

Akshith Gunasekaran

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Summary

Security researcher with a focus on System Security and Software Engineering. Skilled in LLVM, learning MLIR, developing program analysis tools to identify and mitigate security vulnerabilities in large software systems.

Work

- 2022 **Program Analysis Research Intern, SRI International, Melno Park, CA**
- Worked on identifying malicious influence operations on large open-source software projects using a combination of code change analysis and social dynamics mined from patch contributions.
 - I specifically developed a graph-based model of code evolution to identify code changes that introduce security vulnerabilities.
 - We integrated the analysis pipeline into our CI/CD system to flag potentially malicious code changes in the Linux Kernel.
 - Tools: LLVM, Static Analysis, Tree Sitter, Neo4j, Mining Software Repositories, Linux Kernel.
- 2021 **Reverse Engineer Research Intern, Intelligent Systems Lab, PARC, Palo Alto, CA**
- Worked on reverse engineering and isolating algorithms from control binary for software re-synthesis to eliminate backdoors.
 - Evaluated and implemented various decompilation techniques as well as a neural decompilation method to locate and isolate software features.
 - Contributed to the genetic algorithm for software re-synthesis that optimizes the search space for re-synthesis.
 - Tools: Ghidra(API), GDB, Python, Genetic Algorithms.
- 2014 - 2017 **Founding Team Developer, Simpl, Bangalore, India**
- Developed a credit based payment platform used by around 7 million while at Simpl to over 25 million users today.
 - Along with 5 other engineers, we built the core microservice based technology stack.
 - Along with 2 other engineers, we built the data analysis platform to support the business with insights and analytics.
 - I took an interest in security and volunteered to take on the responsibility of platform integrations and security.
 - Tools: Golang, Ruby on Rails, AWS, CI/CD, Python, Kafka, Spark, Cassandra, Web and API Security.

Publication

- 2023 **SENSOR: Graph-based Revision History Analysis for Code Evolution Introspection, Akshith Gunasekaran, Huascar Sanchez, Briland Hitaj**
- We present a graph-based model of code evolution to identify code changes that introduce security vulnerabilities.
 - We integrate the analysis pipeline into our CI/CD system to flag potentially malicious code changes in the Linux Kernel.
 - Tools: LLVM, Static Analysis, Tree Sitter, Neo4j, Mining Software Repositories, Linux Kernel.
- 2023 **In Pursuit of Lean OS Kernels - Examining Benefits and Barriers to Unlocking Aggressive Debloating, Akshith Gunasekaran, Gabriel Ritter, Rakesh Bobba, Yeongjin Jang**
- We systematically study the kernel configuration space to identify improvements to that can further help reduce kernel size.
 - Additionally, we improve existing kernel configuration specialization technique by handling the noise from kernel's non-determinism resulting in upto 20% more reduction in kernel size.
 - Tools: LLVM, Kconfig, SAT Solvers, Program Analysis.

- 2022 **CONSTRUCT: A Program Synthesis Approach for Reconstructing Control Algorithms from Embedded System Binaries in Cyber-Physical Systems**, *Ali Shokri, Alexandre Perez, Souma Chowdhury, Chen Zeng, Gerald Kaloor, Ion Matej, Peter-Patel Schneider, Akshith Gunasekaran, and Shantanu Rane*
- We present a program synthesis approach to reconstruct control algorithms from embedded system binaries in cyber-physical systems.
 - We evaluate multiple traditional decompilation techniques and a neural decompilation method to locate and isolate software features.
 - Tools: Ghidra, GDB, Python, Genetic Algorithms.
- 2019 **MultiK: A Framework for Orchestrating Specialized Kernels**
- A framework to specialize kernel for specific workloads with the goal of reducing the attack surface.
 - Supports running multiple specialized kernels on a single machine.
 - Tools: Linux Kernel, Runtime Profiling, Binary Specialization, QEMU, GDB.
- NDSS 2019 **Balancing Image Privacy and Usability with Thumbnail-Preserving Encryption**
- Image encryption scheme that balance privacy and usability.
 - Readily deployable on existing cloud platforms without any modification to the cloud infrastructure.

Education

- 2017 - 2024 **MS/PhD - Computer Science**, *Oregon State University, Corvallis OR*
- Area of focus: System Security, Program Analysis.
 - Co-Advised by: Rakesh Bobba, Yeongjin Jang
 - Completed coursework in CS Theory (algorithms, graph theory, distributed systems), Security (operating systems, cryptography), AI (machine learning, reinforcement learning, machine learning for security), and PL (Programming Languages, Functional Programming).

Activities

CTF Team, *OSUSEC*, Oregon State University, Corvallis OR

- Competed in DEFCON CTF, BSides PDX CTF, NSA Codebreaker.
- Made it to DEFCON 2022 Finals, 16th place.
- Skills: Pwn, Reverse Engineering, Program Analysis

External Reviewer

- IEEE Symposium on Security and Privacy (Oakland), 2022.
- ACM Conference on Computer and Communications Security (CSS), 2021, 2022, 2023, 2024.
- ACM Asia Conference on Computer and Communications Security (ASIACCS) 2023, 2024.
- IEEE International Conference on Dependable Systems and Network (DSN), 2019, 2022, 2023.
- IEEE Real-Time Systems Symposium (RTSS), 2021, 2022.
- IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS), 2019.

- 2021 **Shadow Program Committee**, *IEEE Security and Privacy*

Teaching Assistant

- CS427 Cryptography - Winter 2021
- CS370 Introduction to Security - Fall 2021
- CS290 Web Technologies and Web Security - Fall 2017

- Summer 2019 **Instructor**, *Pacific North West Cyber Camp*

- Taught a week-long hands-on educational camp in basic computer/network security hardening and cyber ethics.

- Summer 2018 **Volunteer**, *Pacific North West Cyber Camp*

Last updated: February 2, 2024