Methodology and Tool Chain for Diagnostic Design and Synthesis

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Agenda

Motivation

Vehicle System Modelling

ECU System and Diagnostic Modelling

Diagnostic ECU Specification

“Fault Finding” and “Generic GUI”
Motivation
Synthesis of relevant repair data

ToDo at repair shop:
- Detect component that causes faulty function
- Find faulty component in vehicle geometry

Wanted:
- Database that joins function, diagnostic data and location within the vehicle geometry.
**Motivation**

*Usage of existing Architecture knowledge*

E/E architecture as starting point for diagnostic specification?
Agenda

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“Fault Finding” and “Generic GUI”
Vehicle System Modelling
Model based E/E Systems Engineering

- Single source data model supporting layers for different stages and disciplines of development process
- Connection of layers by mappings (M)
Vehicle System Modelling
Model based E/E Systems Engineering

- Imports and export of industrial exchange formats e.g. AUTOSAR, KBL, RIF etc. are supported.
- Proprietary formats can be created with moderate effort.
- Utilizing several imports on PREEvision data model allows a merge of data of different domains.
Vehicle System Modelling
Entire Vehicle Network

- The modelling of the network topology is done in the Network Diagram
- Functions are mapped on hardware devices
- This procedure creates implicit knowledge that is needed by diagnostic specification process
As part of the E/E vehicle architecture the network topology of the entire vehicle is described.

Logical functions are mapped to hardware components such as controllers, sensors and actuators.

Due to the design of the system and its hierarchy implicit diagnostic requirements are generated.

Hardware components can be linked to the wiring harness and installation locations. Thus, the geometrical position of each component is held in the same data model.
Agenda

- Motivation
- Vehicle System Modelling
- ECU System and Diagnostic Modelling
- Diagnostic ECU Specification
- “Fault Finding” and “Generic GUI”
ECU System and Diagnostic Modelling

Synthesis of Diagnostic Requirements

- Entire Vehicle Network can be used to derive diagnostic requirements
- In PREEvision diagnostic requirements are synthesized for each ECU system
ECU System and Diagnostic Modelling

ECU System

- Basic diagnostic content is generated automatically
- Enrichment with diagnostic properties is possible
- The diagnostic properties of an ECU system can be exported including its topology information
ECU System and Diagnostic Modelling
Overview of Diagnostic Content

- The properties contain the modeled diagnostic requirements
- Each component contains specific property pages
- Attributes are customer specific and handled in a generic manner
- Additional property pages on the Diagnostic Master also show cumulated properties of one ECU system
ECU System and Diagnostic Modelling

Conclusion

- PREEvision creates diagnostic requirements automatically during the architecture modelling.
- Diagnostic requirements are administrated in a Master / Slave – hierarchy and used as starting point for diagnostic specification.
- PREEvision allows to export individual ECU-Systems including their diagnostic requirements.

ECU System and Diagnostic Modelling

PREEvision ECU-System Diagnostic Requirements → CANdela Studio Diagnostic Specification
Agenda

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ECU System and Diagnostic Modelling

Diagnostic ECU Specification

“Fault Finding” and “Generic GUI”
Specification of Diagnostic Data with CANdelaStudio Requirements Interface

1. Import of Requirements into CANdelaStudio
2. Creation of Diagnostic Objects in CANdelaStudio by “Button Press”
Specification of Diagnostic Data with CANdelaStudio

Workflow

1. Pre-Creation of diagnostic objects by usage of imported requirements
2. Specification of diagnostic data within CANdelaStudio

⇒ Matching of system requirements and data specification

e.g. Fulfilment of generated requirement „the Sensor needs to have assigned at least one measurement value“
ECU System and Diagnostic Modelling

Conclusion

- The PREEvision extract is imported into CANdelaStudio
- The topology information is transported via vehicle system groups
- The seamless **usage of unique IDs** (UUIDs) allows traceability and updates
- In CANdelaStudio the diagnostic requirements are refined into the diagnostic specification
ECU System and Diagnostic Modelling
Project Roadmap

► Reliable generation of relevant Project Data
► Usage of available data sources to ensure repair process

E/E Architecture / Topology ➔ Communication Design ➔ Application SW Design ➔ Test & Validation

Wiring Harness Design / Vehicle Topology

Diagnostic Specification

three years before SOP

SOP
two years before SOP

Diagnostic Design and -Synthesis
Agenda

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Vehicle System Modelling

ECU System and Diagnostic Modelling

Diagnostic ECU Specification

“Fault Finding” and “Generic GUI”
PREEvision Database
Synthesis with Diagnostic Data

PREEvision combines the information of electrical architecture, wiring harness and diagnostic data.
Use-Case “Guided Fault Finding”

Repair Sequence

The creation of a repair sequence is supported by the knowledge of the PREEvision database that contains information about the relevant diagnostic data, ECU-functions and locations in the vehicle geometry.

Design of Functions and Hardware

PREEVision Database

Diagnostic Data

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Use-Case “Generic GUI”  
Vehicle topology oriented view

Presentation of components, ECU-functions and related diagnostic elements by generic user interface

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<th>Category</th>
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<td>Measurement</td>
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<td>IO-Controls</td>
<td>0x0501 Wheelspeed Selftest</td>
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<td>IO-Controls</td>
<td>0x0403 Vacuum</td>
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</tbody>
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![Car Wiring Harness Diagram]
Thank you for your Attention.

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