

# Czech Companies Involved in the ARTEMIS Programme

The ARTEMIS European Technology Platform was established in June 2004. Its aim was to bring together key players in the Embedded Computing arena across the entire spectrum of industrial sectors by 17 major companies. ARTEMIS joints research institutes, SME and big companies to support European research and development in the field of embedded system. Czech companies and research institutes are actively involved in ARTEMIS programme. We introduce three of supported projects.

## SCALOPES – SCALable LOw Power Embedded platformS

**ARTEMIS-2008-1-100029**

**Start date: January 2009;**

**Project duration: 27 months.**

**Total investment: € 36,6 m;**

**Number of participating organisations: 39;**

**Number of countries: 12**

The main objective of SCALOPES is to enable an industrially sustainable path for the evolution of low-power, multicore computing platforms for four application domains with strategic value for European competitiveness. The main technology focus of SCALOPES lies in generating solutions for energy and resource management, low-energy design methods and associated runtime methods as well as standard interfaces (API) between hardware and low-level software. The benefits have been demonstrated by working on platforms that provide real-time data processing capabilities (image, video, audio, packet processing) combined with high energy efficiency.

### Innovation and market impact

The development of these technologies is consistent with existing and emerging standards and is based on existing state-of-the-art tools available in industry and among the key research institutes in Europe involved in this area, all of whom are partners in SCALOPES. The project focuses on cross-domain technology and tool developments for multicore architectures.

These developments are driven by and proven for four different application domains: communication infrastructure, surveillance systems, smart mobile terminals and stationary video & entertainment systems.

The objectives of the SCALOPES project have been successfully achieved by power consumption of multicore embedded systems in all the four covered application domains being reduced by 30% while performance increased by 20%.

For instance, compared to reference home TVs from 2008, power savings of over 35% had been achieved by 2010, and over 50%

at the end of the project. The resource management framework for the display controller should allow resource utilisation to be boosted by 50% and the form factor to be reduced by 50%.

Moreover, improvements in design tools have allowed design time to be reduced by 20% for the typical embedded system architecture design in the application domains covered.

Participants from Czech Republic:

- Institute of Information Theory and Automation of the AS CR, v. v. i.
- ASICentrum s. r. o.

## SMECY – Smart Multicore Embedded SSystems

**ARTEMIS-2009-1-100230**

**Start date: February 2010;**

**Project duration: 36 months.**

**Total investment: € 20,5 Mil.;**

**Number of participating organisations: 30;**

**Number of countries: 9**

SMECY aims to launch an ambitious European initiative to match initiatives in Asia (e.g. teams funded by JST/CREST programmes) and the USA (e.g. PARLAB in Berkeley, Parallel@illinois and Pervasive Parallelism Laboratory in Stanford) and thereby enable Europe to become the leader in multicore technology by developing new programming technologies enabling the exploitation of many (hundreds of ) core architectures.

The conceptual approach of the SMECY project is based on the statement that to be efficient, the front-end/back-end should take into account the application requirements as well as the platform specificities of various embedded systems in different industries.

### Innovation and market impact

The recent emergence of multicore technologies will rapidly develop to massively parallel computing environments whose improved performance, energy and cost characteristics will extensively penetrate the embedded systems industry within a few years. This will affect and shape the entire business landscape in which semiconductor vendors,

for instance, will need to be capable of offering advanced multicore platforms to diverse application sectors.

Intellectual Property (IP) providers need to re-target existing and develop new solutions to be compatible with evolving multicore platforms and the needs of embedded systems houses, in addition to product architecture adaptations and the renewal of their system, architecture, software and hardware development processes.

Multicore technologies are of strategic value in winning market share in all areas of embedded systems. Given the need to extend coverage of embedded systems, SMECY lays the focus on targeting programming multicore architecture for consumer electronics with efficient resource management, with the ultimate aim of enabling Europe to catch up with, and even overtake, Asia and the USA in this field.

Participants from Czech Republic:

- Institute of Information Theory and Automation of the AS CR, v. v. i.
- ČIP plus, s. r. o.
- Brno University of Technology, Faculty of Information Technology

## IDEAS – Interactive power Devices for Efficiency in Automotive with increased reliability and Safety

**ENIAC-2011-2-304603**

**Start date: June 2012;**

**Project duration: 36 months.**

**Total investment: € 9,95 Mil.;**

**Number of participating organisations: 15;**

**Number of countries: 4**

In both conventional and electric vehicles, power supply reliability is a major challenge. Electronic packaging has a substantial impact not only on overall complexity and efficiency but also on safety in the event of a crash and/or fire. The main objective of the ENIAC JU project IDEAS is, therefore, to develop advanced packaging for power supply components and new generation memory systems for applications in electric and/or internal combustion-engine vehicles. The project also covers aspects that have not been addressed in other ENIAC and ARTEMIS automotive-electronics projects.

Thermal failure of electronic components in a vehicle caused by overload may easily lead to a fire. This can rapidly propagate to

the passenger compartment causing injury or even death as well as road traffic disruption.

Specific European working groups and initiatives are now addressing these issues with a particular focus on electric vehicles as these are rapidly gaining in popularity.

The project IDEAS addresses the limitation of the risk of fire by careful design of the overall electrical/electronic packaging to allow for adaptive partitioning and electrical isolation of individual circuits.

Considerable effort is also being applied to improving the thermal performance of the packaging of power supply systems.

Furthermore, in the area of automotive electronics, the control systems, which rely on multicore microcontrollers and complex software architectures, place increasing levels of stress on memory devices, which have to be designed for very high bandwidth, speed and reliability. This also tends to raise operating temperatures and increases the risk of thermal breakdown.

#### Innovation and market impact

A key objective is the enhancement of the power-train platform to ensure that thermal performance and reliability requirements are met under all driving conditions throughout the lifetime of the vehicle. This will be achieved by investigating novel power die attachment processes and advanced interconnection technologies, which are fundamental to the improvement of electrical performance.

The aim will be to minimize electrical and mechanical resistance, optimize current distribution and increase lifetime and performance. An advanced technique for the front metallisation of silicon wafers will be adapted and improved to allow for the development of innovative interconnection and cooling solutions to enhance reliability as a key requirement.

Another key objective is to develop a new memory system specifically designed for the aggressive requirements of control systems in advanced internal combustion engine or electrically-propelled vehicles.

The main demand will be for very high bandwidth to ensure fast access for real-time operation with concurrent access. This will allow the use of a multicore processor for coping with rigorous safety requirements and enable complex software architectures to run within low-cost high-performance microcontroller architectures.

Electrification of automotive propulsion systems is currently viewed as the most effective answer to the looming shortage of fossil fuels.

However, responding to a market that is often resistant to disruptive changes means that this solution requires the highest level of safety technology conceivable today.

Several projects are currently running under ENIAC and ARTEMIS management,

#### Institute of Information Theory and Automation of the AS CR, v. v. i. (ÚTIA)

ÚTIA is a public research institution established by the Academy of Sciences of the Czech Republic (in Czech: Ústav teorie informace a automatizace AV ČR, v. v. i.). Our mission is to provide basic research in the fields of theoretical cybernetics and computer sciences. We also assist local academia and industrial partners in solving implementation issues in all their complexity.

The Department of Signal Processing specialises in implementing algorithms on dedicated chips or programmable hardware. We have been partners in the ESPRIT project *No. 33544 High Speed Logarithmic Arithmetic Unit* and the IST project *No. IST-2001-34016 Design methodology and environment for the dynamic RECONFigurable FPGA*. The first project focused on the implementation of the logarithmic arithmetic as an efficient solution for floating-point computations in embedded devices, the latter focused on the development of a design methodology for the dynamic reconfiguration of Xilinx and Atmel devices as a means for the rapid implementation of complex algorithms in small and low-cost devices.

The department has also participated in the EU-funded IST project *No. FP6-2004-IST-4-027611 AETHER – self-Adaptive Embedded Technologies for Pervasive Computing Architectures* that researched possible applications of self-adaptation for the more efficient design of complex embedded systems. Recently, we participated in the EU-funded ICT project *No. FP7-ICT-215216 Apple-CORE – Architecture Paradigms and Programming Languages for Efficient programming of multiple CORES* that investigated the efficient implementation of the micro-threaded model of computation in compilers and processor architectures.

We have also been actively involved in the Czech SESA Project, which is related to Czech participation in *The European software technology process for standardization of automotive software AUTOSAR*.

ÚTIA is an ARTEMIS-IA and AENEAS academic member. ÚTIA has participated in Artemis projects *SCALOPES – Scalable Low Power Embedded Platform* and *SMECY – Smart Multicore Embedded SYstems* and participates in the Eniac project *IDEAS – Interactive power Devices for Efficiency in Automotive with increased reliability and Safety* as described above.

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while the European Green Cars Initiative established by the European Commission addresses other aspects of electro-mobility technology.

The IDEAS project aims to complete these projects by covering critical aspects of electric vehicle safety, which may also have immediate applications in advanced internal combustion engine vehicles by:

- Providing novel component packaging technologies, which will drastically enhance the performance and reliability of the power supply systems; and
- Addressing improvements in the data communication channel (including high bandwidth memories) to make it resistant to electrical interference and malicious attacks. Data communications between sensors, memories and processors for engine management and for assisted driving is a key technological enabler for the deployment of new-generation car-computing systems.

Benefits are envisioned in distributed propulsion systems, which will equip the new generation of electric vehicles and future advanced driving systems – both in electric vehicles and in internal combustion engine cars – relying on multicore microcontroller technologies and complex real-time software algorithms.

Technologically, IDEAS will contribute to the process of making products manufactured in Europe more intelligent, more comfortable, safer and more energy efficient. Makers of all types of vehicles will benefit from the successful outcome by gaining or consolidating a strong market position as a result of cheaper and more reliable devices.

Participants from Czech Republic:

- Institute of Microelectronic Applications
- Brno University of Technology, Central European Institute of Technology
- Institute of Information Theory and Automation of the AS CR, v. v. i.

