ITEA 2

INFORMATION TECHNOLOGY FOR EUROPEAN ADVANCEMENT

Project Profile

Model-driven development offers high level approach

Speeds development of highly configurable embedded software-intensive systems

Automating software development in the embedded systems industry

MoSiS sees modelling, with its capacity for abstraction and more automated software production, as a key enabling technology for successful design, development and management of embedded software systems. The model-driven development of highly configurable embedded software-intensive systems (MoSiS) project will develop languages and tools for high-level modelling – as well as processes for using this technology.

To compete successfully in a world of globalisation, products must adapt to market needs that vary with geography, culture and the environment in which they are used. Flexible and adaptable high quality products with a higher level of complexity must be produced more cost efficiently than today.

MoSiS will combine and extend results from model-driven development, ambient intelligence and product family engineering to enable organisations to produce high quality products with variants in a fast and reliable manner. It will develop next generation, model-driven software engineering technology combining general modelling with variability management to meet the needs of the embedded domain.

HIGH PRODUCTIVITY ESSENTIAL

Handling complexity in a global context is a major challenge for the embedded systems sector. With highly qualified personnel and associated costs, European companies must be extremely productive to compete successfully.

Effort should be invested in understanding market needs and defining products with functionality to meet those needs. Product managers and engineers should use multi-view models at several levels of abstraction to model systems and their variability while focusing on market needs. From high-level models it should be possible to produce highly configurable and adaptable systems of high quality automatically, in a fast and reliable manner.

Since some of the market requirements will manifest themselves as extra-functional – non-functional – system properties, there is also a need to transform models of such properties automatically into high quality software.

FLEXIBLE AND ADAPTABLE

MoSiS will develop technology – and processes for how to use it – so that Europe's embedded systems industry can make products more flexible and adaptable, high quality products more cost efficiently, and more complex products reliably.

The project will focus on how to model the variation of extra-functional system properties and how to create and handle embedded MoSiS systems efficiently. Such systems will be:

- Software intensive – where software is crucial to the success of the system, the bulk of development effort is software related and most of the innovation stems from software;
- Highly configurable – where many different appearances of a system are possible, while still originating from one generic platform; and

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Partners

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Telvent
Universidad Politécnica de Madrid
University of Oslo
University of Skövde
Verum
Vrije Universiteit Amsterdam
VTT Technical Research Centre of Finland

Countries involved

Finland
The Netherlands
Norway
Spain
Sweden

Project start

July 2007

Project end

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Dagstuhl Seminar Proceedings 08142
Combining the Advantages of Product Lines and Open Source
http://drops.dagstuhl.de/opus/volltexte/2008/1542

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- Run-time adaptable – so that a system is not only configured before it starts to perform its task, but that adaptability is possible during normal execution by reconfiguring the system.

Automating software development in the embedded systems industry

OVERCOMING THE CHALLENGES

A pressing challenge is to adapt model-driven development (MDD) to meet the needs and constraints set by embedded systems. Modelling practices in embedded systems are immature, especially when modelling quality aspects. More research is needed on what inhibits modelling of extra-functional system properties and on how to exploit the benefits of such modelling.

Despite the relevance of variability modelling, there are a number of deficits. Lack of standardisation in targeted modelling languages and of techniques for relating variability and base models, as well as of strategies for resolving variability, leads to local and ad-hoc solutions not well supported by tools. Lack of modelling principles for extra-functional variability also leads to incomplete models, where the quality of derived systems cannot be judged.

There are a number of tools supporting product family engineering, but these are isolated solutions that address specific aspects. There is no integrated solution – i.e. no consistent set of concepts, languages and associated tools – that supports modelling and management of variability and that relates tools for variability modelling with MDD.

CONFIGURABLE AND ADAPTABLE SYSTEMS

MoSiS will add specific innovations to handle variability aspects at modelling level, and use MDD techniques to provide a continuum from resolving variability at design time to resolving it at runtime, ensuring highly configurable, runtime adaptable systems.

The project will deliver the MoSiS language, handling both functional and extra-functional properties when modelling variability. This language will unify and simplify the development process of software-intensive systems, as variability is completely described in one model. And this model will be used throughout the whole life cycle of a MoSiS system for managing variability.

Instrumental for achieving the overall objectives are the following results, which will be industrially validated:

- Standardised MoSiS language(s) for modelling and management of variability;
- Best-practice processes for model-driven development of MoSiS systems; and
- Tool prototypes, mostly open source, which support the MoSiS language(s) and processes.

INDUSTRY STRENGTH SUPPORT

The standardisation of a MoSiS language together with the prototype tools will enable industry strength tool support. Developers can then define variability at a high level of abstraction, where decisions for a specific variant are well documented and traceable. The generator-based software development for MoSiS systems will automate certain steps in the development process and improve the quality of the products developed.

MoSiS results will be applicable to all parts of the embedded systems market. The intention is that the standardised language will be used by the whole embedded system community, and also by software developers outside this sector. The same goes for tool support for the language, which should be commercialised outside the project. The best practice processes and the tool prototypes will be used initially by the project partners. However, the target is for a global uptake also of these results.

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ITEA 2 – Information Technology for European Advancement – is Europe's premier co-operative R&D programme driving pre-competitive research on embedded and distributed software-intensive systems and services. As a EUREKA strategic Cluster, we support co-ordinated national funding submissions and provide the link between those who provide finance, technology and software engineering. Our aim is to mobilise a total of 20,000 person-years over the full eight-year period of our programme from 2006 to 2013.

ITEA 2-labelled projects are industry-driven initiatives building vital middleware and preparing standards to lay the foundations for the next generation of products, systems, appliances and services. Our programme results in real product innovation that boosts European competitiveness in a wide range of industries. Specifically, we play a key role in crucial application domains where software dominates, such as aerospace, automotive, consumer electronics, healthcare/medical systems and telecommunications.

ITEA 2 projects involve complementary R&D from at least two companies in two countries. We issue annual Calls for Projects, evaluate projects and help bring research partners together. Our projects are open to partners from large industrial companies and small and medium-sized enterprises (SMEs) as well as public research institutes and universities.

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