Diagnostic Data from One Tool for Many Use Cases
Agenda

- **Vehicle Development Life Cycle**
  - Data and Process Requirements
  - Diagnostic Workflow
  - CANdelaStudio
  - ODX/Manufacturer Specific Data
  - Summary
Vehicle Development Life Cycle

Development, Manufacturing and After Sales

Development of vehicles

Manufacturing of vehicles

Repairing

Development

Manufacturing

Vehicle Fleet

After Sales

OEM

SOP

Many years

Abb. Description

OEM Original Equipment Manufacturer
The essential data is the same. Testers are different.
Agenda

Vehicle Development Life Cycle

- **Data and Process Requirements**
  - Diagnostic Workflow
  - CANdelaStudio
  - ODX/Manufacturer Specific Data
  - Summary
Types of Diagnostic Data

- Diagnostic Requirements
  - PREEvision, DOORS, (other requirement management tools), ...

- AUTOSAR automated code generation
  - DEXT (Diagnostic extract)

- Documentation
  - RTF, CSV, HTML

- Development, Production and After-sales tools
  - CDD, ODX, (other proprietary formats), ...
### Diagnostic Data

#### Data and Process Requirements

<table>
<thead>
<tr>
<th>Abb</th>
<th>Description</th>
<th>Explanation</th>
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<tbody>
<tr>
<td>CDD</td>
<td>CANdelaStudio Document</td>
<td>ECU Diagnostic Specification</td>
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<tr>
<td>ODX</td>
<td>Open Diagnostic Exchange Data Format</td>
<td>Vehicle/ECU Tester Data</td>
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<tr>
<td>DEXT</td>
<td>AUTOSAR Diagnostic Extract</td>
<td>ECU Parametrization of diagnostics in AUTOSAR</td>
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#### Diagram

![Diagram showing the relationship between Development, Manufacturing, Vehicle Fleet, and After Sales stages with data formats and specifications.](image-url)
Diagnostic Extract (DEXT)

- AUTOSAR standard data format
- Exchange of diagnostic functionality information
- Configuration of DCM & DEM (AUTOSAR diagnostic components)
  - DCM
    - Diagnostic Services
    - Data objects
  - DEM
    - Fault Memory data configuration
Data and Process Requirements

Separation of Tasks
Data and Process Requirements

ODX Categories

- ODX groups similar data into categories

- One ODX file contains exactly one ODX-CATEGORY
  - ODX-FD Vehicle Functions documentation data
  - ODX-E ECU Configuration data
  - ODX-F Flash/reprogramming data
  - ODX-C/CS Communication Parameters
  - ODX-D Diagnostic Services
  - ODX-V Vehicle Info

- PDX Files (Packaged ODX)
  - Contains one or several ODX files.
  - Intention: PDX represents ECU or vehicle
  - Zip file, but with extension .pdx
  - May contain additional files: Picture, text, java code ...
  - Must contain a file index.xml which contains the content of the package.
Data and Process Requirements

**ODX in the Vehicle Life-Cycle**

- **ODX-FD**  Vehicle Functions documentation data
- **ODX-E**  ECU Configuration data
- **ODX-F**  Flash/reprogramming data
- **ODX-C/CS**  Communication Parameters
- **ODX-D**  Diagnostic Services
- **ODX-V**  Vehicle Info

**PDX**  Packaged ODX
Data and Process Requirements

Use Cases

AUTOSAR SW Configuration

Documentation

Tester Parametrization

- AUTOSAR Diagnostic Extract (.arxml)
- .rtf
- .html
- .cdd
- .ddx
- .mdx
- .xml
- ODX
- 2.0.1
- 2.1.0
- 2.2.0
- customer Specific

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## Not All Tools Consume ODX, or the same ODX

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<th>EOL testing</th>
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<th>Dealer diagnostics</th>
<th>Reprogramming</th>
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m = Minor Contribution
M = Major Contribution
**ODX, DEXT and CDD**

- **Focus of ODX** is tester parameterization, spanning multiple models.
- **Focus of DEXT** is AUTOSAR BSW configuration.
- **CDD** supports tester parameterization, BSW configuration and diagnostic validation.
Agenda

Vehicle Development Life Cycle
Data and Process Requirements

- **Diagnostic Workflow**
  - CANdelaStudio
  - ODX/Manufacturer Specific Data
  - Summary
Diagnostic Workflow

Diagnostic Workflow with Vector Toolchain

- **Specification**
  - CANdelaStudio
  - CANdela (CDD)
  - AUTOSAR DEXT
  - CANdesc DaVinci

- **Requirements**
  - PREEvision
  - 3rd Party Tools e.g. DOORS

- **Code Generation**

- **Tester Validation Flashing**
  - CANoe
  - CANalyzer
  - CANape
  - Indigo
  - CANoe.DiVa
  - vFlash

- **3rd Party Tools**
  - e.g. DOORS
  - AUTOSAR
  - DEXT

- **Tester Validation Flashing**
Development of Diagnostic Communication

Supplier

Development
- CANoe DiVa
- CANoe/Indigo
- CANdela Studio
- cdd/odx
- cdd/odx/DEXT
- GENy/DaVinci

Diagnostic Spec.

OEM

Development
- ODX Authoring Guideline
- CANdela Studio
- odx/prop
- cdd/odx
- cdd/odx/DEXT
- GENy/DaVinci

Production
- Tester
- CANoe DiVa
- CANoe/Indigo

Service
- Tester

Data flow
- Document
- Data
- Tool

Dependency

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Agenda

- Vehicle Development Life Cycle
- Data and Process Requirements
- Diagnostic Workflow
  - **CANdelaStudio**
  - ODX/Manufacturer Specific Data
  - Summary
Executive Summary

- CANdelaStudio is an authoring tool:
  - specify the diagnostic functionality of an ECU
- Template concept
  - guides input of diagnostic data
  - guarantees conformity to the OEM specific requirements
- Powerful data exchange features allow to...
  - reuse existing data in other formats
  - generate data to drive individual processes
  - adapt multiple versions of standards (e.g. ODX 2.0.1 and 2.2.0)
- Comfortable user-interface
  - short start-up period
  - no need to dive into details of diagnostic data modeling and formats like e.g. ODX
- Proven in many car projects worldwide
CANdelaStudio

Template concept

Combine diagnostic information in a machine-readable CANdela template

- ISO-standards:
  - ISO 14229, ISO 15765, ISO 13400...

- OEM specific diagnostic specifications

- Diagnostic use-cases

- Default diagnostic data

- Configuration of diagnostics tools

- E.g. provide all standard UDS services

- E.g. define 3 additional OEM specific services

- ISO-standards: ISO 14229, ISO 15765, ISO 13400...

- Diagnostic template OEM.cddt (XML)

- „Diagnostic Class“ maps services to use-cases: Present Data, Variant Coding, Routine, Fault Memory...

- Data Types, DIDs, DTCs, ... usable for all ECUs

- Attribute definition for ODX export, code generator, validation...
CANdelaStudio

Template concept

- CANdela template
  - represents the diagnostic specification for an OEM
  - available on request for most known OEMs

- CANdela documents
  - are instances of the template
  - ... for individual ECUs
CANdelaStudio

Data Exchange Capabilities

**Import**
- ODX
  - 2.0.1
  - 2.2.0
- ASAP2 (.a2l)
- AUTOSAR (.arxml)
- CANdb (.dbc)
- FIBEX (.xml)
- .cdi
- .csv
- .tmx

**Export**
- ODX
  - 2.0.1
  - 2.1.0
  - 2.2.0
- .cdi
- .xml
- .arxml
- .ddx
- .mdx
- .tmx
- .html
- .csv
- .rtf

**CANdelaStudio**
ODX/Manufacturer Specific Data

Why export it?

- **CANdelaStudio**
  - Enables generating diagnostic data
  - Focus on diagnostics
    - No need for special knowledge of the underlying data formats
  - Supports import and export of diagnostic data from/to ODX
  - Decouples your data from the wide diversity of ODX format conventions
    - Is therefore ideal for migration of master data to the ODX format
  - Many OEMs/suppliers implement consistency in ODX
  - Template concept to ensure OEM conforming data
  - Quick but stable solution

Authorsing  Generating  Consuming
Agenda

Vehicle Development Life Cycle
Data and Process Requirements
Diagnostic Workflow
CANdelaStudio
ODX/Manufacturer Specific Data

Summary
Data Import and Export

- Different data formats for different use cases
  - CANdelaStudio is capable of generating these data formats

- Imports and Exports can be from standardized formats or customized
  - Imports
    - Standard import features
    - Custom import from a database
  - Exports
    - Standard
      - CDD - Vector proprietary data format
      - DEXT - AUTOSAR standard format for code generation
      - RTF - Documentation
      - DTC export
    - Custom
      - ODX (odx-d and PDX) - Authoring guidelines
      - OEM proprietary data format