Introduction

- The **Vehicle** – A **driving low cost Computer network**
  - … more than 40 Mio. new vehicles with 1.000 Mio. ECU per year
  - … **ECU Software** for 8…32-Bit Fixed-Point Processor
Introduction

- The **Vehicle** – A **driving low cost Computer network** contains
  - ... heterogeneous Components
    - Gasoline & Electrical Engines, Wireless Cell Phones, ...

must be delivered
- ... with 0 Defects
- ... for 5.000 Euro – 150.000 Euro
- ... within 3 years Development Time

must be developed
- ... together with **many**, highly integrated **Suppliers**

must be maintained
- ... for 30 years
Trends in the Automotive Industry

- The Vehicle - A driving **low cost** Computer network

![Controller][1]

8 Bit … 32 Bit Controllers

5kByte – 2MByte Bytes Flash

*Why is there so much pressure on Controller size and Memory consumption?*

⇒ *1MByte Flash costs 10 Euro!*
Trends in the Automotive Industry

- The Vehicle - A driving low cost **Computer network**
  - **Standardization** of ECU Software Architecture and Data due to problems with
    - ECU networks and
    - Exchange of Data **between Tools** and between OEM & suppliers

When will AUTOSAR really be introduced?
Trends in the Automotive Industry

- **The Vehicle** - A driving low cost **Computer** network
  - System & software engineers are using **Graphical Design**

... more than 60% of Application Software of an ECU graphically written

Tools must support co-existence of C and Graphic

Is C-Coding really necessary?

<table>
<thead>
<tr>
<th>Graphic</th>
<th>C</th>
<th>Assembler</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>a=b+c;</td>
<td>R=0x5;</td>
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<tr>
<td>2006</td>
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<tr>
<td>2021</td>
<td></td>
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</tbody>
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Trends in the Automotive Industry

- The Vehicle - A **driving** low cost **Computer** network
  - Road -> Test Cell -> Lab -> Math

Where and how can I find my Data?

Tools must support seamless exchange of Measurement Data!

Do we really need the Road for final Testing?

**NI VIP**
Th, 11am (NI)
Google your Data with Diadem
Trends in the Automotive Industry

- **Worldwide** distributed Development Teams
  - e.g. 1000 Employees & 100 Projects per year for one ECU generation

Do we already have the Tools which support this use case?
Trends in the Automotive Industry

- **Increasing complexity**
  - An Example: Legal Requirements

![Graph showing emission regulations and real world vs. zero emission](source: Robert Bosch GmbH)

Much more software needed … and … other system concepts, e.g. Hybrids, Fuel Cell, …
Trends in the Automotive Industry

- **Increasing Complexity** due to
  - Customer Requirements, Legal Requirements
  - more Variants and more complex Controllers
    - 50 Registers -> 1000 Registers

Which Tools can manage this huge amount of Data?
Trends in the Automotive Industry

- **How** does the Automotive Industry master these challenges?
  - CMMI or SPICE complaint Processes
  - Tricky development Methods and …
  - ... Graphical Design & Test with Tools, Tools, Tools, …

Is CMMI 3,4 or 5 the right final level?
Trends in the Automotive Industry

- **CAE-Tools** for the Development of **Software** for Vehicles
  - V-Cycle for ECU Software

Many Tools from different Vendors are in use!

Can **ONE Tool Family** or **ONE Vendor** dominate the V-Cycle?
Trends in the Automotive Industry

- **What** are additional **Initiatives** in the Automotive Industry in order to master these challenges?
Initiatives in the Automotive Industry

- The Virtual Development Initiative

Which Tool Vendor supports Co-Design of ECU Software, ECU Hardware and Vehicle Components first?

Integrated Development Environment
- ECU Simulation Backplane -
Initiatives in the Automotive Industry

- The Automation Initiative

Great improvements have been achieved, but ... Why is still a re-work of the Design Model necessary?

Why can we not generate the Design Model from the Requirements?
Initiatives in the Automotive Industry

- The Automation Initiative

With what language shall I code my Test Scripts?

Can I share them with others?

How can I manage them?

Is manual coding really necessary?

HIL Tests are very important for release of high quality Software!, but …
Initiatives in the Automotive Industry

- The Automation Initiative

Automatic Test Script Generation

Huge Efficiency increase possible, **but…**

still no Technology available!

Let us take a look to…

**NI VIP**
We, 11am (Telelogic)
11.30am (NI)
Requirements -> Test Scripts

Th, 2.30pm (MicroConsult)
UML Design -> Test Scripts
Initiatives in the Automotive Industry

- The Standardization Initiative

- Some of the Objectives
  - Standardization of Basic Software
  - Transferability of Software Components throughout network
  - Integration of Software Components from multiple suppliers
Initiatives in the Automotive Industry

- The Standardization Initiative

- Seat Heating
  - Supplier 1

- Window Lifter
  - Supplier 3

- Climate Control
  - Supplier 2

- ECU 1
  - Supplier 1

- ECU 2
  - Supplier 2

- ECU 3
  - Supplier 3

- Virtual Bus

- Tools

Bus
Initiatives in the Automotive Industry

- AUTOSAR from another angle …

**AUTOSAR** Tools

*must support Component-based Software Development for Distributed Systems*

Do we need new Tools? Are there new Vendors? Which Tool Supplier is providing what?

All in all …

- **Graphical Design** will be even more encouraged than before!
- **Tests** will also gain more importance than ever before!

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What can you expect from SYSTECS?

- **SYSTECS** is providing
  - Software Engineering Services
  - Innovative Frameworks for CAE-Tools
    - Architecture enforcement
    - Re-usable automotive Software Components
  - Consulting, Seminars & Workshops for use of best-in-class Processes, Methods, CAE-Tools & Software Architectures
    - SYSTECS is Associated Member of .NET Application Framework

AUTOSAR
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