AUTOSAR Configuration Process
- How to handle 1000s of parameters

Webinar 2013-04-19
> Introduction

AUTOSAR ECU Configuration Description

ECU Configuration Workflow

Multi-User Workflow

Webinar Series
Introduction

**AUTOSAR Method**

Complete SW functionality of the vehicle is defined as a system of SWCs...

- **VFB**: Virtual Function Bus
- SWC1
- SWC2
- SWC3

**Software Component Description***

An extract is created for each ECU...

**System Description***

The ECU is configured based on the ECU Extract.

**Extract of System Description***

..and distributed to ECUs

**ECU Configuration Description (ECUC)***

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Introduction

AUTOSAR Method

- ECU Extract (XML)
- Base ECU Configuration Generator
- ECU Configuration Description (XML)
  - RTE Config
  - OS Config
  - Basic SW Module A Config
- List of implementations of SW Components

- AUTOSAR RTE Configurator
- Configurator for OS, COM, etc.
- Configurator for other Basic SW
- MCAL Configurator
Introduction

AUTOSAR Method

- 1000s of parameters
- Large XML file
- Realistic file size
  - Small ECU: e.g. 10 MB
  - Large ECU: e.g. 50 MB
Agenda

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What is a parameter?

- Name
- Multiplicity (e.g. 0..1, 1..n)
- Type (integer, enum, ...)
- Min/Max values, literals
- Description
- ...

Example:
Name: `NvmBlockUsedCrcType`
Multiplicity: 1:1
Type: `enum (NVM_NOCRC, NVM_CRC16, NVM_CRC32)`

Example:
Value of the parameter within the configuration of a concrete ECU

Example: `NVM_CRC16`
Parameters are hierarchically organized in **Containers**

A container consists of:
- Parameters
- sub-containers

**Example:**
Name: *NvmBlockDescriptor*
Multiplicity: 1:65536
Basic Software Module Description (BSWMD) contains
- Parameter definitions
- Preconfigured values, recommended values
- XML format
  - Schema defined by AUTOSAR
  - Content defined by BSW vendor
  - May contain AUTOSAR standard parameters, and vendor specific parameters
- Typically one file per BSW module
AUTOSAR ECU Configuration Description

Challenges

- Degree of freedom is reduced by
  - Parameters (indirectly) given by the OEM
    - Network communication description
    - Parts of the diagnostic description
  - Parameters given by preconfiguration (preconfigured by the basic SW supplier)
- But
  - Still there are lots of parameters to be set
  - Dependencies between parameters
  - Additional challenges due to project situation
    - Several developers work in parallel at the same ECU
    - BSW is supplied by several vendors (e.g. Vector, micro-controller manufacturer)

Key for success: configuration tools
AUTOSAR ECU Configuration Description

Tool Support

- Comfort Views
  - Structured display of the ECU configuration
- Assistance for creating the configuration
  - Derive parameters from the ECU Extract of System Description
  - Automatic baud rate calculation, hardware masks
  - Automatic fragmentation of EEPROM blocks, ...
  - Validation (e.g. is configuration of FullCAN objects consistent)
- Support for integration of MCALs and add-on modules
  - Migration (platform switch)
  - Development of tool extensions (Validation rules, configuration GUI, code generators)
Agenda

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Multi-User Workflow

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ECU Configuration Workflow

Overview

**PREEvision**

- **DBC**
  - Input files provided by OEM
  - Contains communication information needed for the ECU

- **LDF**
  - Software Component Description files

- **Fibex**
  - ECU Extract of System Description provided by OEM
  - Contains system information needed for the ECU

**DaVinci Configurator Pro**

- **SystemDesc Conversion**
  - .xml
  - ECU Extract of System Description

- **Base ECUC Generation**
  - .xml
  - ECU Configuration Description

**Editing and Generation**

- **.c .h**
  - RTE header and code files
  - SWC header files

- **.c .h**
  - BSW module configuration header and code files

**DaVinci Developer**

- Embedded Coder

- TargetLink

**Other AUTOSAR tools**

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ECU Configuration Workflow
Integration of third party BSW (MCALs, Complex Driver)

- Configuration and Generation
  - Via standard tool features (Generic Configuration Editor, call of external code generators)
  - Via specific Plug-Ins (GUI, code generator based on DaVinci Configurator technology)

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AUTOSAR ECU Configuration Description

ECU Configuration Workflow

> Multi-User Workflow

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Multi-User Workflow

General

- Several developers are working in parallel at the same AUTOSAR ECU
- Integration effort must be small
- AUTOSAR configuration artifacts (AUTOSAR XML files) must be managed consistently with other artifacts of ECU development (code files, specification documents, test environments, ...)
- Use customer’s CM (configuration management) system
Multi-User Workflow
Responsibilities

Several possible ways to organize responsibilities, e.g.

Component responsibles
- Each component (e.g. SWC, BSW module or cluster) has one responsible
- Only the component responsible is allowed to change the component

Feature responsibles
- Feature developer makes changes in potentially all SWCs or BSW modules
- Overlapping modifications – several users change e.g. same SWC
- No strict assignment of user to SWC/BSW-Module
Multi-User Workflow

Access Strategy

Two general approaches regarding development process/access strategy

Concurrent editing
- Several persons change in parallel the same objects (e.g. SWCs or BSW module configurations)
- Typically realized via branches in a configuration management (CM) system
- Requires diff/merge

Exclusive editing
- Only one person allowed to change an object
- Typically realized via check-out control strategy of CM system
- Requires sequencing of work packages – difficult to organize!
- Avoids merge
Multi-User Workflow

Tool Support

- Standalone Diff-Tool
  - Compare two ARXML files (any content)
  - Show differences in native view

- DaVinci Tools
  - Generic diff/merge of SWCs and ECUC
  - Read-only display of objects like SWCs, Port Interfaces, Data Types, modules
  - Available for all relevant objects, e.g.
    - SWCs
    - Port Interfaces
    - Data Types
    - Module Configurations
Multi-User Workflow
Fine-grained Configuration Management

- Split-up the project data into several files
  - Define access rights based on individual files (reflected in file state r/o vs. r/w)
  - Only the modified files need to be merged
- File granularity can be selected when setting-up the project
  - Single file
  - Split files
Webinar Series

The webinar series about AUTOSAR (http://www.vector.com/vi_autosar_webinars_en.html):

- 2013-01-22 Analyzing and testing of ECU-internal (AUTOSAR) parameter using CANoe.XCP and CANoe.AMD
- 2013-03-12 ECU development with AUTOSAR - An introduction for AUTOSAR beginners
- 2013-04-16 Introduction to the AUTOSAR Method for ECU development
- 2013-04-19 AUTOSAR Configuration Process - How to handle 1000s of parameters
- 2013-04-26 Reliable Testing of AUTOSAR ECUs
- 2013-05-07 MICROSAR Safe: AUTOSAR basic software for safety-relevant ECUs (ISO 26262)
- 2013-06-05 AUTOSAR System and Software Design with PREEvision

Various Webinars on MICROSAR OS – the AUTOSAR operating system from Vector http://www.vector.com/vi_operatingsystems_webinars_en.html

Registration to the upcoming Webinars and the list of recorded Webinars: http://www.vector.com/vi_webinars_en.html

The overview of Vector’s training services: http://www.vector.com/vi_training_en.html
Thank you for your attention.

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