Hardware/Software Co-Simulation of SPI enabled ASICs and Software Drivers for Fault Injection and Regression Tests

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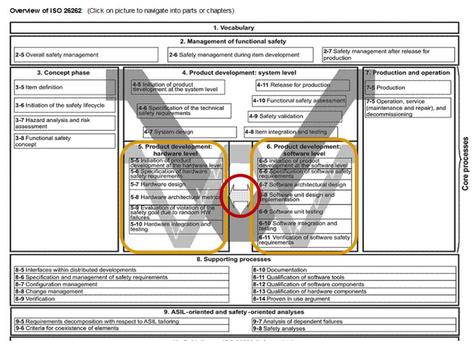
INTRODUCTION & MOTIVATION

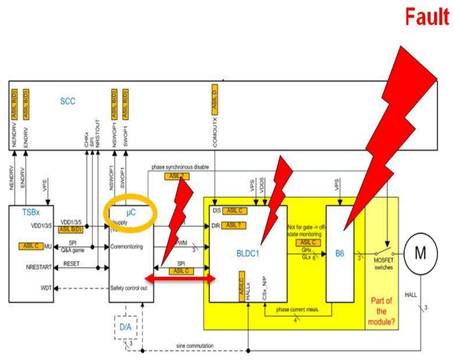
KEY market demands

- Increasing safety level requested from OEMs
- ISO26262 standard up to ASIL-D
- Risk of product recall due to safety weakness
- More complex HW/SW automotive systems



Problem Areas

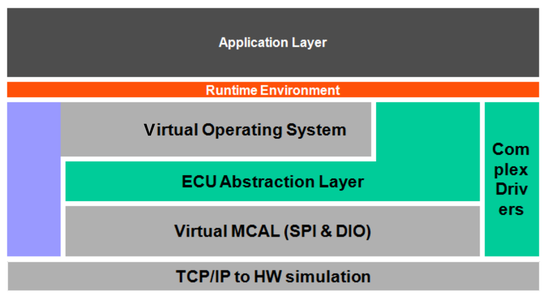
- late verification of SW driver interface to ASIC design can lead to ASIC redesign iterations
- late verification of safety architecture
  - fault injection only theoretically
  - late verification of HSI (e.g. SPI)
  - only possible with the first ASIC samples



OBJECTIVES

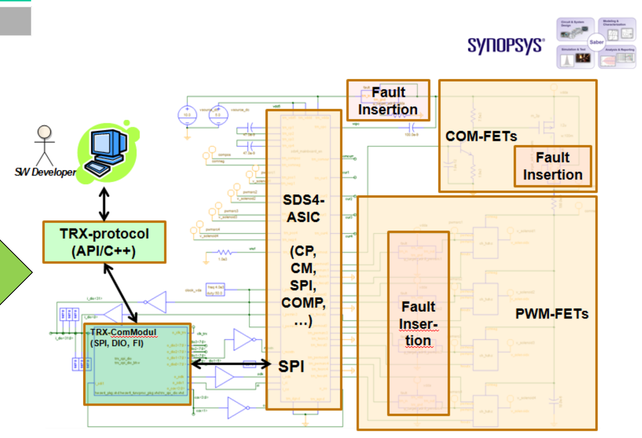
Early Integration	• HW/SW-Cosimulation • Early verification of HSI interface (e.g. SPI)	• Time to market 4-5 months earlier • less ASIC redesign cycles
Fault modeling	• Verification of functional safety concepts (system architecture) • Regression testing	• Robust design • quality improvement
Re-use	• of HW tool chain and system models (VHDL-AMS/VHDL/C++) • of SW tool chain and driver libs (compiler, debugger)	• No additional invest

RESULTS-1: Virtual HW-Prototype & Software Environment

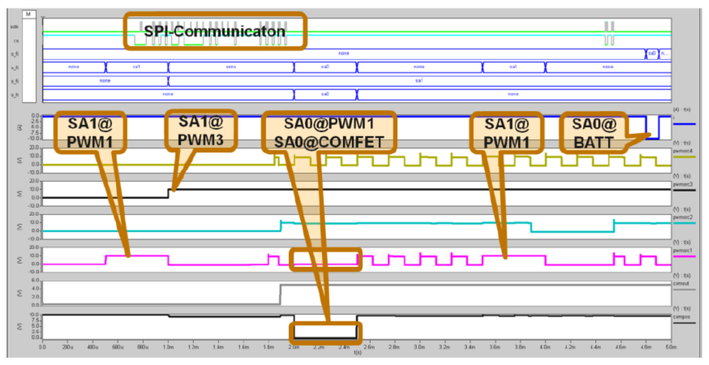


- Simulated AUTOSAR Software Architecture on PC Workstation
- Virtual MCAL layer and RTOS
- Use of ETAS ISOLAR EVE C++ framework

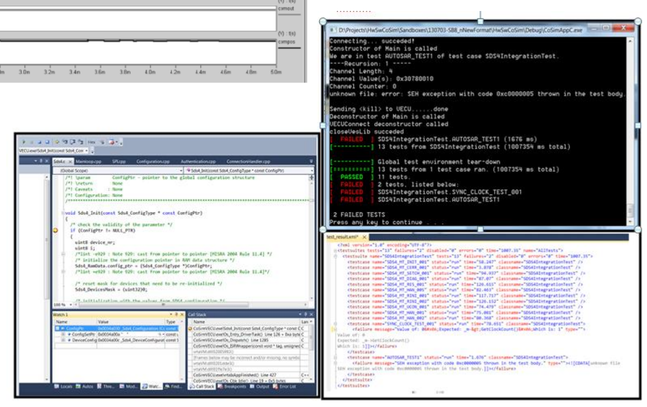
- Virtual Hardware Prototype (Synopsys Saber)
- Communication Module (TRX) offers access to software developer (DIO, SPI)
- Simulation of analog-mixed-signal components



RESULTS-2: HW/SW Co-Simulation & Fault Injection



- Automatic tests with Google Test framework
- Software Development in Visual Studio
- Fault Insertion in SW and HW



CONCLUSIONS

Validation of ASIC/HW Specification	• Alignment with virtual models (VHDL, VHDL-AMS) • Verification of HW/SW interface (e.g. SPI, DIO)
Regression Test	• VHDL-Test benches for ASIC (HW) • SW unit testing
Fault Insertion & Analysis	• Multiple and sequential failures (HW, CRC) • SW faults (incomplete messages, wrong timing) • Verification of functional safety concepts
Early HSI Integration	• Virtual prototype of ASIC for SW unit test • Early SW driver development possible

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The work was done within a internal innovation project of Continental AG and supported by José A. Avila, Executive Board Member, and responsible for the Automotive Division Powertrain. Special thanks for contribution, comments and review to Michal Pluska, Marta Giribet, Sida Xu, Michael Eckl, Eric Taistra, and Marc Arabackyj

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