

# **ASAM OTX Based Standards: OTX- Extensions, MCD-2 CERP and CPX**

General Assembly Meeting 2017, Stuttgart, Germany

Presenters

**Dr. Jörg Supke**

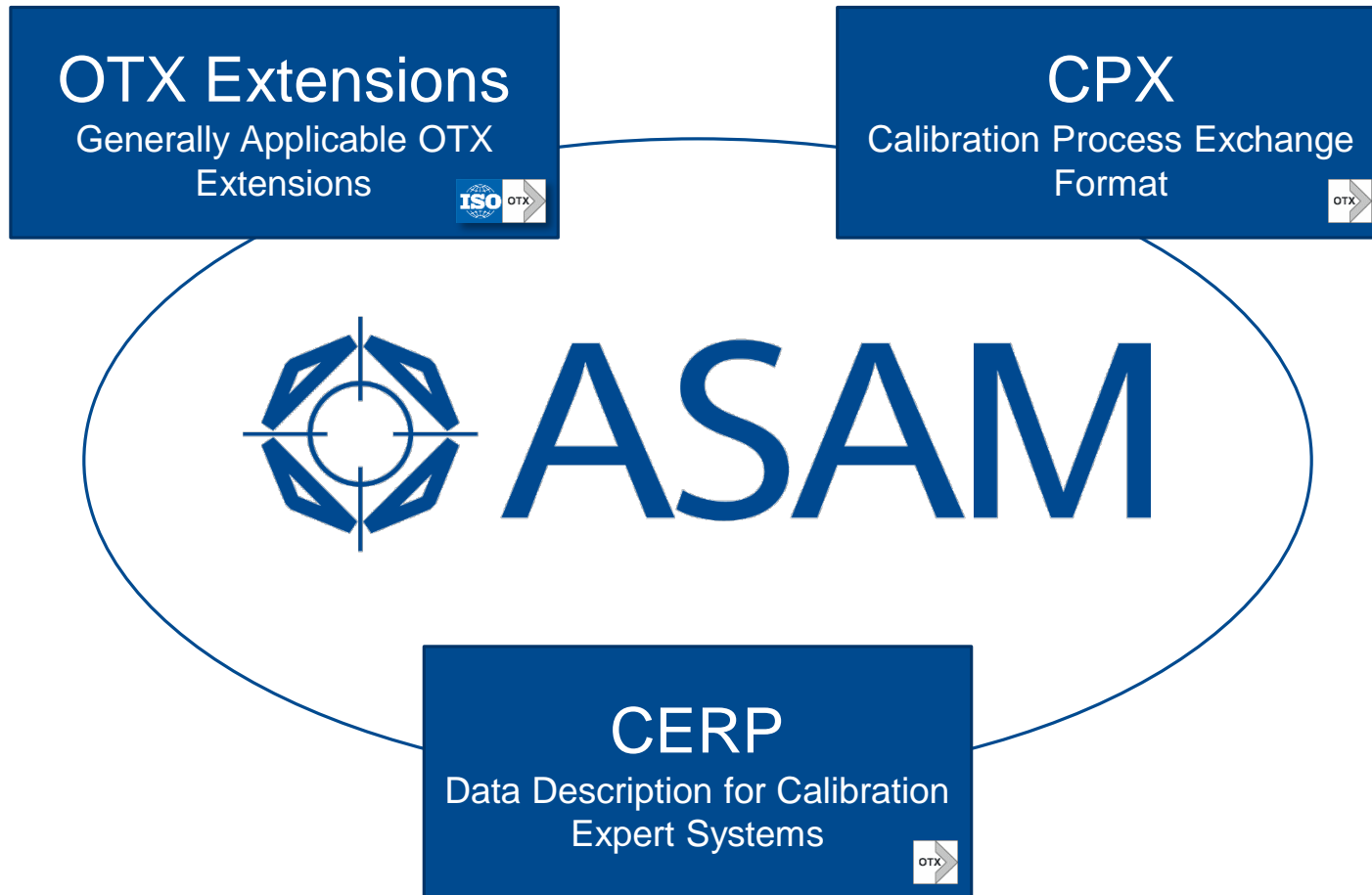
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# New ASAM Standards based on OTX

## Main Projects



# Content

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2	ASAM OTX
3	ASAM MCD-2 CERP
4	ASAM CPX

# Introduction

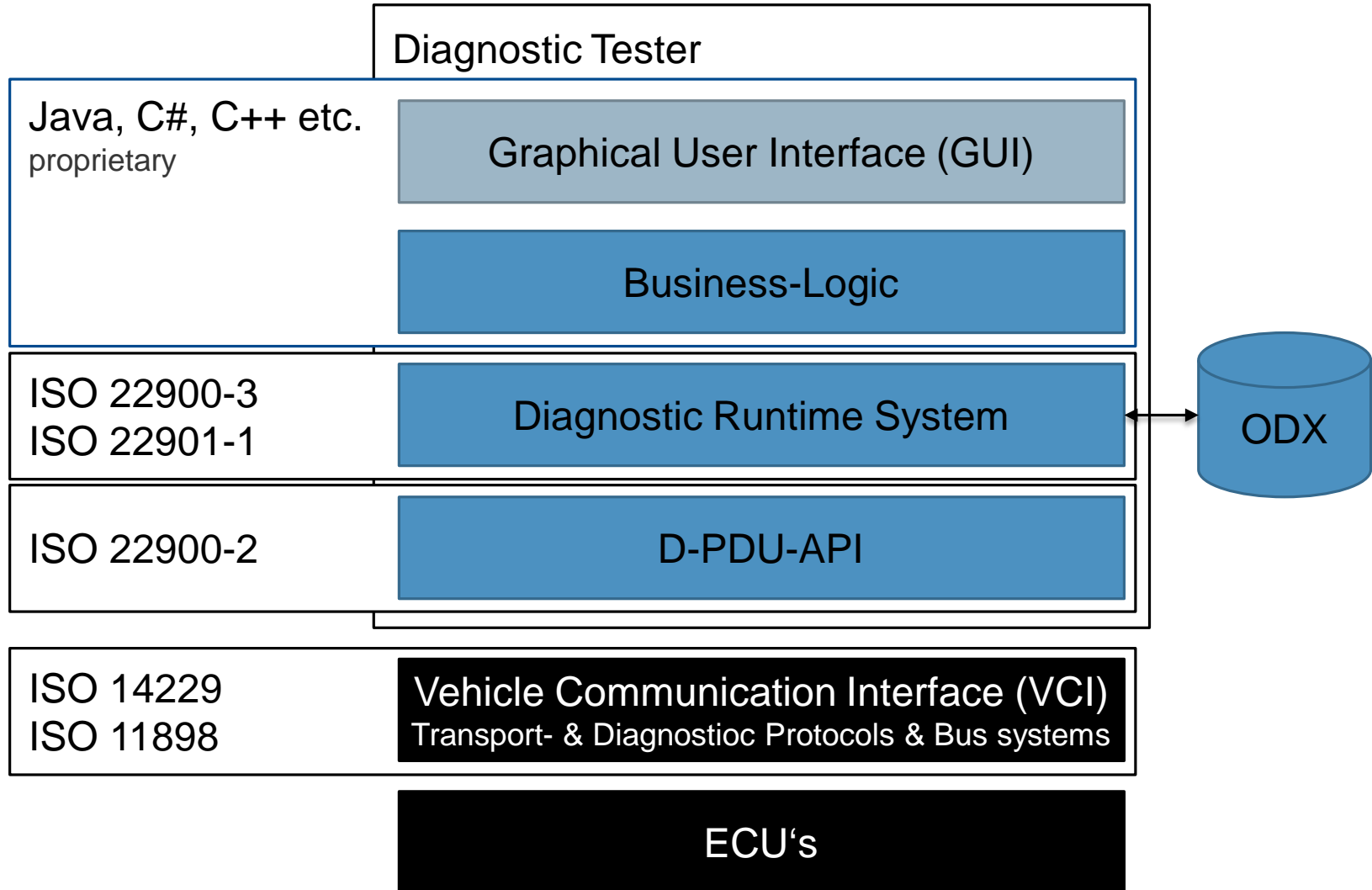
## What is OTX?

- ▶ Open Test sequence eXchange published 2012 by ISO 13209
- ▶ OTX is a standardized programming language to describe executable test sequences for vehicle diagnostics and vehicle test automation
- ▶ Platform and tester independent XML based exchange format
- ▶ Main goal is the mastering of the increasing complexity in vehicle test automation
- ▶ OTX is the logical and consistent further step of standardization in the vehicle diagnostics



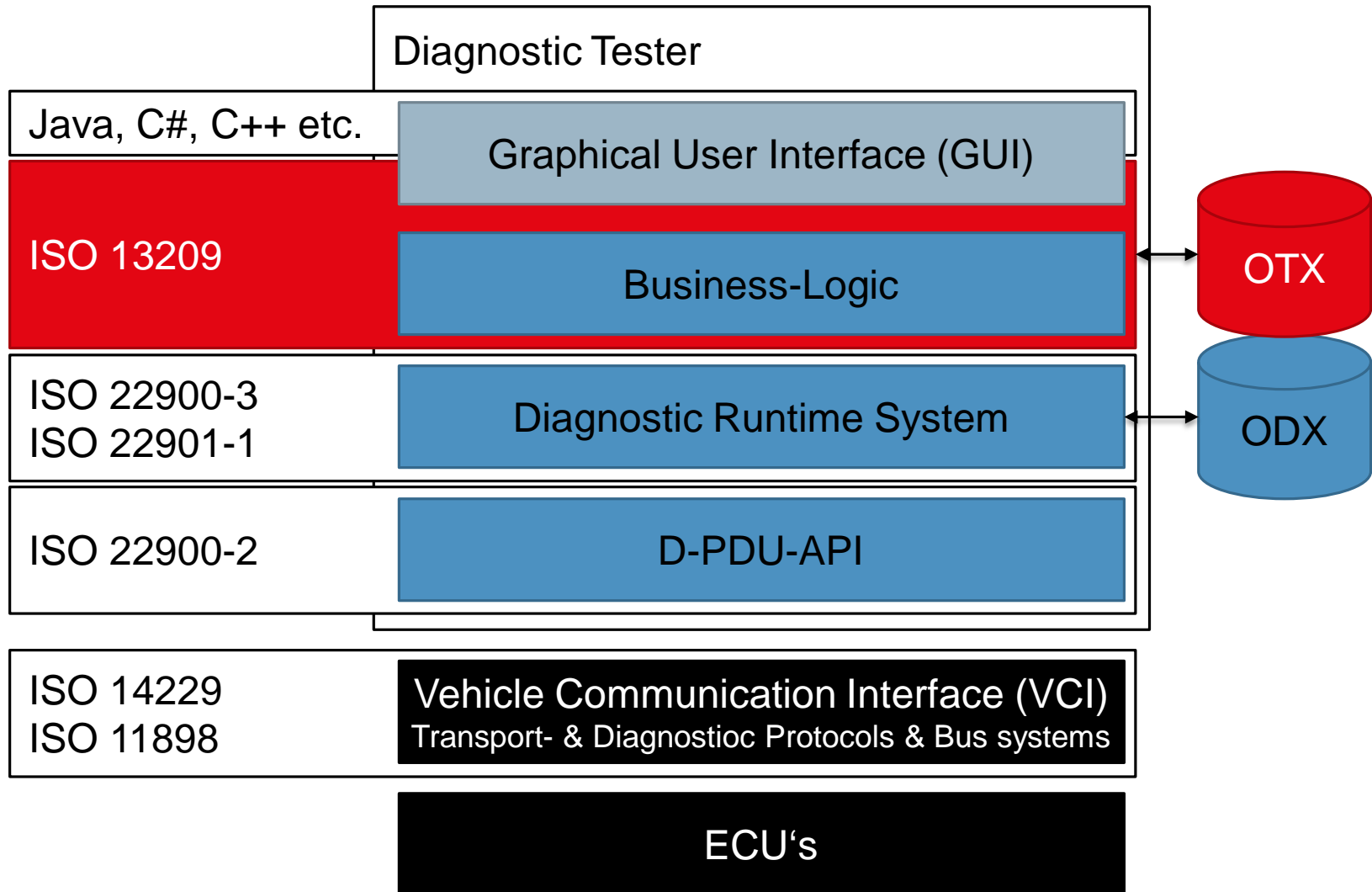
# Introduction

## History



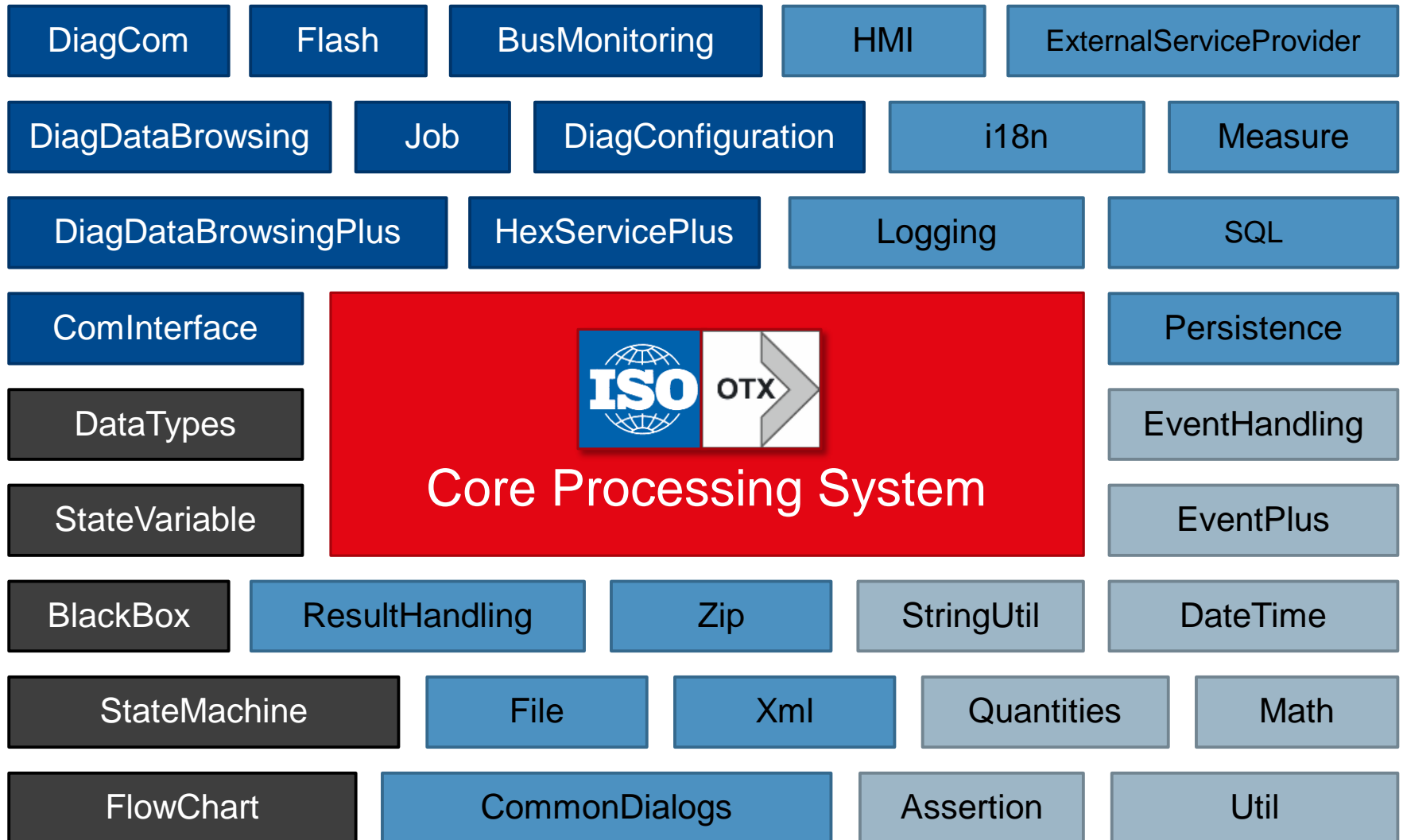
# Introduction

Today



# OTX Structure

35 Extensions (13 from ISO and 22 from ASAM)



# Introduction

## OTX Benefits

- ▶ Significant process simplification
- ▶ Process reliable storage of testing knowledge
- ▶ Executable test specification
- ▶ Platform and tester independent test logic
- ▶ Bridge between other standards (e.g. ASAM MCD3-MC & MCD3-D)
- ▶ Continuous validation during test design
- ▶ Expandable through standard compliant extensions
- ▶ Vendor independent and reusable tests
  
- ▶ Productive applications have proved the high potential
- ▶ Without OTX no integrated MCD Toolset



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# ASAM OTX

Goal: ASAM Generally Applicable OTX-Extensions

Title: ASAM AE OTX / P2015-05 / BS / V1.0

Release: 15<sup>th</sup> February 2017

## Features

- Development of new and generally usable OTX Extensions, which are not part of ISO 13209 yet
- Extension of the standard's application area
- To ensure exchangeability of OTX-files between different tools and suppliers
- Improvement of OTX code quality
- Improvement of standard acceptance

# ASAM OTX

## Results

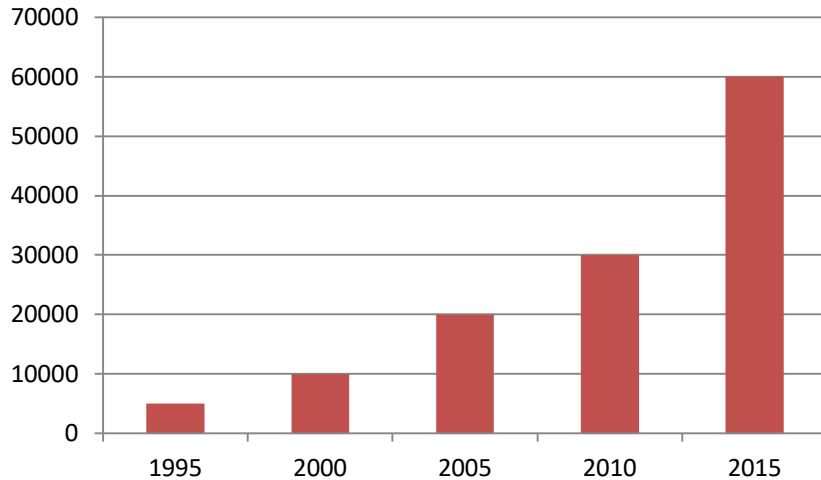
- ▶ 22 new OTX extensions related to
  - Extended Support for Diagnostic Communication
  - Extended Support for External Service Providers
  - Support for General File and XML-File Access
  - New Data Types STRUCTURE and ENUMERATION
  - ...
- ▶ New OTX container format: PTX
- ▶ Closing known gaps and limitations in OTX (ISO 13209 part 2 and 3)
- ▶ Result will be transferred to ISO 13209 part 4

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# Increasing complexity of calibration

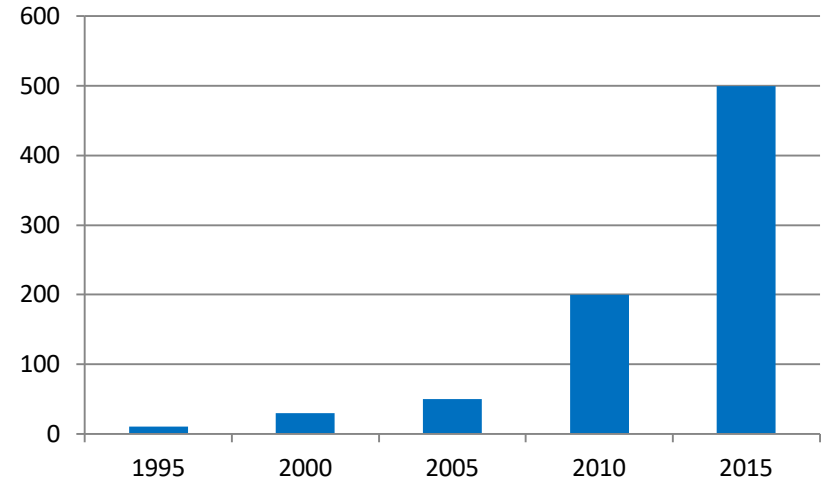
## Number of calibration parameters



### Drivers for number of parameters:

- ▶ Emission control and exhaust treatment
- ▶ Hybrid and electrification
- ▶ OBD and monitoring requirements
- ▶ Driver assistant systems
- ▶ Variant coding

## Number of calibration variants (engine cal.)



### Drivers for variability:

- ▶ Downsizing (high reuse of engine block)
- ▶ Model variability
- ▶ Individualized cars
- ▶ Emerging markets

# Challenges

- ▶ How to guarantee correctness of 60.000+ parameters?
- ▶ How to guarantee consistency of 500+ variants?
- ▶ How to leverage data for new calibration variants?

# Capturing and Automation of Expert Knowledge

## The measures

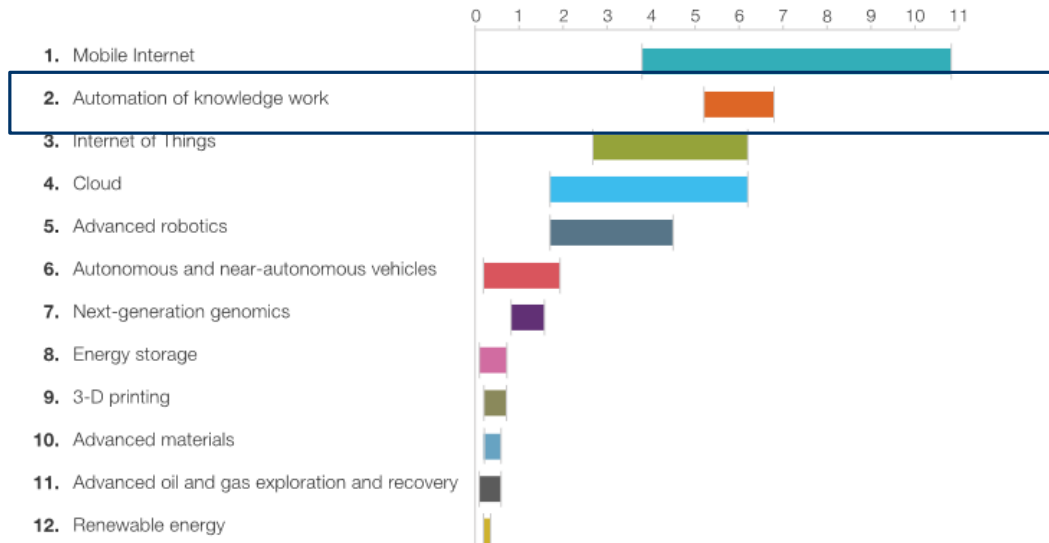
- ▶ Formalize procedures
- ▶ Automate routine tasks

## The results

- ▶ Avoid mistakes
- ▶ Set experts free for innovation

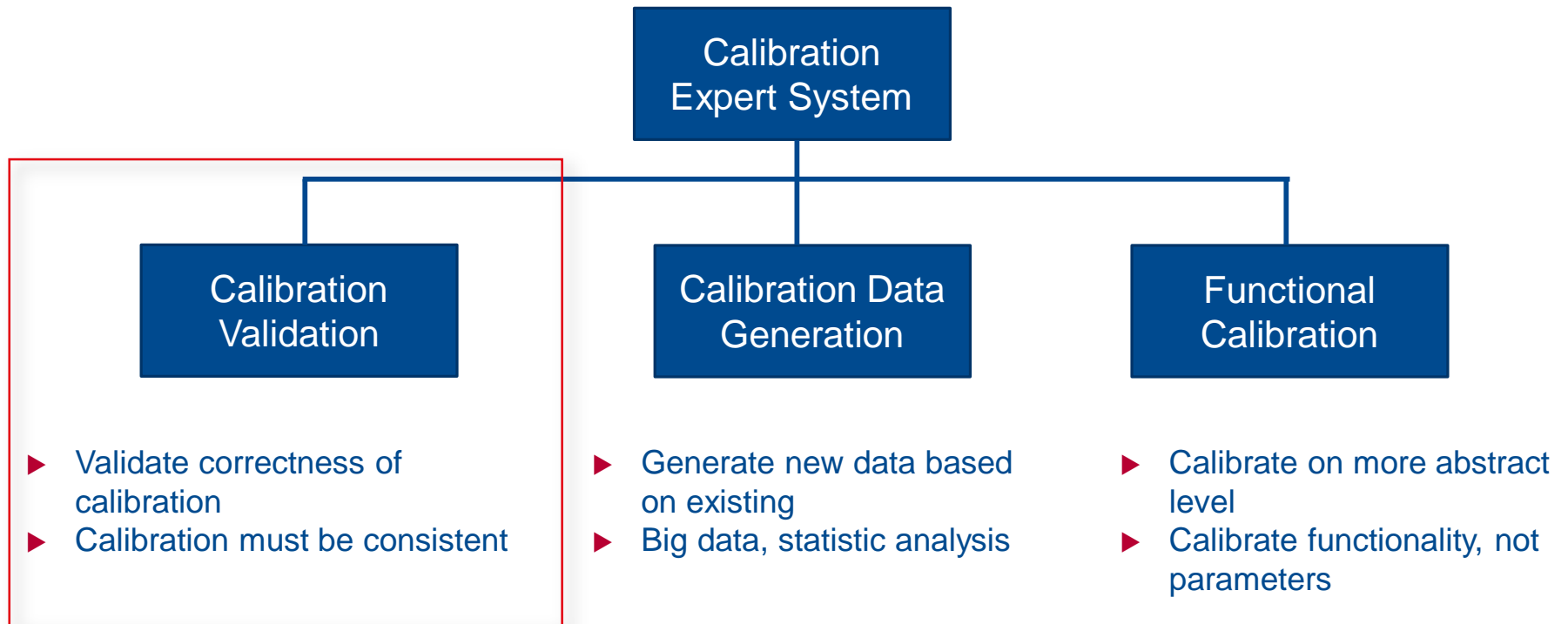
### A gallery of disruptive technologies

Estimated potential economic impact of technologies across sized applications in 2025, \$ trillion, annual



SOURCE: McKinsey Global Institute

# Calibration Expert Knowledge – Our Definition

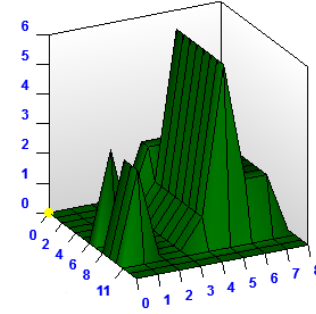
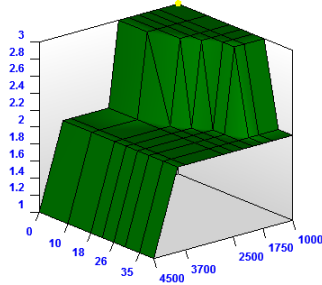


Focus of first standard release



# Calibration Validation

Parameter consistency (within or across ECUs)



Consistency of ECU and other vehicle components



Consistency across variants



Focus of first standard release

# Calibration Validation Examples

## Example 1:

```
If ParamA 25 ... 100 and ParamCheck == 1 then  
    PlausA > 5 and PlausA < 10
```

**Parameter / Parameter**

## Example 2:

```
If ParamX > 15 and InjectorTyp = ABC then  
    ParamY > 100
```

**Parameter / Hardware or system  
property**

## Example 3:

```
If ParamF < 100 und Emission = US then  
    ParamG > 100
```

**Parameter / Calibration objective**

# ASAM MCD-2 CERP

Goal: Validation of calibration data

Title: ASAM MCD-2 CERP/ P2014-02 / BS / V1.0

Release: 22<sup>nd</sup> February 2016

## Features

- Focus of 1<sup>st</sup> release: Validation of calibration data of one ECU variant
- Rule language for calibration data validation based on OTX
- About 200 functions to access and compare calibration data
- Feature model for vehicle properties
- 12 OTX extensions. 9 extensions shared with CPX.

# Future extensions

- ▶ New validation functions
- ▶ Access on multiple data variants
- ▶ Validate consistency of variants
- ▶ Generate data from existing data stock

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# ASAM CPX

Goal: Calibration Process Exchange Format

Title: ASAM AE CPX / P2014-03 / BS / V1.0

Release: 22<sup>nd</sup> February 2016

## Features

- CPX (Calibration Process Exchange Format) is a vendor independent exchange format for the description of calibration process sequences based on OTX according to ISO 13209
- Support OEMs, suppliers and engineering service providers to publish, to exchange and to consume processes knowledge and to create, reuse and automate workflows

# ASAM CPX

## Results

### ▶ 14 new OTX Extensions:

- **State Machine**  
Describes a workflow
- **Flow Chart**  
States, triggers and transitions
- **MeasurementRead**  
Control and access of measured data
- **ControlMath**  
Mathematical calculations for captured measurements
- **Model**  
Start and stop of different models, Model Port Mapping, Access to calculation results
- **9 shared Extensions for Calibration; harmonized and reviewed together with CERP**  
Read or write characteristic values, Low and High level functions

### ▶ **State Machine and Flow Chart Workflow Extensions will be transferred to ISO 13209 part 4**



Questions?

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