Memory management technology for adaptive and efficient design of embedded systems

MNEMEE IST Project Sheet

The "MNEMEE" project will provide a novel solution for mapping applications cost-efficiently to the memory hierarchy of any MPSoC platform without significant optimization of the initial source code. The activity is aiming at the data (statically and dynamically allocated) management between the state-of-the-art optimizations at the application functionality and the compiler design layer.
This FP7 funded project is the base for a collaboration between major industrial players in this field, research institutes and academic partners : Thales, IntraCom Telecom, IMEC, ICD, ICCS and Technische Universiteit Eindhoven.

Scope

- 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 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.

Innovation

- The project proposal consists of multi-objective explorations that allow trade-offs which designers highly need to rightly position their product in the huge search space.
- A combination of design-time and run-time techniques to boost the cost-efficiency and performance.
- 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.

Focus

- The key objective of the project lies in 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 existing today 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.

Technological challenges

- Provide a framework for source-to-source optimization methodologies, which targets both statically and dynamically allocated data.
- Introduce a novel source-to-source optimization design layer.
- Analyze the embedded software applications and highlight the source-to-source optimization opportunities.
- Develop a set of prototype tools.
- Provide data memory-hierarchy aware assignment and scheduling methodologies.

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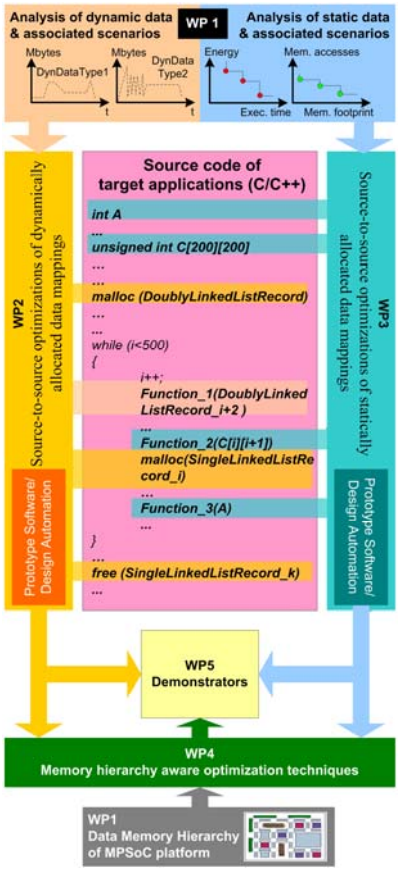
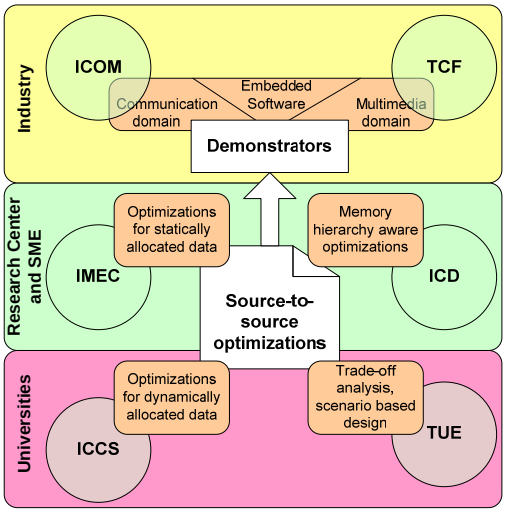
Progress beyond state-of-the-art

The below Figure shows the relation between the work-packages.

- The first workpackage delivers data analysis, memory hierarchy requirements, scenario identification and specifications for the embedded software applications.
- The second, third and fourth workpackages provide the source-to-source optimizations.
- The fifth workpackage provides the demonstrators for the MNEMEE optimization approach.





Project Approach

The above Figure shows the relation between the partners and their role in the project.

- Workpackage 1 : Data analysis, specifications and scenario identification for embedded software applications.
- Workpackage 2 : Source-to-source optimizations of dynamically allocated data mapping on MPSoC platforms.
- Workpackage 3 : Source-to-source optimizations of statically allocated data mapping on MPSoC platforms.
- Workpackage 4 : Memory hierarchy aware optimization techniques
- Workpackage 5 : Demonstrators
- Workpackage 6 : Dissemination and exploitation

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