Zixuan Wang
Ph.D. Candidate
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EDUCATION

University of California, San Diego San Diego, CA, US
Ph.D. candidate in Computer Science. *Sep. 2018 – Present*

Zhejiang University Hangzhou, China
BS in Computer Science. *Sep. 2014 – July. 2018*

INTEREST

Building scalable and secure systems: My *research* concerns emerging technologies at the architecture, system, and programming language levels. At each level I conduct systematic analysis, from characterizing performance, to attacking and securing the system, then developing programming support. My *industrial efforts* across multiple companies are all on deploying emerging technologies in real-world systems, with a focus on confidential virtual machines. My *open-source* works facilitate research, industry, and personal usage.

EXPERIENCE

Research Experience

Graduate Research Assistant, STABLE Lab UC San Diego
Advisor: Jishen Zhao; Also work with: Steven Swanson, Dean Tullsen *Sep. 2018 – Present*

- **Emerging Architecture:**
  - Characterizing emerging main memory systems via a low-level memory profiling tool and a cycle-accurate memory performance modeling framework [3] [5] [PU4].
  - Attacking off-chip architectures in emerging memory systems [1].
  - Developing generative AI that automatically re-write legacy code to leverage emerging memory systems [4].
- **System Integration:**
  - Characterizing performance of CXL–an emerging memory interconnection protocols–and building CXL-based distributed AI training infrastructure [2].
  - Reverse-engineering and attacking CXL-enabled systems [PP1].
  - Developing general-purpose programming support for heterogeneous systems [PP2].
- **Emerging Application and Programming Techniques:**
  - Investigating system supprot for autonomous vehicle systems [PU2] [PU3].
  - Characterizing performance of serverless systems based on WebAssembly [PU1].
  - Developing generic programming framework for heterogeneous systems [PP2].

Research Intern, SOLAB SK Hynix USA
Mentors: Joonseop Sim, Euicheol Lim *Jun. 2019 – Sep. 2019*

- **Emerging Memory:** One of the first performance evaluations of CXL, an emerging memory interconnection protocol.
- **ML Training Acceleration:** Efficient distributed infrastructure to train ML models using CXL [2].

Undergraduate Research Assistant, Computer Architecture Lab Zhejiang University
Advisors: Qingsong Shi, Wenzhi Chen *Sep. 2015 – Jun. 2018*

- **Developed a Full Computer System from Scratch:** Implemented a CPU (with peripherals) on FPGA, a fully functional operating system kernel in C and assembly, and integrated the kernel to run on this CPU.
- **Developed new Undergrad Courses:** Developed two new courses that guide undergrads to develop their own operating system running on their own CPU.

Industry Experience

Software Engineering Intern GCP, Google
With Confidential VM team, enhanced user data confidentiality with emerging AMD SEV-SNP SVSM. *Jun. 2023 – Sep. 2023*

Part-Time Student Researcher Network Infra, Meta
With Network Platform Security team, deployed the confidential VM platform at scale. *Sep. 2022 – Jan. 2023*

Software Engineering Intern Network Infra, Meta
With Network Platform Security team, initiated and developed Meta's first confidential VM platform. *Jun. 2022 – Sep. 2022*

Software Engineering Intern GCP, Google
With Confidential VM team, Linux KVM testing with AMD SEV confidential VM supports. *Jun. 2021 – Sep. 2021*

PUBLICATIONS

In Progress & Under Submission

[PP1] *Zixuan Wang*, Milad Esrafilian, Daniel Moghimi, Jishen Zhao, Mohammadkazem Taram. CXLeak: Architectural Attacks via Practical CXL Systems

[PP2] *Zixuan Wang*, Jishen Zhao. Fork is All You Needed in the Era of Heterogeneous Computing

Peer Reviewed

[1] *Zixuan Wang*, Mohammadkazem Taram, Daniel Moghimi, Steven Swanson, Dean Tullsen, Jishen Zhao. NVLeak: Off-Chip Side-Channel Attacks via Non-Volatile Memory Systems, *USENIX Security, 2023*

[2] *Zixuan Wang*, Joonseop Sim, Euicheol Lim, Jishen Zhao. Enabling Efficient Large-Scale Deep Learning Training with Cache Coherent Disaggregated Memory Systems, *HPCA, 2022*

[3] *Zixuan Wang*, Xiao Liu, Jian Yang, Theodore Michailidis, Steven Swanson, Jishen Zhao. Characterizing and Modeling Non-Volatile Memory Systems, *IEEE Micro Top Picks, 2021*

[4] Hanxian Huang, *Zixuan Wang*, Juno Kim, Steven Swanson, Jishen Zhao. Ayudante: A Deep Reinforcement Learning Approach to Assist Persistent Memory Programming, *USENIX ATC, 2021*

[5] *Zixuan Wang*, Xiao Liu, Jian Yang, Theodore Michailidis, Steven Swanson, Jishen Zhao. Characterizing and Modeling Non-Volatile Memory Systems, *MICRO, 2020*

Preprint & Workshop

[PU1] Jamshed Ashurov, *Zixuan Wang*, Jishen Zhao. Characterizing WebAssembly Performance in the Era of Serverless Computing, *ISSTA SRC, 2023*

[PU2] Haolan Liu, *Zixuan Wang*, Jishen Zhao. COLA: Characterizing and Optimizing the Tail Latency for Safe Level-4 Autonomous Vehicle Systems, *ArXiV, 2023*

[PU3] Maximilian Apodaca, Shengye Wang, *Zixuan Wang*, Jishen Zhao. Enabling Fast Recovery for Autonomous Vehicle Systems with Linux Container Checkpointing, *SOSP SRC, 2021*

[PU4] Joseph Izraelevitz, Jian Yang, Lu Zhang, Juno Kim, Xiao Liu, Amirsaman Memaripour,Yun Joon Soh, *Zixuan Wang*, Yi Xu, Subramanya R. Dulloor, Jishen Zhao, Steven Swanson. Basic Performance Measurements of the Intel Optane DC Persistent Memory Module, *ArXiv, 2019*

[PU5] *Zixuan Wang*, Xiao Liu, Jongryool Kim, Hokyoon Lee, Jishen Zhao. Reliable and Flexible Large Scale Memory Network, *NVMW, 2019*

SERVICES

Co-Founder and Organizing Committee Students@Systems

I'm one of the founders and organizers of Students@Systems: www.students-at-systems.org *Jan. 2022 – Present*

○ I have hosted three panel discussions on academic job hunting (2022 June, 2023 Oct) and artifact reproducibility (2023 Apr).

○ I helped with organizing more than ten online events, including panels on applying for PhD, and interviews with researchers from underrepresented groups.

Submission Chair MICRO 2021

I served as a submission chair for MICRO 2021 conference. *Mar. 2021 – Jun. 2021*

○ I have developed MightyPC, a recommendation system to match submissions with reviewers.

○ MightyPC has then been used by: MICRO'21, IEEE MICRO TopPicks'22, HPCA'22, MICRO'22, DSN'23, and more.

MENTORSHIPS

Jamshed Ashurov (Undergrad → Master) UC San Diego

WebAssembly system interface characterization, published on ISSTA'23 SRC. *2022 – Present*

Haolan Liu (PhD Student) UC San Diego

Characterizing autonomous vehicle system, under submission. *2022 – Present*

Maximilian Apodaca (Undergrad → Tesla) UC San Diego

Container checkpointing, published on SOSP'23 SRC. *2020 – 2021*

Hanxian Huang (PhD Student) UC San Diego

Generative AI for programming, published on USENIX ATC'21. *2020 – 2021*

TEACHING

Teaching Assistant: Introduction to Computer Architecture University of California, San Diego
Undergrad level computer arch course. *Jan. 2022 – Mar. 2022*

Associate Instructor: Hardware-Based Computer System Design Zhejiang University
Guided students to develop their own SoC (on FPGA) to run their OS. *Mar. 2018 – Jun. 2018*

Associate Instructor: Operating System Course Zhejiang University
Guided students to develop their own OS. *Sep. 2017 – Feb. 2018*

TALKS

NVLeak: Off-Chip Side-Channel Attacks via Non-Volatile Memory Systems
USENIX Security'23, NVMW'23

Enabling Efficient Large-Scale Deep Learning Training with Cache Coherent Disaggregated Memory Systems
HPCA'22, SK hynix Inc., Micron Inc., Higgs Co., Alibaba Inc., Intel Co., FoMR, IBM Research

Characterizing and Modeling Non-Volatile Memory Systems
MICRO'20, TECHCON'20, NVMW'21, FoMR

Trust but Verify: Co-Locating Hypervisor Services with User Code via AMD SEV-SNP SVSM
Google Cloud'23

Securing User Data with Confidential Virtual Machine
Meta Annual Security Summit'22

Modernizing KVM-Unit-Tests with UEFI and AMD Confidential Virtual Machine
Google Cloud'21, AMD'21

HONORS & AWARDS

IEEE Micro TopPicks: Annually awarded to 12 best papers in computer architecture area, 2021 IEEE
Google Peer Bonus: Awarded one peer bonuse recognizing the impact of my project, 2023 Google
Google Peer Bonus: Awarded two peer bonuses recognizing the impact of my project, 2021 Google
Outstanding Dissertation: Outstanding undergraduate dissertation, 2018 Zhejiang University
He-Zhi-Jun Scholarship: Top 10 outstanding students of the computer science department, 2017 Zhejiang University
Outstanding Prize: Challenge Cup, National Undergraduate Academic Science and Technology Works Competition, 2017 China
Rising Star in Academic: Top 1% of computer science students in academic achievements, 2017 Zhejiang University
Academic Scholarship: Top 10% students of the computer science department
Second Prize: Digilent Design Contest, 2017 China
Third Prize: Advanced Computer Architecture Undergraduate Innovation Competition, 2016 CCF China

INDUSTRY PROJECTS

Trusted Execution of Hypervisor Code within Guest VM *June, 2023*
Initiated the AMD SEV-SNP SVSM support to enhance Google Cloud's confidential virtual machines.

- I built the initial SVSM support in Google Cloud's Linux kernel, hypervisor, guest firmware, and guest kernel.

Confidential Virtual Machine Platform *June, 2022*
Initiated and developed the first confidential VM platform at Meta, highlighted at Meta's Annual Security Summit.

- I built the software and operating system support for the first CVM platform at Meta.
- I deployed this CVM platform in production to protect user privacy.
- The project is highlighted at Meta's Annual Security Summit.

Modernizing Linux KVM Testing Infrastructure with Confidential VM *June, 2021*
Implement UEFI and AMD SEV/SEV-ES support in KVM-Unit-Tests, patches merged to upstream Linux KVM.

- We are the first to implement UEFI and AMD SEV/SEV-ES in the KVM testing framework.
- It serves as a solid foundation for the future development of trusted execution in KVM.
- 19 patches have been merged in upstream Linux KVM, now used by all cloud companies.

REFERENCES

Jishen Zhao	Associate Professor, UC San Diego
Steven Swanson	Professor, UC San Diego
Dean Tullsen	Professor, UC San Diego
Yuan Xie	Chair Professor, HKUST