Mengxing Liu

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Education

Tsinghua University, Computer Science and Technology, *Ph.D.* 2015.9 - Present

- Research interests: non-volatile memory, concurrency control, transactional memory, linearizability theory.

Tsinghau University, Computer Science and Technology, *Bachelor* 2010.9 - 2015.7

- GPA: 90/100

Selected Honors

- **Ph.D. Perior**: National Scholarship, Sohu Scholarship, Guanghua Scholarship.
- **Undergraduate period**: Excellent Theses Award, Excellent Graduate, National Endeavor Fellowship.
- **High school period**: Top scorer in CEE, First prize in the National High School Mathematics Contest.

Internship

Hashfuture, Backend team leader 2018.1-2019.4

- Developed the backend of the first beta version on my own. Now there are more than 1.5 million users.
- Leading a team with 7 members who mainly come from Tsinghua, BUPT and BUAA.
- Mainly responsible for the design of the code architecture and the database schema, the management of developers, and investigation on new tool chains.
- New tool chains including online log collection, scheduled tasks, container, and shared accounts among applications.
- Designed a solution to cross-application transfer by using the *Try-Confirm-Cancel* technique, ensuring the data consistency in spite of network errors.

Google Summer of Code , Intern 2017.5-2017.8

- Digged into the design of serializable snapshot isolation in PostgreSQL and the theory behind it by thoroughly reading the original paper and related source code.
- Made investigation of how to improve the performance of detecting conflicts.
- Replaced the linked list with skip list and hash table in conflicts dectecting and designed different benchmarks for evaluation.

Microsoft Research Asia, Research Intern 2016.9-2017.3

- Leaded the DudeTX project, providing the transactional interface with lock on non-volatile memory (NVM), using dependency relationships to maintain the recoverability of transactions.
- Related work was published on the top journal *Transaction on Storage*.
- Joined the RAIN project (a distributed NVM-oriented storage library similar to RAID).
- Proved the RAIN theorem and built an in-memory database on RAIN for evaluation.

Tencent, Intern 2013.7-2013.8

- Implemented an enterprise office assistance based on Wechat public platform.
- Chose the framework for our team and did the main development tasks.

Research Projects

DudeTM: Durable Transactional Memory on NVM

- Got published the paper on the top conference *ASPLOS'17* as the first author. This work has been referenced nearly 60 times, which is the state-of-art in the area.
- Provided a transactional memory library on NVM with full ACID supports. The key idea is to decouple a transaction into three totally decoupled components to overcome performance overhead of traditional redo logging and undo logging mechanisms.
- Used hardware virtualization to handle the challenge of address mapping.
- Solved the problem of TLB flushing by adding a *TLB Shootdown* freature to the virtualization module we used.

DudeTX: Durable transactions interactive with locks

- Got published on the top journal *Transaction on Storage* as the first author.
- Provided transactions only with atomicity and durability, leaving developers to implement isolation.
- Introduced dependency relationships detecting to gurantee the recoverability of transactions.
- Designed a faster detecting algorithm when limiting programmers to use 2-phase lock.

RNTree: High performance persistent B+tree

- Got published on the top conference ICPP'19 as the first author.
- Designed a high performance B+tree on NVM.
- Solved the problem of trade-off between sorted leaf node and write amplification problem by using HTM.
- Increased the scalability by moving I/O operations out of critical sections.

NIL: A CAP-like theorem for concurrent data structures on NVM

- Found and proved the NIL theorem. (Now the paper is in writing)
- For concurrent data structures on NVM, it is impossible to get non-blocking, independence and log-freedom simultaneously.

DFS-Rsync: Remote synchronization for DFS

- Provided a new interface for distributed file system: remote synchronization (RSync), which was patented.
- Decreased the network transmission by reading blocks from the local system.
- Improved the performance by 10× by optimizing multi-process and multi-thread

SSEvent: Cooperative task management without stack ripping in distributed transactions

- Won the Excellent Theses Award of Tsinghua University (6/123) as my graduation project.
- Wrapped events with corountine in c++ Boost library to solve the stack ripping in event programming.

PUBLICATIONS

1. DudeTM: Building Durable Transactions with Decoupling for Persistent Memory
   Mengxing Liu, Mingxing Zhang, Kang Chen, Xuehai Qian, Yongwei Wu, Weimin Zheng, and Jinglei Ren.
   *Proceedings of the 22nd ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS'17). (**CCF A**)*
2. DudeTX: Durable Decoupled Transaction
   Mengxing Liu, Mingxing Zhang, Kang Chen, Xuehai Qian, Yongwei Wu, Weimin Zheng, and Jinglei Ren.
   *ACM Transactions on Storage(TOS) 2018 (**CCF A**)*
3. Large Scale Communication in Cloud Needs Hybrid RDMA Schema
   Teng Ma, Mingxing Zhang, Zhuo Song, **Mengxing Liu**, Kang Chen, and Yongwei Wu
   Presented in the Poster Section of OSDI'18.
4. Building Scalable NVM-based B+tree with HTM
   Mengxing Liu, Jiankai Xing, Kang Chen, Yongwei Wu
   *Proceeding of the 48th International Conference on Parallel Processing (ICPP'19). (**CCF B**)*
5. NIL Theorem and Concurrent Data Structure On NVM
   Mengxing Liu, Kang Chen, Yongwei Wu
   Preparing for submission

SKILLS

- Experienced in C++/Python. Java/Go/Shell/JS/CSS are used in some of my projects.
- Experienced in the CPU architecture. I have implemented a CPU with MIPS32 ISA, which can support Tsinghua's teaching operating system.
- Experienced in transactional theory, experienced in the design and implementation of the transaction system in PostgreSQL, and fundamental knowledge of MySQL.
- Experienced in NVM and newest research works in this area.
- Experienced in parallel programming and linearizability theory.
- Fundamental knowledge of hardware transactional memory.
- Fundamental knowledge of the distributed system.