

# Zihan (Tomson) Li

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## EDUCATION

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### Washington University in St. Louis

*Doctor of Philosophy in Computer Science*

St. Louis, MO

*Aug. 2023 – Present*

### Washington University in St. Louis

*Bachelor of Science in Computer Engineering, Master of Science in Cybersecurity Engineering*

St. Louis, MO

*Aug. 2020 – May 2023*

### DePauw University

*Bachelor of Arts*

Greencastle, IN

*Aug. 2017 – May 2020*

## EXPERIENCE

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### Graduate Research Assistant

*Washington University in St. Louis*

May 2022 – Present

*St. Louis, MO*

- Research focuses on **system security and cyber-physical systems**.
- Analyzed IoT firmware updates, examining 150 images from 33 device families. Discovered **zero-day and n-day** vulnerabilities, leading to **25 CVE IDs and one PSV ID** through responsible disclosure.
- 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

*Youme.im*

July 2020 – Sept. 2020

*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

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### Federated Learning Optimization | *Machine Learning, Federated Learning, Python*

Aug 2024 – Dec 2024

- Designed adaptive ML protocols for distributed predictive modeling, using **PyTorch, pandas, and NumPy**. Cut communication costs by **30%** while preserving **95%** training accuracy.
- 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.
- Accepted by *2025 62th ACM/IEEE Design Automation Conference (DAC)*

## PUBLICATIONS

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### Resilient Federated Learning on Embedded Devices with Constrained Network Connectivity

*2025 62th ACM/IEEE Design Automation Conference (DAC)*

**Zihan Li**, Han Liu, Ao Li, Ching-hsiang Chan, Yevgeniy Vorobeychik, William Yeoh, Wenjing Lou, Ning Zhang

### Your Firmware Has Arrived: A Study of Firmware Update Vulnerabilities

*33rd USENIX Security Symposium (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

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**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

## SERVICES

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### Reviewer

- IEEE Transactions on Information Forensics and Security
- IEEE/ACM Transactions on Networking
- ACM Transactions on Cyber-Physical Systems
- ISOC Symposium on Vehicle Security and Privacy (VehicleSec '24)

## TECHNICAL SKILLS

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**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