technische universität dortmund

computer science 12

Bachelor / Master Thesis

A Realistic Energy Evalution Setup for Scheudling in Multicore Embedded Non-Volatile Memory Systems

Christian Hakert
Dr.-Ing. Kuan-Hsun Chen
Otto-Hahn Str. 16
Technische Universität Dortmund
Email: christian.hakert@tu-dortmund.de
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Emerging technologies for non-volatile memory (NVM) allow new design paradigms for embedded systems. Due to the fact, that data in the main memory still persists in the main memory after a reboot, shutting down and power up the system again can become part of the usual system schedule. Once the amount of time, where the system can be turned off, exceeds a certain break-even time, the energy consumption during the system execution can be reduced. This allows the design of systems and algorithms which achieve low energy consumption on purpose.

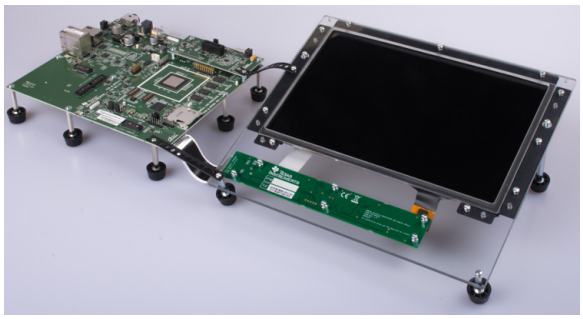

Figure 1: TI AM65X Evaluation Module

Evaluating such algorithms, however, faces many challenges, since only a few real systems with NVM are available commercially. Therefore, researches usually tend to use simulations of the behavior or system simulations to estimate the energy consumption of a proposed approach. These simulations often face the difficulty, that they cannot include all side effects and important aspects of a real system.

An alternative to system simulations and behavioral simulations is the emulation of certain systems on another real system. As long as the key differences between the analyzed and the simulating system can be precisely modeled, the simulation also delivers precise results. The Texas Instruments AM65X Evaluation module [1] is a multicore embedded platform, which integrates a main memory mapped Flash NVM chip. This platform, therefore can be used to mimic many other embedded NVM systems.

In this thesis, students first should get familiar with the given hardware platform (TI AM65X Evaluation Module). After getting to know how to program the device with custom bare-metal kernels, students should implement procedures to shut the system down and power it up again, without losing data in the NVM. Once this is done, a target application has to be realized in the implementation, which utilizes the feature to power off the system. Allover, a practical evaluation has to be conducted, where the energy consumption of the entire device is tracked in a laboratory setup. The potential to reduce the energy consumption during execution by powering off the system should be analyzed and reported. The entire implementation should be designed in a modular way, such that other applications and scenarios can be easily implemented for future simulations.

Other suggestions and related topics are also welcome. Please do not hesitate to make an appointment.

Required Skills:

- Knowledge of C and C++ programming
- Knowledge of embedded systems and system programming
- Basic understanding of the characteristics of energy and power consumption

Acquired Skills after the thesis:

- Deep knowledge about the TI AM65X system and system properties
- Broad knowledge about applications, which may benefit from NVMs and systems, which can be turned off during execution

[1] https://www.ti.com/tool/TMDX654GPEVM