Model-Based Body Controller Software Development

Transforming Customer Expectations into Virtual Reality
Overview

Model-based software development V-model

System requirements - The Customer Experience

Feature requirements – Functional description of software components

Software component modeling and verification
Model Based Software Development V-Model

- **System Requirements**
  - DOORS

- **Feature Requirements**
  - MATLAB/SIMULINK
  - XDIS

- **System Description**
  - SWC's
  - System Comm Matrix

- **BSW and ECU Resource Description**
  - ECU Extract
  - Integration into ECU Configuration
  - Code Generation

- **Iteration Loops**
  - Vehicle Level System Validation
  - Hardware in the Loop Verification
  - Model in the Loop Verification
  - Software in the Loop Verification

- **Daimler Supplier**
  - VAPS and TPT
Model Based Software Development V-Model

System Requirements

Feature Requirements

DOORS

MATLAB SIMULINK

XDIS

System Description

SWC's System Comm Matrix

BSW and ECU Resource Description

ECU Extract Integration into ECU Configuration

Code Generation

Software in the Loop Verification

Hardware in the Loop Verification

Model in the Loop Verification

Vehicle Level System Validation

Iteration Loops

Daimler Supplier

VAPS and TPT
System Requirements

Customer User Experience

- Vehicle Platform Requirements
- HVAC Requirements
- 3rd Party Requirements
- Power Requirements
- Powertrain Requirements
- Telematics Requirements
- Spatial and Environmental Requirements
- Lighting Requirements
- HMI Requirements
- Flexible Function Requirements
- Safety System Requirements
- Body and Trailer Requirements
Model Based Software Development V-Model
Feature Requirements

Feature owners create feature requirements which become software component descriptions.

Body Controller is divided into functional features.

Software Component Requirements
- Each requirement shall be testable
- Each requirement shall be traceable

Approach allows for feature requirements that are cross platform in a global Daimler market.
Feature quality improves as requirements mature.
Model Based Software Development V-Model

System Requirements

Feature Requirements

DOORS

MATLAB SIMULINK

System Description
SWC's System Comm Matrix

BSW and ECU Resource Description

ECU Extract Integration into ECU Configuration Code Generation

Software in the Loop Verification

Model in the Loop Verification

Hardware in the Loop Verification

Vehicle Level System Validation

Iteration Loops

Daimler Supplier

VAPS and TPT

Daimler

Transforming Customer Expectations into Virtual Reality
System Description: Software Component Modeling

Software Component Model is Developed from Feature Requirements

- Process allows global library of mature SWC models
- Baseline SWC’s are used to develop innovation and vehicle platform specific functionality

Models are developed in close communication with feature owner

Un-complied model is verified through simulation environments

Model in the Loop Testing

VAPS

TPT

Executable models automatically generate C Code

Requirement errors are corrected early in development cycle

DOORS

XDIS

Body Controller

Autosar Runtime Environment

Standardized Autosar Interface

Basic Software Component

ECU Hardware

ECU Extract provides System Description

Transforming Customer Expectations into Virtual Reality
Model Based Software Development V-Model

System Requirements

Feature Requirements

Iteration Loops

Vehicle Level System Validation

Hardware in the Loop Verification

Model in the Loop Verification

System Description

SWC’s

System Comm Matrix

BSW and ECU Resource Description

ECU Extract

Integration into ECU Configuration

Code Generation

Daimler Supplier

VAPS and TPT

MathWorks SIMULINK

XDIS

DOORS

Transforming Customer Expectations into Virtual Reality

Daimler Trucks | Mechatronics Engineering | MathWorks Automotive Conference 2015
Model in the Loop Verification - VAPS

Transforming Customer Expectations into Virtual Reality

SWC is verified through graphical user interface

Customer user experience is observable

Parameter permutations are selectable

External SWC stimulus is provided

Transmit and internal messages
Thank You