PROJECT PROFILE

A508: Specification and algorithm/architecture-co-design for highly complex applications in automotive and communication – flexible and multidisciplinary system design approach for heterogeneous system-on-chip (SpeAC)

DESIGN METHODOLOGIES

Partners:

Arexsys
Astrium
Robert Bosch
Bull
Cadence Design Systems
EuroTelematik
FZI Karlsruhe
Infineon Technologies
Italtel
Melexis
Memscap
NetModule
Politecnico di Milano
sci-worx
STMicroelectronics
Swiss Federal Institute of Technology Zurich
Synopsys
Tecnotron Elektronik
THALES Communications
UJF/TIMA

Project leader:

Wolfgang Rosenstiel,
FZI Karlsruhe, University of Tuebingen

Key project dates:

Start: February 2001
End: December 2004

Countries involved:

France
Germany
Italy
Switzerland

Appropriate system design architecture is crucial to efficient implementation of complex algorithms found in advanced electronic applications. Raising the level of abstraction at which creative work is performed is recognised as the most effective means of improving design efficiency beyond that of the design flows currently employed in industry. The MEDEA+ SpeAC project vision is that the next level above hardware/software co-design on predefined platforms is specification, algorithm and architecture optimisation as well as architecture generation. This project will combine two platform-based approaches: algorithm/architecture co-design; and component-based design for heterogeneous systems.

Raising the level of abstraction at which creative work is performed is the most efficient method of improving electronic design efficiency. The goal of the MEDEA+ A508 SpeAC project is to build new generation system-level front ends using higher level design flows than found currently.

To manage this layered approach seamlessly, the SpeAC consortium includes large system houses from the automotive and telecommunications industries, user companies in the semiconductor, communications and computer industries, electronic design automation (EDA) companies, design centres and research institutes well known for their work in the system design related field.

Specification and algorithm/architecture co-design are today based on choices made by experienced engineers and often only treated informally and manually. An implementation platform is defined, made up of processors, bus and provisions for dedicated application-specific co-processors and external interfaces. This platform is then used to map as many applications as possible using hardware/software (HW/SW) co-design.

Designing such a platform is a heavy, resource-consuming task and few supporting tools are available to help. So, there is a strong push to reuse the platform – even if the resulting implementation is less than optimal – to meet time-to-market pressure.

Wide spectrum of expertise

Making platform-based design an easier and faster task is therefore the next challenge for electronic system design automation (ESDA) toolmakers. It requires a wide spectrum of expertise, including macro and micro architecture specification and refinement, HW/SW co-design, parallel computing and software design, as well as the simultaneous exploration of different approaches and a significant investment in research and development resources. It is unlikely, therefore, that any single company or project would take the risk or have the necessary expertise to develop workable solutions.

On the other hand, there is a dramatic need to acquire appropriate solutions to ensure that Europe will maintain its leading position in domains such as smart cards, automotive electronics, communications media and advanced microelectronics. This is the main enabler for the whole systems industry against fierce competition from Asia and the USA.

SpeAC is particularly relevant to the MEDEA+ programme for three primary reasons:

- The need to gather expertise from different players;
- The need to share the risks inherent to fields where techniques are known; and
- The consequences for the European electronic systems industry.

State-of-the-art design

In recent years, serious efforts have been made to bridge the gap between hardware and software design and to move the design flow upwards to the system level. The major computer-aided design (CAD) vendors have introduced tools and technologies to enable integration of hardware and software earlier in the design flow.

However, many issues requiring specific methods and tools are still pending. Research effort is required for the definition, evaluation and customisation of virtual architectures as well as their implementation as platforms. Work is also needed on the optimal mapping of algorithms on those platforms, with fine-tuning for both hardware and software, as well as for the co-verification task.

Most of the project partners have sound records in this research area. They participated in earlier work, such as the MEDEA SMT and Euripides projects, as well as in European Commission-funded IST projects relating to system design methods. Significant commercial success followed from the MEDEA work, in particular through start-up companies such as Arexsys and MetaSymbiose as well as in increased product differentiation.

European competitive position

The strong position of some leading European electronics systems industries depends entirely on their capacity to market better and more innovative products faster than the competition. For that reason, they need the appropriate tools to help speed-up the definition of application architectures.

What is at stake is the competitiveness of the European electronics industry. This is a powerful argument to make significant efforts to develop the tools required by the European systems industry in Europe.

The development of system-level design tools requires many different kinds of expertise, in particular in systems architecture. Despite its almost non-existent EDA industry, Europe has a reasonable chance of developing and marketing ESDA tools that are much better tuned to the needs of European industry than those from US CAD companies, which are mostly driven by the short-term needs of the US market.

An evident consequence of putting the most innovative tools on the worldwide market through major EDA companies is to give non-European companies the same weapons and so weaken the potential competitive advantage of the European systems industry.

As competences are developed in Europe, strong industrial partnerships between ESDA companies and advanced users will enable European industries to be the first players trained in these innovative technologies. Advanced users will benefit from tools tuned to their needs, well ahead of the competition. Such partnerships, initiated in the framework of MEDEA+, are part of the business model of the SMEs involved in the project.

Building European advantage

Exploitation of project results will occur through three main channels:

1. Early exploitation by system partner companies co-operating with research institutes and forming partnerships with ESDA tool makers, in particular SMEs;
2. Later commercial exploitation of the tools after further industrialisation by ESDA tool makers, in particular SMEs; and
3. Early exploitation by SME service companies from the consortium.

Dissemination of results through education and training will help to provide Europe with the next generation of engineers required. Universities and research centres in the consortium are large centres of excellence able to bring innovative concepts to the largest number of European engineers and students through standard training in universities, advanced courses dedicated to innovative concepts from SpeAC and conference publications.

Industrial participants are well established companies, with a significant share of the European market, giving high credibility to the methods and tools developed and tested within this environment. The modular technical approach gives users the opportunity to scale solutions and even to include their own special tools. Further marketing will be driven by international co-operation of established CAD partners who will actively assist the development of the methodology within their own design flows to provide a tremendous multiplication effect.

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MEDEA+ Σ!2365 is the new industry-driven pan-European programme for advanced co-operative R&D in microelectronics to ensure Europe's technological and industrial competitiveness in this sector on a worldwide basis.

MEDEA+ focuses on enabling technologies for the Information Society and aims to make Europe a leader in system innovation on silicon for the e-economy.