UNIVERSITY OF GOTHENBURG

Measuring the evolution of meta-models, models and design requirements to facilitate architectural updates in large software systems

Darko Durisic
darko.durisic@volvocars.com

The PhD thesis will be defended in English
on November 15th, 2017 at 13:00
in Saga building, room Alfa,
Hörselgången 4, Lindolmen, Göteborg

The discussion leader is Prof. Andrzej Wasowski
IT University of Copenhagen

The thesis is available at
The Dept. of Computer Science and Engineering
Chalmers | University of Gothenburg
and
The Dept. of Electrical Systems Design
Volvo Car Group

ABSTRACT

Background: In order to reduce complexity of the system and its development cost, the architecture of large software systems is often developed following the MDE (Model-Driven Engineering) approach. MDE relies on three main artifacts in the development process: domain-specific meta-models, architectural models and design requirements. System architecture is defined in the architectural models developed in modeling tools. The syntax of the models is defined in domain-specific meta-models, while their semantics is usually provided in a form of design requirements.

Objective: The main objective of this thesis was to develop methods and tools for managing architectural updates in the development of large software systems. Our goal was to automatically assess the impact of using new architectural features on the development projects (e.g., in terms of model complexity and updates of the modeling tools) in order to assist system designers in planning their implementation. The assessment is based on measuring the evolution of domain-specific meta-models, architectural models and design requirements related to relevant architectural features.

Method: We performed a series of case studies focusing on the meta-model, architectural models and system design requirements from the automotive domain. On the one hand, the case studies helped us to understand the relevant industrial and scientific contexts of our research area and develop our methods using constructive research. On the other hand, the case studies helped us to evaluate our methods and validate their results.

Results: We developed three new methods and software tools for automated impact assessment. The first method and the tool (*QTool*) show the complexity increase in the architectural models after adding a set of new features to the system. The second method (*MeFIA*) and the tool (*ARCA*) assess the impact of using different features in the system on the used modeling tools. Finally, the third method and the tool (*SREA*) identify a subset of design requirements that are affected by the use of new features.

Conclusion: We showed that the use of our methods and tools enables faster implementation of architectural features in the development of large software systems. More concretely, we showed that quantitative analysis of evolution of domain-specific meta-models, architectural models and design requirements related to new features can be a valuable indicator of which features shall be used and what is their impact on the development projects.