Project profile

Cluster for Application and Technology Research in Europe on NanoElectronics

CA109 | Scalable heterogeneous architecture offers critical performance needed by highly demanding applications [SHARP]

PROJECT CONTRIBUTES TO

Communication	✔
Automotive and transport	
Health and aging society	
Safety and security	
Energy efficiency	
Digital lifestyle	
Design technology	✔
Sensors and actuators	
Process development	
Manufacturing science	
More than Moore	
More Moore	
Technology node	

Partners:

Bull
Thales Communications
CEA/Leti France
UPMC/Lip6
FZI

Project leader:

Huy-Nam Nguyen
Bull

Key project dates:

Start: September 2012
End: August 2015

Countries involved:

France
Germany

Key European industries need to secure their competitive edge by enhancing their computing performance for a very large range of applications – from complex system modelling and simulation, to real-time data mining and image processing. The SHARP project will achieve this by designing and developing scalable and heterogeneous high-performance computing architectures, mixing general-purpose, many-core processors with more dedicated acceleration ones, implemented using a variety of parallel-computing technologies.

SHARP will develop, implement and validate scalable and hybrid high-performance architectures. The SHARP distributed processing systems will be built as a scalable interconnection of clusters sharing common hardware and software infrastructures and providing a parallel set of resources to services or applications. It should be noted that the state-of-the-art of high-performance computers (HPCs) is still in the range of petaflops (a key metric for measuring processing power).

This HPC architecture is composed of several types of processing clusters comprising:

- Classical high-end, general-purpose processors (up to 16-64 cores);
- Field-programmable gate arrays (FPGAs) for dedicated hardware accelerators;
- General-purpose graphical processors;
- Coherent shared memory many-cores processors (from n102 to n103 cores).

Each cluster will manage its own private memory space, and the various clusters communicate through a high-speed network acting as a single computer. The first two types of clusters already exist in commercially available products; the last two types will be developed as part of the SHARP project.

Energy, reliability and security

Power consumption will be an all-important criterion for optimisation, just behind performance. Such an approach will favour the coverage of a large spectrum of applications with different requirements in terms of data distribution and parallel computing and granularity. Designed to deal with failing components, this solution fully supports fault-tolerance and in-place reconfiguration, thus ensuring reliability, availability and serviceability (RAS). Security, another key issue, will be implemented in an integrated manner, complementary to existing technologies in this domain. The proposal is to integrate security through virtualisation, providing testable and verifiable isolation properties. Scalability of these security capabilities is also addressed.

At the application level, multimedia processing – including high-speed video processing, medical image analysis (image de-noising, alignment and segmentation techniques to help with diagnostic work) and computerised vision-based advanced driver assistance systems (ADAS) – will focus on demonstrating the efficacy and efficiency of this approach. However, SHARP also expects to establish links with other projects (such as Itea2/

Care4Me) to widen its application domains.

The four-member European project consortium has wide expertise and experience, ranging from hardware development for open servers and HPC solutions, and heterogeneous systems design and analysis, to parallelisation and embedded solutions dealing with telecom, multimedia and security applications.

Furthermore, the core consortium already collaborated in the MEDEA+ (programme before CATRENE) TSAR project which dealt with the design of homogeneous, many-core-processor architectures. SHARP will therefore integrate some of TSAR's deliverables and results into the design of its own HPC solution.

Europe's gain

Project developments will focus on general concepts in high-performance computing applicable, not only to HPCs, but also cloud computing and embedded systems. SHARP will have strategic relevance for Europe in various aspects of design automation: from specification, validation, verification and testing, to system architecture exploration, hardware-dependent software and rapid system prototyping.

SHARP will also contribute to the European R&D effort towards the design of innovative, heterogeneous many-core-processor architectures to support a large variety of applications: from complex system modelling and simulation (like weather, finance, electromagnetism, and geophysics), artificial intelligence to real-time data mining and image processing. Crucially, SHARP will secure the competitive power of some key European industry sectors: (bio-) medical applications, multimedia, financial modelling, physics simulation and artificial intelligence.

The market for HPC power, which supports a large range of market segments of different sizes and evolution, looks promising. The traditional HPC industry will be worth US$21.8 billion by 2014 and the HPC market will grow at a compound annual growth rate of 7.8% for the next five years. IT cloud-services revenue worldwide is forecast at about US$44.2 billion in 2013. And the global market for embedded systems is expected to increase from US$92 billion in 2008 to an estimated US$112.5 billion by the end of 2013. Embedded hardware was worth US$89.8 billion in 2008 and is expected to reach US$109.6 billion in 2013, while embedded software generated US$2.2 billion in 2008. This should increase to US$2.9 billion in 2013.

Finally, the cloud-security market growth is estimated at US$1.5 billion by 2015. Organisations are expected to allocate funds to security within cloud projects, rather than reallocating portions of existing security budgets to cloud computing, therefore creating new business opportunities for security market as a whole.

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CATRENE focuses on delivering nano-/microelectronic solutions that respond to the needs of society at large, improving the economic prosperity of Europe and reinforcing the ability of its industry to be at the forefront of the global competition.