Seonjin Na

Phone: +82 10-3027-8795
Email: sjna@casys.kaist.ac.kr
Github: `https://github.com/sjna-casys`
Website: `https://sjna-casys.github.io`

Research Interests

My research interests lie in GPU architecture, trusted computing, heterogeneous systems, distributed computing, and systems for machine learning. My current research focuses on building secure architecture to provide the trusted execution environment(TEE) on accelerators such as GPUs, and NPUs with low-performance overhead.

Education

KAIST *Mar. 2018 - Present*
Ph.D. in Computer Science
Advisor: Jaehyuk Huh

KAIST *Mar. 2016 - Feb. 2018*
M.S. in Computer Science
Advisor: Jaehyuk Huh

Sogang University *Mar. 2012 - Feb. 2016*
B.S. in Computer Science
Summa Cum Laude

Research Projects

Trusted Multi-GPU Architecture *Sep. 2021 - Present*

- Investigated the performance degradation when applying existing securing communication mechanism to multi-GPU system on the MGPU-Sim simulator.
- Analyzed the communication patterns of various workloads running on Multi-GPU systems and proposed a dynamic security-metadata partitioning mechanism.

Trusted NPU Architecture *Sep. 2019 - Sep. 2021*

- Designed a TEE design for NPU integrated in processors.
- Extended the existing CPU TEE design to isolate the context for NPU execution
- Proposed a novel tree-less integrity protection by exploiting the tensor-based semantics of NPU execution model.
- Measured the performance improvement compared with conventional tree-based memory protection on the Scale-Sim simulator.
- Published in **HPCA 2022**

Efficient Memory Protection Mechanism for Secure GPU Memory *Sep. 2017 - Sep. 2020*

- Designed and implemented a secure GPU architecture that provides the confidentiality and integrity of the data on GPU memory with low-performance overhead.
- Analyzed the memory update behaviors of GPU benchmark suites and real-world GPU applications on Real-GPU hardware using NVbit tool.
- Proposed a efficient GPU memory encryption and integrity verification mechanism and evaluated the performance improvement compared to state-of-the-art memory protection techniques on the GPGPU-Sim simulator.

- Published in **HPCA 2021**

Machine Learning Inference on Mobiles *Mar. 2019 - Jun. 2019*

- Analyzed the performance characterization of mobile ML inferences using TensorFlow Lite framework.
- This project was done during Microsoft Research Asia internship.

Hardware Prefetching *Mar. 2018 - Aug. 2018*

- Investigated and analyzed the performance of HW-based prefetching techniques on the CPU system.
- Implemented HW-based prefetching techniques on Gem5 simulator.

Publications

- Sunho Lee, Seonjin Na, Jungwoo Kim, Jongse Park, and Jaehyuk Huh, ”Tunable Memory Protection for Secure Neural Processing Units”, **ICCD 2022 (Under Review)**.
- Sunho Lee, Jungwoo Kim, Seonjin Na, Jongse Park, and Jaehyuk Huh, ”TNPU: Supporting Trusted Execution with Tree-less Integrity Protection for Neural Processing Unit”, **HPCA 2022**.
- Seonjin Na, Sunho Lee, Yeonjae Kim, Jongse Park, and Jaehyuk Huh, ”Common Counters: Compressed Encryption Counters for Secure GPU Memory”, **HPCA 2021**.

Research Experience

Microsoft Research Asia *Mar. 2019 - Jun. 2019*

- Research Intern, Advisor: Lintao Zhang, Yunxin Liu

KAIST *Mar. 2016 - Present*

- Graduate Research Assistant & Teaching Assistant

Teaching Experience

KAIST

- CS230 System Programming: Fall 2016, Spring 2017, Fall 2018, Fall 2020
- CS311 Computer Organization: Fall 2019

Sogang University

- Introduction to C Programming: Winter 2014

Awards and Honors

National Scholarship, KAIST *Mar. 2016 - Present*

Gold Prize *Nov. 2015*

- The 2015 ACM-ICPC Asia Daejeon Regional Contest 4th place

Honorable Mention *Nov. 2013*

- The 2015 ACM-ICPC Asia Daejeon Regional Contest 13th place

Academic Scholarship, 8 semesters *Mar. 2012 - Sep. 2015*

- Sogang University

SKILLS

- **Programming Languages** : C/C++, Go, CUDA, Python, Java
- **Library/Frameworks** : NVBit, Pytorch, Tensorflow
- **Simulators** : GPGPU-Sim, MGPU-Sim, Gem5, Gem5-gpu, Scale-Sim