making
cities smart

![Fraunhofer FOKUS]

**FRAUNHOFER INSTITUTE FOR
OPEN COMMUNICATION SYSTEMS FOKUS**

COMPETENCIES

– Automated architecture design space exploration
  and evaluation
– Software Product lines and variant management
– Architecture analysis and validation
– Empirical execution time analysis on
  multi-core processors
– Modelling and implementation of system and
  software architectures
– Quality assurance based on constructive and
  analytical methods
– Consultancy and guidance on certification

INDUSTRIES

– Aviation
– Rail
– Automotive
– Industrial automation

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SAFE ARCHITECTURES

CHALLENGE

Embedded systems and their software are becoming increasingly more complex as they realize more and more safety-critical features. A failure in their implementation may cause significant property damage and could even endanger people. In addition to the challenge of increasing complexity, the space, weight and power requirements of the hardware architecture are also becoming more and more significant. Therefore, a more efficient use of resources, while at the same time ensuring safety requirements, is becoming increasingly important. As more and more tasks of our everyday life are realized by complex and interconnected systems, the demands on their quality, safety and service ability are increasing. Furthermore systems have to be very flexible: they should be individually customisable in accordance with the needs of the customer, while at the same time, being compatible with third-party products. A tight integration of different products in a single control unit increases the organisational and technical complexity even further. This is a result of the fact that applications with different criticalities have to be executed in parallel on multi-core processor systems, while at the same time being separated in time and space for safety reasons. An optimal system resource configuration, which is compliant with real-time requirements, is an important prerequisite for cost effective and competitive system architectures.
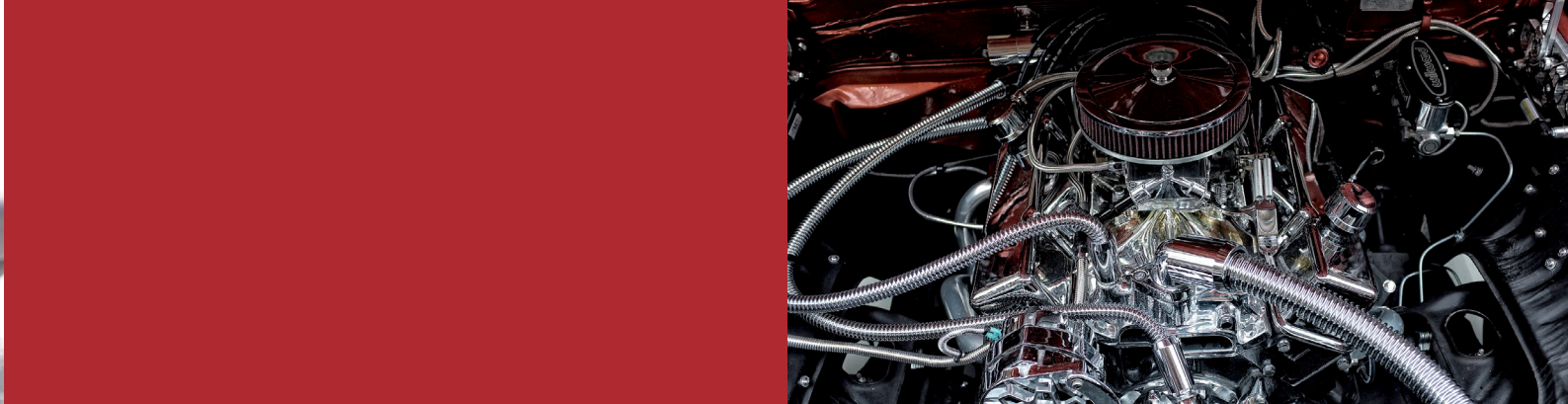
COMPETENCIES

The System Quality Center (SQC) at Fraunhofer FOKUS works on developing efficient development processes for safe and reliable architectures. We support our customers throughout the entire development cycle of embedded systems and have expertise in both, automated architecture design space exploration and in automated architecture assessment. This allows several system architecture candidates to be automatically generated and evaluated based on given requirements and optimization criteria.

The automation of this process allows all potential options to be checked and guarantees that optimal solutions are produced. As a result of the availability of powerful processor platforms (multi-core processors) and standardisation efforts (e.g. AUTO-SAR), architectures of complex, embedded systems can be designed to be more and more flexible.

SQC tools and methods support this flexibility in the engineering process by automatically creating and assessing hardware and software architectures. We will assist you in the selection and detailed modelling of a suitable system architecture, in its implementation (both software and hardware), and in the quality assurance process. We will also advise you on the certification of developments.

We have many years of experience with industry-relevant standards (such as DO-178C, ISO 61508, EN 50128 / EN 50129, AUTOSAR and ISO 26262). We have gained proven expertise in product lines and variant management in a variety of different projects.

Figure 1: Fraunhofer FOKUS tools allow software architectures to be automatically deployed onto complex hardware architectures
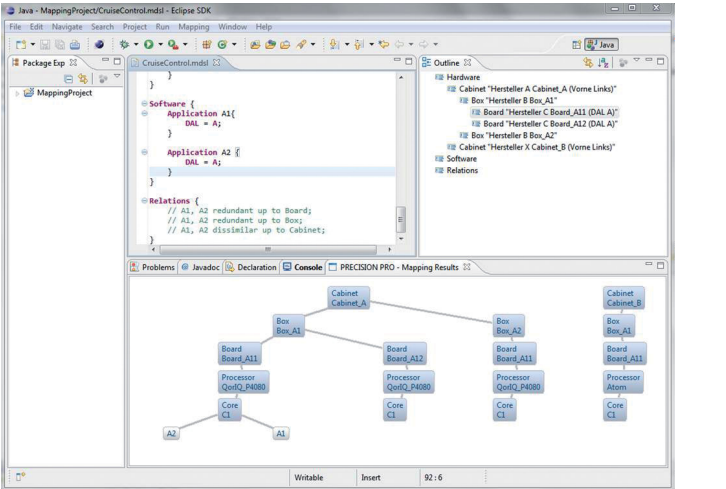
YOUR BENEFITS

Fraunhofer FOKUS processes enable the optimisation of safe and reliable architectures in all stages of development – from modeling and design to analysis, validation and evaluation. By automating these processes, improvements to current products and entire redesigns can be implemented much more efficiently. This leads to lower development costs and shorter development cycles for system architectures. Developers can rely on automation and early validation when systems have to be constructed with varying functionalities and different hardware components in shorter periods of time. This is a well-proven approach to reduce engineering uncertainties and to reduce development and material costs.

Automatic deployment of software components

The automation of the software deployment process results in fewer surprises when functionalities from different suppliers have to be integrated on a single control unit. In order to really take advantage of multi-core processors, many different applications from different suppliers have to be executed on a single processor, where they compete for resources (e.g. data buses). This can lead to undesirable waiting times and delays, which endanger the real-time behaviour of an application. These problems often only become apparent during in the integration phase.

SQC employs technologies which use static schedules and allocations to partition shared resources before the integration process in order to ensure that all applications are 'compatible', and that real-time behaviour is not adversely affected during runtime.

Certification

By using our tools, certification processes become more simple, shorter and more cost-effective. As the system's compliance with the relevant standards and requirements is ensured early on in the development process, there are fewer things to test and change later. This leads to generally lower development costs and shorter development cycles. SQC technologies enable architectures to be developed more quickly and cost-effectively, while remaining safe, reliable and certifiable.