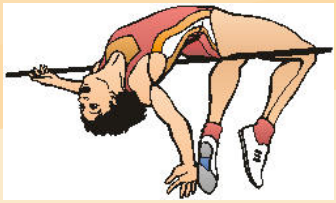
ARCHITECTURE ORIENTED PARALLELIZATION FOR HIGH PERFORMANCE EMBEDDED MULTICORE SYSTEMS USING SCILAB

ALMA



Key innovation

The mapping process of high performance embedded applications to today's multiprocessor system on chip devices suffers from a complex toolchain and programming process. The problem here is the expression of parallelism with a pure imperative programming language which is commonly C. This traditional approach limits the mapping, partitioning and the generation of optimized parallel code, and consequently the achievable performance and power consumption of applications from different domains. The **A**rchitecture oriented para**L**lelization for high performance embedded **M**ulticore systems using scil**A**b (ALMA) project aims to bridge these hurdles through the introduction and exploitation of a Scilab-based toolchain which enables the efficient mapping of applications on multiprocessor platforms from high level of abstraction.

Technical approach

With respect to parallelization and optimization, ALMA will define semantics for parallelism that will be introduced in Scilab and will develop an innovative approach for parsing input descriptions with annotations for parallelism. Algorithms for the estimation of the hardware resources required realization of the targeted applications within performance constraints will be developed as well. ALMA will also develop algorithms that identify potential independent or semi-independent partitions and schedule them using optimization techniques to the different resources of the underlying architectures. Hybrid state of art optimization algorithms that combine metaheuristics like Tabu search, GRASP, Ant Colony Optimization and exact methods like Branch-Cut-Price that are used to solve large scale optimization problems in other applications domains will be employed. The result will be a near optimal partition of the task graph and a mapping to the available hardware resources that satisfies all the constraints imposed.

Demonstration and Use

The two case studies, which will be targeted in ALMA, are borrowed from complementary market domains with different requirements.
The INTRACOM Telecom's case study is an application representing the next generation of Point-to-Point/Point-to-Multipoint wireless communication systems. In this type of applications, the use of multicore architectures is a very good fit due to the fact that there are many performance critical functions that must be executed in parallel in order to meet real-time constraints imposed by the application requirements. The second application scenario, the Multi-object tracking in image

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Project coordinator

Prof. Dr.-Ing. Jürgen Becker

Contact person

Jürgen Becker

Institute for Information Processing Technologies

Karlsruhe Institute of Technology (KIT)

Vincenz-Priessnitzstr. 1

76131 Karlsruhe

Karlsruhe, Germany

Tel: +49 721 608 4 2503

Fax: +49 721 608 4 2925

becker@kit.edu

Project website

www.alma-project.eu

Community contribution to the project

2.3 Million Euro

Project start date

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Duration

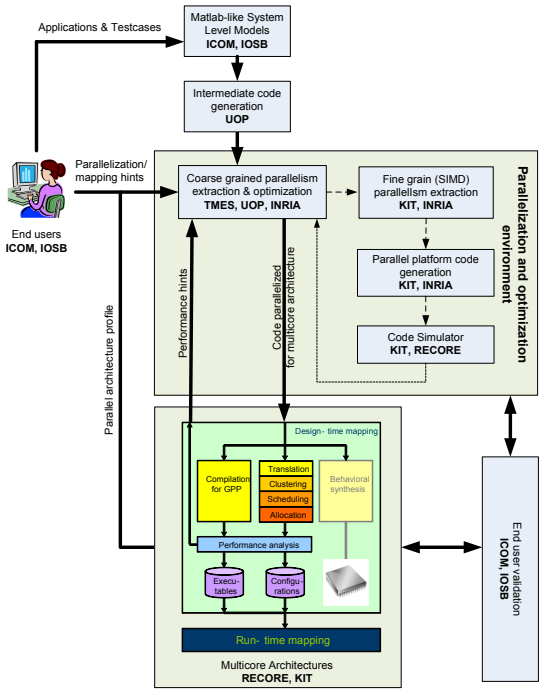
36 months

processing focuses the steady increase of pixel resolutions and frame rates of video cameras, which make image processing applications more and more demanding. The time frame for complex real-time computing shrinks with higher frame rates, while the amount of data to be processed increases.

Scientific, Economic and societal Impact

The ALMA approach is expected to significantly reduce the design time required for the development of complex applications on parallel multiprocessor platforms leading to shorter time to market. ALMA will contribute to achieving this impact by investigating innovative disruptive technology aimed at 2015 and beyond. New research directions include extending Scilab so as to provide explicit parallel directives and the provision of a front-end which will generate an Intermediate Representation (IR) that will extend the Gecos framework IR (http://gecos.gforge.inria.fr).

There is currently a shortage of highly experienced engineers with a practical and theoretical background in the areas of parallel processing platforms. The curricula in the universities are in a phase of exchange, in order to teach the novel paradigms in future lectures. For this purpose, not only an understanding in programming parallel processors is mandatory, also the knowledge of the underlying hardware is required. ALMA builds a bridge between these requirements in order to enable the efficient usage of powerful parallel hardware in different domains and without too deep knowledge of the hardware. ALMA will be the enabler for this and helps to introduce the novel parallel programming paradigms into the industrial as well as academic community. The ALMA project will significantly enhance the maturity of European know-how in critical areas of information technology such as parallel computing systems.



ALMA Design Flow

In addition, ALMA will develop key design technologies that will enrich Europe's Information Technology industry and thus their capability to respond to the challenges in an increasingly global and competitive market place.

Key Features

- Automatic parallelization of applications developed with high level design tools
- Holistic ALMA toolset enabling fast and efficient development of applications for multiprocessor hardware
- Support for scalable embedded multiprocessor hardware featuring high performance

Project partners	Countı
Karlsruhe Institute of Technology (KIT)	Ger
Université de Rennes I	Fr
Recore Systems B.V.	NL
University of Peleponnese	Gr
Technological Educational Institute of Messolonghi	Gr
Intracom SA Telecom Solutions	Gr
Fraunhofer Institute of Optronics, System Technologies and Image Exploitation	Ger