Zihan (Tomson) Li

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Education

Washington University in St. Louis — St. Louis, MO
Doctor of Philosophy in Computer Science — *(Anticipated May. 2028)*

Washington University in St. Louis — St. Louis, MO
Bachelor of Science in Computer Engineering, Master of Science in Cybersecurity Engineering — *Aug. 2020 – May 2023*

DePauw University — Greencastle, IN
Bachelor of Arts — *Aug. 2017 – May 2020*

Experience

Graduate Research Assistant — May 2022 – Present
Washington University in St. Louis — *St. Louis, MO*

- Research focuses on **system security and cyber-physical systems.**
- Conducted IoT devices firmware update pipeline vulnerability study. Validated 150 firmware images from 33 device families, leading to the discovery of both **zero-day and n-day** vulnerabilities. Our findings were disclosed responsibly, resulting in the assignment of **25 CVE IDs and one PSV ID**
- Developed experimental Linux scheduler enforcer for **timing violation detection and mitigation** with **an average performance overhead of only around 2.8%**.
- Performed sensitive analysis on Linux perf counters, assisting offline CPU performance profiling.
- Optimization on communication cost of Federated Learning. Reducing communication cost by **30%** while maintaining training accuracy of **95%**.

C++ Backend Development Intern — July 2020 – Sept. 2020
Youme.im — *Shenzhen, China*

- Developed an **end-to-end encryption module** for audio and video real-time communication
- Integrated the encryption module into the cross-platform compilation build workflow
- Utilizing optimization techniques to ensure **low-performance overhead** for encryption and decryption.

Projects

Federated Learning Optimization | *Machine Learning, Federated Learning, Python* — Aug 2024 – Dec 2024

- Developed adaptive machine learning protocols for predictive modeling in distributed environments, leveraging advanced statistical techniques and Python libraries such as **Pytorch, pandas, and NumPy**. Reducing communication cost by **30%** while maintaining training accuracy of **95%**
- Conduct an empirical study on communication cost for federated learning.
- Designed and optimized data pipelines for processing large-scale distributed datasets. Adaptive gradient compression rate can reach up to **210x**
- Real-world FL simulation demonstrates the feasibility of the proposed approach.

Publications

Your Firmware Has Arrived: A Study of Firmware Update Vulnerabilities
USENIX Security '24
Yuhao Wu, Jinwen Wang, Yujie Wang, Shixuan Zhai, **Zihan Li**, Yi He, Kun Sun, Qi Li, Ning Zhang

Work-in-Progress: Measuring Security Protection in Real-time Embedded Firmware
2022 IEEE Real-Time Systems Symposium (RTSS)
Yuhao Wu, Yujie Wang, Shixuan Zhai, **Zihan Li**, Ao Li, Jinwen Wang, Ning Zhang

Honor Awards

2022 Dean's Select PhD Fellowship
Washington University in St. Louis

Nominated for the 2022 Dean's Select PhD Fellowship at Washington University in St. Louis.

Dean's List
DePauw University

Recognized on the Dean's List for 2017 and 2020

Technical Skills

Languages: C/C++, Python, Java, JavaScript, HTML/CSS, VHDL, Assembly, SQL, PHP
Frameworks: React, Node.js, ROS, ROS2
Developer Tools: Git, Cmake, Docker, VS Code, Visual Studio, Eclipse, Wireshark, Xcode, Ghidra, Database Management Systems, Excel, Gazebo
Libraries: pandas, NumPy, Matplotlib, Tkinter, Pytorch
OS: Linux Kernel Programming, Kernel Scheduler, Kernel Network Stack