Bryan S. Kim
Postdoctoral researcher
Institute of Computer Technology
Seoul National University

bryansjkim@snu.ac.kr
archi.snu.ac.kr/bryansjkim
(+82) 2-880-7296 (office)

Research Interests

My ultimate goal in research is to **build efficient data storage systems with predictable performance**. Predictability is an important quality from embedded real-time systems to large-scale distributed systems, but achieving this will become increasingly difficult as systems scale and hardware limitations materialize. More specifically, the end of Moore's law puts a halt to the traditional scaling of performance and capacity, making it necessary to re-examine existing systems and suggest innovative architectures. My prior publications start at the underlying storage device, more specifically, flash memory-based devices (solid-state drives, or SSDs), but my interests span across the storage stack, including not only the storage device, but also storage arrays, file systems, and data store applications. My current research trajectories focus on the following aspects of data storage: autonomicity, multi-tenancy, reliability, and heterogeneity.

Education

- **Seoul National University** — Seoul, South Korea
  Doctor of Philosophy in Computer Science & Engineering — *Sep. 2014–Feb. 2018*
  - Advisor: Prof. 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*
  - Topic: Non-Volatile Memory Architectures
- **Seoul National University** — Seoul, South Korea
  Master of Science in Electrical Engineering & Computer Science — *Sep. 2007–Aug. 2009*
  - Advisor: Prof. 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

- **Seoul National University** — Seoul, South Korea
  Postdoctoral researcher at the Institute of Computer Technology — *Mar. 2018–present*
  - Study performance variations in flash memory-based storages.
  - Investigate performance-reliability tradeoffs in flash memory-based storages.
  - Explore changes in the storage hierarchy with disruptive non-volatile memory technology.
  - Mentor graduate students of the CSE department.
- **SK Telecom** — Seongnam, 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 diligence 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 identifying transient threads.
- **Samsung Advanced Institute of Technology** Yongin, South Korea
  Research intern at Semiconductor lab *Jul. 2010–Sep. 2010*
  - Analyzed performance, energy, and area tradeoffs of non-volatile memory designs.
- **n&k Technology Inc.** San Jose, USA
  Application engineer *Jul. 2006–Jul. 2007*
  - Collected, modeled, and analyzed semiconductor wafer scatterometry data.
  - Developed a prototype metrology system that integrates data from scatterometry and atomic force microscopy.
  - Interacted with global customers as a field engineer and provided technical support for sales representatives.

Publications

- Youil Han, **Bryan S. Kim**, Jeseong Yeon, Sungjin Lee, and Eunji Lee.
  TeksDB: Weaving Data Structures for a High-Performance Key-Value Stores.
  To appear in *Proceedings of the ACM on Measurement and Analysis of Computing Systems*, 2019 **(POMACS'19)**

- **Bryan S. Kim**, Jongmoo Choi, and Sang Lyul Min.
  Design Tradeoffs for SSD Reliability.
  To appear in *USENIX Conference on File and Storage Techologies*, 2019 **(FAST'19)**

- **Bryan S. Kim**.
  The Human Manual.
  In *ACM Crossroads Student Magazine*, 25(1): 34–37, 2018 **(XRDS'18)**

- Geonhee Lee, Hyeon Gyu Lee, Juwon Lee, **Bryan S. Kim*** and Sang Lyul Min.
  An Empirical Study on NVM-based Block I/O Caches.
  In *ACM SIGOPS 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)**

- 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)**

- **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)**

- 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)**

Patents

- **Bryan S. Kim** and Sang Lyul Min.
  Control Device for Dynamically Allocating Storage Space
  and Data Storage Device Including the Control Device.
  Korea Patent Application 10-2018-0116646; filed Sep. 2018 **(Korea patent pending)**

- **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 Jul. 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.
  - Provide performance guarantees for a NVM-SSD hybrid storage system.
- **DRAM-less Flash Memory Storage Device**
  SK Hynix *Dec. 2015–present*
  - Design and implement an SSD that guarantees host performance.
  - Evaluate the SSD-internal reliability enhancement techniques and their impact on performance in SSDs.
- **Variability Expedition**
  National Science Foundation *Apr. 2012–Dec. 2012*
  - Developed a fault injection platform for the OpenSPARC CPU 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.
- **High-Performance Flash Memory SSD Controller**
  Mtron Corp. *Oct. 2008–Aug. 2009*
  - Designed and implemented a high-performance flash memory controller based on out-of-order execution.
- **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.

Talks & Presentations

- **Performance Implications for Flash Memory Error Handling** Seongnam, Korea
  SK Hynix *Dec. 2018*
- **AutoSSD: an Autonomic SSD Architecture** Boston, USA
  USENIX Annaul 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 and 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
  Empirical Study on Software Overhead in NVM-based I/O Cache Layer — *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

- **Technical Program Committee**
  Design Automation Conference (DAC) — *2019*
- **Shadow Program Committee**
  European Conference on Computer Systems (EuroSys) — *2019*
- **Student Volunteer**
  International Symposium on Computer Architecture (ISCA) — *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*
- **San Diego Honors Math Competition** — 1st place
  UC San Diego — *2002*
- **San Diego Honors Math Competition** — 1st place
  UC San Diego — *2001*
- **American Invitational Math Exam (AIME)** — Score: 7/15
  Mean score in 1999 was 2.195/15; qualitifed for USAMO — *2001*
- **American Math Competitions (AMC)** — Score: 114/150
  90/150 is within top 5%; qualitified for AIME — *2001*

Personal Information

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

References

- **Prof. Sang Lyul Min** — symin@snu.ac.kr
  Department of Computer Science & Engineering — *Seoul National University*
- **Prof. Ben Lee** — benl@eecs.oregonstate.edu
  Department of Electrical & Computer Engineering — *Oregon State University*
- **Prof. Jongmoo Choi** — choijm@dankook.ac.kr
  Department of Software Science — *Dankook University*
- **Dr. Eyee Hyun Nam** — ehnam@fadutec.com
  CTO & Founder — *FADU Inc.*