



Project Results

MERgE

A multi-concern framework for a more secure, eco-efficient society

EXECUTIVE SUMMARY

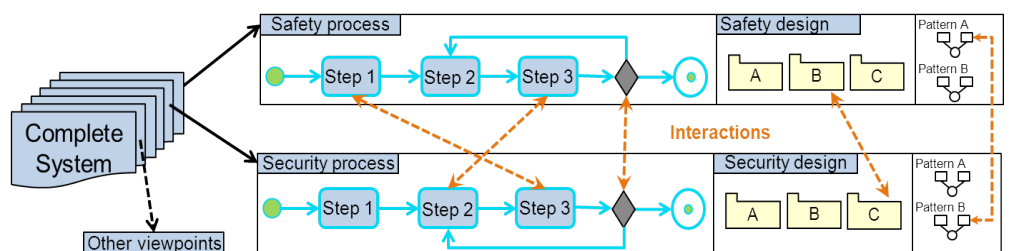
MERgE has advanced the state-of-the-art by developing a multi-concern framework to enable a set of common concepts to model all concerns in an aligned model. This includes enabling the seamless integration of a multi-concern process with general software development processes, the systematic identification of interactions among two or more concerns, and an inter-concern analysis and trade-off.

PROJECT ORIGINS

In a variety of application domains, engineering methods and practices, support tools and architectural solutions exist to ensure compliance with demanding system-wide requirements such as safety and security. However, given the lack of unified tools and methods for these domains, MERgE provides a new framework to bridge that gap. By developing, demonstrating and validating novel concepts, tools and methods for integrated engineering and management of safety and security concerns and their traceability, MERgE helps developers, regulators and end users to comply with existing and future requirements.

TECHNOLOGY APPLIED

The novelty of the MERgE solution is contained in the systematic integration of multiple concerns, like safety and security considerations, from requirements through architecture design implementation and maintenance to the provision of process guidance implemented within a process-centric environment (PCE). PCE is expected to alleviate both problems of lack of training and failure to follow standard procedures, which are two of the root causes of the traceability problem. Among the innovative



Safety-Security enhancement via the MERgE Platform & Configurator

aspects of the MERgE project is the use of multi-view/multi-concern technology to support mainly safety and security concerns at the earlier stages of the design process. MERgE will have a considerable impact on progress beyond the state-of-the-art as well as both theoretical and practical significance. The advances will be demonstrated by enhanced acceptability of the tooling by system architects, safety experts and security experts, flexibility of the concepts and tooling to adapt to different application domains, and the quality of multi-concern, e.g. safety and security, co-development.

Four use case demonstrators were defined and executed each for a different domain. In the Communication domain, innovation and exploration were strongly represented while the Automotive and Aerospace domains accentuated strong business model

investigation and development for software engineering whereby safety is a key concern. In the Industrial Control System domain, safety is the initial concern but with the growth of wireless distribution, security is becoming a bigger issue. The challenges identified here included the infeasibility of testing in production, the near non-existence of test environments, the lack of testing tools and the absence of overall security management. This case study thus responded by developing a security testing environment for ICS needs, ICS security testing tools and ICS security assessment and management capability.

MAKING THE DIFFERENCE

The project's work on the disruptive technology of model-driven engineering, especially in the Industrial Control System domain, helps engineers to easily learn and move between sites with differing

requirements. Furthermore, a frontend component – the MERgE Platform Configurator (MPC) that integrates both the consortium open source and commercial tools – allows the user to select the requisite tools and download a platform with those relevant tools. The MPC has been published for free download and use on the MERgE website. This in conjunction with the consortium member OBEO tool Omph! provides the capability to tailor the platform to compensate for/address weaknesses in domain specific toolsets.

Integration of the project's research into academic teaching programmes has also taken place for example at KU Leuven and UPMC related to safety and security concerns and approaches to handling technology. OBEO has provided significant input here for students. The educational aspect is especially relevant to acquiring future expertise for state-of-the-art technology that is ahead of its time. An important goal of the project was to use collaborative relationships within the project to explore the opportunities (in the four different domains/use cases). Exploitation is evident in the 3S framework developed,

piloted and implemented in Finland, which is now expanding to IAEA and INMM as well as different EU Member States. OBEO is exploiting Eclipse Sirius/UML Designer (training and expertise, specific development and configuration, team licence) while pattern technology has been integrated into Capella. The MERgE consortium is also contributing to national standards (i.e. E-Bios), domain/industry-specific standards (i.e. IAEA NSSxx) and international, generic standards (i.e. IEC/ISO).

In terms of future business impact, the provision of advanced engineering capabilities help facilitate a transformation in several business domains whereby a more secure, eco-efficient society will emerge that, in turn, will contribute to a more economy-efficient Europe. At the same time, enacting a standardisation strategy towards the relevant standardisation bodies will pave the way for increased European SMEs leadership in respect of products and services offered, thereby boosting the position of European research and industry.

MAJOR PROJECT OUTCOMES

Dissemination

- 67 conferences and papers
- 21 presentations
- 10 community events such as exhibitions
- 13 workshops

Exploitation (so far)

- MERgE Platform Configurator released for tailoring to domain/company specific concerns
- Research transfer of several techniques within Thales, Melexis, POHTO and nSense
- 2 taught courses with results integrated
- 7 guides for ICS Security
- 5+ training sessions to improve security practices and introduce techniques to students

Standardisation

- 9 standardisation activities (related to OMG, IEC, ISO 26262)

Spin-offs

- Two SME partners acquired by other organisations

ITEA is the EUREKA Cluster programme supporting innovative, industry-driven, pre-competitive R&D projects in the area of Software-intensive Systems & Services (SiSS). ITEA stimulates projects in an open community of large industry, SMEs, universities, research institutes and user organisations. As ITEA is a EUREKA Cluster, the community is founded in Europe based on the EUREKA principles and is open to participants worldwide.

MERgE

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Partners

Belgium

E2S

Katholieke Universiteit Leuven
Melexis Technologies NV
Space Applications Services NV

Finland

Codenomicon Oy

nSense Oy

Pohto

STUK

University of Jyväskylä

University of Oulu

France

ALL4TEC

INRIA

OBEO

Onera

Thales Communications and Security

Thales Global Services

Thales Research & Technology

Université Paris VI

Project start

December 2012

Project end

March 2016

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