

Bryan S. Kim

Postdoctoral researcher
Institute of Computer Technology
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Research Interests

- Storage system and architecture in general; flash memory-based storage in particular
- Scheduling for QoS performance in storage systems and devices
- Key-value stores and data-intensive applications

Research Summary

My research goal is to build efficient flash memory and non-volatile memory-based storage systems with predictable performance. As more and more quirks are introduced to solid-state memories (driven by cost-competitiveness), it is becoming increasingly difficult to guarantee the performance of those storage systems. My approach is to examine the hardware trends of solid-state memories and carefully design storage systems for these trends, both at the host-level and the device-level. I prefer architecting stable, general-purpose, and deployable systems, and wholeheartedly believe in the power of abstraction and keeping it simple.

Education

- **Seoul National University** Seoul, South Korea
Doctor of Philosophy in Computer Science & Engineering *Sep. 2014 - Feb. 2018*
 - Advisor: Sang Lyul Min
 - Thesis: An Autonomic SSD Architecture
- **University of California, San Diego** San Diego, USA
Graduate Program in Computer Science & Engineering *Sep. 2009 - Dec. 2012*
 - Advisor: Tajana Šimunić Rosing (2009-2011), Steven James Swanson (2012)
- **Seoul National University** Seoul, South Korea
Master of Science in Electrical Engineering & Computer Science *Sep. 2007 - Aug. 2009*
 - Advisor: Sang Lyul Min
 - Thesis: Efficient Flash Memory Read Request Handling Based on Split Transactions
- **University of California, Berkeley** Berkeley, USA
Bachelor of Science in Electrical Engineering & Computer Science *Sep. 2002 - May. 2006*

Work Experience

- **Institute of Computer Technology, Seoul National University** Seoul, South Korea
Research scientist *Mar. 2018 - present*
 - Study QoS performance in flash memory-based storages
 - Study performance-reliability tradeoffs in flash memory-based storages
- **SK Telecom** Seong-nam, South Korea
Manager/engineer at Storage tech. lab *Apr. 2013 - Sep. 2015*
 - Developed high-performance flash memory controllers for enterprise-class storages.
 - Managed and collaborated with outsource developers for various projects.
 - Participated in M&A due diligences for technical evaluations of assets.

- **Oracle Corporation** Santa Clara, USA
Research intern at Solaris kernel team Jun. 2011 - Sep. 2011
 - Investigated online thread characterization techniques for scheduling with a focus on identifying transient properties as short-lived high-priority tasks can adversely affect the performance of others.
- **Samsung Advanced Institute of Technology** Yong-in, South Korea
Research intern at Semiconductor lab Jul. 2010 - Sep. 2010
 - Modeled, simulated, and analyzed performance, energy, and area characteristics of memory hierarchy and organization based on emerging non-volatile memories.
- **n&k Technology Inc.** San Jose, USA
Application engineer Jul. 2006 - Jul. 2007
 - Collected, modeled, and analyzed semiconductor wafer scatterometry data.
 - Developed prototype metrology system that integrates data from scatterometry and atomic force microscopy.
 - Interacted with global customers as a field engineer and technical support for sales representatives.

Journal & Article Papers

- Eyee Hyun Nam, **Bryan S. Kim**, Hyeonsang Eom, and Sang Lyul Min.
OZONE (O3): AN OUT-OF-ORDER FLASH MEMORY CONTROLLER ARCHITECTURE.
In *IEEE Transactions on Computers*, 60(5): 653-666, 2011. (TC'11)
- Jin Hyuk Yoon, Eyee Hyun Nam, Yoon Jae Seong, Hongseok Kim, **Bryan S. Kim**, Sang Lyul Min, and Yookun Cho.
CHAMELEON: A HIGH PERFORMANCE FLASH/FRAM HYBRID SOLID STATE DISK ARCHITECTURE.
In *IEEE Computer Architecture Letters*, 7(1): 17-20, 2008 (CAL'08)

Conference & Workshop Papers

- Geonhee Lee, Hyeon Gyu Lee, Juwon Lee, **Bryan S. Kim*** and Sang Lyul Min.
AN EMPIRICAL STUDY ON NVM-BASED BLOCK I/O CACHES.
To appear in *ACM Asia-Pacific Workshop on Systems*, 2018 (APSys'18)
- **Bryan S. Kim**, Hyun Suk Yang, and Sang Lyul Min.
AUTOSSD: AN AUTONOMIC SSD ARCHITECTURE.
In *USENIX Annual Technical Conference*, 2018: 677-689 (ATC'18)
- **Bryan S. Kim**.
UTILITARIAN PERFORMANCE ISOLATION IN SHARED SSDs.
In *USENIX Workshop on Hot Topics in Storage and File Systems*, 2018 (HotStorage'18)
- **Bryan S. Kim**, Yonggun Lee, and Sang Lyul Min.
FRAMEWORK FOR EFFICIENT AND FLEXIBLE SCHEDULING OF FLASH MEMORY OPERATIONS.
In *IEEE Non-Volatile Memory Systems and Applications*, 2017: 1-5 (NVMSA'17)
- **Bryan S. Kim** and Sang Lyul Min.
QOS-AWARE FLASH MEMORY CONTROLLER.
In *IEEE Real-Time and Embedded Technology and Applications Symposium*, 2017: 51-62 (RTAS'17)
- **Bryan S. Kim**, Eyee Hyun Nam, Yoon Jae Seong, Hang Joon Min, and Sang Lyul Min.
EFFICIENT FLASH MEMORY READ REQUEST HANDLING BASED ON SPLIT TRANSACTIONS.
In *International Workshop on Software Support for Portable Storage*, 2009 (IWSSPS'09)

- Joon Ho Um, **Bryan S. Kim**, Sung Gab Lee, Eyee Hyun Nam, and Sang Lyul Min.
FLASH MEMORY-BASED DEVELOPMENT PLATFORM FOR HOMECARE DEVICES.
In *IEEE International Conference on Systems, Man, and Cybernetics*, 2008: 2259-2263
(SMC'08)

Patents

- **Bryan S. Kim** and Sang Lyul Min.
SEMICONDUCTOR DEVICE FOR SCHEDULING TASKS FOR MEMORY DEVICE
AND SYSTEM INCLUDING THE SAME.
China Patent Application 2018-1-0298334.X; filed Apr. 2018 (**China patent pending**)
- **Bryan S. Kim** and Sang Lyul Min.
SEMICONDUCTOR DEVICE FOR SCHEDULING TASKS FOR MEMORY DEVICE
AND SYSTEM INCLUDING THE SAME.
U.S. Patent Application 15/914915; filed Mar. 2018 (**U.S. patent pending**)
- **Bryan S. Kim** and Sang Lyul Min.
SEMICONDUCTOR DEVICE FOR SCHEDULING TASKS FOR MEMORY DEVICE
AND SYSTEM INCLUDING THE SAME.
Korea Patent Application 10-2017-0153547; filed Nov. 2017 (**Korea patent pending**)
- **Bryan S. Kim** and Eyee Hyun Nam.
MEMORY APPARATUS AND CONTROL METHOD THEREOF.
Korea Patent 10-1564574; filed Nov. 2013 and issued Oct. 2015 (**Korea patent granted**)
- Hongseok Kim, **Bryan S. Kim**, and Eyee Hyun Nam.
MEMORY APPARATUS AND CONTROL METHOD THEREOF.
Korea Patent 10-1531965; filed Nov. 2013 and issued Jun. 2015 (**Korea patent granted**)
- Jinhyuk Kim, Donggi Lee, Taesung Jung, Byeongse So, Duckhyun Chang, Sang Lyul Min,
Bryan S. Kim.
MEMORY DEVICE AND PROGRAM METHOD THEREOF.
U.S. Patent 8,493,782; filed Oct 2009 and issued July 2013 (**U.S. patent granted**)
- Jinhyuk Kim, Donggi Lee, Taesung Jung, Byeongse So, Duckhyun Chang, Sang Lyul Min,
Bryan S. Kim.
MEMORY DEVICE AND PROGRAM METHOD THEREOF.
China Patent 101727983; filed Oct 2009 and issued Jun. 2016 (**China patent granted**)
- Sang Lyul Min, **Bryan S. Kim**, Jinhyuk Kim, Donggi Lee, Taesung Jung, Byeongse So,
Duckhyun Chang.
MEMORY DEVICE AND PROGRAM METHOD THEREOF.
Korea Patent 10-1544607; filed Oct. 2008 and issued Aug. 2015 (**Korea patent granted**)

Research Projects

- **PF-class Heterogeneous High Performance Computer**
National Research Foundation of Korea *Nov. 2016 - present*
 - Design and implement a storage subsystem using NVMs and SSDs for high-performance computing.
- **DRAM-less Flash Memory Storage Device**
SK Hynix *Dec. 2015 - present*
 - Design and implement a fair scheduler for guaranteeing host performance.
 - Implement and evaluate using a combination of simulation based on DiskSim and emulation based ZC706 development board.

- Variability Expedition**
National Science Foundation *Apr. 2012 - Dec. 2012*
 – Developed a fault injection platform based on OpenSPARC CPU that boots Linux for testing error-resilient software system running on top of error-prone hardware.
- Heterogenous Memory System**
Qualcomm *Oct. 2009 - Apr. 2011*
 – Explored memory design space using different memory technologies to optimize performance and energy under thermal constraints for embedded processors.
 – Design space explored using M5 system scale simulator, McPAT power simulator, and SPEC benchmark suite.
- High Performance Flash Memory SSD Controller**
Mtron Corp. *Oct. 2008 - Aug. 2009*
 – Design and implemented a high-performance flash memory controller based on out-of-order execution.
 – Designed in Verilog RTL, simulated using ModelSim, and implemented and evaluated on a Xilinx Virtex 4 FPGA-based development board.
- Flash Memory-based Embedded Multimedia Software**
IT R&D Program of Korea *Sep. 2007 - Feb. 2009*
 – Analyzed host system workload and devised experimental methodologies for evaluating Flash-FRAM hybrid architecture.
- Verification of Flash File System Reliability**
LG Electronics *Sep. 2007 - Feb. 2008*
 – Verified software system integrity of mobile phones under sudden power fluctuations.
 – Designed a NI DAQ-compatible custom PCB for emulating power fluctuations.

Talks & Presentations

- AutoSSD: an Autonomic SSD Architecture** Boston, USA
USENIX Annul Technical Conference *July. 2018*
- Utilitarian Performance Isolation in Shared SSDs** Boston, USA
USENIX HotStorage *July. 2018*
- The Balancing Act in SSDs** Daegu, Korea
(invited) DGIST *June. 2018*
- Evaluating the Performance-Reliability of Flash Storages** Seongnam, Korea
SK Hynix *June. 2018*
- An Autonomic SSD Architecture** Seoul, Korea
(invited) KIISE SIG on File and Storage Technology *May. 2018*
- NVM-based Storage Systems for HPC I/O Nodes** Wonju, Korea
KIISE SIG on Heterogenous Computing and Storage *Jan. 2018*
- DRAM-less Flash Memory Storage Device** Seongnam, Korea
SK Hynix *Nov. 2017*
- Efficient and Flexible Flash Memory Operation Scheduling** Hsinchu, Taiwan
NVMSA *Aug. 2017*
- QoS-aware Flash Memory Controller** Pittsburg, USA
RTAS *Apr. 2017*

Mentoring

- **Geonhee Lee (M.S. student)** Seoul National University
An Empirical Study on NVM-based I/O Caches Spring 2018
- **Yonggun Lee (M.S. student)** Seoul National University
Programmable Flash Interface and Its Application Spring 2017

Teaching Experience

- **Computer Concept and Practice (undergrad)** Seoul National University
Lecturer (rating: 4.62/5.00) Spring 2018
- **Computer Concept and Practice (undergrad, online)** Seoul National University
Teaching assistant Spring 2017
- **Digital Systems Design (undergrad)** University of California, San Diego
Teaching assistant (rating: 4.75/5.00) Winter 2012
- **Computer Architecture (graduate)** University of California, San Diego
Teaching assistant (rating: 4.51/5.00) Fall 2011
- **Computer Architecture (undergrad)** Seoul National University
Teaching assistant Spring 2008

Activities & Services

- **Student Volunteer**
International Symposium on Computer Architecture 2016

Awards, Honors, and Certifications

- **R&D Strategic Planning** Level 3 certification
Strategy and Technology Management Institute 2014
- **Humantech Paper Award** Silver medal
Samsung 2010
- **NATCAR: Autonomous Vehicle Racing** 3rd place
UC Davis & National Semiconductor 2006

Additional Information

- U.S. citizen
- Languages: Fluent in English and Korean
- Membership: Member of the IEEE, ACM, and USENIX