INHO SONG

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EDUCATION

Virginia Tech, Blacksburg, VA, USA *Aug. 2023 - present*

Ph.D. in Computer Science
Research Topic: Software/Hardware co-design
for low, predictable end-to-end latency and high throughput
Co-advised by Huaicheng Li and Sam H. Noh

Dankook University, Yongin-si, Republic of Korea *Graduated in Aug. 2023*

Master's Degree in Computer Science GPA 4.4/4.5
Research Topic: SW/HW Co-optimizing with ZNS SSD Internals and Filesystem
Master's Thesis: Design Tradeoff in ZNS SSD performance
Advisor: Jongmoo Choi

Syracuse University, Syracuse, NY, USA *July – Dec. 2022*

Visiting Scholar
Electrical Engineering and Computer Science
Co-advised by Bryan S. Kim and Jongmoo Choi

Dankook University, Yongin-si, Republic of Korea *Graduated in Feb. 2022*

Bachelor of Computer Science GPA 4.06/4.5
Department of Software

CONFERENCE PUBLICATIONS

Hangyul Kim, **Inho Song**, and Sam H. Noh
CRAZNS: A Case for Conventional Namespace Support for RAID with ZNS SSDs [S5]
The 40th ACM/SIGAPP Symposium On Applied Computing 2025 (SIGSAC'25)

Inho Song, Myunghoon Oh, Bryan S. Kim, Seewhan Yoo, Jae-Dong Lee, and Jongmoo Choi
ConfZNS: A Novel Emulator for Exploring Design Space of ZNS SSDs [S4]
The ACM International Systems and Storage Conference 2023 (SYSTOR'23)

Inho Song, Gunhee Choi, Bryan S. Kim, Wonjin Lee, Seewhan Yoo, Jae-Dong Lee, and Jongmoo Choi
Analysis of Zone Reclaiming Overhead [K3]
Korean Computer Congress 2023 (KCC 2023) ***Best paper award***

Inho Song, Yejin Han, Hojin Shin, Seehwan Yoo, Jongmoo Choi, and Yoojin Chung
Quantitative Analysis of Compaction Policies in a Key-Value Store [I2]
7th International Conference on Next Generation Computing (ICNGC 2021)

Inho Song and Jongmoo Choi
Heap-based Data Structure for Stride Scheduling to Enhance Multicore Parallelism [K1]
Korea Computer Congress 2020 (KCC 2020)

JOURNAL PUBLICATION

Inho Song, Wonjin Lee, Jae-Dong Lee, Seehwan Yoo, Jongmoo Choi
Overcoming a Zone Reclaiming Overhead with Partial-Zone Reclaiming ***Best paper award*** [KJ]
Journal of Korean Institute of Information Scientists and Engineers(KIISE) :Computer Systems and Theory in 2024

PATENT

Jongmoo Choi, Samuel Woo, and **Inho Song** *Korea: granted*
Method for analyzing vehicle forensic and computing device for execution the same *10-2022-0139234*

EXPERIENCE

Intern, Controller Architecture Modeling Engineer *May – Aug, 2024*
Samsung Electronics, Controller Architecture Team(CAT) San Jose, CA

I developed a device-level solution by **modeling FDP SSD internals** along with **customer-specific storage systems** and policies, **delivering the optimized device solution tailored to client environments.**

SKILLS

Programming	C/C++, Python, and Java
Hacking Systems	Linux Kernel (page cache), Filesystem (Ext4, and F2FS), and eBPF tracing
Real-world apps, benchmarks, and libraries	KVStore(RocksDB), CacheLib, YCSB, FIO, Filebench, SDPK, xNVMe, and NVMe-cli
Interfaces	NAND Flash Chip-off, Physical PCIe packet tracer, JTAG
Open source contribution	FEMU:Flash Emulator [GitHub](w.r.t FDP, ZNS SSD)

MY EXPERTISE

- A half-decade of research experience in system software, considering underlying device behaviors, controller architecture design, and implementation for storage systems, including both industrial and academic experiences.
  - During my internship in **Samsung**, I successfully **completed a device-system simulation project** directly related to Samsung's clients, **providing device solutions for their systems.**
  - I built **FDP and ZNS SSD emulator(Song et al., ConfZNS, SYSTOR'23) using QEMU based platform**, which shows **highly accurate latency** results compared to real devices; **3.5% to 6% error rate** in relative value, **9% to 13% error rate** in absolute value.
  - **Contributor and maintainer in open source project, FEMU**, an open-source flash emulator. Currently, I'm upgrading FEMU, implementing FDP features, showcasing my readiness for new technologies, and strong coding skills.
  - Participating in both academic and industrial next-generation NAND Flash SSD research, such as NVMe FDP(Flexible Data Placement), ZNS(Zoned Namespaced SSD).
- **Design idea for improving end-to-end system performance** for each layers.
  - My publications [K1, I2, K3] focused on high-level design for high-performance system behavior. Paper [S4] also conveys what is the better behavior to exploit parallelism from a software perspective.
  - Not only underlying device behavior but also practical experience for **analyzing and optimizing key-value store** core algorithm (i.e., compaction).
- Strong background and knowledge in operating system concept in **Linux Kernel**, **Computer Architecture**, and **Compiler**.
- Practical experience in **building an artificial intelligence** in AI contest. **Ensemble learning** model based on LightGBM, XGBoost, SVG, Random forest, **shows 94% accuracy**, ranked **13 out of 400** teams in final.

For whom may concern. I identify myself to be a highly motivated, but also discipline-driven person. I sincerely hope that you can easily understand who I am, what attitude I have towards life, not only in my research work, but also in miscellaneous achievements that I've done so far.
I'm good at learning new things in a short-term period. I started to learn NVMe FDP in my first semester as a PhD student, and I have already finished emulating this new NVMe feature. I'd like to emphasize my implementation skills through other activities such as CPU cache simulator and RISC-V code generator.

RESEARCH PROJECTS

Semantic-aware Vehicle Forensic
funded by Supreme Prosecutors' Office of Korea(2020-2021) and IITP(2022)

My key role: 1)Data retrieval process and 2) Data analysis and retreival in the Infotainment system for Digital forensics.Throughout a holistic approach, including not only system software hacking in hex-code level file system analysis to retrieve the artifacts from the vehicle, but also NAND Flash Chip-off and forensic tools, we found **critical artifacts that strongly imply the driver's or accompanying behaviors**.

Building a Big Data System with Next-generation SSD *funded by IITP (2022 –)*
My key role : Based on Next-generation SSD, discovering performance sweet spot for compaction in KVStore.

- This is the **StarLab project in IITP**. There are numerous studies about next-generation SSD focusing on the bottleneck of the existing storage system. I am **expecting to provide higher isolation support** and **stable tail latency with HW-SW co-design.**

Design Tradeoff in ZNS SSD *funded by SK Hynix(2020-2022)*
My key role: I build the timing model for ZNS not only changing the number of physical unit configurations for a single zone in SSD but also considering accuracy.

ACADEMIC AWARDS AND ACHIEVEMENTS

- Academic Excellence Scholarship *Fall 2022*
- Academic Excellence Scholarship *Spring 2022*
- Graduation Excellence Award *Dankook Univ. 2022*
- Dean's List *Spring 2020*
- Academic Excellence Scholarship *Spring 2020*
- Dean's List *Fall Semester 2019*
- Academic Excellence Scholarship *Fall 2016*
- Admission Scholarship *Spring 2015*

CERTIFICATION

- **Teacher's Certificate** *Ministry of Education,*
  The Secondary School Teacher(Grade II) of Information & Computer *Republic of Korea, 2022*

MISCELLANEOUS ACTIVITIES

- RISC-V compiler & code generator *CS-5304 2023*
  - Basic operations, control flow, optimization(liveliness analysis, Common subexpression elimination, local and global register allocation, graph coloring, and alias anaylsis.
- Visiting Scholar (Syracuse University)
  International Joint Workshop for High-Potential Individuals Global Training Program, USA, 2022
- Bit-level CPU cache simulator [Git] *2021*
- Dankook university data analysis AI contest (Rank: 13/400) *DACON 2021*
- Camino de Santiago *Santiago Compostella, Spain, 2018*
- Military service in Republic of Korea Army *Republic of Korea, Jan. 2017 – Oct. 2018*
  – Special Warrior Certification
- **Editor**, Consulate General of the Republic of Korea in Jeddah *Jeddah, Saudi Arabia, Sep. – Dec. 2016*