The prospering Eclipse Era in Automotive Industry

EclipseCon Europe 2013

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Agenda

 ➞ Overview of the Automotive Environment
 ➞ Bosch ECU development environment
   • yesterday
   • today
   • and tomorrow
 ➞ Experiences in establishing Eclipse
   • Obstacles
   • Resistance
   • Solutions
 ➞ Live Demo
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- **Overview of the Automotive Environment**
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Electronic control unit (ECU) development

- Which kind of ECU?
  - Real-time Operating System (OS)
  - Safety critical
  - Assembler and C are the languages of choice

- Modern cars consist of 60-100 different ECUs

Source: http://www.bosch-presse.de/presseforum/
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Powertrain

- Examples
  - Fuel injection
  - Ignition
  - Denoxtronic ("clean Diesel")
  - Driving dynamics

Source: http://www.bosch-presse.de/presseforum/
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Safety

➔ Examples:
  • Antilock Braking system (ABS)
  • Electronic stability program (ESP®)
  • Airbag

Source: http://www.bosch-presse.de/presseforum/
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Driver assistance

→ Examples:
  - Park pilot
  - Adaptive cruise control (ACC)
  - Predictive emergency braking system
  - Autonomous driving

Source: http://www.bosch-presse.de/presseforum/
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Overview of the automotive environment

⇒ All domains already use or will use AUTOSAR in future
⇒ What is AUTOSAR?
  • Describes the SW structure of a complete car in XML
  • Methodology - break down complex SW system design by abstraction and a unified architecture
  • Industrial standard started in 2003
    • All big Car Manufacturers and Suppliers contribute
    • AUTOSAR core members
The AUTOSAR specification

- Typical numbers of an AUTOSAR specification (AUTOSAR 4.1.2)
  - AUTOSAR XML-Schema has a size of 5MB
  - 22000 pages of specification

- Schema + specification is a pack of paper of around 3.5 meters height

You can still climb this pack of papers without a rope.....
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The AUTOSAR specification

- Typical numbers of an AUTOSAR project
  - >1GB of XML data
  - >100MB of c-files/h-files

- This is a pack of paper of >8 meters height

There you definitely need a rope.....

Source: private, all rights reserved
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So altogether – what does it mean?

➢ Over all automotive domains we have around ~10,000 ECU developers of AUTOSAR projects....

➢ without a highly performing, efficient and interoperable ECU development environment (tool landscape) it is impossible to release AUTOSAR-based ECU products.

Source: http://www.123rf.com, #13756182
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Earlier (1985-2005)...island paradise like Palau

Source: http://www.123rf.com, #11291217
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Bosch ECU development environment

The earlier phase (1985 – 2005) is characterized by

- lower complexity
- not connected automotive domains
- specialized non-interoperable standalone tools
- no overview about a complete ECU development project
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Bosch ECU development environment 2013

- CDT: C Development Toolkit
- Xpand/Xtend: Development Environment
- Perl: Development Environment
- Common Processors: Compiler, RTE, ...
- BCT: BSW processing
- BCT: BSW Editing
- NET Importer: DBC, Fibex, LDF
- iSolar-A: ASW Editing
- BFW: Build Framework
- Domain Models: BDOM + ARTOP
- Metadata Framework
- Eclipse Base System (3.8)

OSS tools
RB components
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Bosch ECU development environment

The last years until today (2005-2013) are characterized by

- rising complexity
- rising need for domains growing together - interoperable ECU software and tools is getting more and more important

**Eclipse is being established as Integrated Development Environment for AUTOSAR**

- interoperable platform
- highly extendable
- no islands anymore – an overview about a complete project is possible
Bosch ECU development environment

- The next decade (2013 - 2025) will be characterized by:
  - Application Lifecycle Management System based on Eclipse
    - Project Management
    - Requirement Development / Management
    - Source Code Management
  - Rising collaboration in Automotive Industry, different initiatives and cooperation models
    - www.artop.org
    - Eclipse Auto-IWG
    - ECU code and tooling as OSS development
      https://www.comasso.org

Eclipse is the backbone of ECU development at Bosch for the next 10-15 years!
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Experiences in establishing Eclipse

- Technical problems
  - very poor performance at the beginning
  - memory footprint (32 bit systems limitation to 1.3GB for Java-VM)
  - at the beginning small feature set for daily work of ECU developers
  - ... and a lot of other smaller or bigger issues

actually we thought we just have to climb up a mountain...
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Experiences in establishing Eclipse

... until we recognized that...
it actually was an iceberg...
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Experiences in establishing Eclipse

Far the most important root cause for resistance was (and still is!) Decrease of Autonomy

Source: http://www.123rf.com, #6514234
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Experiences in establishing Eclipse

Automotive Engineers are used to be completely free with 100% control

Source: http://www.123rf.com, #16293115
Using Eclipse feels like jumping into a fishbowl...
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Experiences in establishing Eclipse

Examples for this Decrease of Autonomy

- Eclipse comes along with a high background noise which is usually not understood ("out of sync", "background task", PC freeze due to garbage collector)

- Difficulty in integrating well-known scripting languages used by engineers for tool extension (like Perl)

- Eclipse Workspace-Management concept involves a lot of limitations
  - File changes outside Eclipse are not being recognized automatically
  - Files outside an Eclipse-Workspace are invisible
  - All files in an Eclipse Workspace are automatically being loaded
    - no variants possible
    - this contradicts a process reliability for series release quality gates
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Solutions

- Some of our solutions that extend the Eclipse Platform
  - **Project Import Framework** (extensible project importer and configurator, wizard and headless)
  - **Metadata framework** (define what is being loaded, switch between different configuration variants is possible)
  - **Full Text Index based Search** (based on Apache Lucene)
  - **Model Compare** (a “Beyond Compare”-like interface based on EMF Compare)
  - **Build-Framework** (like MAKE that processes files AS WELL AS in-memory models, task-chaining algorithm for M2M transformations)

We are in the process of contributing these solutions to Eclipse Auto-IWG (they are already available in our free COMASSO products)
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Bosch ECU development environment 2014

Eclipse Platform (Eclipse Auto-IWG Compliant)

Eclipse Base System (4.3)

Metadata Framework

Domain Models
BDOM + ARTOP

BFW
Build Framework

CDT
C Development Toolkit

Xpand/Xtend
Development Environment

Perl
Development Environment

Common Processors
Compiler, RTE, …

BCT
BSW processing

BCT
BSW Editing

NET Importer
DBC, Fibex, LDF

iSolar-A
ASW Editing

ALM components

OSS tools

RB components

ALM Plugins

Cross Divisional Group - Software, Methods and Tools

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Bosch ECU development environment 2014

- Eclipse Base System (4.3)
- Metadata Framework
- Eclipse Platform (Eclipse Auto-IWG Compliant)
- ALM components
  - BFW
    - Build Framework
  - Domain Models
    - BDOM + ARTOP
  - OSS tools
  - RB components
  - ALM Plugins

CDT: C Development Toolkit
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