Realizing Multi-core environments for AUTOSAR based ADAS

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Realizing Multi-core environments for AUTOSAR based ADAS

Agenda

- Evolution of ECU Network Architectures
- Freedom from Interference as Safety Key for ADAS
- Software Architectures for Domain Controller
- Software Integration
- No Safety without Security
- Summary
Current ECU Architecture

- Gateway
  - CAN
  - CAN
  - FlexRay
  - ...
  - ...

- Body
- Power Train
- ADAS
- Chassis
- Head Unit
Domain Controller Architecture – Future Concept
Current vs. Future Architectures: Main Differences

Current Architecture
- More Computing Power / Performance
- Coexistence of different functions in one ECU

Future Domain Controller
- Lane Departure Warning System
- Parking Assistant
- Traffic Jam Assistant
- Brake Assistant

Single ADAS Systems

ADAS Domain Controller
The Evolution of Desktop-CPU Performance...

... shows us the potential of Multi-Core vs. Single-Core Systems

Automotive CPUs today?

Source: Data from c’t 7/2014
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Freedom from Interference as Safety Key for ADAS

Freedom of Interference...

... is fundamental for a safe coexistence of functions

<table>
<thead>
<tr>
<th>Current Architecture</th>
<th>Domain Controller</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Hardware</strong></td>
<td>Shared Microcontroller/Memory</td>
</tr>
<tr>
<td><strong>Independent</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Software</strong></td>
<td>Shared Basic Software / Operating System</td>
</tr>
<tr>
<td><strong>Network</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td>Shared Runtime Environment</td>
</tr>
</tbody>
</table>
### Achieving Freedom from Interference

<table>
<thead>
<tr>
<th>Freedom of Interference (ISO 26262)</th>
<th>required SW modules</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Memory</strong></td>
<td><strong>Multi-Core Safety OS</strong></td>
</tr>
<tr>
<td>• Unintended writing to memory of another partition</td>
<td></td>
</tr>
<tr>
<td>• Register/Configuration corruption</td>
<td></td>
</tr>
<tr>
<td><strong>CPU time</strong></td>
<td><strong>Alive Supervision, Control-Flow-, Deadline Monitoring,</strong></td>
</tr>
<tr>
<td>• Blocking of partitions</td>
<td></td>
</tr>
<tr>
<td>• Wrong allocation of processor execution time</td>
<td></td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td><strong>End to End communication protection</strong></td>
</tr>
<tr>
<td>• Loss of communication</td>
<td></td>
</tr>
<tr>
<td>• Insertions of messages</td>
<td></td>
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</tbody>
</table>
Certified Functional Safety Products

Certified safety products are available on the automotive market.
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- **Software Architectures for Domain Controller**
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Multi-Core and Functional Safety

The “old” approach:

• Use a standard single core AUTOSAR system on each core.
• Use Complex Device Drivers (CDDs) to connect to the other cores
Independent Core Architecture (Example)
Multi-Core Safety Architecture
A safe AUTOSAR Multi-Core operating system

Advantages

- Extends existing partitioning schemes from single-core
- Same mechanisms for error detection available
- Easy migration from single-core to multi-core
- One configuration project

Open points ...

- How to avoid blocking API calls to other core
- Multi-Core error handling

... already solved by EB with EB tresos Safety OS Multi-Core
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- **Software Integration**
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Different software solutions from different suppliers need to be integrated on one ECU without interfering with each other opens...

... new field of Software Integration:

- **Tier 1 suppliers**
  Focus on the inner workings of their software

- **Carmakers**
  Focus on the complete solution on network level

- **Software Companies**
  - Cross Domain and Cross T1 knowledge
  - Independent Software experts (no T1 competitor)
Mastering Software Integration Challenges

- SafetyOS
- Genivi
- AUTOSAR
- eSolution
- Integrity
- MultiCore
- Linux
- Datenbank
- MQX
- Filesystem
- Middleware
- QNX

Functions | Suppliers | ECU | Specifications | Domains | Requirements
---|---|---|---|---|---

EB Automotive Software Factory

Processes | Services | Tools | Data management
Mastering Software Integration Challenges

- Software Integration Challenges
  - System Requirements
  - Software and Function Requirements
  - Functions- and Implementation model
  - Integration test
  - Modul test
  - SW-Implementation

- Partner

- Software
  - System Integration
  - Software and Functions test
  - Module test

- 60 Software Functions
- 200 Software Modules
- Over 25 Series
- 9 ECU platforms
- 6 different suppliers
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„There is no Safety without Security and vice versa“

José Manuel Durão Barroso, President of the European Commission, in a speech about nuclear energy in 2012

SECURITY PROTECTS SAFETY
Summary

• **Trend** towards fewer ECUs with more functions bundled on **one ECU per car domain** driven by higher-capacity hardware

• **Multi-Core** solutions needed

• The complexity of car software is increasing and opens **new concepts for software integration**

• Car2Car and Car2X connectivity make **automotive security** to a key priority for the industry
Thank you

Contact us!

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