Sekwon Lee

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Research Interest

Computer Systems

Storage and File systems, Operating Systems, Distributed Systems, Database Systems

- Focus: Persistent Memory (PM) & Disaggregated Memory aware system designs
- Key-value store and its core indexing structures
- Improving the performance and reliability of PM-based file systems

Education

University of Texas at Austin — *TX, U.S.A*
Ph.D. in Computer Science — *Aug. 2018 - Present*
- Advisor: Vijay Chidambaram

UNIST (Ulsan National Institute of Science and Technology) — *Ulsan, South Korea*
M.S. in Computer Science and Engineering — *Mar. 2016 - Feb. 2018*
- Advisor: Prof. Sam H. Noh

Virginia Polytechnic Institute and State University — *VA, U.S.A*
Visiting student — *Mar. 2017 - May 2017*
- Co-research advised by Prof. Changhee Jung
- Participated in the project of a new fault-tolerant programming model for PM

Hongik University — *Seoul, South Korea*
B.S. in Computer Engineering — *Mar. 2009 - Feb. 2015*
- Undergraduate advisor: Prof. Sam H. Noh

Work Experience

Hewlett Packard Labs — *Palo Alto, CA, US*
Research Associate Intern — *Jun. 2019 - Aug. 2019*
- Duties included: Designing far-memory data structures optimized for one-sided operation
- Mentors: Kimberly Keeton and Sharad Singhal

UNIST (Ulsan National Institute of Science and Technology) — *Ulsan, South Korea*
Researcher — *Mar. 2018 - Jul. 2018*
- Duties included: Enabling the compiler-directed crash consistency for PM-based systems
- Supervisor: Sam H. Noh

Hewlett Packard Labs — *Palo Alto, CA, US*
Research Associate Intern — *Jun. 2017 - Sep. 2017*
- Duties included: Designing a DRAM cache for PM-aware key-value store working on Fabric-Attached Memory (FAM)
- Mentors: Kimberly Keeton, Haris Volos, and Yupu Zhang

UNIST (Ulsan National Institute of Science and Technology) — *Ulsan, South Korea*
Researcher — *Oct. 2015 - Feb. 2016*
- Duties included: Analyzing PM-based file system (PMFS) and evaluating its performance
- Supervisor: Sam H. Noh

Republic of Korea Army — *Gwacheon, South Korea*
Signaller — *Aug. 2010 - May. 2012*

Publication

Conferences

Se Kwon Lee, Jayashree Mohan, Sanidhya Kashyap, Taesoo Kim, and Vijay Chidambaram, **RECIPE: Reusing Concurrent In-Memory Indexes for Persistent Memory**, Proceedings of the 27th ACM Symposium on Operating Systems Principles (SOSP 2019).

- This paper presents RECIPE, a principled approach for converting concurrent DRAM indexes into crash consistent indexes for PM. RECIPE provides a set of conditions and the corresponding conversion actions to convert DRAM indexes with minimal changes.

Rohan Kadekodi, **Se Kwon Lee**, Sanidhya Kashyap, Taesoo Kim, Aasheesh Kolli and Vijay Chidambaram, **SplitFS: Reducing Software Overhead in File Systems for Persistent Memory**, Proceedings of the 27th ACM Symposium on Operating Systems Principles (SOSP 2019).

- This paper presents SplitFS, a file system for persistent memory (PM) that reduces software overhead significantly compared to state-of-the-art PM file systems. SplitFS presents a novel split of responsibilities between a user-space library file system and an existing kernel PM file system.

Qingrui Liu, Joseph Izraelevitz, **Se Kwon Lee**, Michael L. Scott, Sam H. Noh, and Changhee Jung, **iDO: Compiler-Directed Failure Atomicity for Nonvolatile Memory**, Proceedings of the 51st Annual IEEE/ACM International Symposium on Microarchitecture (MICRO 2018).

- This paper presents iDO, a compiler-directed approach to failure atomicity with nonvolatile memory. The iDO compiler identifies idempotent instruction sequences, whose re-execution is guaranteed to be side effect-free, thereby eliminating the need to log every persistent store.

Se Kwon Lee, K. Hyun Lim, Hyunsub Song, Beomseok Nam, and Sam H. Noh, **WORT: Write Optimal Radix Tree for Persistent Memory Storage Systems**, Proceedings of the 15th USENIX Conference on File and Storage Technology (FAST 2017).

- This paper proposes radix tree variants, WORT and WOART, that are optimal for PM in the sense that consistency is always guaranteed by a single 8-byte failure atomic write without any additional copies for logging or Copy-on-Write.

Hyunsub Song, Young Je Moon, **Se Kwon Lee** and Sam H. Noh, **PMAL: Enabling Lightweight Adaptation of Legacy File Systems on Persistent Memory Systems**, Proceedings of the 2017 IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS 2017).

- This paper proposes PMAL (Persistent Memory Adaptation Layer) that allows us to make use of legacy file system for PM while we can leverage the maturity ingrained in legacy file systems and reap the high performance offered by PM.

Se Kwon Lee, Hyunsub Song, Young Je Moon and Sam H. Noh, **Experimental Evaluation of File System Data Structures for New Memory based Storage** (written with Korean), Proceedings of the 2016 Korea Computer Congress (KCC 2016, domestic conference in South Korea, **Best Paper Award**).

- This paper shows empirical studies about PM-dedicated file system, PMFS. In this work, we measured and analyzed the performance of PMFS while changing index structures and logging mechanisms.

Workshops

Qingrui Liu, Joseph Izraelevitz, **Se Kwon Lee**, Michael L. Scott, Sam H. Noh, and Changhee Jung, **iDO: Compiler-Directed Failure Atomicity for Nonvolatile Memory** (Extended abstract of MICRO 2018 paper), The 10th Annual Non-Volatile Memories Workshop (NVMW 2019).

Se Kwon Lee, K. Hyun Lim, Hyunsub Song, Beomseok Nam, and Sam H. Noh, **WORT: Write Optimal Radix Tree for Persistent Memory Storage Systems** (Extended abstract of FAST 2017 paper), The 8th Annual Non-Volatile Memories Workshop (NVMW 2017).

Hyunsub Song, Young Je Moon, **Se Kwon Lee**, and Sam H. Noh, **Transforming Legacy File Systems into Persistent Memory Exploiting File Systems with MeLo@V**, The 8th Annual Non-Volatile Memories Workshop (NVMW 2017).

- This project presents MeLo@V, which is a simple yet general method for transforming legacy file systems into PM exploiting file systems. In this project, I implemented the variations of PMFS and NOVA for replacing their original consistency mechanisms with MeLo@V.

Posters

Haris Volos, Kimberly Keeton, Yupu Zhang, Milind Chabbi, **Se Kwon Lee**, Mark Lillibridge, Yuvraj Patel, and Wei Zhang, **Memory-Oriented Distributed Computing at Rack Scale**, Poster at the 9th ACM Symposium on Cloud Computing (SOCC 2018).

Rohan Kadekodi, **Se Kwon Lee**, Aasheesh Kolli, and Vijay Chidambaram, **Ledger: Increasing Performance of POSIX Applications on Persistent Memory**, Poster at the 13th USENIX Symposium on Operating Systems Design and Implementation (OSDI 2018).

Haris Volos, Kimberly Keeton, Yupu Zhang, Milind Chabbi, **Se Kwon Lee**, Mark Lillibridge, Yuvraj Patel, and Wei Zhang, **Software challenges for persistent fabric-attached memory**, Poster at the 13th USENIX Symposium on Operating Systems Design and Implementation (OSDI 2018).

Hyunsub Song, Young Je Moon, **Se Kwon Lee**, and Sam H. Noh, **Adapting Legacy File Systems to Work Efficiently for Persistent Memory based Storage**, Poster at the 14th USENIX Conference on File and Storage Technology (FAST 2016).

Skills

Programming Languages	C, C++, Python, x86 assembly, Bash script
System Programming	Linux kernel, Memcached, Tizen
Benchmarks	Filebench, Fio, YCSB, ForestDB-benchmark, MC-benchmark, SPLASH3, Parsec, SPEC SFS2014, TPC-C

Teaching Experience

Elements of Software Design (CS313E) — *UT Austin*
Teaching Assistant — *Fall 2018*

Objec-Oriented Programming — *UNIST*
Teaching Assistant — *Spring 2016*

System Programming — *Hongik University*
Teaching Assistant — *Spring 2015*

Reference

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