Building Executable Specifications using Model Based Design


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AGENDA

- OLD WORKFLOW
- PROBLEM STATEMENT
- NEW WORKFLOW
- RESULTS ACHIEVED
OLD WORKFLOW

DO A COMPLETE ANALYSIS OF WHAT IS REQUIRED AND DOCUMENT THEM MANUALLY

GIVE THIS AS A REQUIREMENT TO THE SUPPLIER DIRECTLY
PROBLEM STATEMENT

- Communication gap as most of our suppliers are from North-East Asia
- Huge development time
- Delay in software deliveries
- Numerous software bugs
NEW WORKFLOW

CAPTURE REQUIREMENTS BASED ON PROBLEM STATEMENT

TRACE REQUIREMENTS TO CREATE MODELS AND VICE-VERSA

MODEL
VALIDATE
REPORT

SHARED WITH SUPPLIER AS EXECUTABLE SPECIFICATION

FBK
CAPTURE REQUIREMENTS

- Communication gap as most of our suppliers are from North-East Asia
- VAST TEXTUAL CONTENT, NEED FOR MAKING IT MORE ILLUSTRATIVE
- Huge development time
- Delay in software deliveries
- Numerous software bugs

MAKE THE SPECIFICATION VISIBLE AND EXECUTABLE
2 SCOPE

This document describes the CAN wakeup strategy in which certain nodes (here being ECUs) are required to be functionally active with communication after IGN OFF.

3 CAN Wakeup

There are two concepts involved for wakeup communication: NM_MASTER and SLAVE. NM_MASTER node is the one that initiates communication on the detection of pre-defined triggers. Based on these triggers the NM_MASTER node would initialize and send CAN messages on CAN port to other nodes in network. SLAVE node is the one which on receiving a wakeup message performs the activities intended.

For proceeding with the logic to be implemented consider the following ECUs:

1. NM_MASTER
2. SLAVE1
3. SLAVE2
4. SLAVE3
5. SLAVE4
**REQUIREMENT TRACEABILITY AND MODELLING**

**CANBUS_REQ XXX:** This signal would be transmitted by any node that requires CAN Bus to be alive.

If the NM_MASTER gets less than 5 REMOTE triggers then after a calibratable time it should come back to MODE1.
VALIDATION

➢ Design Error detection using Simulink Design Verifier
➢ Test case generation and validation using excel sheet / signal builder
➢ Coverage analysis
➢ Creating Hardware-In-Loop environment for actual ECU testing
DESIGN ERROR DETECTION
SIGNAL BUILDER

EXCEL SHEET HAVING ALL AND EXPECTED OUTPUTS

IMPORT ALL USING SIGNAL BUILDER

HARNESS MODEL

INPUTS AND EXPECTED / ACTUAL OUTPUTS COMPARISON

INPUTS

ACTUAL OUTPUTS
HARDWARE-IN-LOOP

*dll file for real-time interaction between CANoE and MATLAB
# RESULTS

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>TARGET ACHIEVED</th>
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<tbody>
<tr>
<td>Communication gap as most of our suppliers are from North-East Asia</td>
<td>➔ Visibility and readability of specs improved drastically</td>
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<tr>
<td></td>
<td>➔ Real time simulation of specs</td>
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<tr>
<td>Huge development time</td>
<td>➔ 40% reduction in development time and software deliveries</td>
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<tr>
<td>Delay in software deliveries</td>
<td></td>
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<tr>
<td>Numerous software bugs</td>
<td>➔ Iterations of buggy software reduced to 80%</td>
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</tbody>
</table>
TOOLS USED

- Simulink
- Stateflow
- Simulink Design Verifier
- Simulink Verification and Validation
- Vector CANoe Integration with MATLAB
- Report Generator
QUESTIONS
??????
THANK YOU

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