Tong Zhang

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Compiler Engineer at SAMSUNG Electronics, focus on system software engineering and research, Linux Kernel, FreeBSD, LLVM Contributor, Security Researcher (e.g. CVE-2022-0487).

EDUCATION

Virginia Tech, Blacksburg, VA *PhD, Computer Science and Application, 2019*
Advisor: Dr. Changhee Jung and Dr. Dongyoon Lee.
My research focuses on system software: Operation System, Compiler, Programming Language, Program Analysis.
Virginia Tech, Blacksburg, VA *MS, Computer Science and Application, May 2019*
Selected Coursework: Ubiquitous Parallelism, Advanced Topics in Compilers and Computer Architecture, Translator Design and Construction, Advanced Topics in Software Engineering, CPS Software Security, Multiprocessor Programming
Shandong University, Jinan, China *BE, Software Engineering, May 2013*

SKILLS

Operating System and Virtual Machine : Linux Kernel / RTOS, device driver, linux perf tool, KVM, QEMU
Compiler : LLVM middle/backend, Pin Tool, runtime library, program analysis, fuzzing, verification
Programming Languages : C, C++, ASM, Bash Script, Makefile, CMake

RESEARCH AND TECHNICAL EXPERIENCE

Samsung Semiconductor, San Jose, CA *Staff Compiler Research Engineer* *Mar 2023 - present*
• Lead Memory simulator team, develop and maintain x86 and CXL device simulator, driver, runtime library and OS support. Propose and draft patents for new device and techniques.
Samsung Semiconductor, San Jose, CA *Sr. Compiler Research Engineer* *Jan 2020 - Mar 2023*
• Responsible for development of SSD simulator and CXL device simulator, PoC, host software stack including driver, runtime library and OS support. Propose and draft patents for new device and techniques.
Samsung Research America, Mountain View, CA *Research Intern* *May-August, 2018*
Mentored by Dr. Wenbo Shen, supervised by Dr. Ahmed Azab.
•I worked on PeX, a permission check analysis framework for Linux kernel. Our PeX tool have discovered real bugs in Linux kernel.
Virginia Tech, Blacksburg, VA *Graduate Research Assistant* *2014 - 2019*
Advised by Dr. Dongyoon Lee and Dr. Changhee Jung.
My research topic is to use compiler techniques, modern hardware features for software bug detection. My works are listed below:
•*TxRace* is a dynamic data race detector for in-house testing. It takes advantage of Intel HTM(hardware transactional memory).
•*ProRace* is a dynamic data race detector for production setting. It leverages hardware PMU(performance monitor unit) and PT(Processor Tracing) in Intel CPUs in a lightweight manner and it does novel offline memory sample reconstruction to enhance sampling based data race detector. We designed our own efficient PMU driver to replace vanilla Linux PMU driver.
•*BOGO* is a full memory safety solution which adds temporal memory safety upon MPX's spatial memory safety, so that the system can achieve full memory safety(prevent buffer overflow attack and use-after-free).
Inspur, Jinan, China *Research Intern* *2013 - 2014*
Supervised by Dr. Hongjun Dai, I did research on system reliability and real-time systems. I am also part of the team responsible for new board bring up(ARM and PowerPC Processor), device driver(Linux and baremetal), and performance optimizations for their storage product team and consumer product.

PUBLICATIONS

•[ISCA'24] Jianping Zeng, Tong Zhang, Changhee Jung ,*Compiler-Directed Whole-System Persistence*, ACM/IEEE International Symposium on Computer Architecture (ISCA), June 2024
•[ASPLOS'24, Best Paper] Tianao Ge, Tong Zhang, Hongyuan Liu ,*ngAP: Non-blocking Large-scale Automata Processing on GPUs*, International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), San Diego, CA, USA, April 2024.
•[IEEE Security & Privacy 2023] Yilun Wu, Tong Zhang, Changhee Jung, Dongyoon Lee, *DEVFUZZ: Automatic Device Model-Guided Device Driver Fuzzing*, The 44nd IEEE Symposium on Security and Privacy (S&P), San Francisco, CA, USA, May 2023
•[IEEE TDSC 2022] Jinmeng Zhou, Tong Zhang, Wenbo Shen, Dongyoon Lee, Changhee Jung, Ahmed Azab, Ruowen Wang, Peng Ning, Kui Ren , *Automatic Permission Check Analysis for Linux Kernel* , IEEE Transactions on Dependable and Secure Computing, 2022

•[USENIX Security' 19] Tong Zhang, Wenbo Shen, Dongyoon Lee, Changhee Jung, Ahmed Azab, Ruowen Wang, *PeX: A Permission Check Analysis Framework for Linux Kernel*, USENIX Security, 2019,Santa Clara, CA, USA, August 2019
•[ASPLOS'19] Tong Zhang, Dongyoon Lee, and Changhee Jung,*BOGO: Buy Spatial Memory Safety, Get Temporal Memory Safety (Almost) Free*, International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), Providence, RI, USA, April 2019. [acceptance rate: 74/350=21%]
•[MICRO'18] Sam Silvestro, Hongyu Liu, Tong Zhang, Changhee Jung, Dongyoon Lee, Tongping Liu, *Sampler: PMU-based Sampling to Detect Memory Errors Latent in Production Software*, The 51st Annual IEEE/ACM International Symposium on Microarchitecture (MICRO), Fukuoka City, Japan, October 2018. [acceptance rate: 74/348=21%]
•[ASPLOS'17] Tong Zhang, Changhee Jung, and Dongyoon Lee,*ProRace: Practical Data Race Detection for Production Use*, International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), pp. 149–162, 14 pages, Xi'an, China, April 2017. [acceptance rate: 56/321=17.4%]
•[ASPLOS'16] Tong Zhang, Dongyoon Lee, and Changhee Jung, *TxRace: Efficient Data Race Detection Using Commodity Hardware Transactional Memory*, International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), pp. 159–173, 15 pages, Atlanta, GA, April 2016. [acceptance rate: 53/240=22.1%]

SERVICES

•[LCTES, Languages, Compilers, Tools and Theory of Embedded Systems 2020, 2022-2024], Program Committee
•[CONCURRENCY AND COMPUTATION: PRACTICE AND EXPERIENCE, 2018], Languages, Compilers, Tools and Theory of Embedded Systems, Reviewer