

## Testing Expo North America 2008

Introduction to Standardized Diagnostic  
Communication: UDS on CAN (ISO 15765)  
with MVCI (ISO 22900) and ODX (ISO 22901)

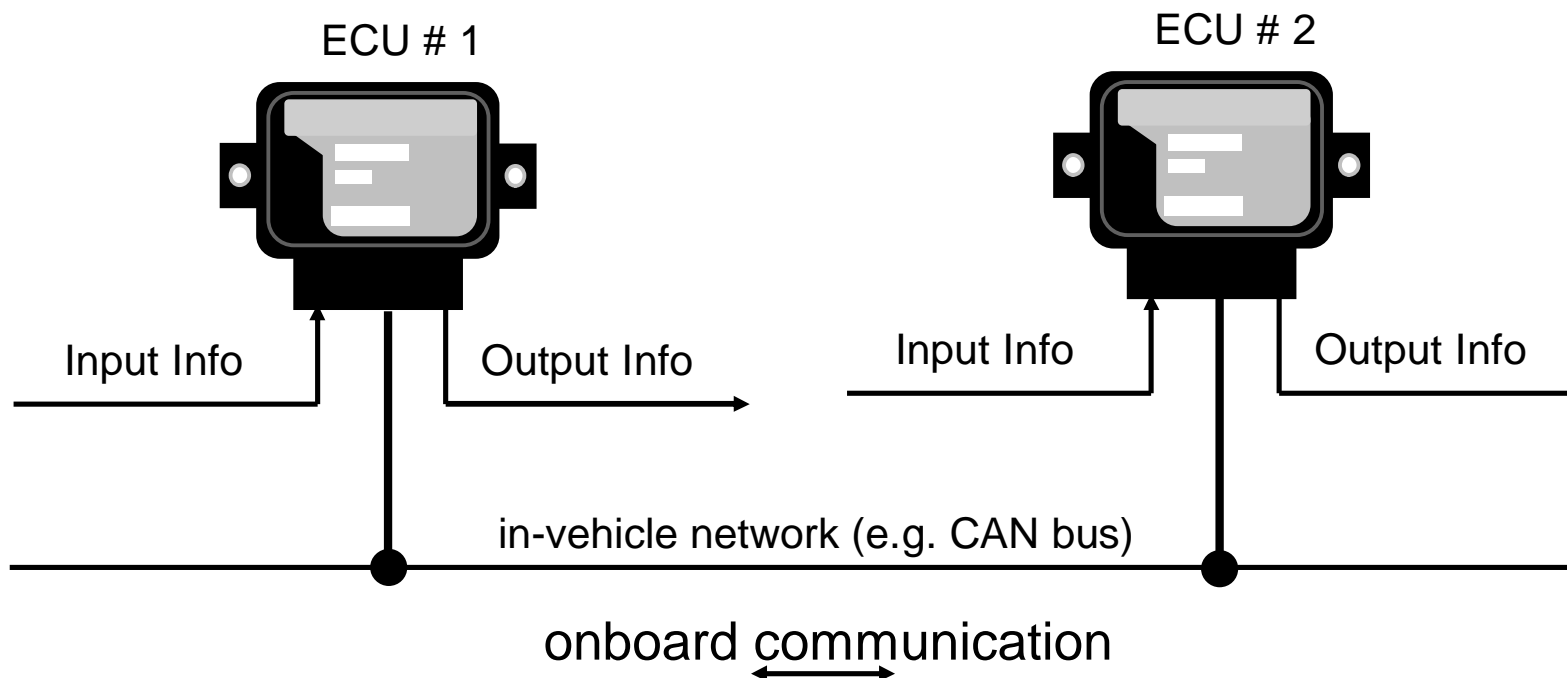


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Key Account Manager  
Automotive Electronics  
Softing AG, Germany  
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# Onboard Communication

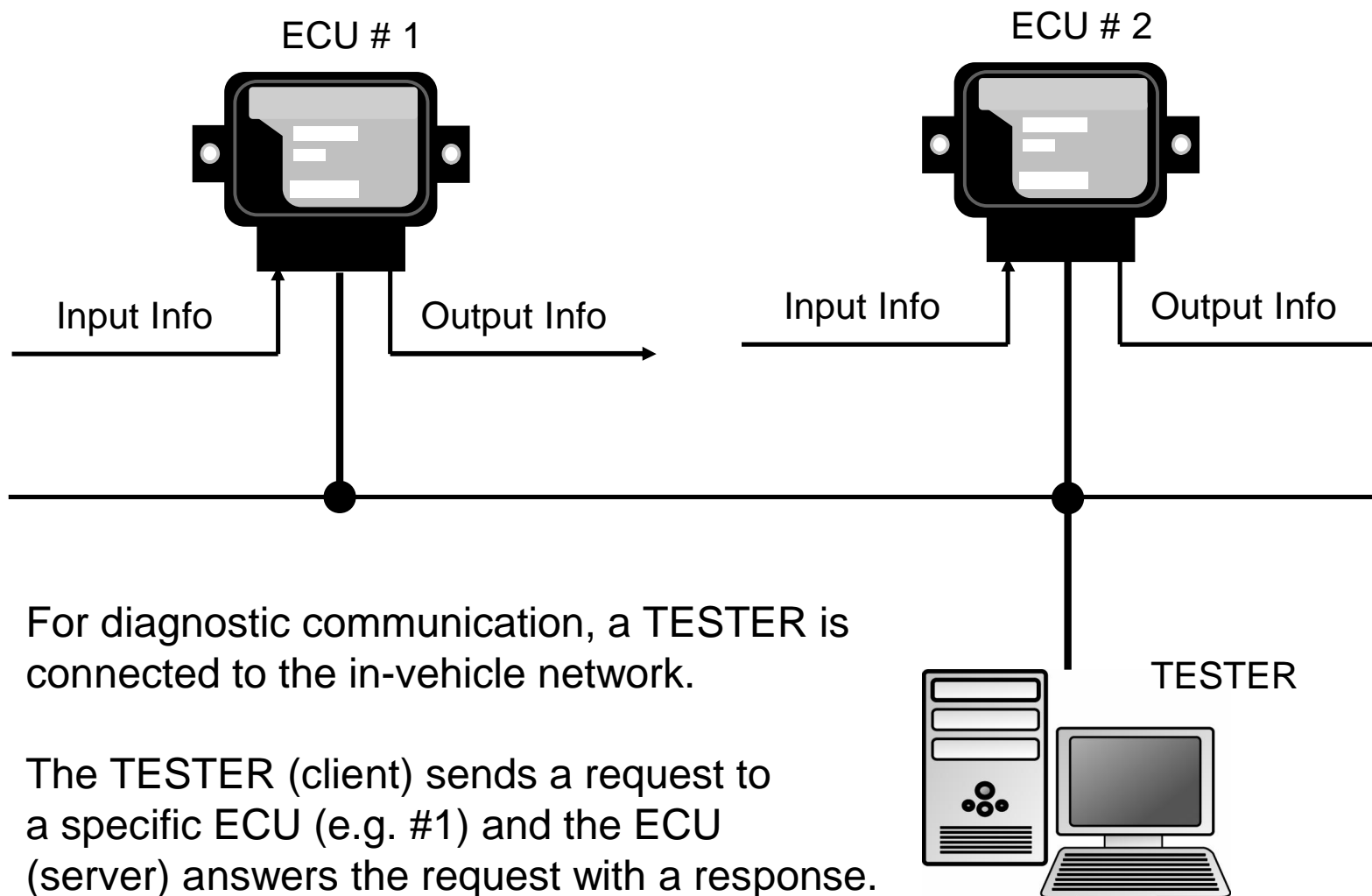


ECUs convert input information from sensors to output information for actuators.

ECUs send information to other ECUs and receive information from other ECUs (onboard communication).

For onboard communication, ECUs are interconnected via an in-vehicle network (e.g. CAN)

# Diagnostic Communication



## Diagnostic Services

Diagnostic communication requires a diagnostic protocol.

A diagnostic protocol contains a set of communication parameters and diagnostic services (request / response).

Typical examples for diagnostic protocols include KWP2000 and UDS.

ISO 14229-1(2006) : Road vehicles – Unified diagnostic services (UDS) specifies a diagnostic protocol on layer 7 of the OSI model.

Examples for diagnostic services of ISO 14229 include:

11<sub>hex</sub> = ECU reset

86<sub>hex</sub> = response on event

19<sub>hex</sub> = read DTC information

23<sub>hex</sub> = read memory by address

31<sub>hex</sub> = routine control

36<sub>hex</sub> = transfer data

## UDS on CAN

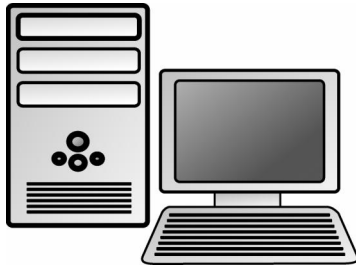
Today, diagnostic communication uses the existing in-vehicle network to transport requests and responses.

The transport protocol for UDS on CAN is specified in

ISO 15765-3 (2004): Road vehicles –  
Diagnostics on controller area network (CAN) –  
Part 3: Implementation of unified diagnostic services (UDS on CAN)

ISO 14229-1:2006 (UDS) and ISO 15765-3:2004 (Diagnostics on CAN) are complementary standards that together specify the diagnostic protocol “UDS on CAN”.

# Communication system

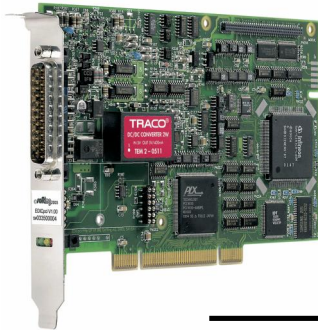


## Tester

Applications (e.g. MONACO, INCA, LabView, AD  
Databases (EDF, ODX, FBX, CANdb, A2L)  
D-Server (EDIABAS, ETESTER, COS, MVCI)

## PC-to-ECU interface software

e.g. EIDBSS, Vecom, D-PDU API



## PC-to-ECU interface hardware

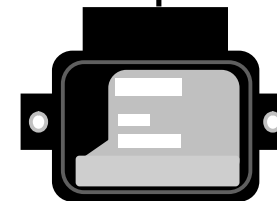
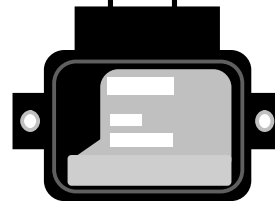
e.g. ETK, EDIC, DCDI, VCI

## Onboard communication

CAN, LIN, FlexRay, MOST

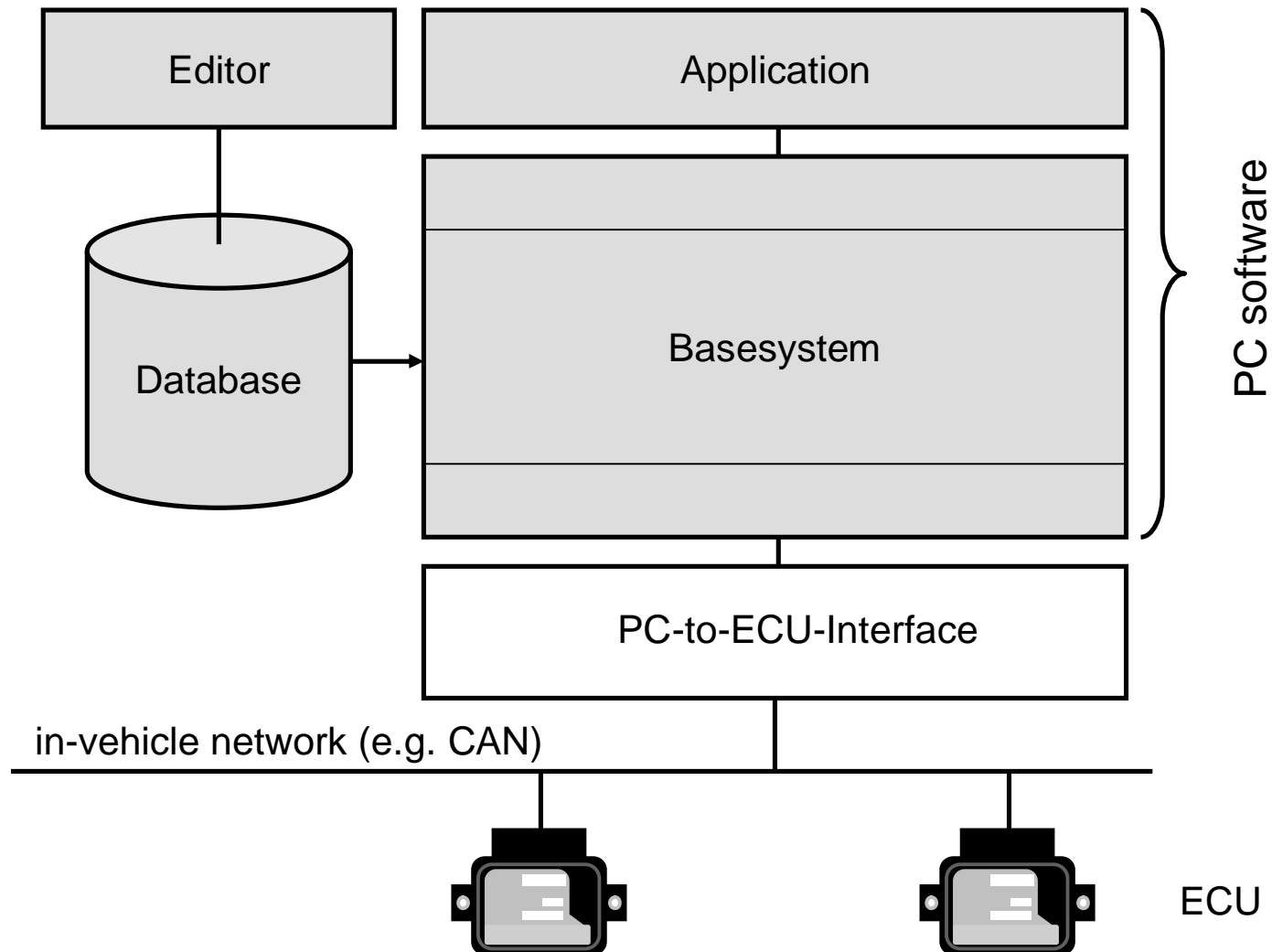
## Diagnostic communication

Diagnostic protocols  
KWP 2000, UDS on CAN  
UDS on FlexRay



ECU software (e.g. AUTOSAR)

# Components of a PC-based Tester

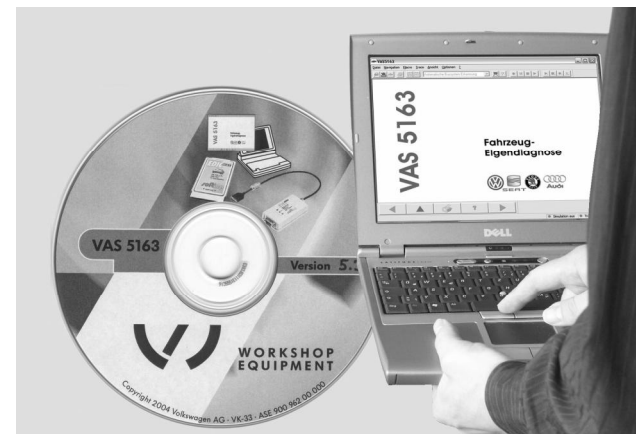
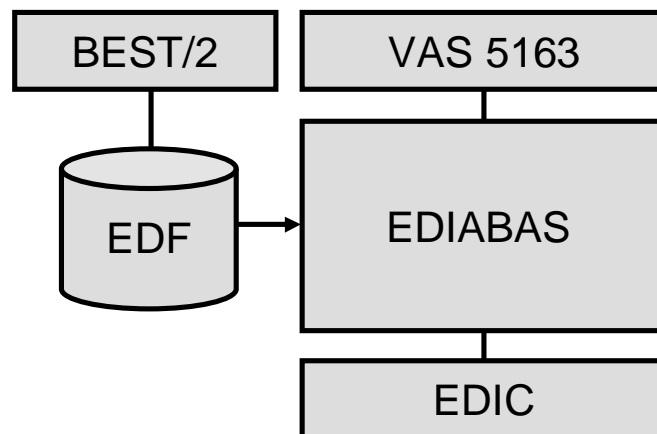
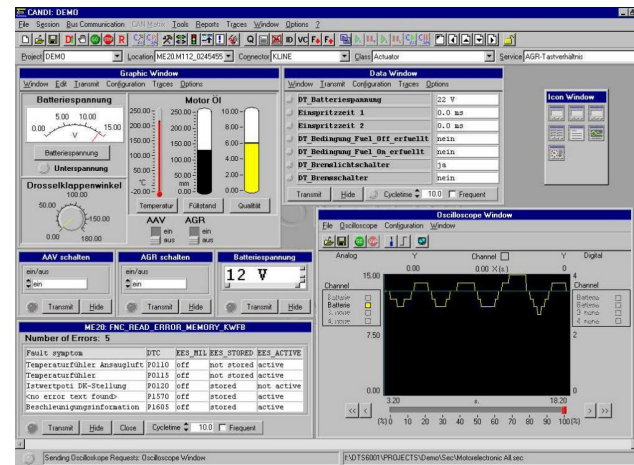
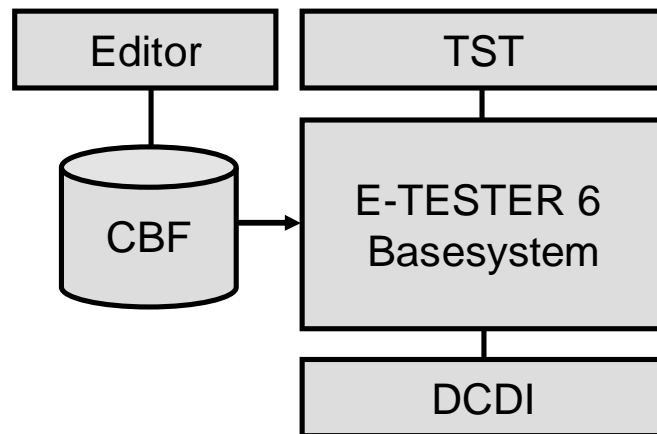


PC hardware



ECU

# OEM-specific PC-based Tester (examples)





## Problem & Solution...

Too much energy is spent on the development of proprietary communication protocols and networking technologies.

Incompatible tester technologies cause high costs at the vehicle manufacturer and their suppliers.

Proprietary technologies make the vehicle manufacturer dependent of the selected tool supplier (single source).

Standardization is an advantage for vehicle manufacturers as well as for their suppliers.

Standardization serves the price, the quality, and the maintainability of the end product via scale and training curve effects.

ASAM LLC



ASAM is short for  
**A**ssociation for the **S**tandardisation of **A**utomation & **M**easuring systems

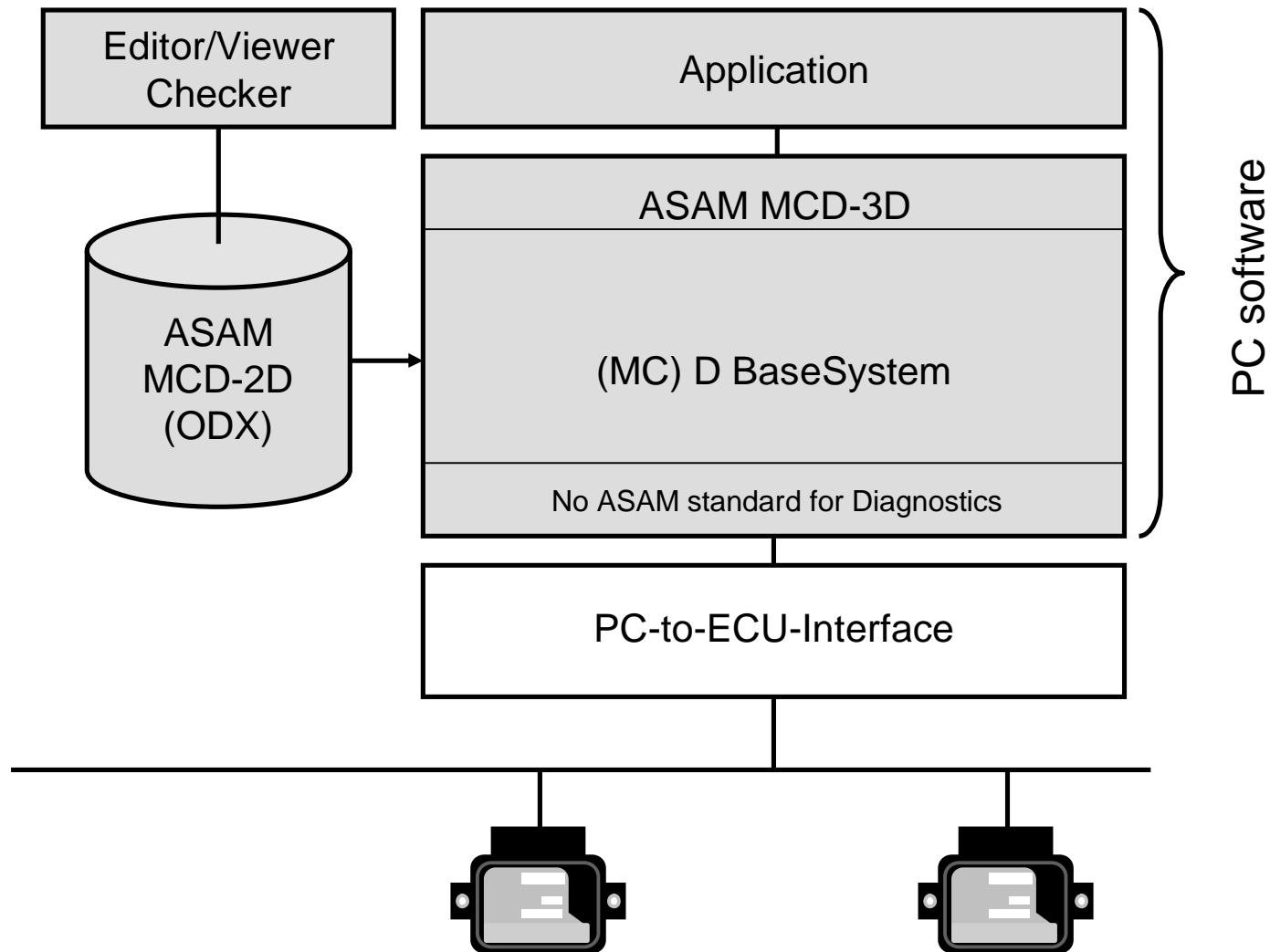
The **vision** of ASAM is that standards enable products that can be freely interconnected with seamless data interchange.

The **mission** of ASAM is to develop platform independent extensible standards, and to enable products that use and are compliant with those standards

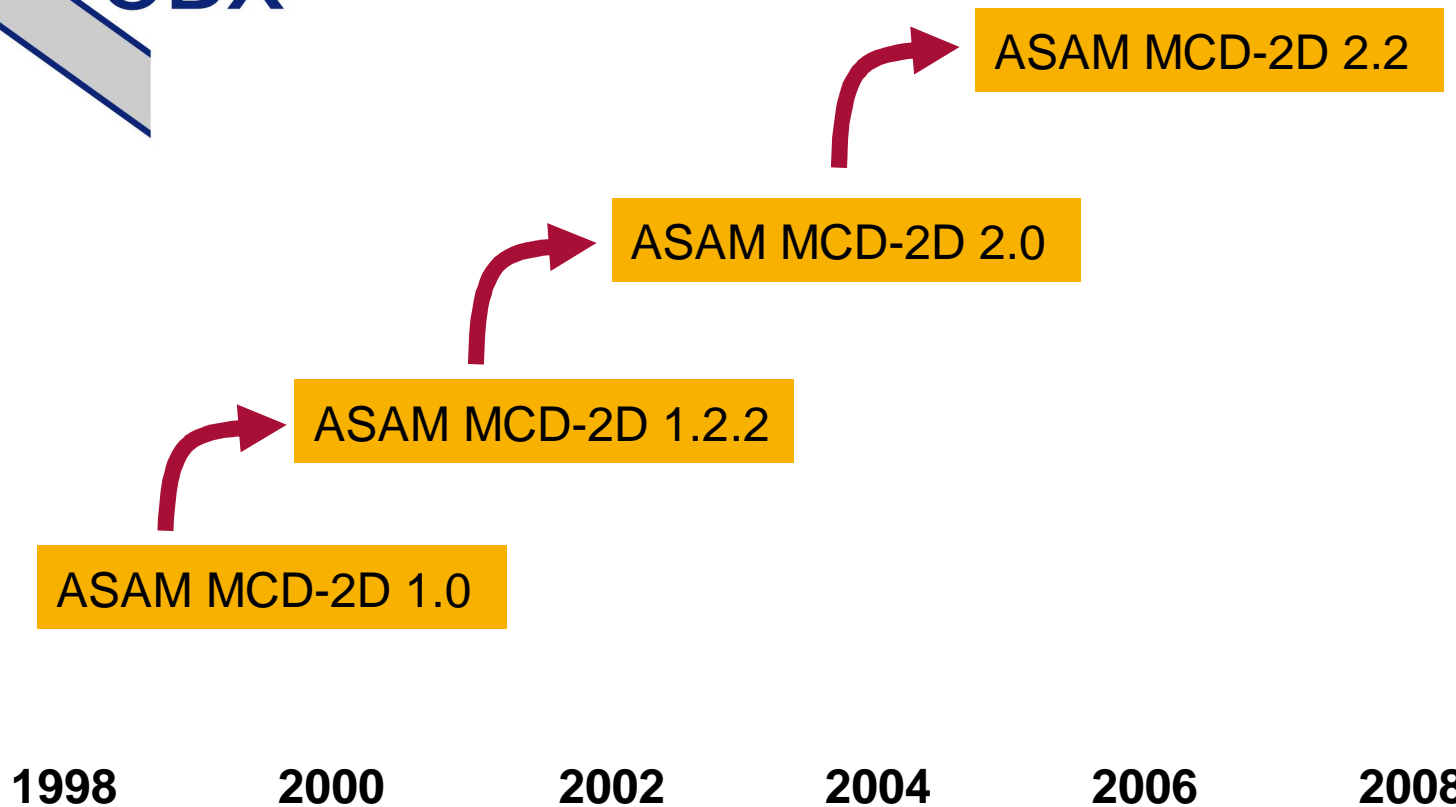
ASAM MCD = Working group for **M**easurement, **C**alibration and **D**iagnostics

ASAM AE = ASAM **A**utomotive **E**lectronics

# The ASAM MCD system



## History of ASAM-MCD 2D (ODX)



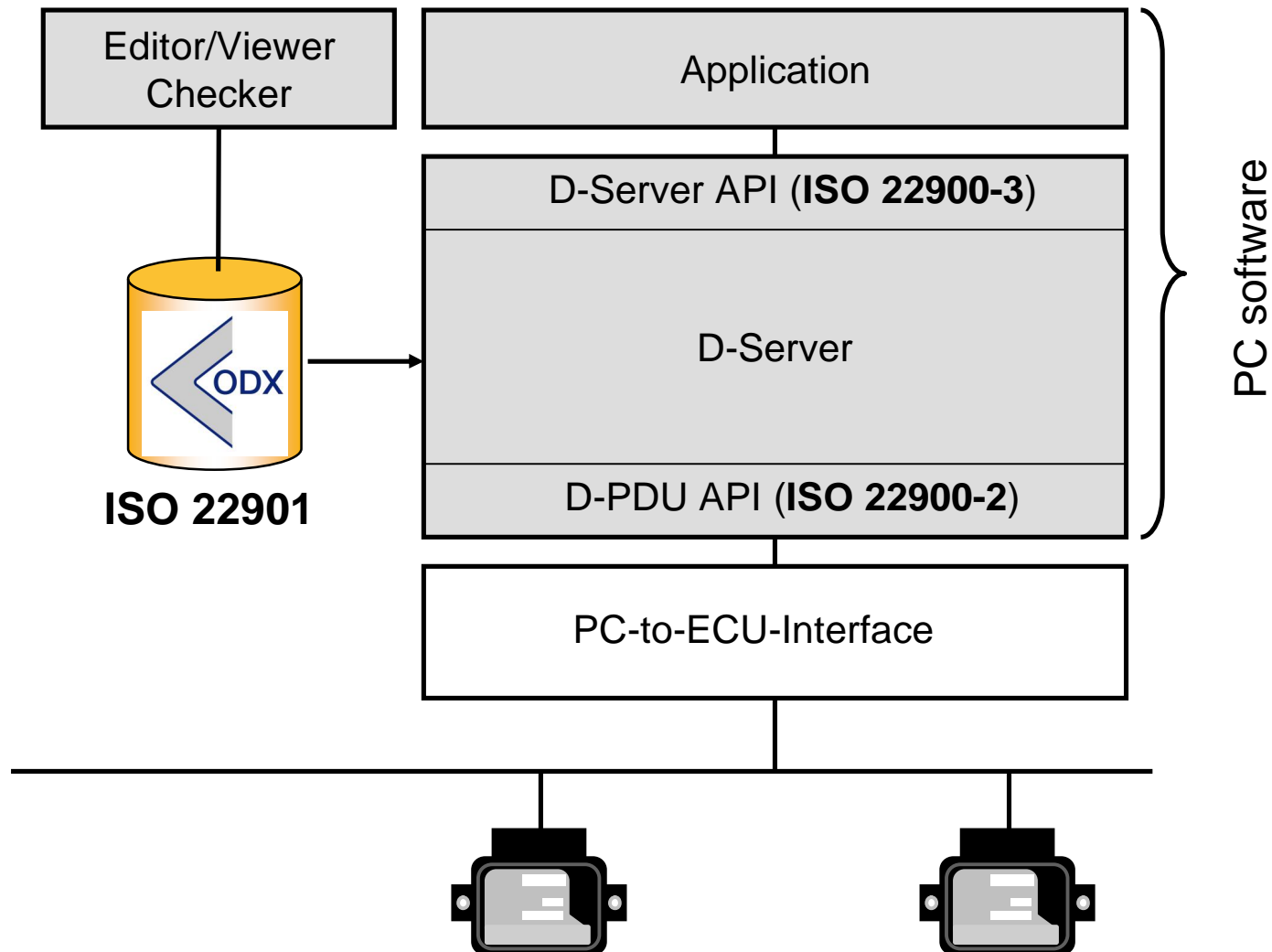
## Combination of ODX and MCD-3D versions

	MCD-3 1.0.1	MCD-3 2.0.1	MCD-3 2.0.2	MCD-3 2.1.0	MCD-3D 2.2.0
ODX 1.2.2	✓				
ODX 2.0.0					
ODX 2.0.1		✓	✓		
ODX 2.1.0				(✓)	
ODX 2.2.0					(✓)

✓ = commonly used combinations

(✓) = to be used in future

## PC based TESTER: ASAM goes ISO (MVCI & ODX)



## ISO 22900 and ISO 22901

### **ISO 22900: Road vehicles – Modular vehicle communication interface (MVCI)**

Part 1(2008): Hardware design requirements

Part 2 (FDIS): Diagnostic protocol data unit application programmer interface (D-PDU API)

Part 3 (DIS): Diagnostic server application programmer interface (D-Server API)

Part 4 (AWI): Conformance test

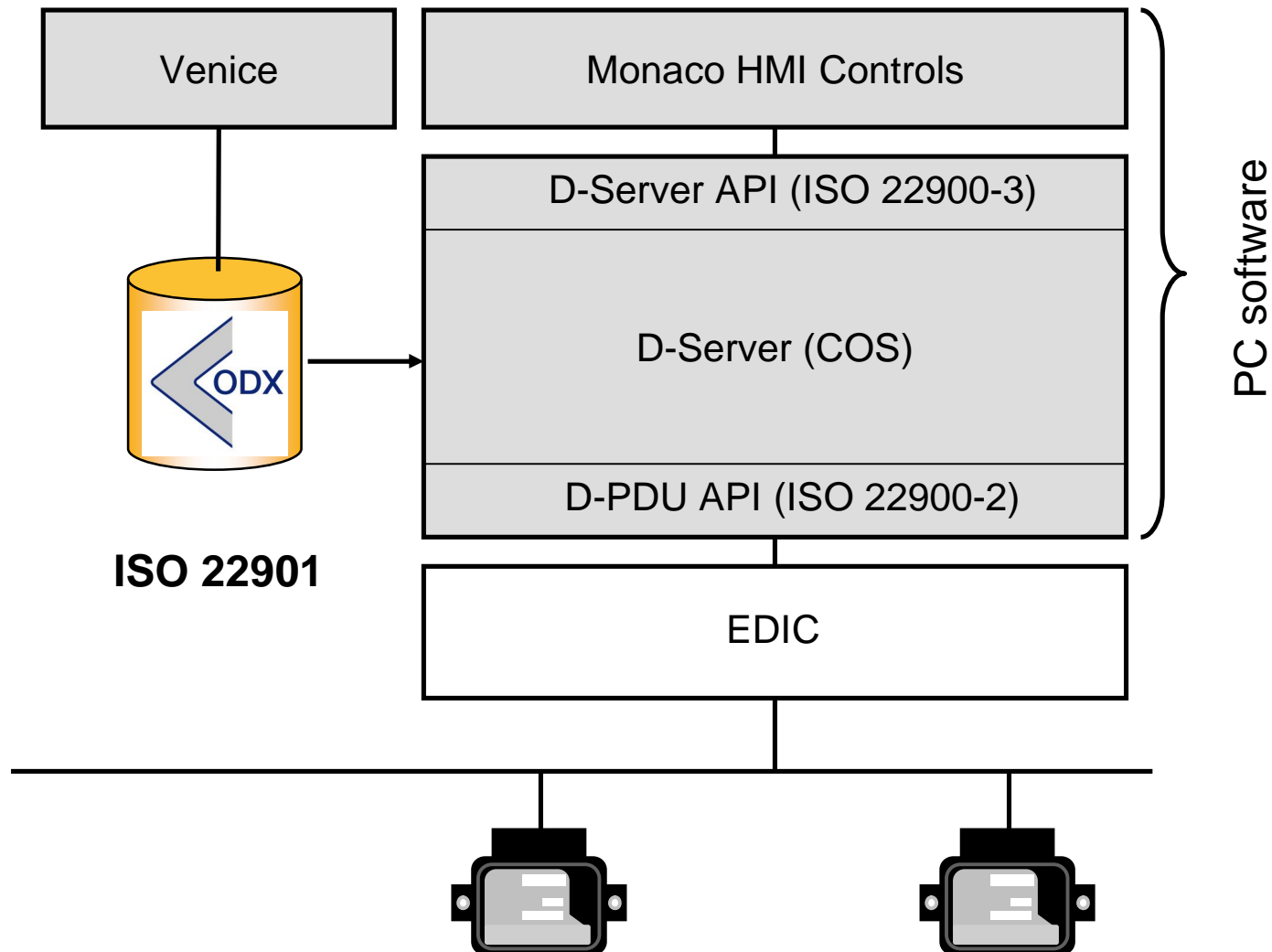
### **ISO 22901: Road vehicles – Open diagnostic data exchange (ODX)**

Part 1 (PRF): Data model specification

Part 2 (CD): Emissions-related diagnostic data in ODX format

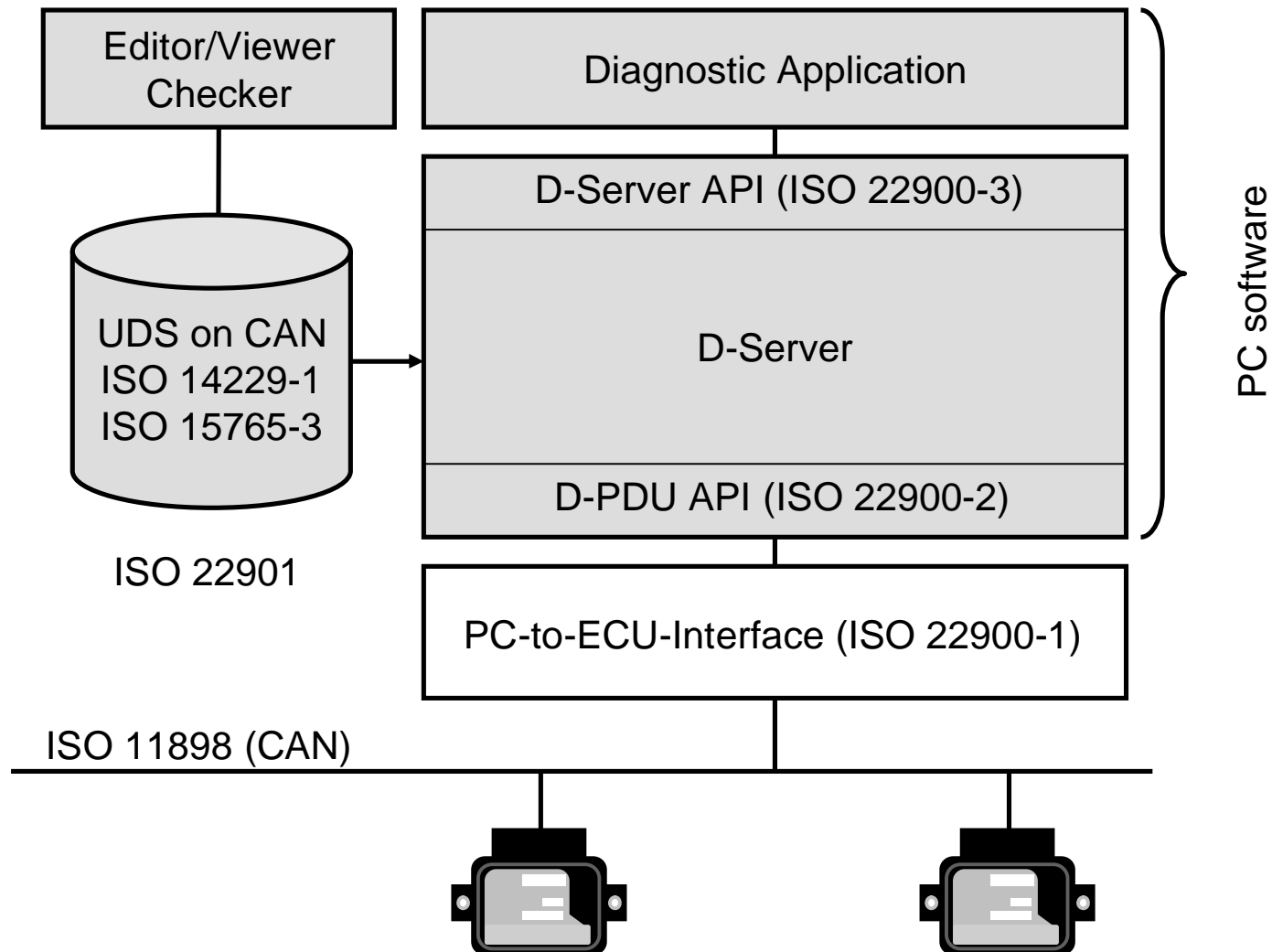
(F)DIS = Final draft International standard - WD = Working draft - .AWI = Approved work item – PRF = proof

## PC-based tester by Softing: DTS V7





## Summary



# Screenshot: ODX database with UDS on CAN

The screenshot displays the DTS-Venice software interface for editing an ODX database. The title bar indicates the file is 'UDSonCAN\_SUB\_V01.sod'. The menu bar includes File, Edit, View, Insert, Database, Check, Tools, Window, and Help. The toolbar contains various icons for file operations, editing, and viewing.

The left-hand tree view shows the project structure:

- ODX
  - Communication Parameter Specification
    - UdsCanCompParamSpec
  - Diagnostic Layer Containers
    - UdsCanTemplate
      - Shared Data
      - Protocols
        - UdsCan
      - Functional Groups
      - ECU BaseVariants
        - ECU\_1
          - ECU Variants
      - VehicleInfo Specs
      - Flashes
      - Multiple ECU Job Specifications
    - PDX
    - FIBEX

The main editor area shows the details for the 'ECUResetRequest' parameter:

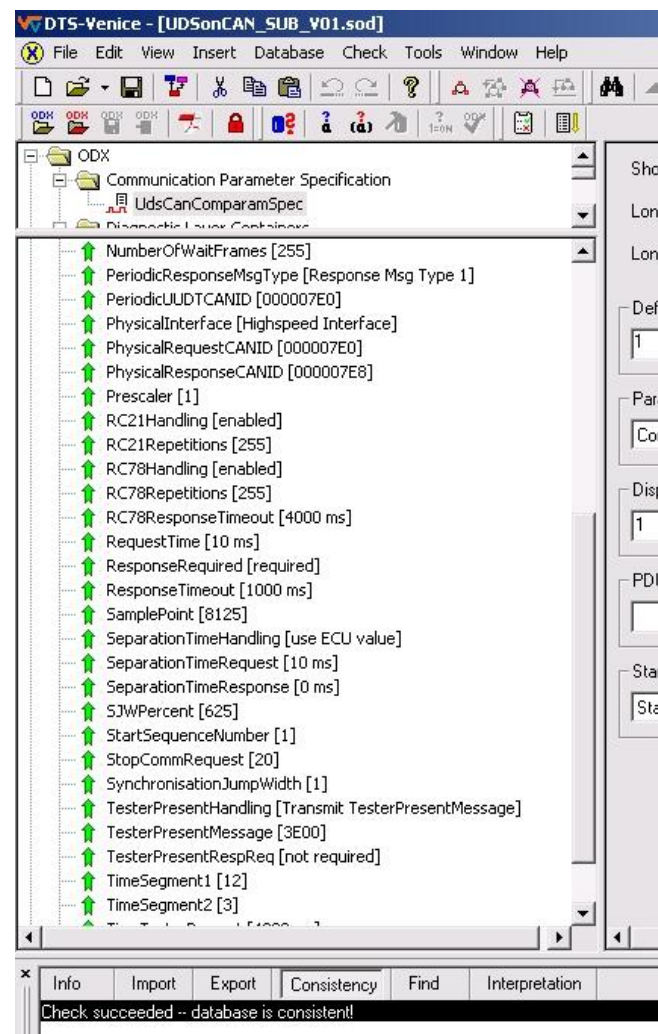
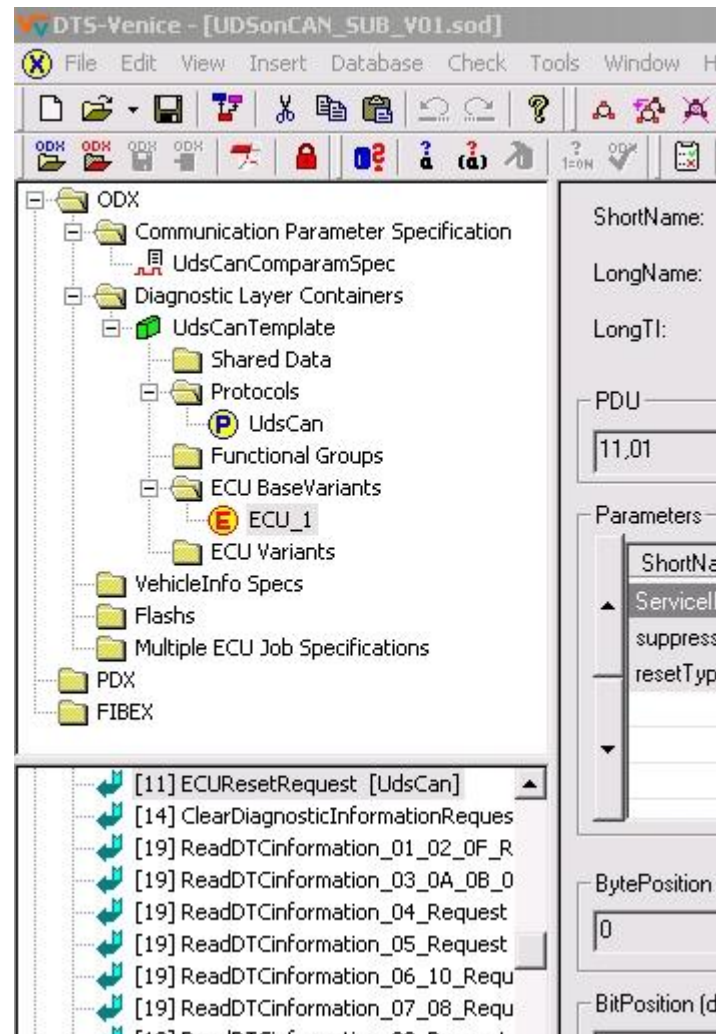
- ShortName: ECUResetRequest
- LongName: ECUReset
- LongTI:
- PDU: 11,01
- Parameters table:

ShortName	LongName	TI	ParamType	Description	Semantic	PDU Position
ServiceID	ServiceID		CodedConst		SERVICE-ID	
suppressPosRspMsg	suppressPosRspMs		Value			[1]  ---
resetType	resetType		Value			[1] -

Below the table, the 'BytePosition (dec)' is set to 0, and the 'BitPosition (dec)' is set to 0. The 'CodedValue' is set to 11. The 'DataType' is 'A\_Uint32', 'Length Info' is 'StandardLengthType', 'Termination' is '<Undefined>', 'BitLength (dec)' is 8, 'BitMask (hex)' is empty, and 'MinLength (dec)' is 0.

The bottom status bar shows the 'Info' tab selected, with a message: 'Check succeeded -- database is consistent!'. The consistency check results are: 'Consistency 0 error(s), 0 warning(s)'. The status bar also displays 'Ready', 'Administrator', 'Softing', 'Consistent', and the system clock '13:57'.

# Screenshot: ODX cats and UDS on CAN comparams



**Thank you for your attention.**

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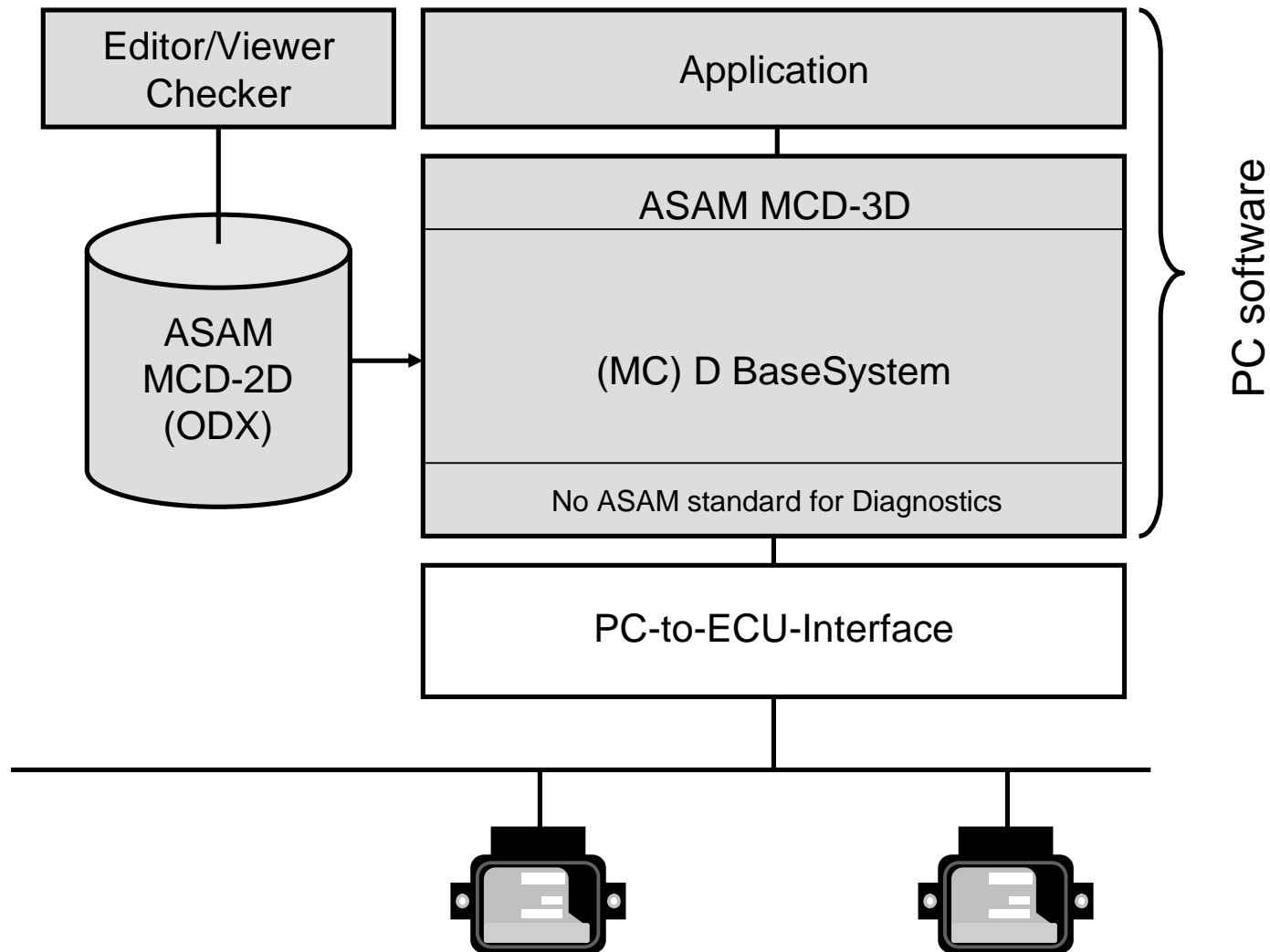
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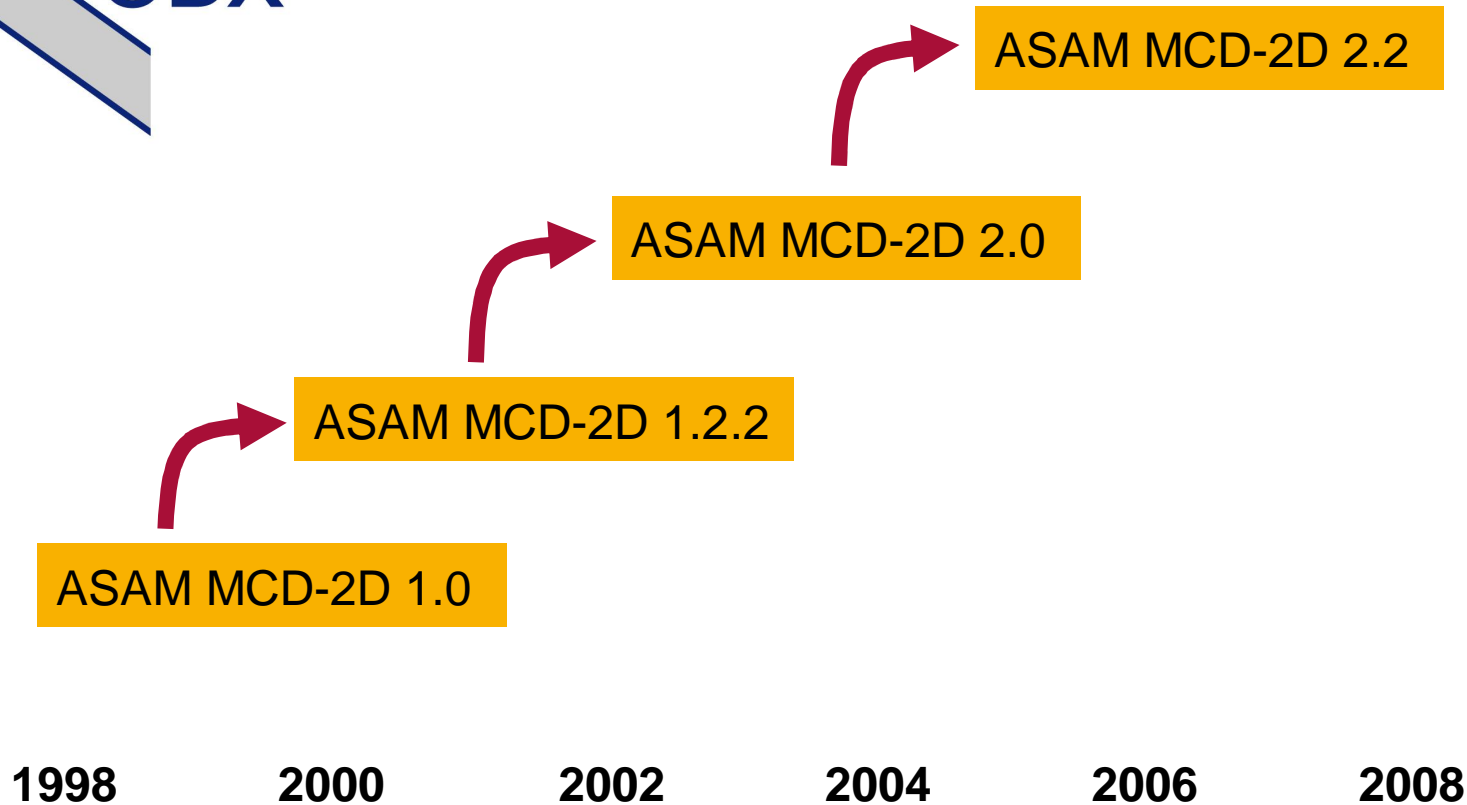
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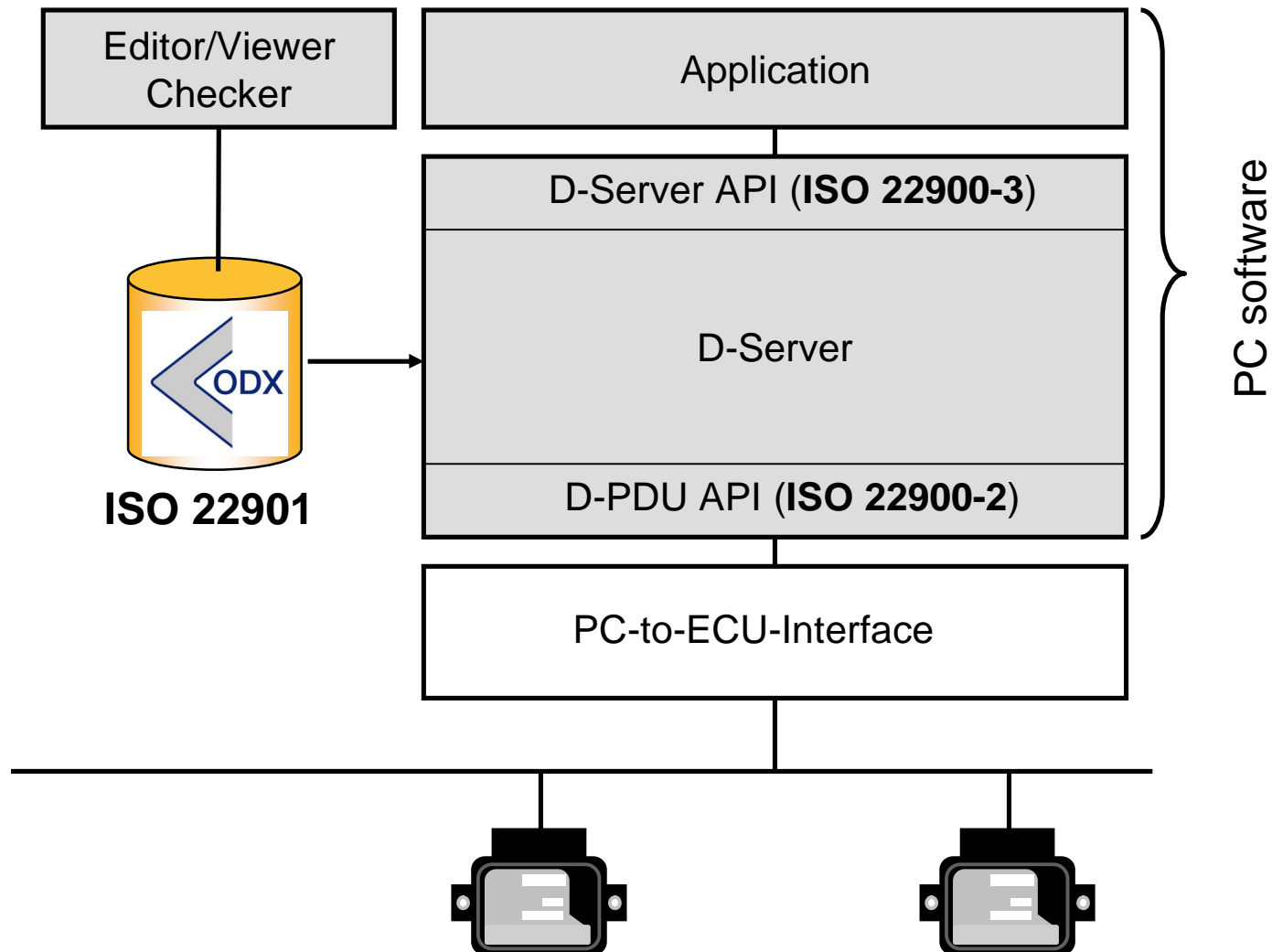
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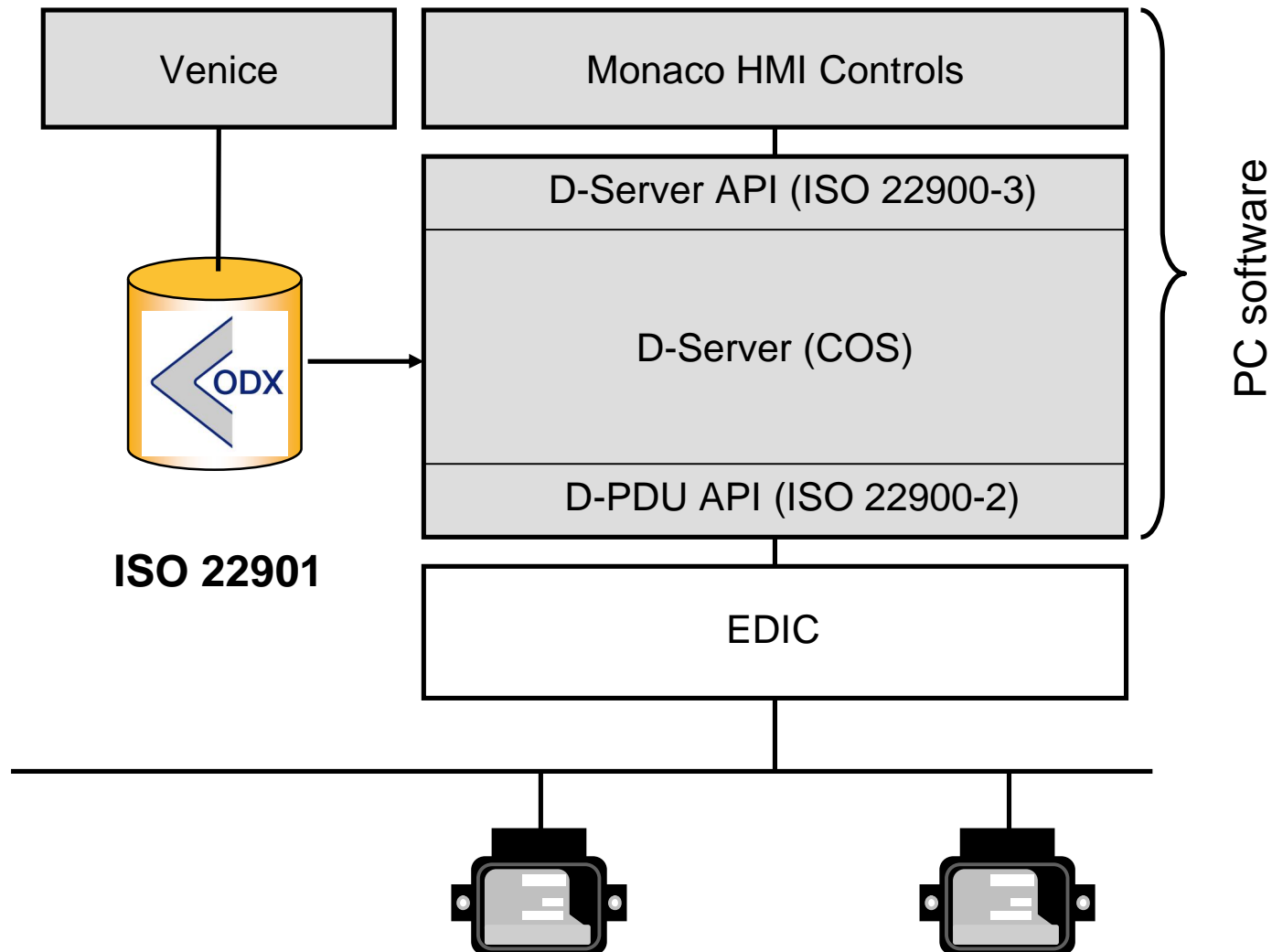
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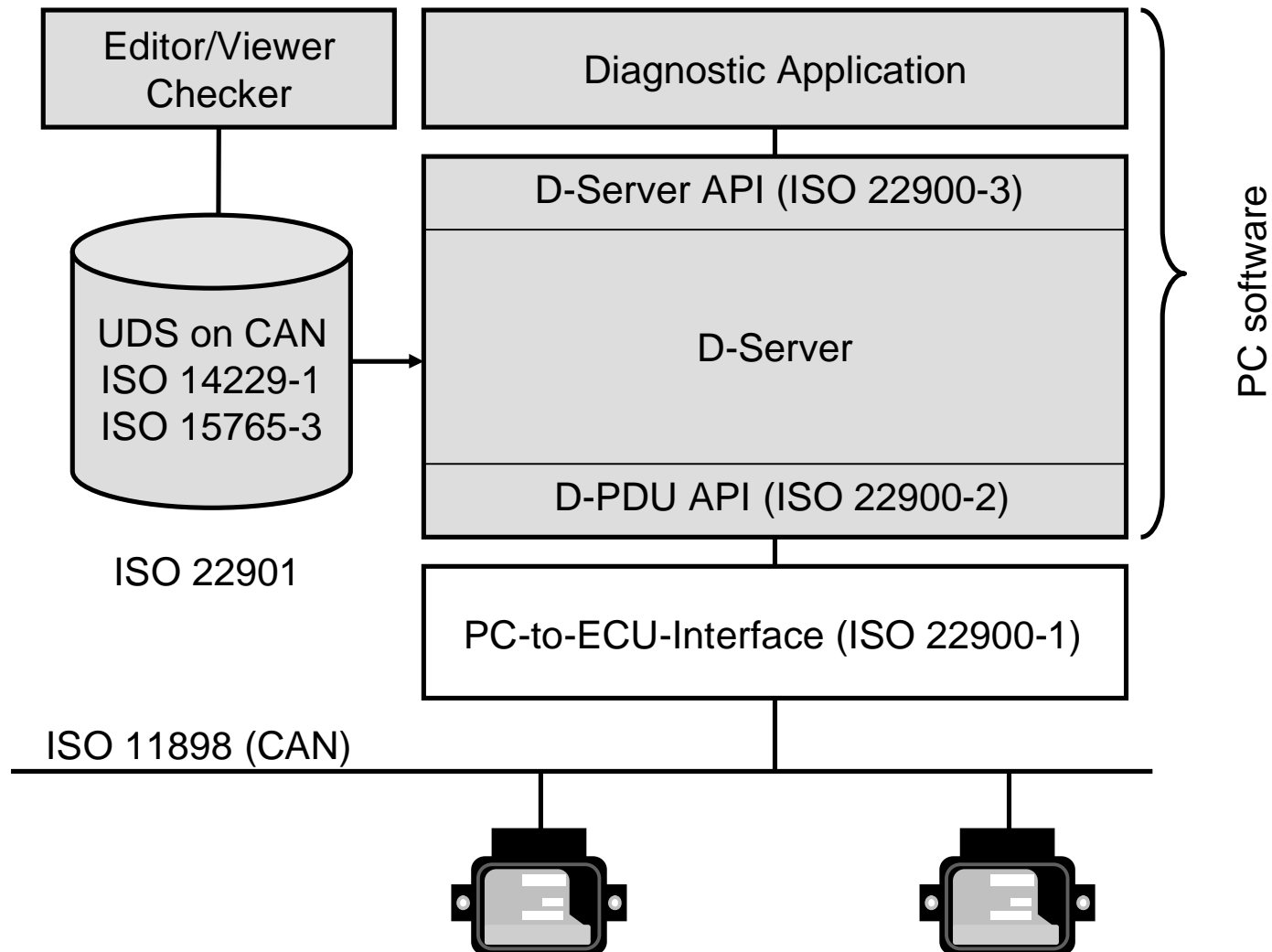
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The left sidebar shows a project tree with the following structure:

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The main editor area displays the details for the "ECUResetRequest" parameter. The fields are as follows:

- ShortName: ECUResetRequest
- LongName: ECUReset
- LongTI:
- PDU: 11,01

The Parameters table lists the following data:

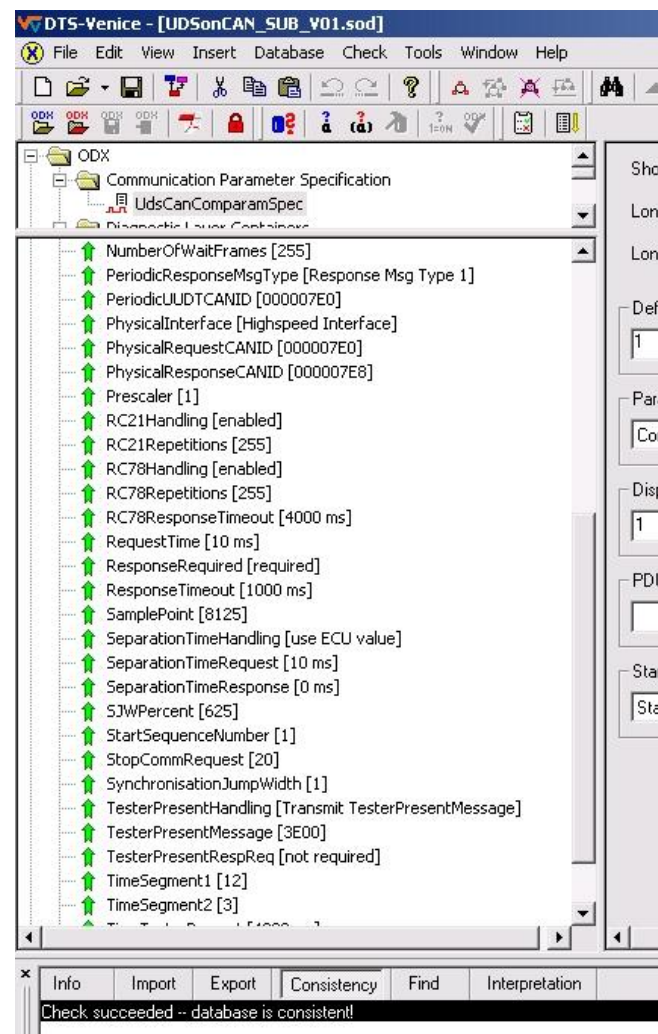
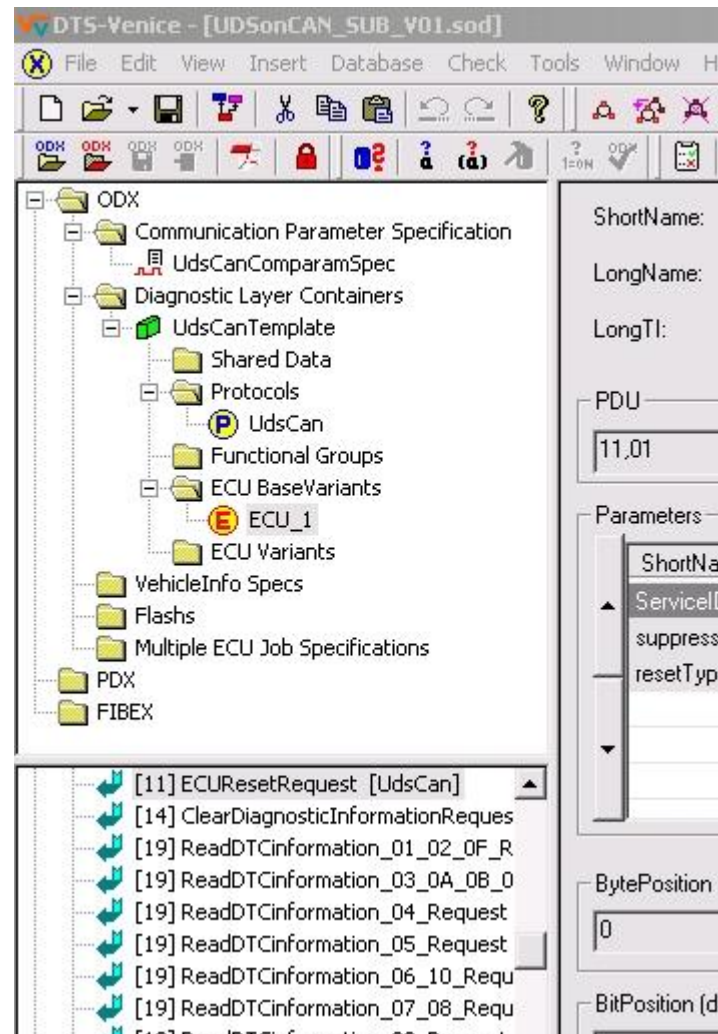
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ServiceID	ServiceID		CodedConst		SERVICE-ID	
suppressPosRspMsg	suppressPosRspMs		Value			[1]  ---
resetType	resetType		Value			[1] -

Below the table, the parameter configuration is shown:

- BytePosition (dec): 0 (d)
- BitPosition (dec): (d)
- CodedValue: 11 (h)
- DataType: A\_Uint32
- Length Info: StandardLengthType
- ParamLengthKey:
- Termination: <Undefined>
- BitLength (dec): 8 (d)
- BitMask (hex):
- MinLength (dec): 0 (d)

The bottom status bar shows a message: "Check succeeded -- database is consistent!" and "Consistency 0 error(s), 0 warning(s)". The taskbar at the bottom indicates the user is Administrator, the application is Softing, and the system is consistent. The time is 13:57.

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