

Christian Doppler Laboratory on Security and Quality Improvement in the Production Systems Life Cycle¹

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Abstract: The size and complexity of software components in production systems engineering, such as manufacturing plants or automation systems, requires effective and efficient approaches for security and quality improvement. In industrial practice, engineers from different disciplines, such as electrical, mechanical, and software disciplines typically follow a plan-driven and sequential engineering process approach with parallel engineering activities within a heterogeneous set of methods and tools. Therefore, major challenges concern (a) insufficient data exchange capabilities between disciplines, (b) a lack of consistency evaluation capabilities across disciplines, tools, and engineering phases, (c) insufficient knowledge representation and exchange between disciplines and project stakeholders and (d) limited security considerations. The goal of the Christian Doppler Laboratory on Security and Quality Improvement in the Production Systems Life Cycle (CDL-SQI) is to address these challenges in cooperation with industry partners in the production systems domain. We build on requirements and use case explorations at industry partners and on best-practices from Business Informatics to develop concepts and prototype solutions for the target domain and evaluate these concepts and prototypes in close collaboration with industry partners. We derive requirements, use cases, and test data from industry and provide concepts and prototypes to the industry partner and to related scientific communities.

Keywords: Production Systems Engineering; Software and Systems Engineering; Security; Quality; Engineering Process Improvement; Testing; Variability Management; Software Models

1 Introduction of the CDL-SQI research project

In this presentation we will introduce to the objective and the organization of the CDL-SQI research lab at TU Wien, focus on important challenges in the production systems automation domain and on selected key use cases and prototype solutions from / for involved industry partners [Bi19a]. The research laboratory, located at TU Wien, Austria started in 2018 and is organized in three modules, each supported by an industry partner in the production systems automation domain or related fields. The main focus of the seven-year research project, funded by the Christian Doppler Association⁴, is related to basic research in collaboration with industry partners. The mission of the CDL-SQI research lab is to both explore and develop concepts which improve the security and quality in cyber-physical production system lifecycles, where software engineering provides important added value,

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but suffers from heterogeneous requirements and data inputs from a multitude of systems engineering disciplines. We will discuss success and risk factors from the interaction of software engineers and systems engineers.

The research lab is organized in three modules each related to industry partners: (a) *Test Automation* and human-in-the loop testing in the production systems domain (Module 1) [Ec19; WMB18], (b) concepts, mechanism, and prototypes for an *efficient and effective data logistics* concept based on *AutomationML*⁵, a standardized data exchange format based on XML (Module 2) in the steel mill production environment (Module 2) [Bi19b], and (c) on *knowledge representation and reuse* in context of a *Product-Process-Resource (PPR)* concept [Sc15] in manufacturing system development.

2 Collaboration between Industry Partners and Academia

The research work follows the *design science cycle* to (a) explore industry partner needs, (b) identify candidate solutions concepts, (c) develop concepts and prototypes, and (d) evaluate prototype solution in academic and industrial contexts. Therefore, regular and individual workshops are organized to discuss and exchange needs, concepts, and prototypes. Industry partners typically provide application use cases, needs, and test data in their individual context and receive concepts, prototypes, and evaluation results. Furthermore, scientific communities can benefit from publications in context of industry use cases and application areas as well as from prototype evaluations in industry settings.

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⁵ AutomationML: www.automationml.org

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