Simulation and test technology

Humans in control of vehicles in critical environments

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Agenda

- Background
- How does it work?
- References
- Summary
Problems we got irritated on…

- Difficult with test time on final product
- Test of SW impossible before the HW was ready and available
- Hard to test system containing black boxes
- Separate HW and SW related problems during initial phases
- Turn around time for development and test using the available SW tools was very long
- Test of system before machine is available or when machine has limited availability
Simulation technology (SimTech) is developed by CrossControl and used in all our projects since 1994

1 test system for a project
Always run all HW modules
Code loading – each module
Observe communication
Primitive monitoring/debug

vs.

Run the whole control system in a PC
Any node can be HW or SW
Short turn around time
Powerful PC development tools available for monitoring
Provides development and test support for complex embedded systems

- Run the whole system in a PC, or parts of it
  - Control system modules (Controllers, I/O-nodes, Displays)
  - Model of the machine
  - Operator’s interface
- Short turn around time during development and test phases
- Forces to good sw architecture (hw independent code)
- Significantly increases the run time for the software
- Enables possibility for automatic testing
- Used during the whole life cycle
  - Development
  - Test
  - Maintenance
- Used by John Deere, BAE Systems Hägglunds, Volvo CE, ESAB, Atlas Copco, Sandvik, Bombardier
How does it work
White box testing and monitoring for all control system modules on a PC reduces the majority of SW related errors.

- All control system modules in the system are executed as a process in the PC.

Application code “HW independent”

Drivers & OS -> CCSimTech

Debuggers and other interaction benefits with PC software can be utilized.
Machine models and operators’ panels are executed in the PC which gives full visibility of all signals in the system.
With CCSimTech we use exactly the same software as in the real machine.

4 Computer nodes

Simulated in a PC environment

PC - win32

SimCAN

SimIO

Machine model

Operator’s panel
All products coming from CrossControl can directly be used in the simulated environment

- **CrossControl products**
  - All products are available in a simulated version

- **3rd party control system modules**
  - CoDeSys controllers
    - Use PC runtime, available from CoDeSys supplier
    - Full support for CoDeSys development environment
  - I/O modules + smart sensors
    - Emulate behaviour
    - CANopen EDS-emulator

- **Machine model**
  - MATLAB/Simulink
  - LabVIEW
  - C/C++/.Net

- **Operator’s interface**
  - QT
All types of signals are visible in the simulated environment which makes it easy to identify errors in SW application code.

- Tools for observing, logging and interaction
  - Bus Tool – Communication buses (CAN, LIN)
  - IO Tool – Analogue, Digital, PWM signals
  - Memory Tool – Internal memories (EEPROM, Flash)
  - Scripting language for test-automation
Customer case
Full SW simulation for a welding machine
Customer case
Full SW simulation for a forest harvesting machine.
SimTech is developed by CrossControl and used since 1994
- It is used in all our development projects
- It is used by our larger customers daily
- Large system solutions with integration complexity gain most
- Gives a common base for all SW development in the project

Our experience with SimTech is:
- Reduced development time
- Majority of SW related errors removed already during the project
- Reduced deployment time of the system onboard the machine
- A tool to manage service and maintenance of the SW package during the lifetime of the machine series
Questions?
Thank you!