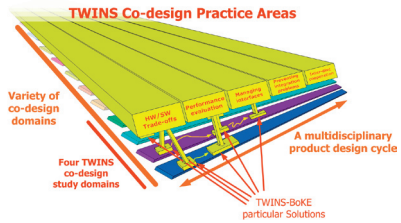
ITEA
INFORMATION TECHNOLOGY FOR EUROPEAN ADVANCEMENT

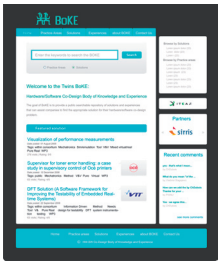
PROJECT RESULTS

Optimising software/ hardware co-design

Sharing real-life industrial knowledge to improve the system design process



The TWINS Co-design Practice Areas



The TWINS Body of Knowledge and Experience (BoKE)

The TWINS project developed new techniques to improve the co-design of products in which hardware and software are tightly integrated. The TWINS Co-Design Practice Areas help pinpointing bottlenecks, waste and quality problems, and together with the TWINS knowledge website help in choice and tailoring of industry-verified software/hardware co-design solutions to specific domains and situations. The new approaches are already being used internally with new tools, products and services based on TWINS developing quickly.

With the proliferation of consumer electronics, the number of embedded systems is growing dramatically. At the same time, embedded systems are increasing in size and complexity in a wide range of industries. In addition, the software functionality content continues to increase and more functionality is implemented in software. Design teams use software to differentiate products, increase flexibility, respond to changing standards, enable inexpensive upgradability and cut time to market.

Host of new challenges
As a result, design teams have to confront new challenges and re-evaluate fundamental practices when dealing with hardware/ software co-design. Challenges include:

- A huge design space that makes efficient allocation of functionality to either hardware or software difficult;
- A wide range of different electronic, mechanical and software components that must be highly integrated;
- Expensive prototyping that demands the maximum of verification and validation before building hardware; and
- Difficulties in modelling systems as a whole as different computation models are used for various parts of the system as a result of the diverse engineering disciplines involved.

Overcoming gap between capabilities and practice
It is vital to deploy best practices in co-design in a seamless workflow but this is not easy. Many of the problems have well-known solutions in theory but there is a major gap between state-of-the art and industrial practice. This comes from the daunting choice challenge posed by the large number of techniques and tools for co-design as well from the non-interoperability of tools used in different engineering disciplines and the lack of multi-disciplinary design and modelling tools.

High technology industry faces a need for greater multi-disciplinarity. TWINS focused on interoperability of engineering methods and tools to lessen the gap between

TWINS (ITEA 05004)

Partners
Barco
CBT
CEA-LIST
Continental Automotive
Datapixel
Espotel
Innovalia
Logica
Metso Automation
NBG Industrial Automation
Neopost Technologies
Nokia Siemens Networks
Océ Technologies
OTB Display
Q-Star
Scaleo chip
Schneider Electric
Sioux Embedded Systems
Sirris
SQS
TU Eindhoven
VTT Technical Research Centre of Finland
ZIV P+C

Countries involved
Belgium
Finland
France
The Netherlands
Spain

Start of the project
November 2006

End of the project
October 2009

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PROJECT RESULTS

the problems and solutions by selecting, combining and extending mono- and inter-disciplinary co-design methods and tools used by the consortium partners.

Focused on four domains

TWINS focused on four domains: mechatronics; balanced hardware-software-firmware; information driven; and electronic hardware modelling. A sample co-design flow was proposed and tested for each domain. This offered an integrated flow of solutions for the complete co-design process – a need clearly identified by the industrial partners. Each company's flow is different but the sample flow can be tailored to the needs of a company in the same domain.

Major innovations were achieved at two levels:

1. Individual partners developed new tools and methods and/or integrated existing/ extended tools and methods– for example, bridges were developed between well-established design methods such as SystemC and formal checking through mCRL2.
2. Overall, a set of practice areas was developed, based on individual real-life industry-tried solutions, that allow companies to pinpoint bottlenecks and sources of waste and quality problems in their software/hardware co-design processes. They can choose and tailor solutions for identified challenges according to their specific domain and situation.

Access to body of knowledge and experience

When faced with a co-design problem, a prospective TWINS user is able to access the TWINS Body of Knowledge and Experiences (BoKE) in various ways to look efficiently for appropriate methods/ tools or co-design experience. The TWINS Co-design Process Areas offer a method to access maturity in multidisciplinary co-design, and then identify the most useful results of TWINS to strengthen their own co-design workflows.

Applications are numerous in industries as diverse as automotive, avionics, copiers and printers, electrical distribution systems and communications networks. The results of TWINS will enrich individual product offerings from tool and service vendors, help develop new advisory services for software-intensive product manufacturers and improve overall software-intensive product development in Europe.

Major project outcomes

Dissemination

- 40 publications
- 7 company events
- 9 workshops and 2 inter-project workshops
- 2 papers in Master's Thesis

Exploitation

New products

- AGILETEST, A toolsuite developed by SQS to implement process of testing with agile methodologies of development.

New services

- Advisory service BERMUDA, defined by SIRRIS, providing a broader frame for advising companies about software-intensive product development.

Internal improvements

- Improvement of the competitive advantage of the companies through the increase of the quality, the reduction of the cost and the reduction of the time to market of the products.

Standardisation

- Sirris is participating in IEEE1648 draft (Agile practices) where some of TWINS results have been included.
- The Barco TWINS NPI process has been defined to be compliant to all international standards applicable to the different Barco divisions (e.g. Avionics). The process takes into account aspects of both current and upcoming standards.

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ITEA - Information Technology for European Advancement - is an eight-year strategic pan-European programme for pre-competitive research and development in embedded and distributed software. Our work has major impact on government, academia and business.

ITEA was established in 1999 as a EUREKA strategic cluster programme. We support coordinated national funding submissions, providing the link between those who provide finance, technology and software engineering. We issue annual Calls for Projects, evaluate projects, and help bring research partners together. We are a prominent player in European software development with some 10,000 person-years of R&D invested in the programme so far.

ITEA-labelled projects build crucial middleware and prepare standards, laying the foundations for the next generation of products, systems, appliances and services. Our projects are industry-driven initiatives, involving complementary R&D from at least two companies in two countries. Our programme is open to partners from large industrial companies, small and medium-sized enterprises (SMEs) as well as public research institutes and universities.

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