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INFORMATION TECHNOLOGY FOR EUROPEAN ADVANCEMENT

PROJECT RESULTS

Software engineering methodologies

for embedded systems

Among the many software product and process development methodologies there are dedicated approaches to software architecture development and assessment, requirements engineering and validation, software process improvement, and tools to support all these methodologies. However, the major disadvantages of these methodologies are that they do not take into account the specific needs of embedded systems and that they are applied in isolation, which is often ineffective, leading to disappointing results.

A cautious environment for software engineering deployment

The current market for software engineering technology isn't yet very mature and is characterised by a large number of isolated and immature methods, techniques, tools and processes. The inventory performed in the beginning of the MOOSE project shows clear dominance of US companies in the development of commercial software engineering tools, and a great potential for European open-source technologies. The most important conclusion from the inventory was that there is a large variety of technologies available. However, in most cases, the industry isn't eager to introduce them quickly and change current practices. This is due mainly to the risks associated with major change under dominant market and business demands at the same time.

Because of this finding the MOOSE project team decided to put a strong emphasis on exchanging technology experiences between industrial companies that are in similar situations in order to encourage creation of new technologies for industrial use. However, the risks need to be made more acceptable and the results guaranteed. In the industrial trials performed in MOOSE, the technologies that seem to fit best are customised components that are designed to solve a specific problem defined by industry. The industrial experiences of these technologies are captured through goal-oriented measurement, and stored in an open web-repository.

A framework for embedded software development

Making significant technological changes without guaranteed effects in an industrial environment that's driven by time-to-market considerations and economic constraints is impossible. Instead of creating the originally planned generic framework, which doesn't appear to be deployable, the project developed a framework that focused explicitly on industrial deployment. It was based on consideration of relevant constraining factors and integration and innovation of local and dedicated technologies. MOOSE calls this the "minimal change, maximal effect" model, and its effectiveness was confirmed in industrial trials. This framework is

MOOSE (ITEA 01002)

Partners
ASML
LogicaCMG
DataPixel
ESI
Nokia Networks
Océ Technologies
Philips Digital Systems Lab.
Solid
SQS
University of Oulu
Team Arteche
Technical University Delft
VTT Electronics

Countries involved
Finland
The Netherlands
Spain

Start of the project
March 2002

End of the project
June 2004

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set up using the experience drawn from the inventory of existing software engineering technologies, and is strongly influenced by the industrial experience of the technologies.

During the inventory, the real needs of industry became clearer and the consortium decided to focus on specific topics. The project team worked towards its original goals, but in a more refined, detailed and practical way. The industrial partners had a dominant role in this refinement. As such, the project has:

- optimised integration and interfacing of embedded software within (expanded and existing) development tool chains. Eg tailored experiments, and a literature overview;
- increased the effectiveness and efficiency of industrial technology deployment through inter-company experience exchange, shown by the industrial case reports, web-repository experiences and asset descriptions;
- collated technology integration experiences by conducting a large number of industrial embedded software development case-studies (21)

Tangible results for the software industry

With the ever-increasing complexity and size of embedded systems, the project realised that better solutions and specific embedded and integrated technologies are required to solve the problems of today and tomorrow. The project has therefore focused on increasing industrial technology deployment by decreasing the threshold to adoption of new technologies. This is done by focusing on assets (including the technology but with experiences, tailoring rules, application guidelines, industrial context descriptions, and personal contacts), and industrial project experiences (as to give guidance to estimate whether certain technologies will bring the required effects for the specific project or product). Within the areas of Requirements Engineering, Software Architecture and Process Improvement, existing technologies were tailored in several industrial cases.

In order to support and deploy the results of the MOOSE project a web-repository has been developed and filled with more than 100 industrial project experiences. The web-repository is open for all other interested organisations, mainly targeting industry. The added value of the web-repository will grow with the increase of the number of industrial experiences entered after the project end.

Specific results in the area of Requirements Engineering (RE) are guidelines for RE methods selection guidelines and an RE process improvement framework. Furthermore, a detailed analysis of selected software development process models and product quality characteristics relationships has been carried out.

Major results were achieved in the area of measurement, where a Software Measurement Guidebook has been developed. In the area of process improvement a software estimation guidebook has been developed and in the area of product assessments a self-assessment method for embedded software products was created.

Major project outcomes

Dissemination

- 34 published papers (including conference presentations)
- 10 papers accepted for publication
- The organisation of the MOOSE Conference, June 2004, Helsinki, Finland

Exploitation

- six new products (own product catalogue)
- seven new products (internal use)
- one new product (licensing)
- six new systems (own product catalogue)
- seven new systems (internal use)
- one new system (licensing)
- six new services (own product catalogue)
- seven new services (internal use)
- eleven new services (licensing)
- eleven new methods (licensing)

ITEA Office
Eindhoven University of Technology Campus
Laplace Building 0.04
PO box 513
5600 MB Eindhoven
The Netherlands
Tel : +31 40 247 5590
Fax : +31 40 247 5595
Email : itea2@itea2.org
Web : www.itea2.org

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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