Duo Zhang

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🌐 https://celestial-d.github.io/

Education

Ph.D. in Computer Engineering | GPA: 3.84/4.0
Iowa State University, USA | *Sept. 2018 - Dec. 2023 (expected)*

M.S. in Electrical Engineering | GPA: 3.78/4.0
Syracuse University, USA | *Sept. 2016 - May. 2018*

B.E. in Automation | GPA: 3.5/4.0
Beijing Union University, China | *Sept. 2010 - May. 2014*

Expertise

- Sufficient knowledge and experience on storage system
- Intensive coding experience with Python, C language, Bash, and C++
- Active engagement in cutting-edge research including publishing peer-reviewed papers, presenting at international conferences, and advising research associates of different levels
- Capability of multi-tasking and collaboration with academic and industrial experts
- Extensive experience in servers maintaining, and new device deployment (e.g., Intel Optone Persistent Memory, Samsung SmartSSD)

Work Experience

Iowa State University, Research Assistant

Uncovering Vulnerabilities for Persistent Memory Based System
Gitlab: https://git.ece.iastate.edu/data-storage-lab/prototypes/pm-bugs

- Collected 1553 persistent memory-related patches in the Linux kernel source tree by Bash script, and analyzed patches in detail
- Designed bug-triggering workloads by C language and Bash to reproduce 8 kernel bug cases, which help understand software stack inner dependencies of persistent memory system
- Performed persistent memory kernel driver bug detection, and identified 29 potential issues through static analysis (LLVM) technique
- Built a full-stack crash consistency testing framework through modified QEMU and Python, and identified 5 unexpected system behavior

Virtual machine-based System Failures Detection and Diagnosis
Github: https://github.com/data-storage-lab/BugBench

- Collected bug cases on the application repo, the Linux kernel Bugzilla by Bash script, and extracted cross-layer features including bug triggering conditions and bug patterns
- Measured and evaluated the debugging observability of FTrace and PANDA via reproduced system failures, and identified their limitations via Bash script and Python
- Modified QEMU to capture device commands and CPU instructions, and align them through timestamp by Python to identify critical paths, which effectively narrow down the search space for the root cause (0.06% - 6.2% of the original kernel function trees generated by FTrace)

Uncovering Vulnerabilities in Local File Systems and Parallel File Systems
GitHub: https://github.com/data-storage-lab/BugBench, https://github.com/data-storage-lab/pfault
- Deployed PFSes (e.g., Lustre and BeeGFS) via VMware workstation and Ceph by AWS EC2, and observed multiple system behavior differences
- Designed and implemented a novel taxonomy for PFSes, and investigated 28 results comprehensively
- Collected and reproduced 59 FS-aware application bug cases by Bash script, and identified general bug patterns and triggering conditions by Python and domain knowledge
- Analyzed parameter dependencies of the local file system (e.g., EXT4 and XFS) by LLVM and Python, and identified 78 potential issues by a configuration-based testing method built by Bash script and Python

Publications

- **Understanding Persistent-Memory Related Issues in the Linux Kernel.** Om R. Gatla, Duo Zhang, Wei Xu, and Mai Zheng. To appear in ACM Transactions on Storage (TOS), 2023

- **Analyzing Configuration Dependencies of DAX File Systems.** Tabassum Mahmud, Om R. Gatla, Duo Zhang, Carson Love, Ryan Bumann, and Mai Zheng. The 14th Annual Non-Volatile Memories Workshop (NVMW), 2023

- **ConfD: Analyzing Configuration Dependencies of File Systems for Fun and Profit.** Tabassum Mahmud, Om R. Gatla, Duo Zhang, Carson Love, Ryan Bumann, and Mai Zheng. Proceedings of the 21st USENIX Conference on File and Storage Technologies (FAST), 2023

- **On the Scalability of Testing the Crash Consistency of PM Systems.** Duo Zhang, Om Rameshwar Gatla, Abdullah Al Raqibul Islam, Dong Dai, and Mai Zheng. The 21th USENIX Conference on File and Storage Technologies (FAST), Work-in-Progress (WiP) & Poster Sessions, 2023.

- **On the Reproducibility of Bugs in File-System Aware Storage Applications.** Duo Zhang, Tabassum Mahmud, Om Rameshwar Gatla, Runzhou Han, Yong Chen and Mai Zheng. 16th International Conference on Networking, Architecture, and Storage (NAS), 2022

- **Understanding configuration dependencies of file systems.** Tabassum Mahmud, Duo Zhang, Om Rameshwar Gatla, Mai Zheng. 14th USENIX Workshop on Hot Topics in Storage and File Systems (HotStorage), 2022 (Best Paper Nominee!)

- **Benchmarking for observability: The case of diagnosing storage failures.** Duo Zhang, Mai Zheng. BenchCouncil Transactions on Benchmarks (Bench), 2021

- **A study of persistent memory bugs in the Linux kernel.** Duo Zhang, Om Rameshwar Gatla, Wei Xu, Mai Zheng. Proceedings of the 14th ACM International Conference on Systems and Storage (SYSTOR), 2021

- **Position: On Failure Diagnosis of the Storage Stack.** Duo Zhang, Om R. Gatla, Runzhou Han, Mai Zheng. The 12th USENIX Workshop on Hot Topics in Storage and File Systems (HotStorage), Position Paper & Poster Sessions, 2020.

- **Fingerprinting the Checker Policies of Parallel File Systems.** Runzhou Han, Duo Zhang, Mai Zheng. IEEE/ACM Fifth International Parallel Data Systems Workshop (PDSW), 2020

- **A Cross-Layer Approach for Diagnosing Storage System Failures.** Duo Zhang, Chander B. Gupta, Mai Zheng, Adam Manzanares, Filip Blagojevic, and Cyril Guyot, The 18th USENIX Conference on File and Storage Technologies (FAST), Work-in-Progress (WiP) & Poster Sessions, 2020.

Certificate

AWS Certified Cloud Practitioner

Teaching Experience

- CPRE308 Operating Systems Principles and Practice, Guest Lecturer & Teaching Assistant (FA'21, SP'22, FA'22, SP'23, FA'23)

- CPRE563X Advanced Data Storage Systems, Guest Lecturer & Teaching Assistant (SP'22)

Service

IEEE IPDPS 2021 reviewer

IEEE SECON 2019 reviewer

IEEE INFOCOM 2019 reviewer

IEEE VNC 2018 reviewer

HONORS & AWARDS

HotStorage Best Paper Nominee, ACM Hot Topics in Storage & File Systems Committee

Graduate tuition award, Iowa State University

USENIX Student Grant, USENIX Conference on File and Storage Technologies Committee