PRO3D

FP7 • ITC4 • 248776

Programming for Future 3D Architectures with Manycore

Introduction

The shift from Systems-on-Chip (SoC) to many-core architectures brings new hardware and software challenges ranging from seamless integration of processors & memories to the design of modular systems and application software that run on massively parallel and scalable platforms. Manycores will benefit tremendously from 3-dimensional (3D) integration technology that enables distribution in space of computational and storage functions to achieve unprecedented performance levels.

The PRO3D consortium brings together world-class leaders in their own field with competencies to cover software, architecture and 3D integration. One of the key differentiators of the PRO3D consortium is its access to an industrial manycore SoC, named "Platform 2012" (P2012) and provided by STM. The industrial impact of PRO3D is potentially high since re-search outcomes will be directly exploitable into STM product roadmaps.

Objectives

PRO3D is an ambitious high risk and high reward project that builds upon existing European world-class R&D expertise of the partners. PRO3D will innovate in both hardware and software technologies and demonstrate the effectiveness of manycores by an integrated and concerted effort in key aspects of hardware and software design. The uniqueness of this proposal stems from the experience of the partners in various aspects of manycore design that need to be addressed concurrently.

The key outcome of PRO3D will be a holistic system design methodology to bring a drastic improvement of productivity to reduce cost development and time to market for future embedded computing. In particular, PRO3D will: (1) Develop a system software flow that can operate transparently on parallel manycore platforms; (2) Develop formal methods for software design guaranteeing the composability and correct operation of both hardware and software; (3) Explore the impact of 3D integration for new computing architectures; (4) Extend the software flow to 3D-stacked manycores.

Expected Results

- 3D Architecture Exploration Environment;
- New 3D Architecture & Concepts in Memory Hierarchy, Cooling and Interconnects;
- Software Development Environment for 3D Manycore Platforms.

Partners and their roles

CEA (Coordinator) – Commissariat à l'énergie atomique et aux énergies alternatives

CEA-LÉTI Minatec is a major research platform adapted to advanced technology modules and complex systems developments. Its activities are usually situated at the cutting edge between academic research and industrial development. CEA-LÉTI will bring its competencies in 3D IC integration and low level programming of multicore architecture. CEA-LÉTI is collaborating closely with STMicroelectronics in the frame of P2012 platform that will be used in this project.

VERIMAG – Université Joseph Fourier Grenoble 1

VERIMAG has well-recognized competences in synchronous languages, validation and verification with focus on security and safety, modelling and temporal and hybrid systems analysis. VERIMAG will lead developments on high level

programming model, compilation and verification, and will contribute to system-level exploration and analysis of 3D designs, application code generation, system configuration and deployment, and application on 3D Manycore Virtual Prototype.

ETHZ – Eidgenössische Technische Hochschule Zürich

ETH Zürich is a world leading technical university with particular strengths in the area of information technology. In PRO3D project, all the knowledge acquired in our group from the domains of multi-objective optimization, performance estimation, stream-based processing, and mapping of regular algorithms will be particularly useful for the system-level design and performance analysis. ETH Zurich will actively participate in establishing an efficient software programming environment oriented towards 3D platforms, in analyzing 3D architectures, and in optimizing the mapping of applications on 3D platforms.

Università di Bologna

The University of Bologna (UNIBO), founded in 1088, is recognized as the oldest university in the western world, and one of the largest in Italy. It is one of most active Italian universities in research and technology transfer.

The MICREL group, belonging to the Department of Electronics, Computer Science and Systems (DEIS) will participate in PRO3D. Design space exploration at the architectural level is essential to fully take advantage of the 3D integration technologies and build high performance 3D chips. To efficiently exploit the benefits of 3D technologies, manycore virtual prototyping tools are imperative. In PRO3D project, UNIBO will be mainly involved in platform modelling and architectural exploration. UNIBO will focus on developing a flexible virtual platform infrastructure for modelling and analysis of 3D integrated architectures and memory systems.

STMicroelectronics

STM has high-qualified expertise on all areas around semiconductor chips in competitive nanometer process technologies, from product definition, circuit development, chip design, wafer production, to chip assembly and backend test. STM will be an active driver in the concept phase with special focus on usability in products and economics. STM will be a main source concerning the multicore platform used, providing e.g. technical data of advanced technologies for simulation. STM will actively participate in the construction of the 3D architecture exploration and the setting of overall software environment.

EPFL – École Polytechnique Fédérale de Lausanne

EPFL will be leading two important activities within PRO3D. (1) Combining microchannels with 3D Through Silicon Via (TSV) technology for multiple substrates. The liquid cooling approach will be modelled and implemented in the 3D integration flow of this project. In this task EPFL will accomplish the correct formation and exploration of the architecture of 3D layers including microchannels and TSVs by exploring the trade-offs for the thickness of the substrate, which affects the size of the die; (2) Active Thermal Management Techniques through Runtime Cooling Control. EPFL will define different strategies to dynamically regulate the temperature in the 3D ICs, and will describe how the software shall address active cooling to preserve manycore's integrity.

More Information

PRO3D is a FP7 project funded by the EU under GA n° 248776

Contact: Mr Christian FABRE,

Address :   CEA
              Bâtiment CTL
              7 avenue de palestine
              ZI de Mayencin, 38610 GIÈRES
              France

e-mail: **christian.fabre1@cea.fr**

web site: **http://pro3d.eu**

Start date: January 1st 2010

End date: June 30th 2012