Electricity and water don’t simply materialize from a socket or faucet, and vehicles like trains and cars can’t drive themselves. Critical infrastructures like these are backed by information and communication systems and their software.

The System Quality Center (SQC) of Fraunhofer FOKUS offers methods, processes and tools for the development and quality assurance of software-based systems that handle central and often safety-critical functions. Such systems are increasingly interconnected these days. Functions that users now take for granted actually demand a great deal of system development experience. Because many of these functions are safety-critical, and their failure could lead not only to financial risks, but also to the loss of life. To guarantee these safety-critical functions and ensure that the technical systems benefit people, it is necessary to protect them from both failure (safety features) and attack (security features). The goal of the around 100 employees of the System Quality Center is to develop reliable, secure and trustworthy software-based systems in order to guarantee functionality, performance, safety, security and robustness.

“By improving the efficiency of development and quality assurance processes, we help our customers increase their innovative potential.”
Tom Ritter, Director System Quality Center

with a medium-sized industrial partner to develop a modular architecture for an SIL3-capable control unit which is used to control safety systems in automation technology. During the project, the developers took an IEC 61508-compliant approach so that the entire development process displayed the necessary high degree of maturity. The project showed that customers can reduce their development time by between 20 and 60 percent using a standards-compliant approach. The scientists contribute their knowledge of software interoperability and standards compliance to a variety of standardization bodies, including the European Telecommunications Standards Institute (ETSI), the Object Management Group (OMG) and the AUTOSAR partnership. They also played a key role in the development of the Testing and Test Control Notation (TTCN-3) and UML Testing Profile (UTP).

SYSTEM DESIGN

System design is a critical step in the development process. The researchers from SQC use model-based development methods for this, among others. With their flexible and extensible ModelBus® tool integration and automation platform, they can significantly reduce the development costs for software-based systems. When designing safety-critical systems such as those used in aerospace, it is necessary to ensure failure-free operation and a high degree of processing power with low energy consumption. In the MUSE project, Fraunhofer researchers investigated what types of high-performance computer architecture will...
Software security vulnerabilities are based on programming errors. This allows attackers to access sensitive data, like bank details.
function reliably and energy-efficiently in a spacecraft despite cosmic radiation.

QUALITY ASSURANCE

Quality assurance is becoming increasingly important to the development of safety-critical systems. High levels of quality are specified by different standards, such as DO 178-B, a standard for software development in aviation, or DIN EN 61508, which is used in the development of electrical, electronic and programmable electronic systems. The System Quality Center provides methods and tools for quality assurance and advises its customers on their use. For example, the researchers in the STANCE project are developing analysis tools for verifying complex software systems in order to check the attack vulnerability of a train guidance system, for example. And in the DIAMONDS project, they are using model-based security tests to ensure that the network interfaces of bill counting machines cannot be manipulated.

CERTIFICATION SUPPORT

The System Quality Center also monitors the Common Criteria certification process in the CertLab, an outpost of the German Federal Office for Information Security (BSI). The scientists are involved in the development of industry standards and test methods here, and they support their customers during the certification process. Among other things, they are working with Vattenfall on the further development of the industry standard known as VHPready (Virtual Heat and Power Ready).
THE SYSTEM QUALITY CENTER PROVIDES
METHODS AND TOOLS FOR THE QUALITY
ASSURANCE OF SOFTWARE-BASED SYSTEMS

DR. TOM RITTER

Tom Ritter studied computer science at Technische Universität Berlin and earned a doctorate in 2011 from Humboldt University of Berlin. He has worked at Fraunhofer FOKUS since 1998. Since December 2013, he has been co-director of the System Quality Center (SQC) with Friedrich Schön. He is primarily interested in the model-driven development of software-intensive systems and the optimization of development and quality assurance processes. Tom Ritter is married and has three children.

FRIEDRICH SCHÖN

Friedrich Schön was born in 1958 and completed his computer science studies at Technische Universität Berlin in 1983. From 2002, he was a department head in the field of software quality at Fraunhofer FIRST and Fraunhofer FOKUS. Since December 2013, he has been co-director of the System Quality Center (SQC) with Tom Ritter. His primary interests range from parallel and distributed system architectures to the model-driven and verifiable construction of systems. Friedrich Schön is married and has a grown daughter.
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