

Siemens Rail - Industrial Case Study: Model-based Development of a Train Guard MT Function

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Abstract: Siemens AG Rail Automation, fortiss GmbH, and the chair for Software and System Engineering at Technische Universität München set up a transfer project to apply the SPES modeling framework (SPES MF) to the Platform Screen Doors (PSD) function of the Siemens Train Guard MT system creating formal models for requirements and system functionality.

Three documents provided by Siemens Rail were used as input: The Glossary Train-guard MT containing the general abbreviations and the definition of TrainguardMT terms, the TGMT System Requirement Specification specifying realization independent system requirements, and the System Architecture Specification TGMT containing the system architecture specifications of onboard and wayside subsystems of the PSD function. We transferred the requirements from the documents into our modeling tool AutoFOCUS3 and added formal interface and behavior descriptions. From these formal requirements we derived the functional architecture (i.e. a structuring of the system in terms of system functions) of the PSD function. Our models allowed to verify the formal requirements against the functional architecture using model checking. Causes of failing model-checks were analyzed.

One of the main findings was a rather big gap between system requirements and requirements originating from the system architecture specification, as different types of design decisions (scoping and refinement) were taken in one step. Introducing medium-level requirements to enable tracing and refinement from system requirements to architecture specification was a necessary design step that allowed consistency checks between the system requirements and the architecture specification.

The functional architecture could to a large degree be derived from the formalized requirements in a schematic manner. By grouping requirements together and identifying internal communication (operating modes), the structure of the functional architecture was defined. This led to a simulatable system model derived solely from the formalized requirements.

This work has been published at the Workshop SER&IPS, collocated with the International Conference on Software Engineering 2014, Hyderabad, India.