

Bachelor's / Master's / Semester Project

Navigating the Main Memory Landscape with Fast and Novel Infrastructures

Memory is the major **performance, energy and reliability bottleneck** of all data-intensive workloads, e.g., graph processing, machine learning using large data sets, data analytics, databases, genome analysis.

The landscape of main memory is **quickly changing** with any technologies appearing and being proposed. This includes **3D-stacked memory** designs that are capable of **processing in memory**, new **non-volatile memory** technologies that are poised to replace DRAM, and many new types of DRAM architectures. The impact of such new technologies on systems and applications need to be quickly evaluated and understood, with rigorous **evaluation infrastructures**.

Our group develops and openly makes available such infrastructures. A prominent example is **Ramulator**, which is a very flexible and fast open-source infrastructure for simulating DRAM architectures:

<https://github.com/CMU-SAFARI/ramulator>

This infrastructure is widely used in both academia and industry (e.g., by Google, Apple, AMD, Samsung).

Your task in this project is to first understand Ramulator and then improve and extend it. Some extensions include support for the new technologies mentioned above (processing in memory, non-volatile memory, hybrid memories, new DRAM architectures). You will also evaluate the impact of such technologies on real workloads.

Requirements

- Outstanding programming skills (C/C++)
- Computer architecture background
- An interest in developing and evaluating new ideas
- Strong work ethic

For **example studies** you may perform please see:

- "[Ramulator: A Fast and Extensible DRAM Simulator](#)", CAL 2015.
- "[ChargeCache: Reducing DRAM Latency by Exploiting Row Access Locality](#)", HPCA 2016.
- "[Low-Cost Inter-Linked Subarrays \(LISA\): Enabling Fast Inter-Subarray Data Movement in DRAM](#)", HPCA 2016.

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