Jaeho Kim

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RESEARCH INTERESTS

- Operating system and computer architecture
- Performance issues of file and storage stack in operating systems
  - Design and implementation of I/O scheduler for solid state drives (SSDs) (Published in ACM EMSOFT '09)
  - To the best of my knowledge, it is the first SSD aware I/O scheduler in Linux kernel (linux-2.6.23)
  - Design and implementation of a management policy in All Flash Array (Published in USENIX ATC'19)
- Improving reliability of flash memory storage systems such as SSDs
  - Design and analysis of reliable SSD with chip-level RAID scheme (Published in DSN'13, IEEE TC'16)
- Quality of Services (QoS) in cloud storage
  - Design and implementation of service level objective (SLO) complying SSD (Published in USENIX FAST'15)
  - Design and implementation of I/O schedulers for fair resource management on shared SSDs (Published in IEEE MASCOTS'16)
- Concurrency control in data structures
  - Design and implementation of concurrent data structures (Published in ACM ASPLOS'19)
  - Design and implementation of durable transactional memory (DTM) systems for Non-volatile main memory (NVMM) (Published in ACM ASPLOS'20)

EDUCATION

Ph.D. in Computer Science, University of Seoul   Feb. 2015
  - Thesis: Analysis of Performance and Reliability for SSD through Flash-aware RAID scheme
  - Advisor: Donghee Lee
  - Co-Advisor: Sam H. Noh (UNIST) & Jongmoo Choi (Dankook University)

M.S. in Computer Science, University of Seoul   Aug. 2009
  - Advisor: Donghee Lee

B.E. in Department of Information and Communications Engineering, Inje University   Feb. 2004

EMPLOYMENT HISTORY

Senior Researcher, Huawei Technologies, Germany   Nov. 2019 ~ present

Postdoctoral Researcher, Virginia Tech   Oct. 2017 ~ Oct. 2019
  - Advisor: Prof. Changwoo Min

Postdoctoral Researcher, Ulsan National Institute of Science and Technology (UNIST)   Oct. 2015 ~ Sep. 2017
  - Advisor: Prof. Sam H. Noh

Lecturer, Daegu Gyeongbuk Institute of Science and Technology (DGIST)   March 2016 ~ Aug. 2017
  - Python programming

Postdoctoral Researcher, Hongik University   Feb. 2015 ~ Sept. 2015
  - Advisor: Prof. Sam H. Noh

Lecturer, University of Seoul   March 2010 ~ Aug. 2015
    - Linux basics, System programming, Data structures, and Digital image editing

Lecturer, Bit Academy (A Private Computer Skills Education Institute)   Sept. 2009 ~ Aug. 2014
    - Linux kernel, ARM assembly, and Linux device driver

Software Engineer, Nuark Inc.   Jan. 2004 ~ Jan. 2007
    - Developing network devices such as routers and switches

PUBLICATIONS

[Conference & Workshop Papers]

1) R. Madhava Krishnan**, Jaeho Kim**, Ajit Mathew, Anthony Demeri, Xinwei Fu, Changwoo Min, and Sudarsun Kannan, **"Durable Transactional Memory Can Scale with TimeStone"**, Annual Non-Volatile Memories Workshop (**NVMW**)**, March** 2020**.**

2) R. Madhava Krishnan**, Jaeho Kim**, Ajit Mathew, Anthony Demeri, Xinwei Fu, Changwoo Min, and Sudarsun Kannan, **"Durable Transactional Memory Can Scale with TimeStone"**, ACM International Conference on Architectural Support for Programming Languages and Operating Systems (**ASPLOS**)**, March** 2020**.**

3) **Jaeho Kim**, and Jung Kyu Park, "**Overcoming Bathtub Failure Curve for Dependable Flash Storage Through Exploiting RAID Protection**," IEEE International Conference on Consumer Electronics (ICCE), Jan. 2020.

4) **Jaeho Kim**, Eunjae Lee, and Jung Kyu Park, "**Flash Based SSD Aware Parity Logging for Building Reliable Massive Capacity SSDs**," IEEE International Conference on Consumer Electronics (ICCE), Jan. 2020.

5) **Jaeho Kim**, Kwanghyun Lim, Youngdon Jung, Sungjin Lee, Changwoo Min, and Sam H. Noh, **"Alleviating Garbage Collection Interference Through Spatial Separation in All Flash Array"**, USENIX Annual Technical Conference (**ATC**), July 2019.

6) **Jaeho Kim**, Ajit Mathew, Sanidhya Kashyap, Madhava Krishnan Ramanathan, and Changwoo Min. **"MV-RLU: Scaling Read-Log-Update with Multi-Versioning"**, Proceedings of the 24th ACM International Conference on Architectural Support for Programming Languages and Operating Systems (**ASPLOS**). April 2019.

7) Jung Kyu Park, Yunjung Seo, and **Jaeho Kim**, "**Solid State Cache Management Scheme for Improving I/O Performance of Hard Disk Drive**," IEEE International Conference on Consumer Electronics (**ICCE'18**), 2018.

8) Byungseok Kim, **Jaeho Kim**, and Sam H. Noh, "**Managing Array of SSDs When the Storage Device Is No Longer the Performance Bottleneck**," The 9th USENIX Workshop on Hot Topics in Storage and File Systems (**HotStorage'17**), 2017.

9) **Jaeho Kim**, Eunjae Lee, and Sam H. Noh, "**I/O Scheduling Schemes for Better I/O Proportionality on Flash-based SSDs**," The IEEE 24th International Symposium on Modeling, Analysis and Simulation of Computer and Telecommunication Systems **(MASCOTS'16)**, Sept. 2016.

10) **Jaeho Kim** and Sam H. Noh, "Fair Allocation of I/O Resource for VM SLO on Flash based SSDs" The 23rd Korean Conference on Semiconductor (KCS'16), Feb. 2016. (in Korean)

11) Heejin Park**, Jaeho Kim**, Jongmoo Choi, Donghee Lee, and Sam H. Noh, "**Incremental Redundancy to Reduce Data Retention Errors in Flash-based SSDs**," The 31st International Conference on Massive Storage Systems and Technologies **(MSST'15)**, June 2015.

12) **Jaeho Kim**, Donghee Lee, and Sam H. Noh, "**Towards SLO Complying SSDs Through OPS Isolation**," The 13th USENIX Conference on File and Storage Technologies **(FAST'15)**, Feb. 2015.

13) **Jaeho Kim**, Heejin Park, and Donghee Lee, "Addressing Bathtub Failure Curve of SSD by FS-RAID Scheme," The 22nd Korean Conference on Semiconductor (KCS'15), Feb. 2015. (in Korean)

14) **Jaeho Kim**, Eunjae Lee, and Donghee Lee, "Aggressively Exploiting Parity of RAID for Reliable Flash SSD," The 22nd Korean Conference on Semiconductor (KCS'15), Feb. 2015. (in Korean)

15) **Jaeho Kim**, Jongmoo Choi, Donghee Lee, and Sam H. Noh, "Analysis of Improving Performance of NAND Flash memory by Using Semantic Information from Host system," Korea Information Institution Science Conference (KIISC'13), Nov. 2013. (in Korean)

16) **Jaeho Kim**, Jongmin Lee, Jongmoo Choi, Donghee Lee, and Sam H. Noh, "**Improving SSD Reliability with RAID via Elastic Striping and Anywhere Parity**," The 43rd Annual IEEE/IFIP International Conference

on Dependable Systems and Networks **(DSN'13)**, June 2013.

17)   **Jaeho Kim**, Jongmin Lee, Jongmoo Choi, Donghee Lee, and Sam H. Noh, "Enhancing SSD Reliability through Efficient RAID Support", The 3rd ACM SIGOPS Asia-Pacific Workshop on Systems (APSys'12), July 2012.

18)   **Jaeho Kim**, Yongseok Oh, Jongmoo Choi, Donghee Lee, and Sam H. Noh, "Optimized IO-Schedulers for SSD" Korea Computer Congress (KCC'10), June 2010. (in Korean)

19)   **Jaeho Kim**, Yongseok Oh, Jongmoo Choi, Donghee Lee, and Sam H. Noh, "**Disk Schedulers for Solid State Drives**" The ACM Conference on Embedded Software **(EMSOFT'09)**, Oct. 2009.

[Journal Papers]

1) **Jaeho Kim**, Eunjae Lee, and Sam H. Noh, "I/O Schedulers for Proportionality and Stability on Flash-based SSDs in Multi-tenant Environment," IEEE Access, Dec. 2020 (SCIE)

2) Jung Kyu Park, Yunjung Seo, and **Jaeho Kim**, "A Flash-based SSD Cache Management Scheme for High Performance Home Cloud Storage," IEEE Transactions on Consumer Electronics, Vol. 65, Issue 3, pp. 418-425 (ISSN: 0098-3063), Aug. 2019 (SCIE)

3) **Jaeho Kim** and Jung Kyu Park, "Analysis of Performance for NAND Flash based SSDs via Using Host Semantic Information," IEICE Transactions on Information and Systems, Vol. E100-D, No 8, pp. 1907-1910 2017 (SCIE)

4) Jung Kyu Park and **Jaeho Kim**, "Energy-Efficient Storage with Flash Device in Wireless Sensor Networks," The Journal of Korean Institute of Communications and Information Science, Vol. 42, NO. 5, May 2017.(KCI)

5) Jung Kyu Park and **Jaeho Kim**, "Development of Full Coverage Test Framework for NVMe Based Storage," Journal of The Korea Society of Computer and Information, Vol. 22, NO. 4, April 2017.(KCI)

6) Jung Kyu Park**, Jaeho Kim**, Sungmin Koo, and Seungjae Baek, "Adaptable I/O System based I/O Reductions for Improving the Performance of HDFS," Journal of Semiconductor Technology and Science, Vol. 16, NO. 6, December 2016. (SCIE)

7) **Jaeho Kim**, Eunjae Lee, Jongmoo Choi, Donghee Lee, and Sam H. Noh, "Chip-Level RAID with Flexible Stripe Size and Parity Placement for Enhanced SSD Reliability," IEEE Transactions on Computers **(TC)**, Volume 65, Number 4, April 2016. (SCI)

8) **Jaeho Kim**, Jongmin Lee, Jongmoo Choi, Donghee Lee, and Sam H. Noh, "An Efficient RAID Scheme for Reliable SSDs", Journal of KIISE : Computing Practices and Letters, Volume 18, Number 5, May 2012. (in Korean)

9) Choulseung Hyun, Hunki Kwon, **Jaeho Kim**, Eujoon Byun, Jongmoo Choi, Donghee Lee, and Sam H. Noh, "Performance Trade-Off of File System between Overwriting and Dynamic Relocation on a Solid State Drive", World Academy of Science, Engineering and Technology 39, 2008.

[Poster Presentations & Talks]

1) Byungseok Kim, **Jaeho Kim**, and Sam H. Noh, "Serial Management of an Array of SSDs for Maximal and Consistent Performance," The 15th USENIX Conference on File and Storage Technologies (FAST'17 Poster and WiP).

2) Jung Kyu Park, **Jaeho Kim**, and Sam H. Noh, "Section based Page Mapping FTL for Improving Performance in SSD," The 14th USENIX Conference on File and Storage Technologies (FAST'16 Poster).

3) **Jaeho Kim**, Donghee Lee, and Sam H. Noh, "Chip-Level RAID with Flexible Stripe Size and Parity Placement for Enhanced SSD Reliability," Flash Memory Summit 2015.

4) **Jaeho Kim**, Donghee Lee, and Sam H. Noh, "Towards SLO Complying SSDs Through OPS Isolation," The 13th USENIX Conference on File and Storage Technologies (FAST'15 Poster).

5) **Jaeho Kim**, Suyeong Bae, and Sam H. Noh, "OPS Isolation to Meet I/O SLA for VM Shared Flash-based SSDs", The 11th USENIX Symposium on Operating Systems Design and Implementation (OSDI'14 Poster).

6) Heejin Park**, Jaeho Kim**, and Donghee Lee, "Analysis of Incremental Redundancy for Data Retention Error of SSDs", The 11th USENIX Symposium on Operating Systems Design and Implementation (OSDI'14 Poster).

7) **Jaeho Kim**, Jongmin Lee, Jongmoo Choi, Donghee Lee, and Sam H. Noh, "Improving SSD Reliability with RAID via Elastic Striping and Anywhere Parity", The 5th Non-Volatile Memories Workshop (NVMW'14

Poster).

8) **Jaeho Kim**, Jongmin Lee, Jongmoo Choi, Donghee Lee, and Sam H. Noh, "DS-RAID: Efficient Parity Update Scheme for SSDs", The 10th USENIX Conference on File and Storage Technology (FAST'12 Poster & WIP).

PATENTS

1) "Apparatus and Method of Managing Multi Solid State Disk System", Sam H. Noh, Byungseok Kim, **Jaeho Kim**, and KwangHyun Lim, Patent No. US10521156B2 (in US)

2) "Apparatus and Method of Managing Multi Solid State Disk System", Sam H. Noh, Byungseok Kim, and **Jaeho Kim**, Patent No. 10-1834082 (in Korean)

3) "Storage System Based On NAND Flash And Data Retention Improving Method", Donghee Lee, Heejin Park, and **Jaeho Kim**, Patent No. 10-1653999 (in Korean)

4) "Effective for improving techniques redundant array of disk SSD Reliability", **Jaeho Kim**, Jongmin Lee, Jongmoo Choi, Donghee Lee, and Sam H. Noh, China Patent No. CN104471546B

5) "Efficient RAID Technique for Reliable SSD", **Jaeho Kim**, Jongmin Lee, Jongmoo Choi, Donghee Lee, and Sam H. Noh, US Patent No. US9496051 B2

6) "Efficient RAID Scheme for Reliable SSD", **Jaeho Kim**, Jongmin Lee, Jongmoo Choi, Donghee Lee, and Sam H. Noh, Patent No. 10-1445025 (in Korean)

7) "Semiconductor Memory and Method of Controlling Thereof", **Jaeho Kim**, Jongmoo Choi, Donghee Lee, and Sam H. Noh, Patent No. 10-1412830 (in Korean)

8) "Computing Method and Apparatus of Determining Size of Over-Provisioning Space", **Jaeho Kim** and Sam H. Noh, Patent No. 10-1539895 (in Korean)

9) "Computing Method and Apparatus of Processing Write in Over-Provisioning Space", **Jaeho Kim** and Sam H. Noh, Patent No. 10-1548086 (in Korean)

10) "Computing Method and Apparatus for Correcting and Detecting for Error", **Jaeho Kim,** HeeJin Park, and Sam H. Noh, Patent No. 10-1609509 (in Korean)

11) "Computing Method and Apparatus for Correcting and Detecting for Error", **Jaeho Kim,** Eunjae Lee, and Sam H. Noh, Patent No. 10-1609510 (in Korean)

RESEARCH PROJECTS

1) "High Performance and Scalable Manycore Operating System", Sponsored by The ETRI (Electronics and Telecommunications Research Institute), Oct. 2017 ~ Oct. 2019, (PI: Changwoo Min)

2) "Operating System Development for Real Deployment of PCM for Flash-based Embedded System", Sponsored by The NRF (National Research Foundation of Korea), Feb. 2015 ~ Sep. 2017, (PI: Sam H. Noh)

3) "Storage Software Optimization for Solid State Drive (SSD)", Sponsored by The NRF (National Research Foundation of Korea), Sept. 2010 ~ Feb. 2015, (PI: Donghee Lee)

4) "Study of Next Generation Memory Hierarchy for Green Computing", Sponsored by The NRF (National Research Foundation of Korea), Sept. 2009 ~ August 2012, (PI: Donghee Lee)

5) "Development of Firmware Technology for High Performance and High Reliable SSD", Sponsored by The NRF (National Research Foundation of Korea), June 2008 ~ July 2009, (PI: Donghee Lee)

6) "New Hybrid Allocation-Ext2 File System for Improving Random Write in SSD", Open Source Software (OSS) Project Sponsored by The NIPA (National IT Industry Promotion Agency), Sept. 2008 ~ Dec. 2008

7) "Design and Implementation of Hyper Link (HL) NAND Simulator and Flash Translation Layer (FTL)", Sponsored by The Indilinx Co., Ltd, Jan. 2008 ~ June 2008 (PI: Donghee Lee)

8) "Development of Flash Memory-based Embedded Multimedia Software", Sponsored by The IITA (Institute for Information Technology Advancement)", July 2007 ~ April 2009

AWARDS

1) Best Paper Award, International Conference on Innovation Convergence Technology 2019
2) SK Hynix Excellent Paper Award, Korean Conference on Semiconductors 2016
3) Graduate Student Excellent Paper Award, University of Seoul 2015
4) Travel Grant, Non-Volatile Memories Workshop (NVMW'14) 2014

5) Teaching Award, University of Seoul 2013
6) ACM SOSP Student Scholarship, Symposium on Operating System (SOSP'13) 2013
7) USENIX Student Award, File and Storage Technologies (FAST) 2012, 2013, 2015
8) Seoul Science Fellowship, Seoul Metropolitan Government 2011-2012

SKILLS
1) Programming Languages: C, C++, ARM assembly, and Python
2) Linux kernel: Implementation and evaluation of file systems and IO schedulers
3) Simulations: SSD Extension for DiskSim and FTL simulator
4) File and I/O system benchmarks

ACTIVIES
1) Journal Peer Review, IEEE Access 2020
2) Journal Peer Review, IEEE Transactions on Parallel and Distributed Systems (TPDS) 2017, 2019
3) Journal Peer Review, ACM Transactions on Design Automation of Electronic Systems (TODAES) 2015
4) Session Chair, Korean Conference on Semiconductors (KCS) 2015, 2016, 2017
5) External Review, USENIX File & Storage Technologies (FAST) 2013

ETC.
1) Guest Lecturer, Virginia Tech, ECE-4984/5984: Linux Kernel Programming Fall 2018