

**Time-Triggered System Architecture**  
Volkswagen Prototype with FlexRay Communication

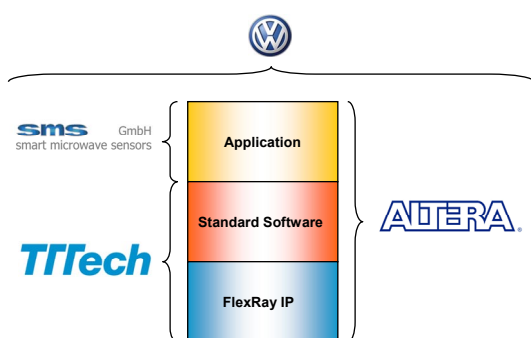
***TTTech***

"For all the partners of the FlexRay communication prototype project it was clear to get as close as possible to a standardized, close-to-series solution. TTTech Automotive's expertise with the FlexRay protocol considerably contributed to that objective."

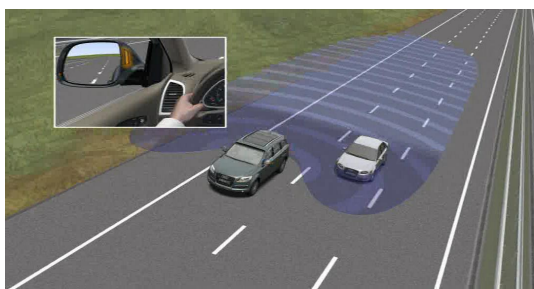
Dr. Martin Döring  
Teamlead FlexRay  
Volkswagen AG



Volkswagen, Smart Microwave Sensors, Altera and TTTech Automotive cooperated on a project to evaluate the implementation of FlexRay-based driver assistance systems and the migration of existing CAN-based implementations to FlexRay using AUTOSAR standard software. With the focus on standard conformance and cost savings, FlexRay and AUTOSAR solutions were deployed to scale driver assistance systems via the reuse of sensor data and reallocation of a system's functionality.



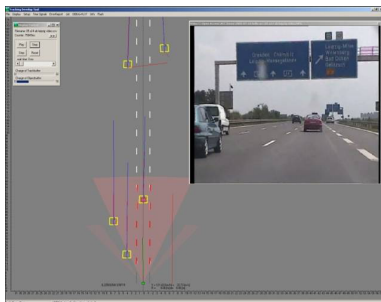
Due to the strict standard conformance approach all project partners were working in their own domains. Volkswagen was responsible for the planning and definition of the project content. Altera provided know-how on hardware. Smart Microwave Sensors took care of the application and its assembly. As development partner for time-triggered systems, TTTech Automotive supplied the AUTOSAR standard software, integrated the FlexRay IP and supported the system integration.



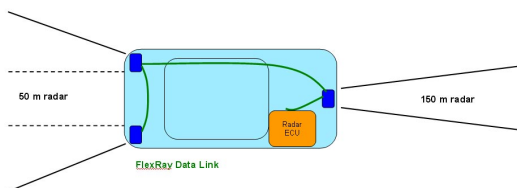
A prototype based on a Volkswagen Touareg was set up to evaluate a new FlexRay-based system architecture. The system architecture used the complementary features of FlexRay and AUTOSAR to decouple sensor data from the driver assistance systems implemented: a Lane Change Assistant (LCA) and an Adaptive Cruise Control (ACC). Two CAN-based radar sensors were formally linked and installed at the rear bumpers.

“TTTech Automotive proved to be a highly competent partner in the implementation of our digital radar technology. Its knowledge of FPGA technology and AUTOSAR-based standard software formed the sound basis for our application.”

Dr. Ralph Mende  
Managing Director  
Smart Microwave Sensors GmbH



Using an FPGA, the application software and the FlexRay controller software were integrated on one single chip to reduce hardware costs for mass production. With the standard software communication layer being available for different hardware platforms, it was possible to do integration tests even before the target hardware was ready. The system architecture and the design of the communication system could thus be evaluated at an early development stage.



The system integration phase was short due to the deterministic communication system and the standardized interface of the communication layer. The results of the evaluation project emphasized the need of qualified verification tools for the standard software configuration data, conformance testing of the standard software with high test coverage, and early network and software integration tests using original configuration data of the ECUs.



The FlexRay communication prototype demonstrated that it was possible to convert a CAN-based system into a FlexRay-based system. The FlexRay communication system was successfully introduced into a close-to-series application with the Volkswagen standard software. By removing functionality from the sensor slaves and taking advantage of the available bandwidth of FlexRay, the new system architecture resulted in significant cost reductions.

### **About TTech Automotive GmbH**

TTTech Automotive is a subsidiary of TTTech Computertechnik AG and acts as development partner for time-triggered systems in the automotive industry. The company's mission is to advance the use of the time-triggered technology on the basis of the FlexRay standard. TTTech Automotive cooperates with automotive partners to bring time-triggered technology into automotive commercial production.

Further information is available at  
**[www.tttech-automotive.com](http://www.tttech-automotive.com)**

### **About Volkswagen**

The Volkswagen Group with its headquarter in Wolfsburg is one of the world's leading automobile manufacturers and the largest car producer in Europe. The product range extends from low-consumption small cars to luxury class vehicles. In the commercial vehicle sector, the product offering spans pick ups, busses and heavy trucks. The Volkswagen Group's models are sold in more than 150 countries.

Further information is available at  
**[www.volkswagen.com](http://www.volkswagen.com)**

### **About Smart Microwave Sensors GmbH**

Smart Microwave Sensors is a specialist in high performance radar design and technology. The company provides off-the-shelf and customized radar sensor solutions for automotive, homeland security and industrial applications. Smart Microwave Sensors does not only develop commercial radar products, but has always been doing related scientific research work.

Further information is available at  
**[www.smartmicro.de](http://www.smartmicro.de)**

# **TTTech**

---

TTTech Automotive GmbH  
Schoenbrunner Strasse 7, A-1040 Vienna, Austria  
Tel.: + 43 1 585 65 38-5000  
Fax: + 43 1 585 65 38-5090  
E-mail: [office@tttech-automotive.com](mailto:office@tttech-automotive.com)