"RELIABILITY AND AVAILABILITY"

The age of the steam engine is long gone. Today's railroad networks use embedded systems to manage trains and signal systems. Yet we only get an inkling of just how complex these electronics are when our train arrives late, or if an accident occurs. Georg Hemzal of Thales Transportation Systems GmbH is a man who is well aware of the complex development that lies behind embedded, safety-critical railroad-control devices.

What kind of electronics are embedded in today's railroad technology?
To a large extent they now consist of simple electronics which will increasingly be replaced in future by highly sophisticated electronic components and systems.

What role is played by information technology?
In the new railroad systems and equipment, software is taking over many performance-defining functions like those in a railroad signaling system. What's more, software solutions enable a much more complex enhancement of functionality.

What kind of jobs are done by embedded systems – for instance in a train or signaling system?
Embedded systems are now used in track- and train-safety systems to ensure that rigorous security requirements are actually met. They are used in a broad variety of situations. Take, for instance, track clear detection which is now increasingly performed by axle counters containing embedded systems. Modern trains are no longer conceivable without embedded systems, which are to be found in engine and brake controlling systems, door control systems, and the Vital computers of the European Train Control System (ETCS). And when you look at the latest braking systems for freight transport in the USA and Canada, you'll find embedded systems in the brake equipment of the freight wagons. It's pretty obvious where the trend is going.

What other kinds of functions will they take on in future?
Along with Automatic Train Protection (ATP) and Automatic Train Operation (ATO), embedded systems will give new momentum to railroad diagnostics and maintenance systems.

What role does networking and information exchange with other systems play? And what role will they play in future?
Planning and control areas would benefit most strongly from being networked with other systems. For instance, control rooms could then respond more rapidly to serious disruptions to train services or changing requirements in terms of the number of carriages needed or special trains. But networking and information exchange is also playing an increasingly important role in the railroad safety sector. Even now they are a basic requirement for any new railroad system such as electronic signaling control and train safety systems like the European Train Control System (ETCS).

1 In future the European Train Control System (ETCS) will standardize the various train safety systems used by European countries
2 Embedded systems help people travel in safety. Standards ensure that the level of quality needed to guarantee this is factored into development

What kind of challenges are involved in developing embedded systems for railroad technology?
Challenges in terms of reliability and availability, among other things! The key words here are high availability and continuous availability, which mean that it must be guaranteed at all times that the computer ensemble works according to its specifications and won't break down, or if parts of it do break down they must be capable of being repaired during on-going operations. In this context, redundancy concepts play an especially important role; a further challenge is the type of migration concept required. The railroad system simply cannot upgrade 20,000 units at one and the same time. The point is that the new systems should interoperate with the legacy ones.

What's so special about the development of safety-critical systems? What role do standards like EN 50128 play?
These systems ensure that the most precious thing we have – people – can travel in safety without fearing for their lives. Standards like EN 50128 and EN 50126 ensure a high level of security in embedded systems. They regulate the fundamental principles of the overall process, of which development is only one part. This is why they are guidelines to which we rigorously adhere in everything we do.

Where should the main focus be – on improving the development cycle or product-related activities?
It's not a question of "either/or". Both aspects in all their interworkings need to be driven forward.

Are you still testing or have you switched to verification?
We're moving ahead and verifying. But testing is still a fixed part of our development and quality assurance procedures.

What are the important aspects of your partnership with Fraunhofer FIRST in terms of software development for embedded systems?
Professional competence and short, simple and direct paths for the application of research results to industry with no time lost.

Why did you choose Fraunhofer FIRST?
Do you want an honest answer? Well, because of the truly excellent work we did together with Professor Schlingloff and his team!

What are the main features of your partnership?
Trust and competence on both sides. Sometimes you need the visionary perspective of a research scientist, and sometimes a research scientist needs an industry partner who brings him or her back to earth. Many good ideas have come from this type of "tension"!

Would you please complete the following sentence: a railroad without embedded systems…
…is like a sail with no wind!

The ETCS
The European Train Control System (ETCS) is the key unit of the future standardized European Rail Traffic Management System. It is designed to replace the many incompatible train safety systems currently used by European railways. The ETCS was founded in 1996 in response to the EU Council Directive on the interoperability of the trans-European high-speed rail system, and in the long term shall be extended to cover the European railway system in its entirety. Within the framework of customer projects Fraunhofer FIRST develops methods for testing and configuring ETCS control software.