

William Blair

GraalVM
Oracle Labs
Washington, D.C.
U.S.A.

url: <https://wdblair.io>
associations: ACM, IEEE
[google scholar](#)

Current Position

Senior Member of Technical Staff, Oracle Labs

Research Interests

I am interested in developing novel program analysis techniques and defenses for cybersecurity. I currently work on this topic on the GraalVM team within Oracle Labs. Previously, I explored how binary analysis tools can inform runtime monitors for cloud services. I had the opportunity to investigate this cloud security topic while interning in the Cyber Security Intelligence (CSI) team at IBM Research where I participated in the DARPA Cyber-Hunting at Scale (CHASE) program. I also use memory protection keys (MPKs) available in recent Intel CPUs to develop techniques to improve applications' memory safety, which is done as a part of the NSF Secure and Trustworthy Cyberspace (SaTC) Taming Memory Corruption with Security Monitors program.

Earlier in my PhD, I worked on *micro-fuzzing*, a novel fuzz testing technique to detect algorithmic complexity (AC) vulnerabilities in production Java programs and libraries. I evaluated the proposed micro-fuzzing technique with HotFuzz, a fuzz testing framework that detects AC vulnerabilities in Java libraries during the DARPA Space and Time Analysis for Cybersecurity (STAC) program. HotFuzz has detected previously unknown vulnerabilities in the Java Runtime Environment (JRE) that have been confirmed by Oracle and IBM. Furthermore, HotFuzz has found bugs in popular Java libraries, including `org.json`.

Education

2014-2023	PhD in Computer Science, Boston University Advisors: Manuel Egele, Hongwei Xi
2012-2014	MS in Computer Science, Boston University Project: <i>Dependent Types for Real Time Constraints</i> Advisor: Hongwei Xi
2008-2012	BA in Computer Science, Boston University

Publications

- 2023 Mark Lemay, Qiancheng Fu, William Blair, Cheng Zhang, Hongwei Xi. A Dependently Typed Language with Dynamic Equality. In Proceedings of the ACM SIGPLAN International Workshop on Type-Driven Development (TyDE), Seattle, WA, US, September 2023.
- 2023 William Blair, William Robertson, Manuel Egele. ThreadLock: Native Principal Isolation Through Memory Protection Keys. In Proceedings of the ACM ASIA Conference on Computer and Communications Security (ASIACCS), Melbourne, VIC, Australia, July 2023.
- 2022 William Blair, William Robertson, Manuel Egele. MPKAlloc: Efficient Heap Meta-Data Integrity Through Hardware Memory Protection Keys. In Proceedings of the Conference on Detection of Intrusions and Malware & Vulnerability Assessment (DIMVA) Cagliari, Sardinia Italy, June 2022.
- 2022 William Blair, Andrea Mambretti, Sajjad Arshad, Michael Weissbacher, William Robertson, Engin Kirda, Manuel Egele. HotFuzz: Discovering Temporal and Spatial Denial-of-Service Vulnerabilities Through Guided Micro-Fuzzing. In the ACM Transactions on Privacy and Security (TOPS) April 2022.
- 2021 Leila Delshadtehrani, Sadullah Canakci, William Blair, Manuel Egele, Ajay Joshi. FlexFilt: Towards Flexible Instruction Filtering for Security. In Proceedings of the Annual Computer Security Applications Conference (ACSAC) December 2021.
- 2020 William Blair, Andrea Mambretti, Sajjad Arshad, Michael Weissbacher, William Robertson, Engin Kirda, Manuel Egele. HotFuzz: Discovering Algorithmic Denial-of-Service Vulnerabilities Through Guided Micro-Fuzzing. In Proceedings of the ISOC Network and Distributed System Security Symposium (NDSS) San Diego, CA US, February 2020.
- 2017 William Blair, Hongwei Xi. Dependent Types for Multi-Rate Data Flows in Synchronous Programming. In Post-Proceedings of the ACM ML/OCAML Workshop September 2015.

Patents

- 2023 Frederico Araujo, William Blair, Teryl Paul Taylor. Stateful Microservice-Aware Intrusion Detection. US Patent 11,720,667
- 2023 Frederico Araujo, Teryl Paul Taylor, Jiyong Jang, William Blair. Intrusion Detection in Micro-Services through Container Telemetry and Behavior Modeling. US Patent 11,748,473
- 2023 Frederico Araujo, William Blair, Sanjeev Das, Jiyong Jang. Guided Micro-Fuzzing through Hybrid Program Analysis. US Patent Application 17/444,497
- 2023 Frederico Araujo, William Blair, Teryl Paul Taylor. Automated Synthesis of Reference Policies for Runtime Microservice Protection. US Patent Application 17/390,881

Talks

- 2021 Symbolic Modeling of Micro Services for Intrusion Detection
IEEE Symposium on Security and Privacy Poster Session 2021

2021	Microservice-Aware Reference Monitoring through Hybrid Program Analysis <i>FloCon 2021 at CMU Software Engineering Institute (SEI)</i>
2019	HotFuzz: Finding Space and Time Vulnerabilities in Java Programs <i>DARPA Space and Time Analysis for Cybersecurity P.I. Meeting</i>
2016	Continuum: Finding Space and Time Vulnerabilities in Java Programs <i>DARPA Space and Time Analysis for Cybersecurity P.I. Meeting</i>
2016	Side Channels and Worst Case Behavior in Java <i>Northeastern-WPI Seminar on Security</i>
2015	Using a Portfolio of SMT Solvers in Software Development <i>NEPLS Fall at Tufts University</i>
2015	Dependent Types for Real Time Constraints <i>ACM Sigplan ML Workshop at ICFP 2015</i>
2015	Integrating SMT into Software Development <i>NEPLS Spring at Wesleyan University</i>
2014	Debugging with Types in ATS <i>Boston Haskell Meetup</i>

Service

2023	Session Chair for ACM ASIA Conference on Computer and Communications Security
2022	Sub-Reviewer for IEEE Symposium on Security and Privacy, IEEE European Symposium on Security and Privacy
2021	Trojan Horse Award reviewer for the IEEE Symposium on Security and Privacy
2021	Shadow Program Committee member for the IEEE Symposium on Security and Privacy
2021	Sub-Reviewer for NDSS, USENIX Security
2020	Sub-Reviewer for ACM CODASPY, DSN, USENIX Security
2019	Sub-Reviewer for ACM CODASPY
2018	Artifact Evaluation Committee member for ACSAC
2018	Sub-Reviewer for ACSAC, RAID, DIMVA, ACM CODASPY
2017	Artifact Evaluation Committee member for ACSAC
2017	Sub-Reviewer for ACM CODASPY

Teaching

Spring 2021	TF for CS210 Computer Systems Lectured on fundamentals of UNIX and C programming and helped students with their programming assignments. Over the course of the semester students implemented their own calculator that parsed and evaluated mathematical expressions given in infix notation. Their calculators used reverse polish notation (RPN) as an intermediate representation for simple arithmetic equations.
Fall 2020	TF for CS630 Graduate Design and Analysis of Algorithms
Fall 2019	Lectured on topics including Linear Algebra, LUP Decomposition, Complexity, Approximation Algorithms, Randomized Algorithms, and Linear Programming. Managed a small team of graders.

Spring 2015	TF for CS111 Introduction to Computer Science
Fall 2014	Assisted students through a breadth first introduction to Computer Science that covers programming in Functional, Imperative, and Object Oriented paradigms. Other topics such as Computer Organization, Assembly Programming, and Computational Complexity were briefly introduced as well. The class was adapted from the “CS For All” class developed at Harvey Mudd University. My role included leading discussion sections, grading, and holding office hours.
Spring 2014	TF for CS211 Object Oriented Programming
	Assisted students with learning Objective C and writing applications for iOS devices. Students first built familiarity with the iOS environment by gradually constructing a tweeting App in iOS, and then developed their own original apps.

Awards

2021	IBM Invention Plateau Award
2020	IBM First Patent Application Award
2020	3rd Place speaker at 7th Annual BU CISE Graduate Student Workshop (CGSW 7.0)
2019	2nd Place speaker at 6th Annual BU CISE Graduate Student Workshop (CGSW 6.0)
2018	Student Travel Award to the IEEE Symposium on Security and Privacy
2016	Sixth Summer School on Formal Techniques at Menlo College
2015	Verification Mentoring Workshop at the International Conference on Computer Aided Verification (CAV)

Professional Experience

2023-present	<i>Senior Member of Technical Staff</i> at Oracle Labs Investigating language-based security topics within the GraalVM.
2019-2021	<i>Research Intern</i> at IBM Research, Thomas J. Watson Research Center Investigated topics related to Intrusion Detection in Microservices with the Cyber Security Intelligence (CSI) team.
2015	<i>Software Engineer Intern</i> at ViaSat Assisted in developing a business process engine (BPE) that provides a fault tolerant programming framework for executing and managing workflows across distributed systems.
2013	<i>Software Engineer Intern</i> at ViaSat Investigated how mobile applications received multi-media from content providers by reverse engineering native ARM libraries in Android applications, and using a man-in-the-middle server to augment Javascript applications.
2009-2012	<i>Software Engineer</i> at 829 Studios LLC Designed, implemented, and deployed OfferedLocal, a web application that allows businesses to run location based advertising campaigns across social networks like Facebook and Twitter. The start-up participated in Mass Challenge and was featured in the Demo Fall 2011 Conference. Developed and maintained the back office system for the Licensing Industry Merchandisers Association (LIMA), along with an online directory of member companies.

2009-2010

Technician at BU Electronics Design Facility

Developed firmware for a medical prototype as part of the Fluorescence-Assisted Resection and Exploration (FLARE) project at Beth Israel Deaconess Medical Center. The system allowed an external device to control the power output of lasers and regulated their temperature using Peltier coolers. The firmware featured serial communication, analog to digital controllers (ADC) to measure laser temperature, and proportional integral and derivative (PID) controllers to control the Peltier coolers' temperature via pulse width modulation. Assisted in the design, layout, and testing of circuit boards for Physics experiments, including the Compact Muon Solenoid (CMS) experiment at CERN.