



PROJECT PROFILE

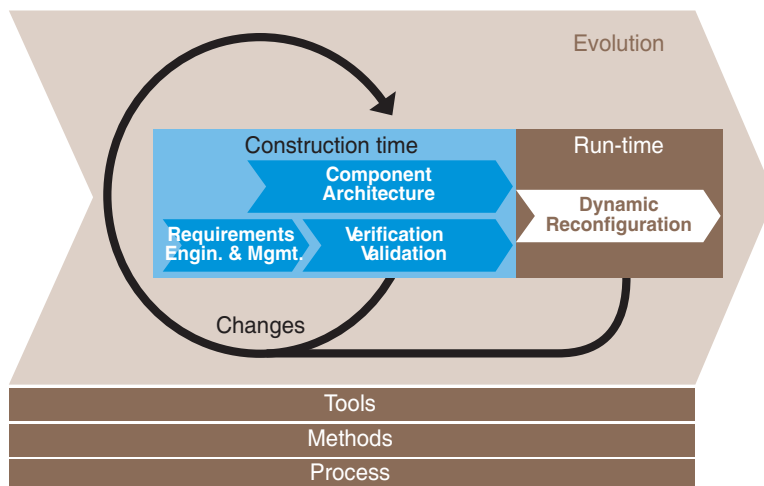
Evolution Management and Process

for real-time embedded software systems

Managing systems evolution is becoming increasingly crucial for the successful development of embedded software. Such systems are no longer closed and stand-alone, but often interact with all kinds of devices connected to a network. Environments with different requirements may need slightly different software versions. It should be possible to keep track of the requirements and co-design all these versions. The addition of new devices will also have an impact, as systems will need to adapt automatically and/or allow (remote) updates/ upgrades of a particular component.

number of components, managing the evolution of a component-based real-time embedded system has to deal with a number of issues:

- Devising a model-driven approach, introducing the concept of components in the requirement analysis and preliminary design stages.
- Defining a generic, adaptable component architecture that will provide adequate support, process and notation for evolution and version control, both at the component and the overall system level.
- Creating a run-time system that enables dynamic evolution of real-time embedded applications.
- Incremental evolution of resource



New methods for supporting systems evolution
The introduction of component-based development is the first step. Although components evolve independently, they may influence others as well as the overall component architecture. As resource constraints can affect a

constraints and non-functional requirements for the evolving component system.

Evolution management presents new challenges for requirements management and re-validation. New methodologies are needed to support requirements, track them

EMPRESS (ITEA 01003)

Partners

- Barco
- Bosch CSI
- Cefriel
- CiaoLAB Technologies
- DaimlerChrysler
- ESI
- Fraunhofer FIRST
- Fraunhofer IESE
- HOOD
- K.U. Leuven
- MSI
- Philips PCMS
- Siemens
- TU Eindhoven
- TU München
- TXT e-solutions
- UNIS
- Universität Magdeburg
- Validas

Countries involved

- Belgium
- Czech Republic
- Germany
- Italy
- The Netherlands
- Spain

Project start

January 2002

Project end

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dynamically through the system, handle change requests for parallel versions of the system and re-validate such changes prior to release. The re-validation method should be incremental, with support for appropriate formalisms and tooling. A formal representation of the existing system and of prospected changes is needed to enable precise reasoning and validation, allowing e.g. automated verification of compatibility and system properties. Formalisation is applied at the specification level, using methods and tools for configuration management, change tracking, impact evaluation and verification of configurations properties.

Another important issue is the quantitative assessment of changes. Suitable metrics have to be defined, both for the product and the process. We will need to build a model framework that enables precise measurement of changes to real-time embedded systems.

A component-based architecture for evolution management

Within EMPRESS we are developing a methodology *and* process for real-time embedded software development that supports the management of evolution in a flexible and dynamic way. We will examine the evolution of requirements, systems and system families, system architectures, individual components, resource constraints (timing & memory requirements) and the underlying hardware.

To achieve this, we will develop an *adaptable component-based architecture* and *stable enabling infrastructure* that will provide support for evolution during development and at run-time. This new architecture and infrastructure will lead to:

- support for controlled evolution of the system architecture and design
- adaptable systems that can deal with dynamic reconfiguration (i.e. at run-time)
- faster system development by adapting and extending existing

systems in order to reduce time-to-market

- easier development and lifetime support of product families with different degrees of functionality and/or hardware.

The two major cornerstones of evolution management within EMPRESS are *an adaptable component architecture* and *an incremental requirements validation approach*. Both require a solid *formal base* for defining evolution paths in order to be able to evaluate changes. EMPRESS will create:

- System modelling standards and tools for evolution management in real-time embedded systems (architecture, infrastructure, methodology, process and guidelines)
- Tools for impact evaluation, incremental validation, component certification, change process modelling and quality assurance
- Prototype run-time execution environments and demonstrators for evolution support and impact evaluation, and metrics that reveal the results of applying the methodology and guidelines.

A European standard for real-time embedded software engineering

The EMPRESS team aims to develop a European standard, methodology, process and tools for real-time embedded software engineering, breaking the current predominance of non-European methodologies and tools. The project results will yield the following benefits:

- The partners will use them to improve their development process, reduce time to market, and increase global competitiveness.
- The methodologies and support tools developed in EMPRESS will be offered to as consultancy services and products so that the entire European real-time embedded software industry benefits.
- As soon as they are sufficiently mature, the advanced tools developed in EMPRESS will be available from major software providers.

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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 more than 5,000 person-years of R&D invested in the programme so far, and another 10,000 anticipated over the next five years.

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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