ITEA 2

INFORMATION TECHNOLOGY FOR EUROPEAN ADVANCEMENT

Project Profile

Optimising real-time embedded system design

New framework to integrate modelling, analysis and runtime adaptation across multiple levels

The SYLEX project is developing a framework that will enable optimisation of the design and execution of adaptive real-time embedded systems (RTES). The objective of this framework is to integrate modelling, analysis, runtime adaptation and optimisation techniques that cross multiple-levels of abstraction and addresses multiple non-functional system constraints of different application domains. As a result, industry will be able to reduce design and development costs in the RTES production chain and reduce time to market for such systems.

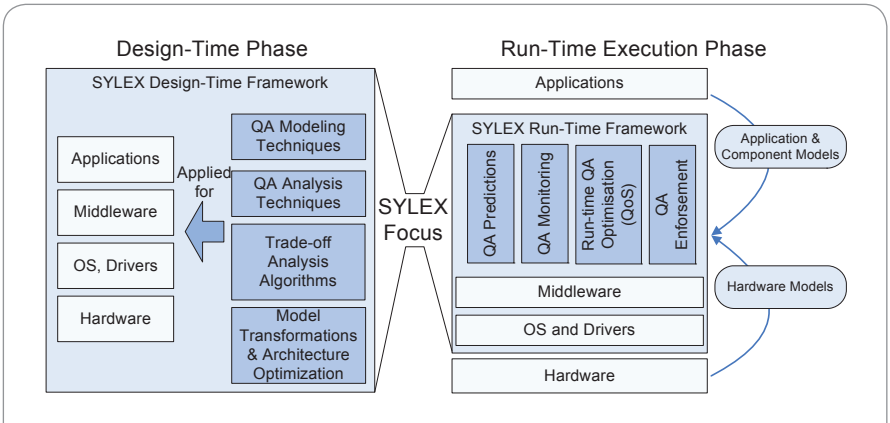
The European embedded systems industry is a leading provider of embedded systems applications worldwide. However, it is challenged by the increased complexity of the products required to keep pace with a demanding market. Moreover, this market has become more and more fragmented as embedded devices have developed into an important part of a large number of domains such as automotive, telecommunications, avionics, home electronics and personal media.

SYLEX intends to establish an open framework for exploration and optimisation of embedded systems during design and in run time to reinforce the competitiveness of European industries in the embedded systems market. The goal is a framework that will be usable at the different levels of the embedded applications development process.

FAST-GROWING EMBEDDED SYSTEMS MARKET

There are many reasons for today's fast growth in the embedded systems market. One example is new emerging markets with personal smart device such as mobile phones and global positioning systems. Other examples that are gaining ever greater attention include smart sensors and actuators. Such embedded systems are increasingly joined together in ad-hoc networks that more or less seamless interact with each other.

New products will have increasingly to aggregate several currently stand-alone applications and mix different technologies in new ways.



Approach of the SYLEX project

SYLEX
(ITEA 2 ~ 08012)

Partners

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CycloMedia Technology
Embedded Systems Institute
ENEA
Integrasys
Leiden Institute of Advanced Computer Science
Nissan Motor Ibérica SA
Seven Solutions
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University Eindhoven (TU/e)

Countries involved

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Project start

April 2009

Project end

March 2012

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Additionally, embedded systems must cope with ever more exigent and stringent non-functional constraints that often change from one domain to another. Fulfilling these constraints has a direct impact on the costs of these embedded devices.

A small personal device has to support low power consumption as well as flexible resource handling. Quality of service (QoS) is an important challenge. Problems that arise are related to how the system will handle lack of resources or decreasing availability of resources. How can a device define a formatted request for service? One purpose of SYLEX is to enable QoS awareness.

The problems for small embedded systems are also true for larger systems. The difference is that resource handling has to be more flexible to tackle resource constraints for both increased performance and environmental reasons.

NEW, MULTI-LEVEL, CROSS-DOMAIN FRAMEWORK

SYLEX represents the next step in the evolutionary effort in the area of distributed embedded systems. The primary goal is the definition, construction, experimentation; validation and deployment of a new, multi-level, cross-domain framework of methods, tools, and technologies allowing seamless multi-party development of adaptive networked RTES that have to meet tough requirements on energy efficiency, performance and robustness.

Embedded systems must often cope with a series of non-functional constraints – such as functional safety and limited resources. Current system modelling languages and techniques often lack support for these kinds of constraints. SYLEX is focusing on non-functional constraints performance, power consumption, timing, robustness and adaptability. The project aims to extend existing modelling languages and techniques with support for non-functional properties. Architectures will be analysed in terms of their non-functional attributes at both design-time and run-time phases of a system.

To address these challenges, the SYLEX approach includes:

- Automated design exploration: employing techniques for multi-criteria optimisation for automatically guiding the design toward the most promising solution(s);
- Automated generation of alternative system designs: introducing architectural patterns by means of model-to-model transformations – the same techniques for exploration of alternatives at design time can also be used for finding optimal run-time configurations – provided the system has support for dynamic self-reconfiguration;
- Integrated analysis of multiple quality system properties: with design alternatives compared based on their non-functional quality characteristics; and
- Development of new multi-criteria optimisation methods at multiple levels of abstraction.

Underlying all of these approaches are emerging technologies in system development, such as model-driven engineering (MDE) techniques to formalise the design, and as a bridge between design-time and run-time optimisations. Developments will cover run-time reconfiguration and adaptation as well as advances at chip, device and distributed levels.

MEETING THE NEEDS OF THE DIFFERENT ACTORS

The ITEA 2 project is driven by the needs of the main types of actors in the RTES domain: systems companies, technology providers, tool providers and end users. It is being carried by software houses that excel in product positioning, system-level specification, exploration and efficient integration.

Other parts of the ecosystem will be populated by innovators – including open-source communities – as well as technology providers, subsystem providers and domain-/application-specific application and software developers. For tool providers, the challenge is to enhance the current tool offerings of model-based and electronic systems-level design.

Apart from establishing an integrated framework comprising the solutions for design-space exploration, trade-off analysis and run-time optimisation, the SYLEX consortium plans to prove the solutions by applying them to development of innovative case studies.

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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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