ITEA3

Project Results

PROMES

Process framework for more efficient development and higher product quality

Executive summary

Embedded systems contain mechanical, electronics and software components; only the smooth integration of these parts can ensure their functionality. The ITEA 2 project PROMES set out to develop new mechanisms for defining and handling process components, or process assets, while integrating the mechanical, electronics and software engineering disciplines. Not only has it delivered a process framework to accomplish such objectives but has developed concrete solutions to real problems in doing so.

Project origins

New engineering technologies such as model-driven development and product-line engineering pose new challenges to development processes. Industries in the high-tech embedded domain are confronted by the rapidly increasing complexity of next generation systems, especially the core embedded software and electronics. Important decisions have to be made early in the development trajectory about the functionality the software should contain, the necessary hardware and the application requirements, cost and time-to-market constraints, life-time considerations, re-use and third-party component integration. In the wake of the new industrial revolution – Smart Industry – the PROMES solution supports the process engineer in how to integrate the processes based on the needs of a specific situation, and provides flexibility that new engineering technologies require.
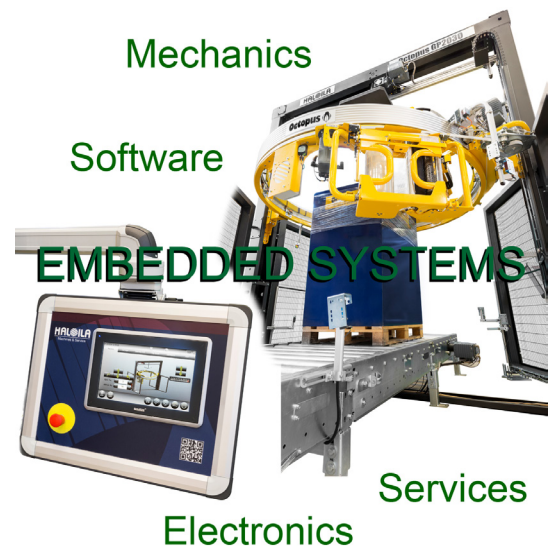
Technology applied

Through novel process components the compositional process framework explicitly supports multiple, communicating lifecycles and the various customisation capabilities such as multiple, synchronised lifecycles along the value chain to enhance multi-organisational and multi-disciplinary development, and modern reuse-centric, multi-lifecycle approaches like

product-line engineering or model-driven development.

PROMES proposes a framework containing state-of-the-art process components with a model and concepts of how to apply them in industry. These process components are designed to meet multiple challenges and are based on industrial needs and state-of-the-art collected during the project. The results are available in PROMES wiki repository thereby supporting process evolution and allowing more detailed customisation in company settings. PROMES provides 15 industrially validated process components, including tools that can be used as a reference for company specific solutions.

Making the difference

New feature sets were installed on existing tools of KE-works (KE-chain) and VectorFabrics (Pareon) while new prototype products were developed by TNO-ESI (Design Framework) and RUG (Decision Architect). The PROMES project also took advantage of the system engineering processes defined in standards, like ISO/IEC 15288, ISO 12207, ISO 15504 and INCOSE. Twelve case studies resulted in several new processes, which were implemented and

validated in the organisations of the industrial partners, including Océ, Nokia, Valmet Automation and Haloila.

The business impact of PROMES is twofold: participating tool vendors, consulting companies and research institutes will be able to enhance their product and service portfolio by valorising the results in terms of mature and marketable products; software-intensive system developers will benefit directly through

Embedded systems require smooth cooperation

efficiency and productivity improvements. These gains can be quantified in terms of cost reductions in real industrial settings – one of the key objectives of PROMES – and the creation of a PROMES wiki repository of process descriptions and guidelines supports SMEs with installing processes for embedded systems development.

In concrete terms, the application of empirical engineering of embedded systems resulted in a range of exploitations and benefits. A few examples:

- The Dutch University of Groningen's Enterprise Architect add-in, licensed under Eclipse Public Licence, increases the quality of decision documentation and improves the productivity of architects as well as enables the seamless integration of decision documentation into the work of software architects, in conformity with ISO/IEC/IEEE 42010.
- Aimed at process engineers and managers, the PROMES Process Framework developed by the consortium supports the reusability

of existing processes by adding, removing or modifying existing process components and is adaptable to different types of processes (both high level and project-specific).

- The Design Framework method developed by TNO is an embedded systems innovation that provides a conceptual modelling and reasoning framework that supports the integration of models from other tools and provides insight in the rationale for design decisions that matter the most.
- PROMES Wiki repository contains process descriptions and guidelines for applying them. The PROMES wiki repository is maintained by VTT.

Future prospects

Ultimately, the framework will help European industries to enhance their level of process and project management, improve the coordination of all the parties involved in the development of embedded systems and thus reduce development time and cost, while improving product quality at the same time.

Major project outcomes

Dissemination

- 40 publications
- 9 journals, 3 submitted
- Several presentations at fairs and seminars

Exploitation (so far)

New products:

- Decision architect: Tool for documenting and reporting architecture decisions, published in open source
- Design framework: The Design Framework method is a conceptual modelling and reasoning framework explicitly addressing the rationale management for, and guarding the design consistency within, model-based system engineering
- KE-chain: a commercially-available, web-based engineering workflow platform developed by KE-works
- Pareon Verify: a commercially available tool for analysis and verification of embedded software from Vector Fabrics

New services:

- Industrial process: industrially validated process component: Reference process component available in PROMES wiki
- Service process: industrially validated process component: Reference process component available in PROMES wiki
- PROMES wiki for exploiting project results including process framework and reference processes

Standardisation

- Participation to multicore association software-hardware interface working group