Design Tools Session

MNEMEE: Memory management technology for adaptive and efficient design of embedded systems

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Abstract

The theme of intelligent ubiquitous devices will dominate future embedded system designs and speed up the integration of multimedia and communication applications, thus creating very complex, dynamic source code. Today it is increasingly impossible for designers to map applications cost-efficiently to any platform without significant optimization of the initial source code.

The MNEMEE [1] project will address this key challenge by introducing an innovative supplementary source-to-source optimization design layer for data management between the state-of-the-art optimizations at the application functionality and the compiler design layer. It is important to perform the proposed optimizations at the source code level (C/C++) as previous researches have proven that the biggest gains can only be achieved at this higher level [2]. Novel features for the MNEMEE project include: i) multi-objective explorations that allow trade-offs which designers highly need to rightly position their product in the huge search space, ii) a combination of design-time and run-time techniques to boost the cost-efficiency and performance, and iii) automated optimizations that are applied once to reduce design effort and can handle very complex code. No existing integrated framework allows this and ongoing projects do not address it sufficiently. The key focus of the project is the efficient data access and memory storage of both dynamically and statically allocated data and their assignment on the memory hierarchy.

The few existing source-to-source approaches only deal with the static manifest arrays and simple code. In contrast, MNEMEE will deliver all the necessary design methodologies, heuristics and prototype tools to enable the fast exploration of the huge dynamic and static design space. These optimizations and automation support will result in reduced exploration design time by at least a factor of 2, decreased memory footprint and memory bandwidth requirements of 30%, and improved energy and power efficiency by a factor of 2. The project will enable customized solutions for programmable Multi-Processor platforms involving the necessary system trade-offs, while meeting all real-time specifications.

[1] MNEMEE, Memory management technology for adaptive and efficient design of embedded systems, www.mnemee.org

[2] Hugo de Man, "Ambient Intelligence: Gigascale Dreams and Nanoscale Realities" Keynote speech in Solid-State Circuits Conference - ISSCC 2005 IEEE International, 2005.