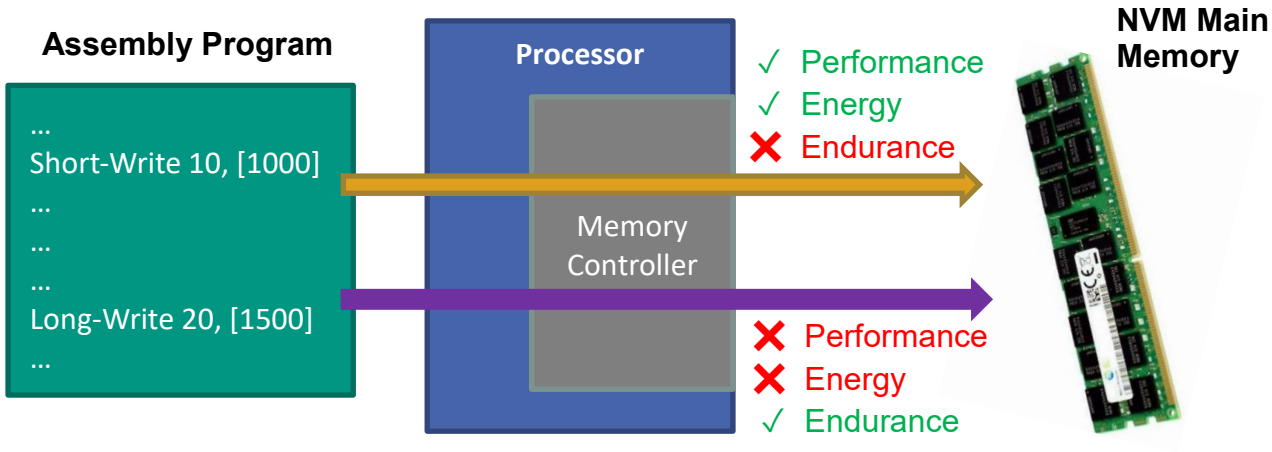
Chair for Embedded Systems

Prof. Dr. J. Henkel

Bachelor/Master Thesis

Writing NVM Energy-Efficiently



As embedded system applications evolve, the demand for high computation, lower power consumption, and larger memory footprint is growing. Emerging non-volatile memories (eNVMs) are a new, disruptive technology (not like Flash memory) that provide large memory space and achieve low power consumption while maintaining high computation capability. For example, recently, STMicroelectronics announced the Stellar 32-bit Automotive Integration MCUs (micro-controller units) based on a 28nm e-NVM using Phase Change Memory (PCM).

The typical features of emerging byte-addressable NVMs, e.g., low leakage power, high density, and low unit costs, are highly attractive to replace DRAM as main memory. However, compared to DRAMs, NVMs also impose different design challenges, such as significantly higher (~10x) write latencies. The write latencies are also proportional to the retention times (how long the memory cell can store the charge).

We want to study the usage of shorter write times (thus shorter retention time) for stack accesses. Depending on your interests and depending on whether it is a BA or MA, the tasks can include:

- Extending the instruction set of a processor to have long/short memory store instructions in VHDL and test them on an FPGA prototype.
- Extend a CPU simulator for quick performance estimation.
- Automatically modify the assembly code of an application to use the instructions for stack accesses.
- Develop an interrupt-based mechanism to re-write stack frames before their retention time expires.

Skills beneficial for the thesis

- Programming skills (VHDL, C/C++)
- Background in computer and memory organization

Skills acquired within the thesis

- Memory performance analysis
- Working in a research environment

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