A community for model based development

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Key Takeaways

1. A fruitful format: Community driven tool application & development

2. Model based development can be valuable for smaller companies
   - …and pre-competitive cooperation in a community helps

3. Education, research and companies can strengthen each other when working on a common platform
HAN Organization

HAN
University of Applied Sciences

≈30.000 students
≈3.000 employees

Faculty of Business and Management (ABS)
Faculty of Health and Social Studies
Faculty of Engineering
Faculty of Education

Institute of Built Environment
Institute of Engineering
Institute of Automotive Engineering
Informatics and Communication Academy
Institute of Life Sciences

Professorship Measurement & Control
HAN Automotive Research
Automotive laboratory
Automotive bachelor/master education
How to introduce MBD to education and SME’s?

**Challenges**

- How to reach the required knowledge/experience level in limited time?

**Opportunities**

- Students get ‘market-conform’ education
- Thinking in systems/applications
- No SW engineering skills required

**Education**

**SME’s**

- Obtaining the necessary modeling/control knowledge

**Investment in tools**

**Using cost effective tools in a lightweight MBD process fits both worlds**
Cost effective tools
Target hardware
HANcoder: library of embedded targets

RC30 Target
- Supported hardware
  - RC36-20/30
  - RC28-14/30
  - RC12-10/30

Prodrive GCU Target
- Supported hardware
  - Prodrive GCU2420

STM32 Target
- Supported hardware
  - Olimexino-STM32
  - STM32-E407
  - STM32-P405

Coming…
- New hardware
  - TMS570
  - HCS12
  - AUTOSAR
Workflow

Simulink® control algorithm

Embedded Coder®

HANcoder RC30 Target

HEX file

Flash tool

ECU

ASAP2 file

XCP Protocol (CAN)

HANtune
Workflow

- **RC30 Target**
- **STM32 Target**
- **Prodrive Target**
- **... Target**

- **Simulink® control algorithm**
- **Embedded Coder®**
- **HAN coder**
- **ASAP2 file**
- **HEX file**
- **Flash tool**
- **ECU**
- **XCP Protocol (CAN)**
- **Ethernet**
- **USB**
- **HAN tune**
- **CANdb file**
**Example applications**

**HyDoblo**
- Fiat Doblo, powered by Hydrogen and electricity
- Powertrain control + fuel cell system control by HANcoder

**Arval Inspire 1**
- Hydrogen fuelled vehicle for 2012 Shell Eco Marathon
- Road allowed vehicle, fuel cell system control by HANcoder
- Only vehicle in its class with student developed FC system control

**The New Cool**
- Refrigeration without diesel (clean/silent)
- Energy from generator in axle / optional solar panels
- Energy axle system control by HANcoder
- Partners: THT, TMC, TRTA, TPTS, VALX, TRS, Bosch Rexroth, HAN

**Plugin hybrid testbed**
- Development of plug-in hybrid powertrain testbed
- Powertrain / transmission / DC-bus control by HANcoder
- Partners: Punch Powertrain, Gomecsys, Spijkstaal, LMS, P2C, KdG, SuperB

**ITER servicing: Master Gripper**
- Haptic feedback control by HANcoder

**Active Roll Stabilization**
- Roll stabilization control by HANcoder
## Evolution

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>2009-2011</td>
<td>Q3 2009: Start RC30 Target &amp; HANtune development</td>
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<tr>
<td>2012</td>
<td>Q1 2012: Professionalization RC28-14/30 supp.</td>
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<tr>
<td>2013</td>
<td>Q2 2012: First demo remote connection</td>
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<tr>
<td>2014</td>
<td>Q2 2013: Fast &amp; Curious AUT / INDUSTRIAL</td>
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<tr>
<td>2015</td>
<td>Q1 2014: STM32 Target (industrial)</td>
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### Applications:

- **Altramotive**: E-powertrain control, datalogger
- **BRACE Automotive**: MBD demo
- **Fontys**: Vision based ACC
- **KdG/Uni Antwerp**: Cruise Control
- **H2 Consultancy**: Fuel cell control
- **HIT**: ITER Robot Master Gripper
- **HyET**: H2 pump control
- **Inalfa**: Sunroof control
- **Terberg**: Special vehicle control
- **VSE**: Electric Weight Compensation, Anti-pitch control, steering system dev.
- **Prodrive**: E-powertrain control, GCU
- **Skogforsk**: Forestry applications
- **Uni Tampere**: Wheel loader/excavator
- **HAN**: many (automotive/industrial)
Current project: SMARTcode

Series production oriented Model-based Approach for Real Time code
SMARTcode deliverables

Tools

Recommended practice

Example MBD aspects:
- Usage of Model Advisor to enforce MAAB/MISRA rules
- Usage of V&V toolbox for requirements management
- Possibilities of Simulink Design Verifier and Polyspace tools

http://www.thesaleslion.com/marketo-vs-eloqua-pardot-review-compare/

Lightweight process
V-cycle for software development
‘MBD’ V-cycle

Future project COMBINE: COmmunity driven Model Based Intelligent systems Engineering

Introducing these techniques at SME’s and in education proves to be effective

Community
Community partners

joined after project start
Community in practice

- Workshops
- Co-development by partners
- Community meetings (@partners)
- Online source code & project management
- Newsletters
- Wiki
- Articles
- Youtube channel/LinkedIn group
- Discussion forum
Development focus: community driven

Change Control Board
- Enforcing short term priorities
- Advising on long term vision

Roadmap
- Defined by community
- Confirmed by CCB
Future community goals

- Open up to the external world
  - Publication of STM32 Target for non-commercial use
  - Open-source?

- Community website
  - Public, only partly restricted
  - Source for tools and recommended practices
  - Lively environment for sharing knowledge and experience
    - Examples / online workshops / discussion forums / etc.

- Role of HAN
  - Facilitator/moderator
  - Service provider for MBD applications
  - Support w.r.t. tools & workflow
Interaction education – research – business

Companies

HAN Automotive Research

Tools

Students (intern/thesis)

Education

Past
Present
Future

Mathworks campus license supports educational rollout
Concluding Remarks

- Using *cost effective tools* in a *lightweight MBD process* can be a good fit for education and SME’s

- Pre-competitive cooperation in a *community* makes sense

- Next steps:
  - Model based systems engineering project
  - Open up to the world

- Join us!
Thank you for your attention