Linde Material Handling logo

Quality Time - Transforming Good Functional Software Requirements into High Software Quality

Software tests and initial quality assurance activities are not the only tasks that influence the overall quality of software. Functional requirements are vital when it comes to developing high quality software. Software models developed on the basis of the functional requirements are tested and optimized in a partially automated process. These are the steps that MES' experts supported Linde Material Handling GmbH (LMH) with in a recent project. LHM already uses two of MES' tools, namely the MES Test Manager® for dynamic tests and the MES Model Examiner® for static tests.

Functional requirements form the basis for a common understanding of the software product being developed. This common understanding is essential for all those involved in the software development process. Writing functional software requirements takes up a large amount of the time in a project. Furthermore, colleagues from various departments in a wide variety of different positions must cooperate together. Aside from requirements engineers, both software developers and testers of a specific functionality should be involved in the process. This helps to avoid unnecessary reviews and ensures good quality requirements at an early stage of the development project. Moreover, this significantly increases efficiency for both software development and testing and ultimately results in higher software quality. When requirements engineers, developers, and testers collaborate at an early stage it also helps to reduce the costs of the project.

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Finding the Right Partner

Linde Material Handling GmbH production site in Aschaffenburg, Germany
Figure 1: Linde Material Handling GmbH
production site in Aschaffenburg, Germany

Linde Material Handling GmbH approached MES for their support in the introduction of model-based development. Together with the MES Academy and the MES Test Center, MES and LMH defined a systematic and comprehensive quality assurance process. One of the main aims of this process was to ensure high software quality even during peak workloads in the development team.

Tools were introduced at LMH in a step-by-step process and at the same time procedures were defined and adopted in the development process. As previously mentioned, the functional requirements for the software to be developed form the basis for the entire development process. They are vitally important in ensuring software of the highest quality. Early on, the MES Test Center supported the requirements

engineers at LMH in creating concrete requirements. The comprehensibility and testability of these requirements are checked in reviews. Then they are translated into the formal language MARS in collaboration with the requirements engineers and software developers.

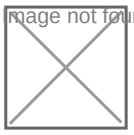
"With the clearly defined language area, it’s possible to create unambiguous and uniformly formulated requirements,” Philipp Hezel, Professional Software Engineering at Linde Material Handling GmbH clarifies. “In addition, technical debts can be reduced by testing during development."

MES and LMH collaborated on a number of important process steps such as defining test entry and exit conditions. Once the software module tests were completed, they were reviewed in a joint process. The completed test projects were then handed over to LMH. These contained result data in the form of the actual test cases as well as the environment parameters. In addition, MES delivered the automated test evaluations including detailed documentation of the test results and the test coverage that were achieved.

Kilian Abb, Senior Professional Software Engineering bei Linde Material Handling GmbH
Figure 2: Kilian Abb, Senior Professional Software Engineering bei Linde Material Handling GmbH

Kilian Abb, Project Manager and Senior Professional Software Engineering at Linde Material Handling GmbH had this to say about the project he oversaw: "The practical and problem-solving work of the team members at MES has been instrumental in helping us adopt process steps and complete projects on time. At the same time, MES support enabled us to establish our own independent testing department."

Vis-à-vis an independent testing department, the results serve LMH as a basis for regression tests that they can conduct autonomously. In this way, the traceability of the test results is guaranteed at all times. Due to the fact that there is no dependency on the service provider, namely MES, adaptations and modifications to the requirements can be quickly retested at any time.



What is more, LMH and MES hosted a joint webinar titled "From Good Requirements to High Software Quality - Insights into Software Development at Linde Material Handling GmbH."

The webinar showed how a test process supported by MES is created and applied in company. Both companies also shared which process improvements were achieved and discussed the insights they gained. Finally, they considered the various hurdles they had to overcome and the solutions to these issues in a live discussion.

About Linde Material Handling GmbH

Linde Material Handling GmbH is part of the Kion Group which emerged from Güldner-Motoren-Gesellschaft GmbH, founded back in 1904. Linde Material Handling GmbH demerged from the industrial gases group Linde in 2006. Linde Material Handling GmbH is the world’s second-largest manufacturer of forklift trucks and warehouse equipment. The company’s portfolio also includes intralogistics solutions such as fleet management, automation, and driver assistance systems, as well as truck-related services. Linde Material Handling GmbH is represented by production and assembly plants as well as a global sales and service network with over 13,000 employees in more than 100 countries. Its headquarters and largest production site is located in Aschaffenburg, Germany.

Linde Material Handling GmbH has extensive experience in the development of control software as well as in the development of electric and conventional drives. Over the past few years, model-based software development has been playing an increasingly important role in the company.

Model Engineering Solutions: Software Quality. In Control.

Model Engineering Solutions GmbH (MES) is a software company that offers solutions for the quality assurance of software projects. MES supports its customers in developing model-based embedded software that complies with industry standards such as IEC 61508, ISO 26262 or ASPICE.

Headquartered in Berlin (Germany), MES was founded in 2006. Dr. Hartmut Pohlheim, one of the most eminent experts in model-based development, has been the managing director of MES since 2008. . With subsidiaries in the U.S. and China, international sales partners, and major industrial customers such as Bosch, Daimler, Ford, Geely, Stihl, and VW, MES maintains a strong worldwide presence. All but a few of the world's top-selling manufacturers and suppliers in the automotive industry rely on MES' solutions in their development environments.

MXAM, MTest, MoRe, and MQC are the four MES quality tools. Together they form a toolchain for the comprehensive quality assurance of all phases of the model-based software development process. With the MES Jenkins Plugin, the toolchain can also be used in a continuous integration environment. The main application is the MATLAB® Simulink® platform. The MES Test Center and the MES Academy's main service areas are quality assurance and the optimization of development processes. MES is a dSPACE Strategic Partner, MathWorks, and ETAS product partner, and cooperates with SAE International.