Led a group of club members interested in development related to computer security. Projects include fuzzer development, exploit writing, and security tool development.
    - **Competitions**: Participated in several collegiate computer security competitions, both as part of an offensive team (CPTC) and as a defensive team (CCDC). Placed first in the 2017 and 2018 CPTC National competitions.

Publications and Patents

- **DCOSS 2020 Paper**: *Design Considerations for Low Power Internet Protocols*. Hudson Ayers, **Paul Crews**, Hubert Teo, Conor McAvity, Philip Levis, Amit Levy. International Conference on Distributed Computing in Sensor Systems (DCOSS), May 2020.
- **AT&T Broadcast Security Patent**: *Mechanisms and apparatus for securing broadcast content distribution of time-sensitive data*. Julius Mueller, **Paul T. Crews**. Filed February 2019. Issued US Patent 11,424,923 August 2022.

Workshops and Talks

- **NESVD 2022 Talk**: *Defining recoverability for arbitrary security properties*. **Paul Crews**, Christopher Hahn, Jon McCune, Caroline Trippel. New England Systems Verification Day (NESVD), October 2022.
- **USENIX Security 2022 Poster**: *A Formal Foundation for Recoverability*. **Paul Crews**. USENIX Security Symposium, August 2022.
- **YArch Workshop 2022**: *Designing SGX Applications for Recoverability*. **Paul Crews**. Young Architects Workshop (YArch'22) at ASPLOS, February 2022.
- **SenSys 2018 Poster**: *Design Considerations for Low Power Internet Protocols*. Hudson Ayers, **Paul Thomas Crews**, Hubert Hua Kian Teo, Conor McAvity, Amit Levy, Philip Levis. ACM Conference on Embedded Networked Sensor Systems (SenSys), November 2018.
- **SOSP 2017 Tutorial**: *SOSP Tutorial: Tock Operating System*. Amit Levy, Daniel B. Giffin, Bradford Campbell, **Paul Thomas Crews**, Mateo Garcia, Branden Ghena, Shane Leonard, Pat Pannuto, Hubert Teo, Prabal Dutta, Philip Levis. ACM Symposium on Operating Systems Principles (SOSP), October 2017.
- **CURIS 2017 Poster**: *Bringing IP Networking to the Internet of Things*. **Paul Crews**, Mateo Garcia, Hubert Teo. Stanford Undergraduate Research Internship in Computer Science (CURIS), September 2017.

Honors and Awards

- **Siebel Scholar, 2019**: Selected by the Siebel Scholars Foundation as a member of the class of 2019.
- **Collegiate Penetration Testing Competition, 2018**: 1st Place (Stanford University)
- **Collegiate Penetration Testing Competition, 2017**: 1st Place (Stanford University)

Programming Skills

- **Languages (Ordered by Experience)**: C++, Go, C, Python, Rust, Java