ITEA
INFORMATION TECHNOLOGY FOR EUROPEAN ADVANCEMENT

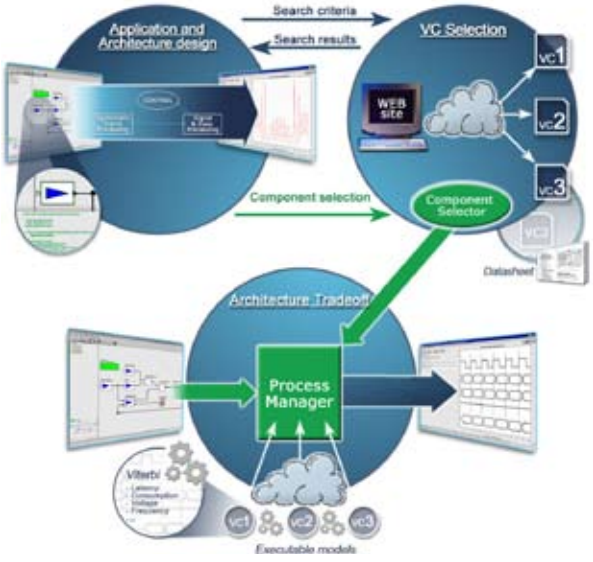
PROJECT RESULTS

Meeting the challenge

of integrating complex software

Complex systems comprising heterogeneous components are notoriously difficult to design, integrate and validate. SOPHOCLES has defined methodologies, platforms and technologies that make these operations possible over a distributed environment.

Heterogeneous architectures
In the next decade software-intensive systems will play a crucial role in telecomms (3rd & 4th generation mobile radio, both in terminals and base stations) and multimedia applications (in set-top boxes and multimedia computers). These systems, which must be able to deal with *intensive processing* (digital filtering, JPEG/MPEG compression/decompression), *image processing* and, or *communications* (protocol stacks), require system-level programming environments.



The architecture of these systems will need to be *heterogeneous*. It will be based on the integration of various computing engines from different suppliers, devoted to specific functions such as intensive processing, data processing and/or decision and supervision.

The project has validated the methodologies, platforms and technologies supporting the integration, validation and programming of complex systems composed of heterogeneous virtual components in a distributed environment.

Complex tasks
Industrial Property (IP) presents major challenges. These, in turn, lead to problems in real-time distributed simulation. The design and implementation of complex real-time systems requires integration of Virtual Components (VCs) from different suppliers. System designers are interested in the overall performance of systems.

Unfortunately, estimating the programming needs and performance of such digital systems is becoming an ever more complex task. Real-time application development using such engines, which are closely interconnected (sometimes on a single silicon die), is no trivial task. The complexity of software development (processing and communication tasks) has increased hugely.

Major project outcomes

Dissemination
- 25 publications
- Seven seminars and workshops, presentations and demos

Exploitation
- One new product
- Two new services for internal use

Patents
Contributions to open source

SOPHOCLES (ITEA 99038)

Partners
ENEA
Esterel Technologies
IPiTEC
LIFL
Philips
THALES Communications
THALES Underwater Systems

Countries involved
France
Italy
The Netherlands

Start of the project
January 2000

End of the project
September 2003

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In order to implement such applications, it will be necessary to use:

- *high level programming environments*, coupled to
- *efficient heterogeneous cycle-accurate simulators*, and
- *global system modelling*.

Currently, new tools and simulators have to be developed for each new system design, starting from proprietary models with no communication standards and/or capabilities.

A trusted Cyber Enterprise

The core idea of SOPHOCLES was, therefore, to create, over the web, a trusted *Cyber Enterprise* between the system designer and the component manufacturer that can collect components or component simulations (which then become *Virtual* components) and help system designers build real-time simulations of the system.

The SOPHOCLES methodology has been designed to encourage the birth of such Cyber Enterprises devoted to providing integration services over the Web.

Main users

Complex system architects, virtual component providers, intellectual property designers, and final system producers.

Key Results

SOPHOCLES has **defined the software tools and middleware** for a high-level modelling platform for real time complex system design. The project has provided, over the web, the **integration services** adapted to the domain of **VC-based simulations** and **distributed simulation** (VCs possibly hosted by their providers).

SOPHOCLES has also created an environment at system level by using a combination of high-level and formal approach to the expression of dataflow and control. This is obtained by:

- **Generating Inter-model communication** with emerging formalism (Esterel Technologies, Esterel C Language - ECL) including formal verification.
- **Enhancing Array Oriented Language**, an approach proposed by THALES to address the needs of intensive Signal Processing applications. This approach was defined to improve the efficiency of the design process.
- **Designing and developing middleware** for VLIW DSP (Very Large Instruction Word Digital Signal Processing) processors (eg the modular VLIW vectorial DSP designed in the mAgic Fpu Esprit programme). To give the programmer strict control over crucial efficiency factors such as data distribution on multiple memory architecture, Evolving grammar, proposed by IPiTEC, is a successful technology.
- **Enhancing MADE middleware technology** (Modular Architecture Description Environment), allowing designers to derive an optimal architectural to support the application implementation procedure.

The project results have been widely disseminated through many papers and conference participations, among which stands out the organisation of a SOPHOCLES workshop at DATE 03 in Munich.

Exploitation is being performed by the industrial partners, notably Esterel Technologies, which is extending its tool suite with the project results.




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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 8,000 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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