Lighting, Reliability testing, Autonomous Vehicles

27/11/2020

AVL, University of Budapest – BME

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 864266.

Welcome

Welcome

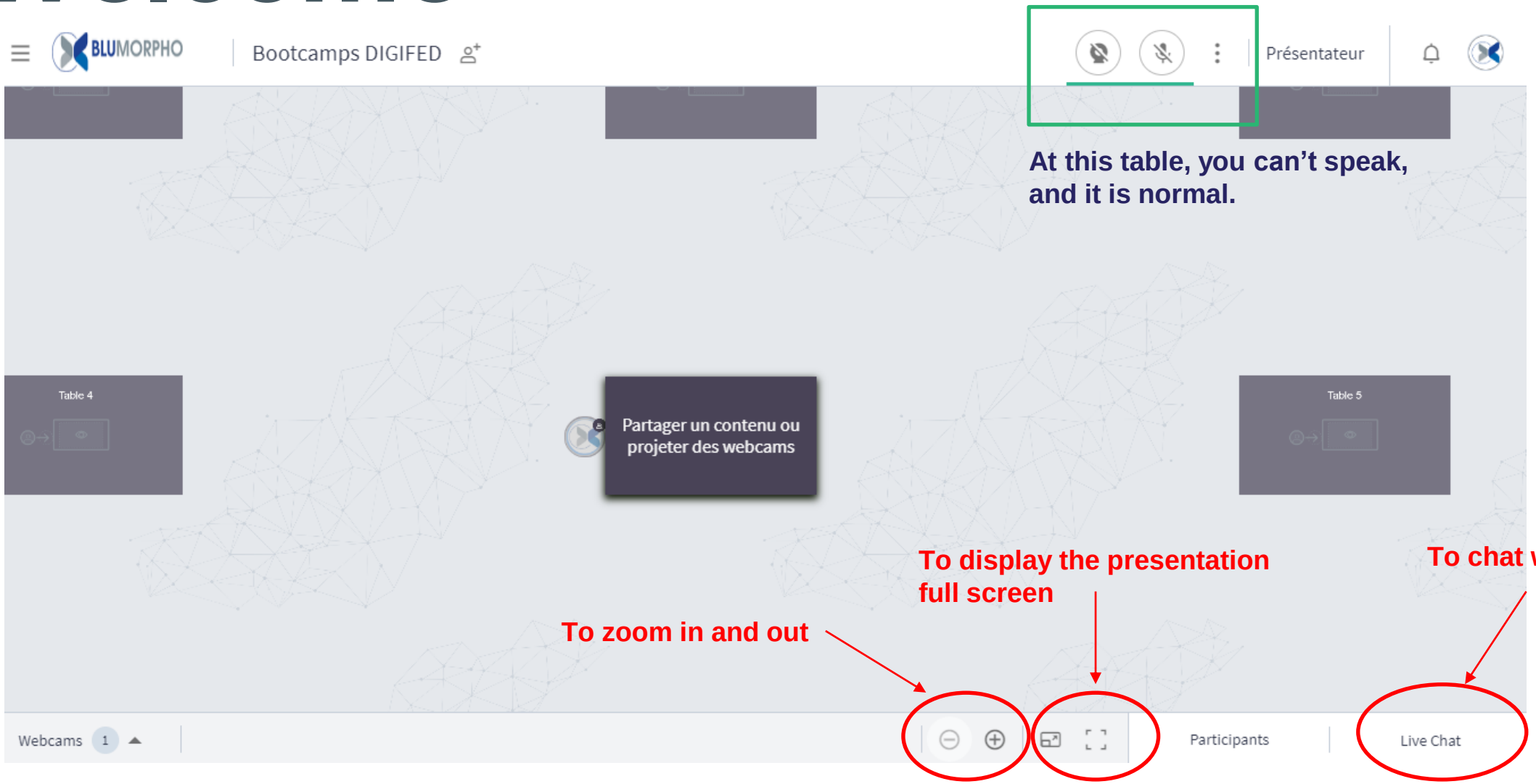
BLUMORPHO
Bootcamps DIGIFED
Présentateur
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Table 4
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Table 5
To display the presentation full screen
To zoom in and out
To chat with us
Webcams 1
Participants
Live Chat

Agenda

- **Introduction, objectives and agenda** (10 minutes)

- **How to use Digifed capabilities in Lighting, Reliability Testing and Autonomous Vehicles as part of your project while leveraging DigiFed Partners to maximise your proposal scores**: Excellence, Impact, Implementation Quality (45 minutes)
  - AVL
  - BME
  - CEA

- **Open floor discussion with Q&A**

DigiFed

Reliable Thermal Design at BME

27/11/2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 864266.

Introduction

- Due to the miniaturization the dissipation per area increases steadily
- Temperature related malfunctions, degradations
- **Thermal limitations** on the dissipation and thus on the performance of cutting-edge IoT/CPS hardware
- Electronic cooling solutions involve active air cooling, liquid cooling, but available space and price tags severely limit the realizations.

DigiFed offer at BME

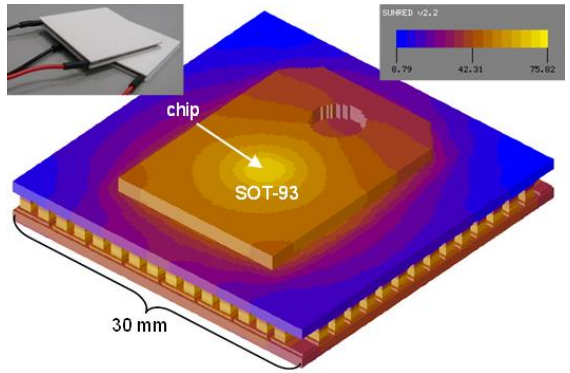
Technologies at BME offered for application experiments**:**

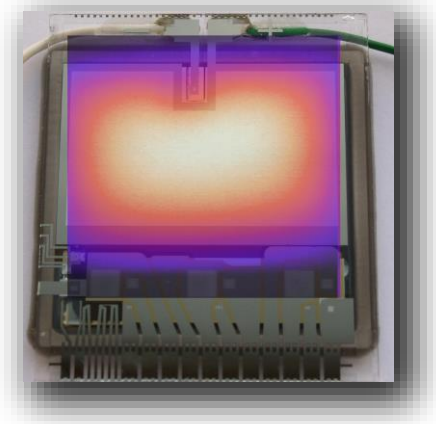
- *Versatile Reliability Tester – Test methods and tools for assessing application conditions*
- *LEDbeSmart – Modelling methodologies and workflow for LED based applications*

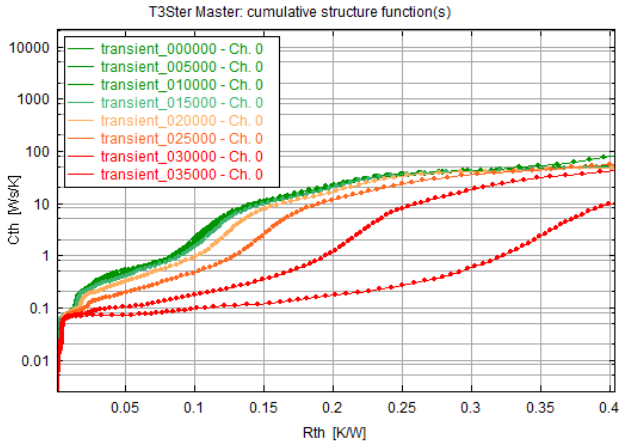
- **RELIABLE THERMAL DESIGN** – Thermal design methodologies with numerical analysis, CFD simulations, supported by thermal transient measurements and thermal imaging

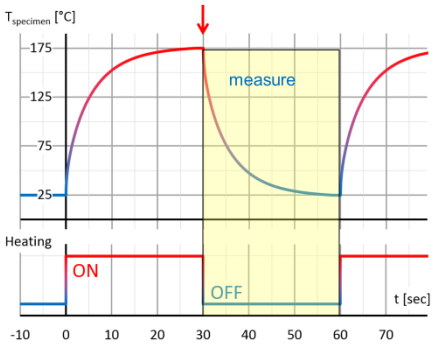
Reliable thermal design

- **Problem:** In electronics design a basically known but often superficially treated issue is the thermal optimization.
- **Virtual prototyping:** With the introduction of numerical analysis tools the thermal performance of electronic systems can be predicted.
- **Principle:**
  - Application of state-of-the-art computational fluid dynamics tools in the early design stages
  - In-situ thermal transient measurements and hot spot analysis for system inspections
- **Guidelines:**
  - JEDEC standard JESD51 1-14, Methodology for the thermal measurement of component packages
  - Gy. Bognár; G., Takács; L. Pohl; P. G. Szabó; Thermal modelling of integrated microscale heatsink structures MICROSYSTEM TECHNOLOGIES (2018)



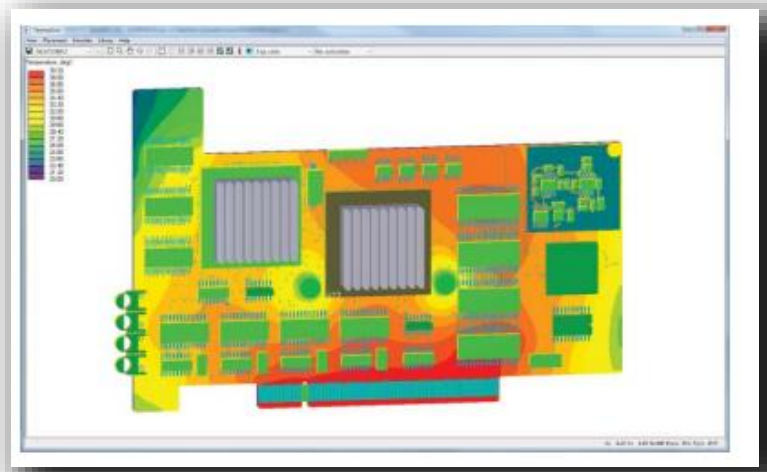


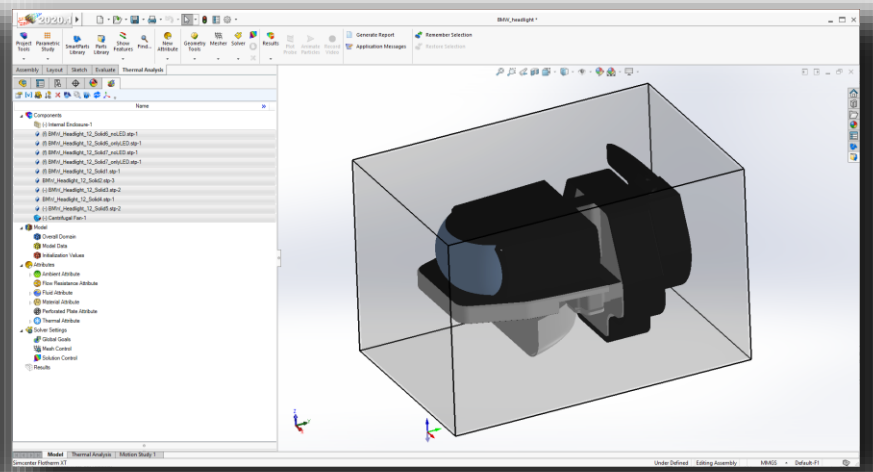


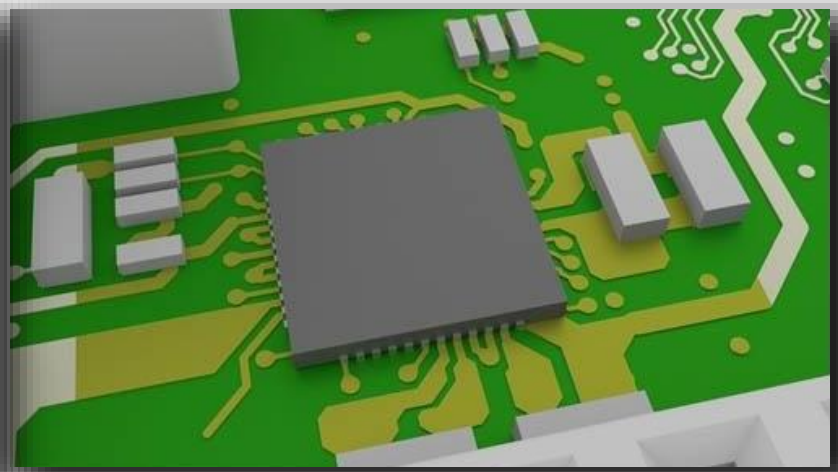


Tools and methods for virtual prototyping

- **Siemens Flotherm**: CFD tools to predict airflow, temperature, and heat transfer in electronic components, PCBs, and complete systems, including racks and data centers.
- **Siemens Flotherm XT**: A CAD-centric user interface. It offers CAD connectivity and advanced CAD modeling capabilities.
- **ANSYS Fluent**: High precision general CFD solver with extensive meshing capabilities. From microfluidics to airplanes.
- **Dassault Systemes CATIA:** Industry leading multiplatform CAD, CAM suite
- **Siemens HyperLynx Thermal:** Quick thermal analyzes for placed, routed PCBs.

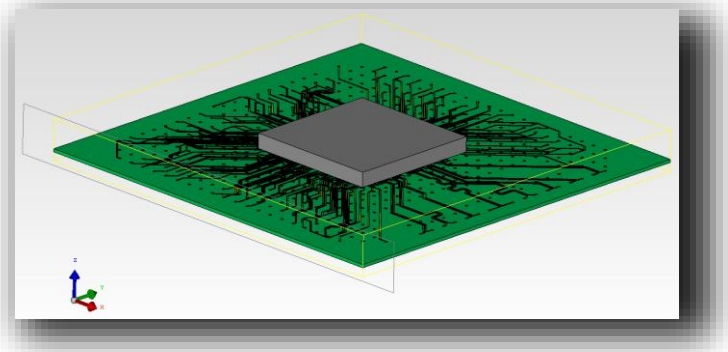


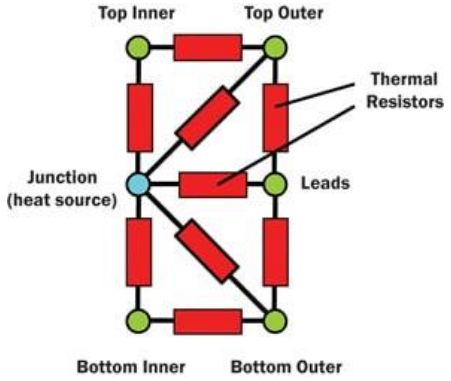


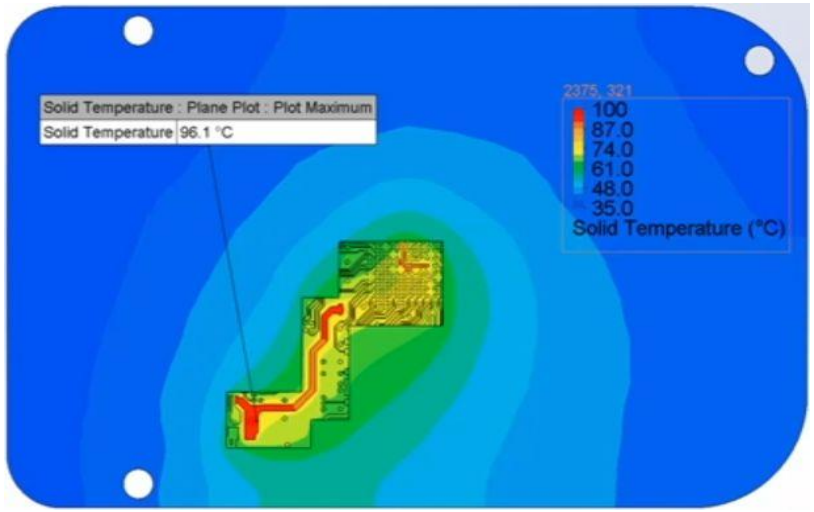


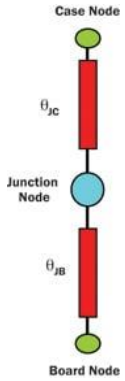
Tools and methods for virtual prototyping

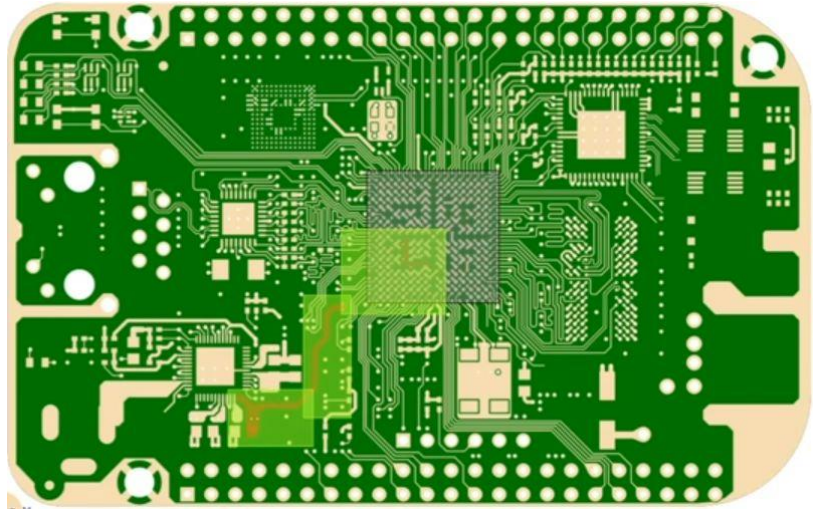
- **2R, Delphi and behavioral compact models** to overcome the differences in sizes for non-essential components.
- **Detailed models** for the most essential ICs.
- **EDA interfacing**: fully designed PCBs can be imported by using ODB++ files.
- **Thermal territories** to accurately model the essential parts of a larger board.
- Parametric studies make **DoE** analysis convenient





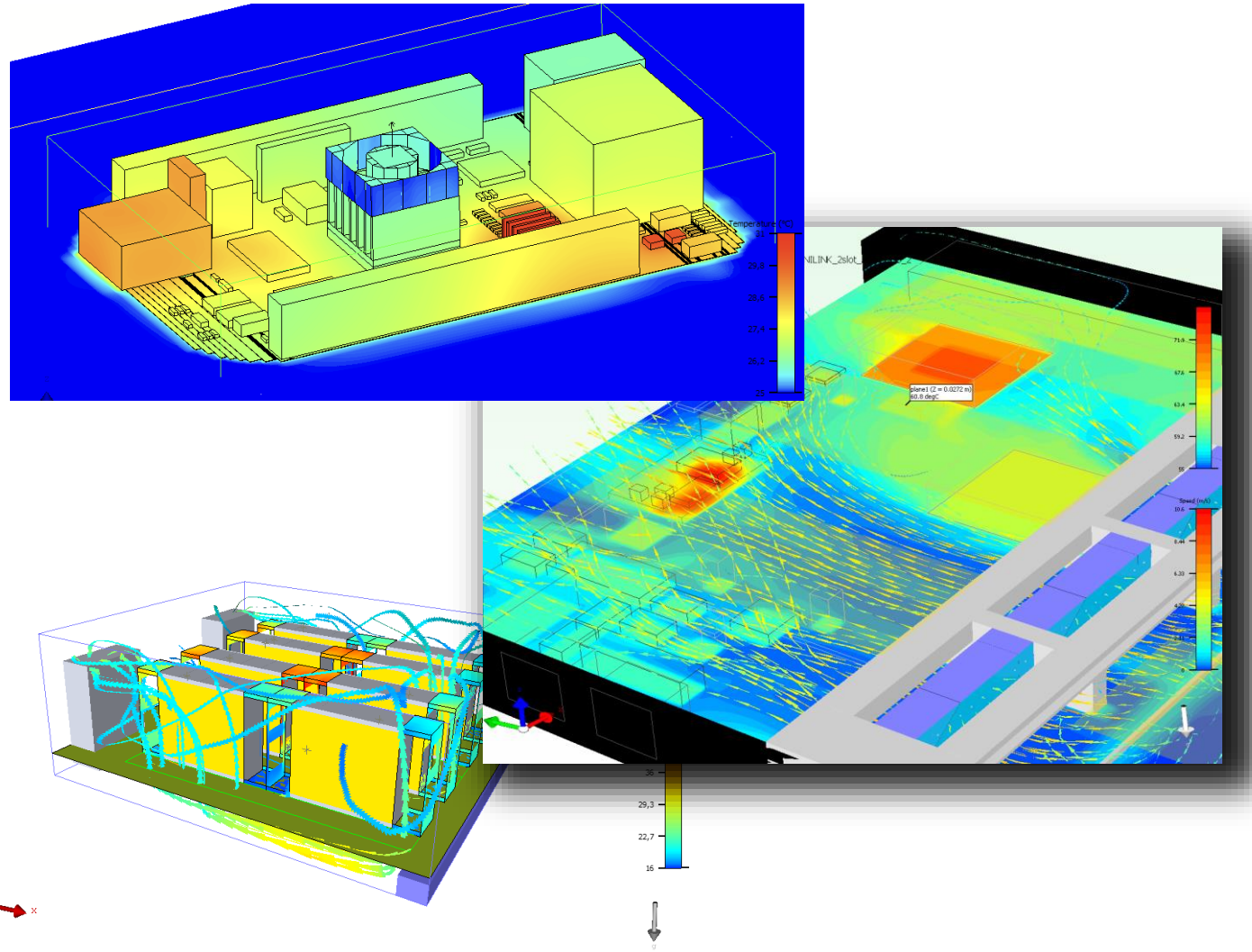






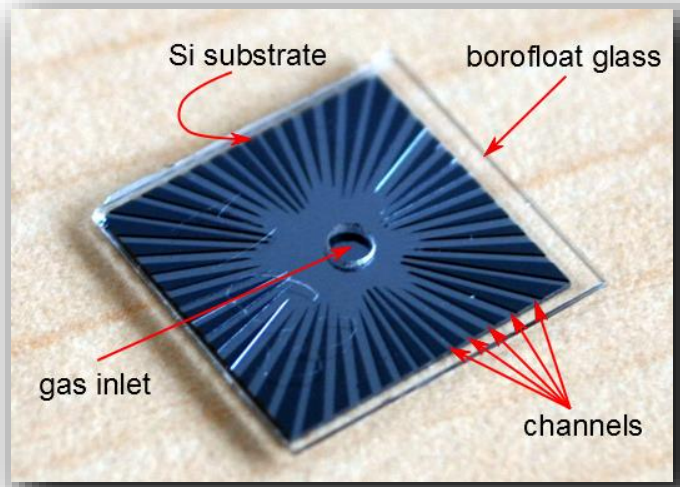
From embedded systems to server rooms

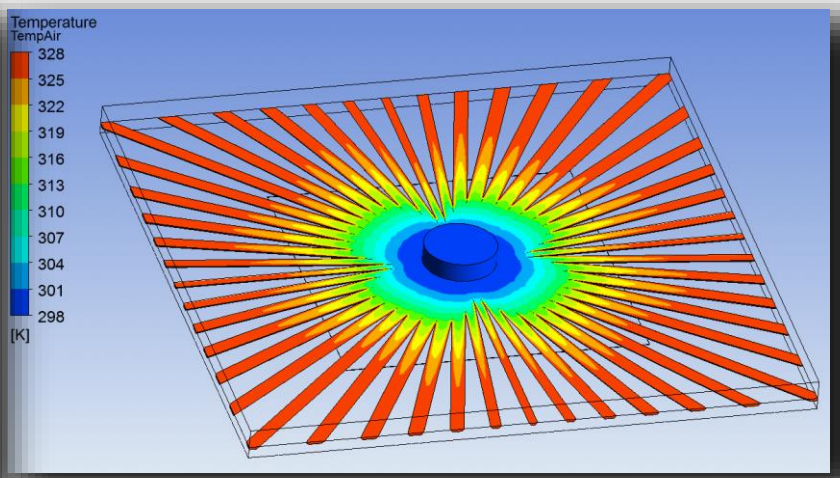
- **Beagle board:** A small board with ARM microprocessor and enhanced functional capabilities but with many thermal bottlenecks.
- **Telecommunication subrack:** Tightly packed 4 and 5G communications racks that leave little room for thermal management.
- **Server room:** The backbone of cloud services, supercomputers now deman their environments to be kept cool.

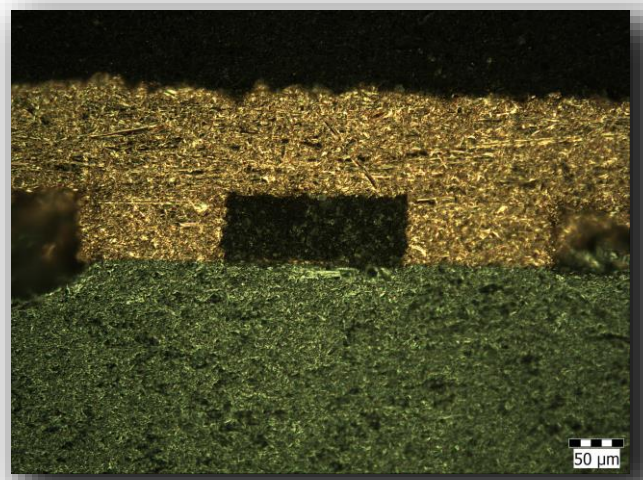


Integrated microscale cooling solutions

- **Chip-level cooling:** Microchannels to enhance heat transfer inside IC packages. Novel packages, microscale test structures are designed in our labs and the know-how can be offered.
- **Concentrator PV cooling:** Integrating microchannels on backside of the CPV cell to maximize the heat transfer with optimal layout that is derived by our thermal design team by means of the combination CFD and compact modelling techniques.

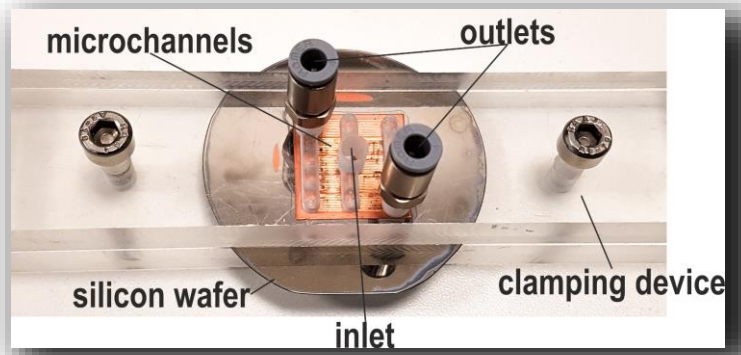


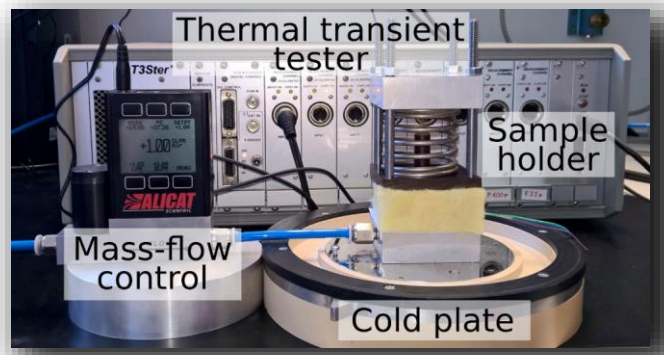


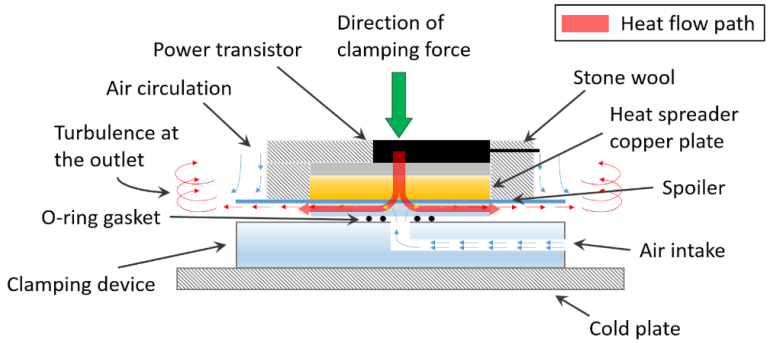


Thermo-hydrodynamic characterization

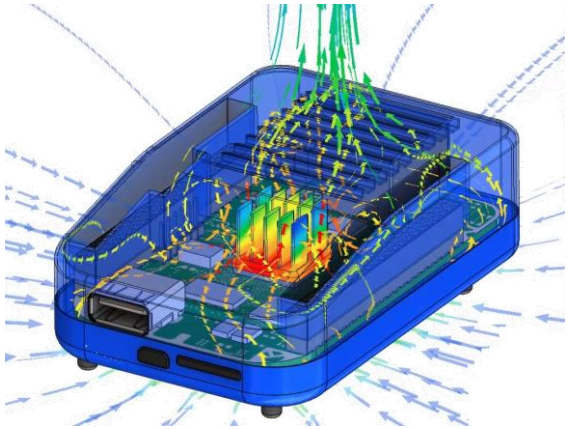
- **JEDEC standard JESD51 thermal transient testing enhanced with unique features**
  - Determination of dynamic thermal properties
  - Material properties of each component in the heat flow path
  - Hydrodynamics parameters like flow-rate, heat transfer capabilities
  - Delamination
  - Movement of MEMS devices
- **Hot-spot and critical path analysis with optical and IR spectroscopy**

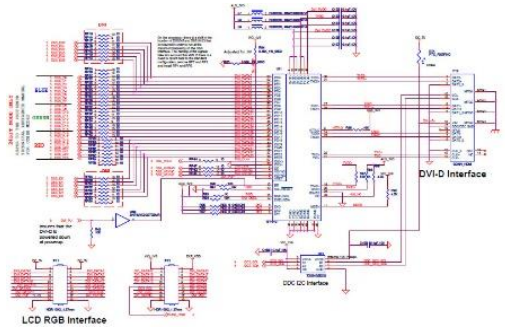


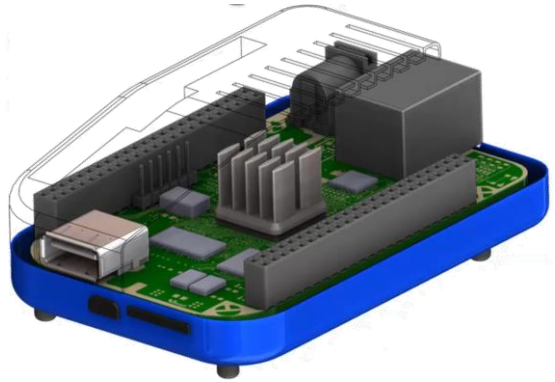


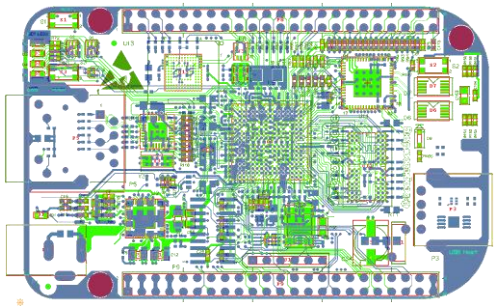


Thermal design*flow*





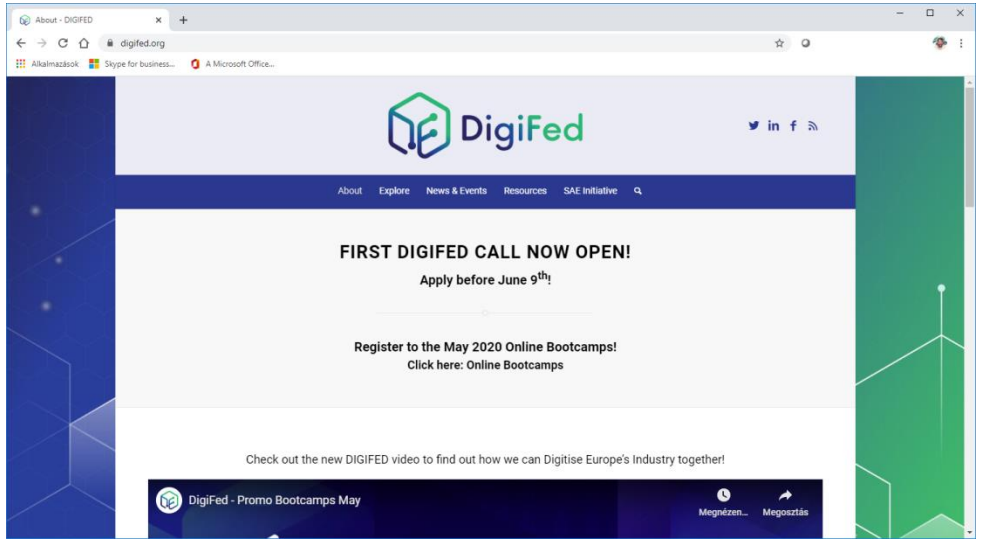


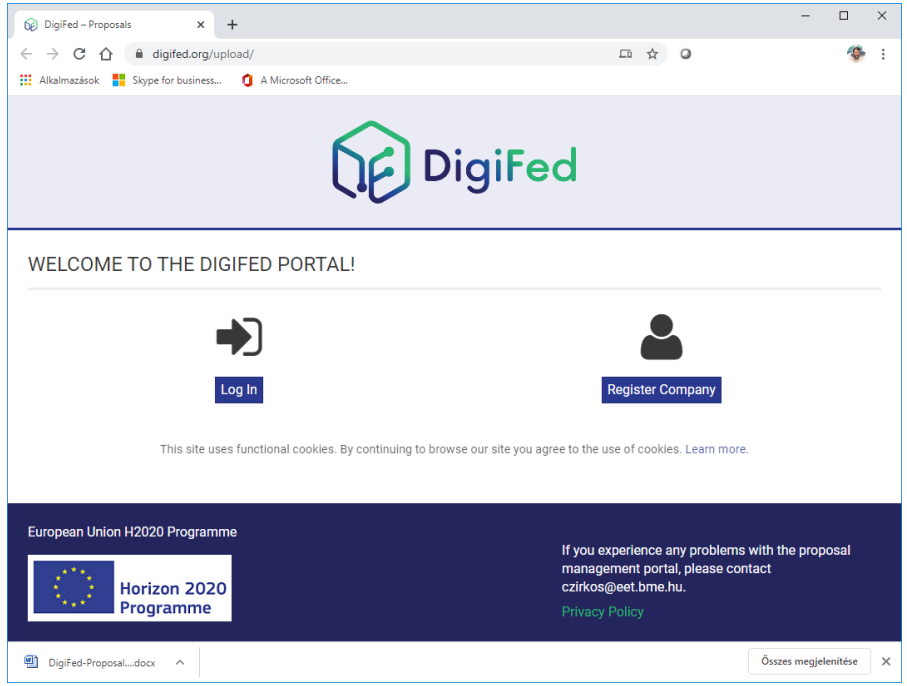


- Early consultations
- Thermal and hydrodynamic characterization
- Enclosure design
- Detailed thermal simulations and feedback
- Identify critical parts and components
- Layout and placement

Learn more

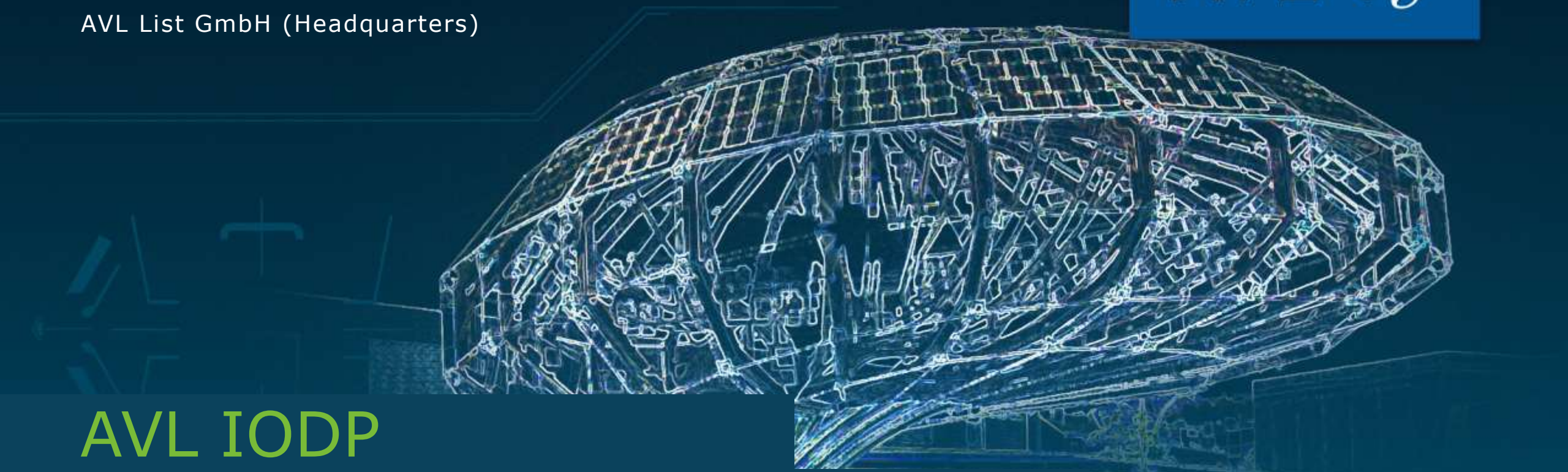
- **Website:** https://digifed.org/
- **Open Call for Application Experiments:** https://digifed.org/explore/open-calls/
  - Guide for applications
  - Application portal
- **BME contact for Reliable Thermal Design: Peter G. Szabo** szabo.peter@vik.bme.hu






AVL

AVL List GmbH (Headquarters)



AVL IODP

Mastering complexity and speed with the Integrated and Open Development Platform

Dr. Josef Zehetner

About myself

DI Dr. Josef Zehetner

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DigiFed Webinar, 17.03.2020

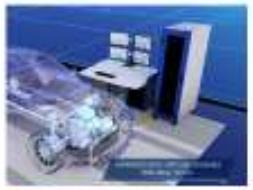
DigiFed

INTEGRATED AND OPEN DEVELOPMENT PLATFORM (AVL)

- **Function**: integration of all elements of the modern product development process - independent of tools
- **Principle:**
  - Integrate real (HW) and virtual (simulation models) components into a single development framework
  - Bridge the gap between development environments to allow reliable, holistic decisions
  - Bringing transparent contributions from various teams into an overall context
- **Key Performances:**
  - Model.CONNECT™ connects simulation models of different components and systems
  - Testbed.CONNECT™ merges simulation models and testbeds into a complete system
  - Data.CONNECT™ guarantees traceability and interoperability between data sources
  - Device.CONNECT™ interlinks globally distributed devices and data centers
- **Uniqueness:**
  - Collaboration through step-by-step integration
  - 100% focus on a functional representation
  - Smooth interaction of teams, processes and tools
- **Maturity/TRL:**

1 > 2 > 3 > 4 > 5 > 6 > 7 > 8 > 9

- **Applications:**
  - Optimal product design based on standardized parameters, exchangeable models and neutral tool interfaces
  - Step-by-step integration of virtual/real components throughout the development process

AVL List

7

Vehicle Development Process

Require-ments

Project start

Vehicle Development Process (VDP)

SOP

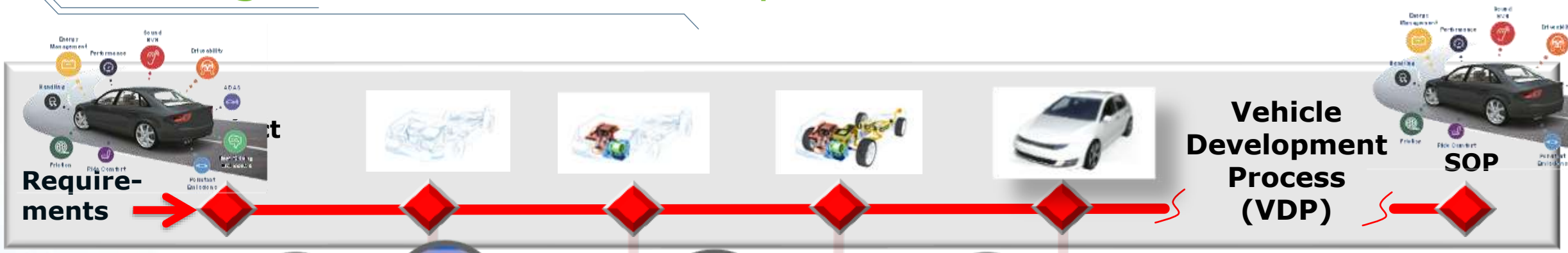
Power-train

Electrics & Electronics

Chassis

Virtual Integration **Simulation Only**	Mixed Integration **Simulation + Hard- & Software**	Hard- & Software Integration **Hard- & Software**

Heterogeneous Tool Landscape

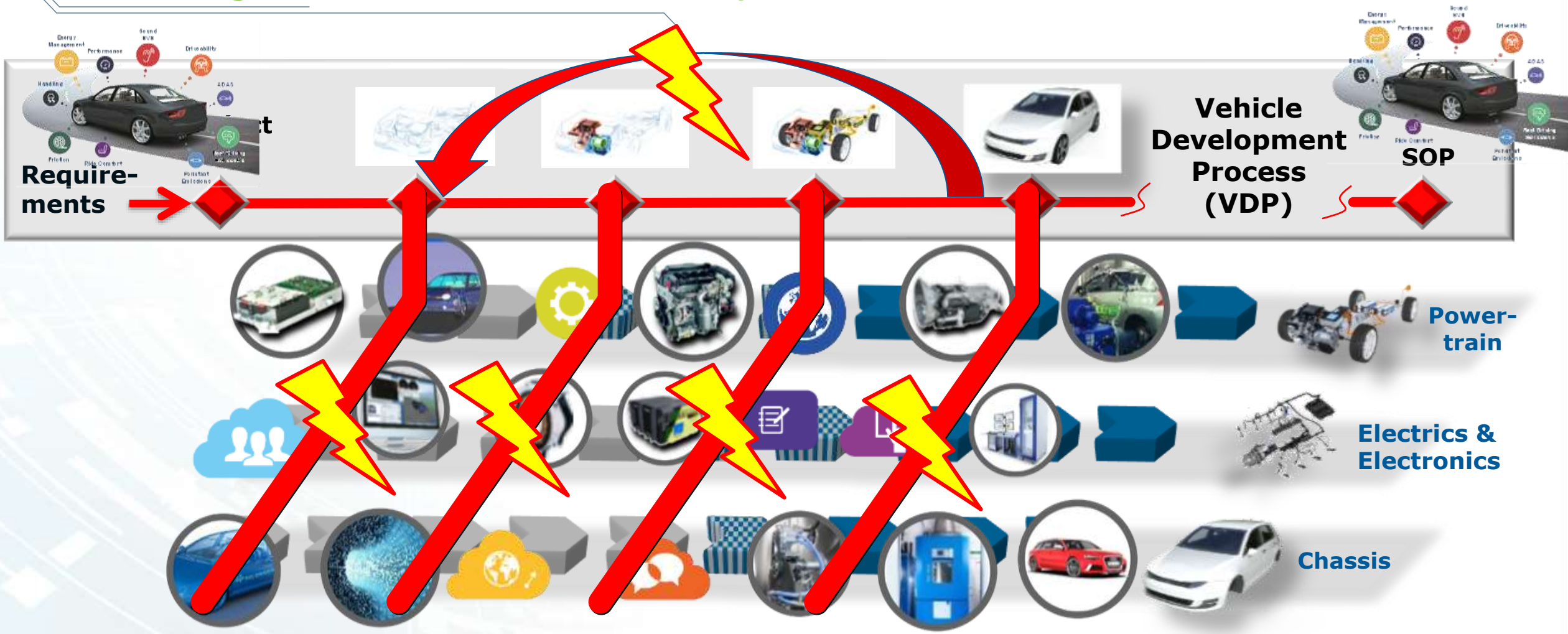


Virtual Integration
Simulation Only

Mixed Integration
Simulation + Hard- & Software

Hard- & Software Integration
Hard- & Software

Heterogeneous Tool Landscape



Main limiting factor entering MBD

Capabilities already existing and established in an organization …

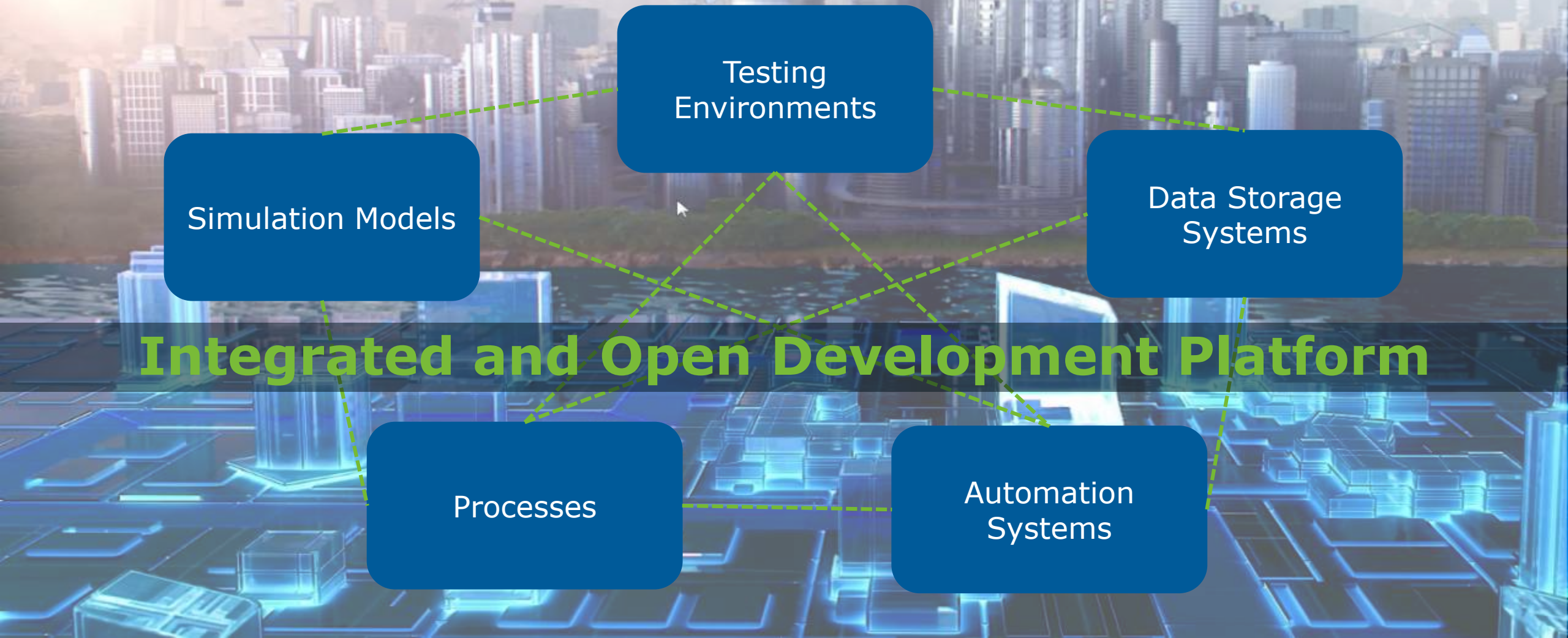
- Testing Environments
- Simulation Models
- Data Storage Systems

… but **DISCONNECTION** of the **VIRTUAL** AND THE **REAL** worlds

- Processes
- Automation Systems

AVL's Answer to Smart Development

Capabilities already existing and established in an organization …



Connects virtual components

Model.CONNECT™

Connects real with virtual components

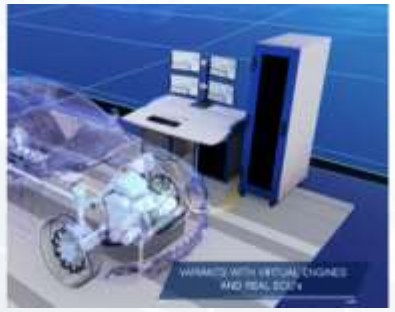
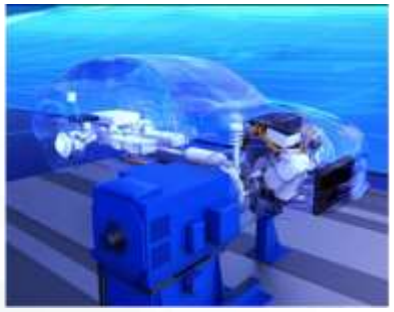
Testbed.CONNECT™

Connects different data sources

Data.CONNECT™

Connects different devices to data sinks

Device.CONNECT™


Value proven in many use cases

Integrated and Open Development Platform

... AVL's answer to smart development

Customer References
Connect Simulation and Test for many Tasks

Thermal management
CRUISE, GT, AMESim, FLOWMASTER, SIMULINK, Exothermia, SIMPACK

Control development
Dymola, Simulink

Turbo-lag behavior
CRUISE M, VSM, DRIVE, GTP

Advanced Calibration of Drivability
CAMEO, PUMA, DriCon, VSM, DRIVE, INCA,…

Virtual Shift Strategy Calibration
Model.CONNECT, VSM, SPA, Simulink,…

Data driven solutions
Integrative different data sources

Belt Starter Generator Control on ETB
PUMA, CRUISE M

Advanced Driver Assistance Systems
VTD, ADAMS, Simulink

Electrification, Thermal Management, ADAS
CRUISE, CRUISE M, VSM, VTD Vires, Simulink

Thermal management in the loop
Cruise, Simulink, Kuli, FMUs, CarMaker

Vehicle controls
Adams, Simulink

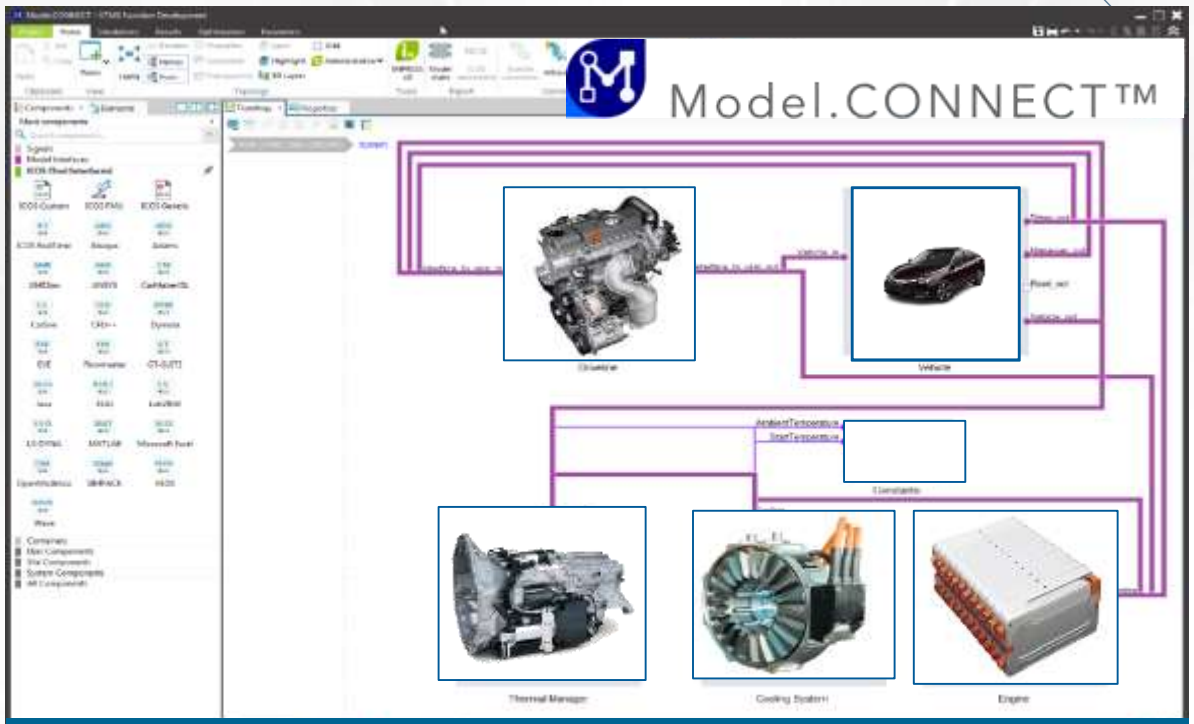
Engine and powertrain control function development
CarMaker, GT, Simulink, Saber
Optimization tasks via DVI server

RDE applications expanding to Testbed.CONNECT
CarMaker, VSM, GT, Simulink, Silver-QTronic

Value proven in many use cases

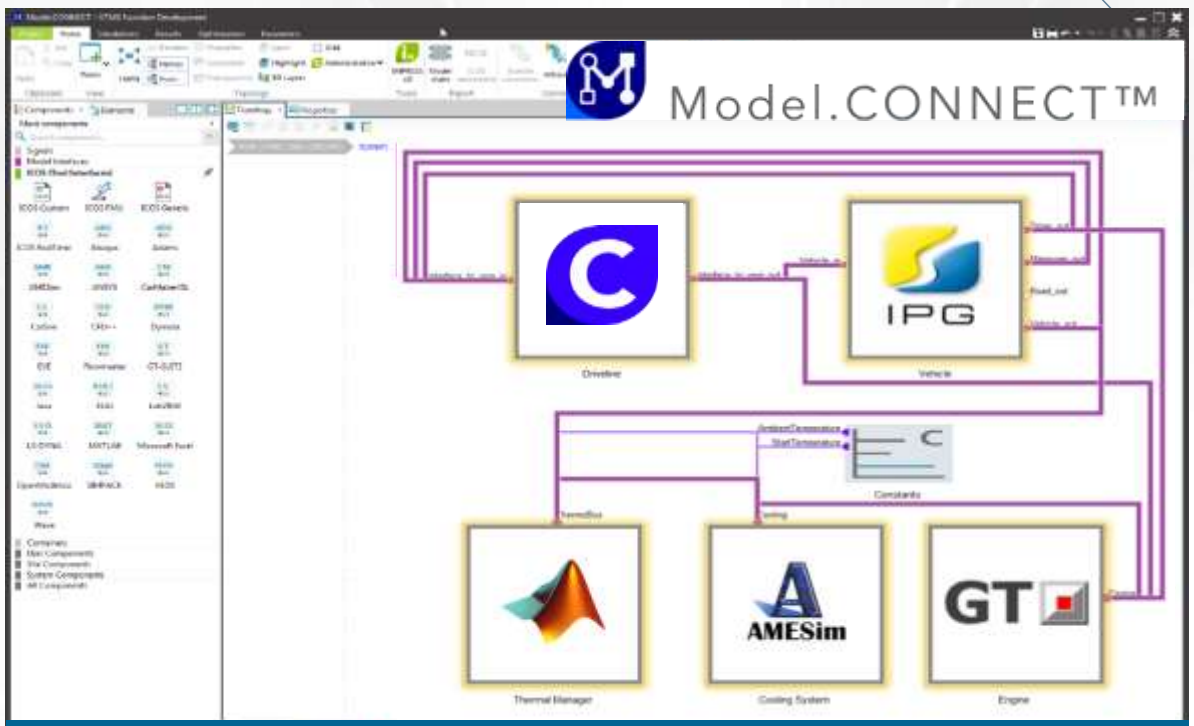
Office Simulation Solutions

Connect components



NEUTRAL and OPEN Integration Platform

Connect components



NEUTRAL and OPEN Integration Platform

Virtual Prototype

Connect different simulation tools
(Reuse existing models)

Virtualization of testbeds
(Connect hardware & software, simulation & test)

Use case oriented
(Flexible architecture supporting multiple tasks)

Tools specific interfaces (30+ software vendors) and interface standards (FMI)

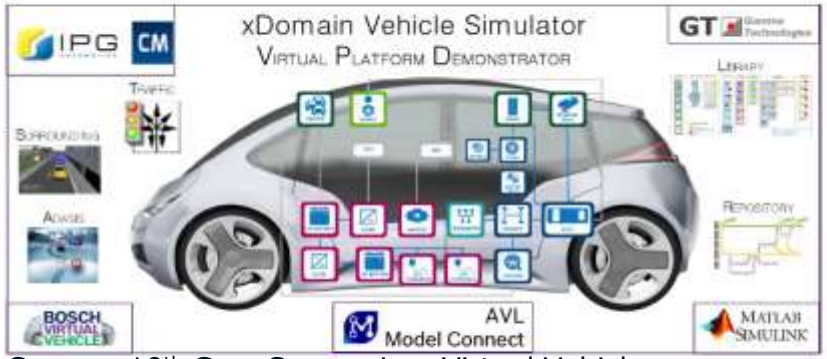
Customer Reference
BOSCH: Cross-domain vehicle system development

Model-based development with reliable co-simulation

SIMULATION CENTRIC APPROACH

xDomain simulation: backbone for vehicle systems engineering

BOSCH xDomain vehicle simulator: big picture



Deliverables

- Simulation platform with elements for reliable Co-Simulation
- Model Library with building blocks for efficient xDomain simulation
- Virtual Platform Demonstrator Vehicle models of mainstream system configurations

Use Cases

- Concept development
- Requirements elicitation
- System design
- System validation

Source: 10th Graz Symposium Virtual Vehicle June 27-28, 2017

xDomain Vehicle Simulator is starting point for simulation use cases in several BOSCH business units & in central automotive Systems Engineering organization (BBM-SE)

DGS: Diesel Gasoline Systems
BBM: Bosch Business Sector Mobility Solutions

BOSCH

Proven Benefits

Reduction of development and testing time	▪ Reuse of existing models from different tools (modeling time saving / model: 2-12 month work) ▪ X-domain integration of components
Reduction of cost	▪ Reduce development iterations ▪ More efficient collaboration between Supplier and OEMS ▪ **Avoid misunderstandings**
Increased product quality	▪ Better understanding of overall system impact ▪ Sound decisions in early phases

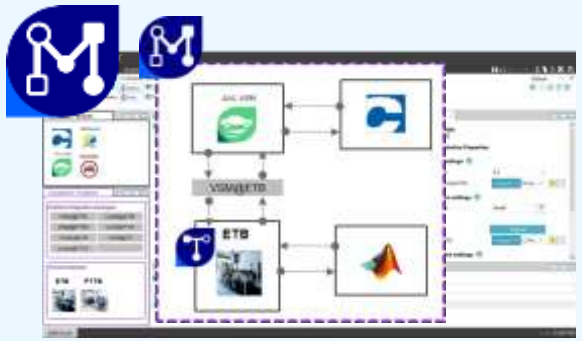
Value proven in many use cases

Simulation-based Testing Solutions

Connect Simulation and TestBEDS

Testbed.CONNECT™

Simulation in the office



Simulation on the testbed

AVL Virtual Testbed™

Testbed.CONNECT™ Workstation

Testbed.CONNECT™

Testbed

Testbed.CONNECT™ Workstation

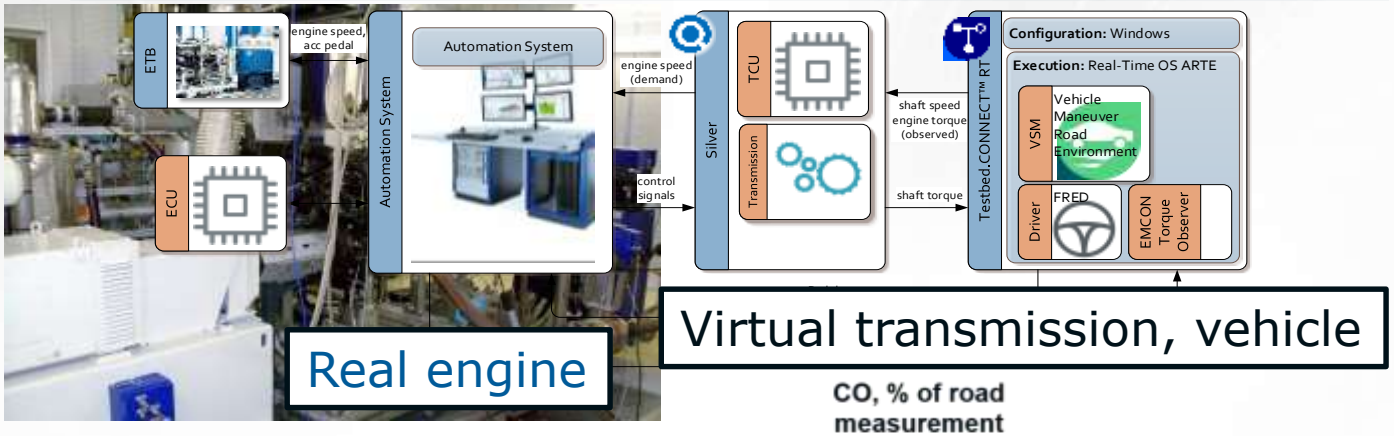
Testbed.CONNECT™

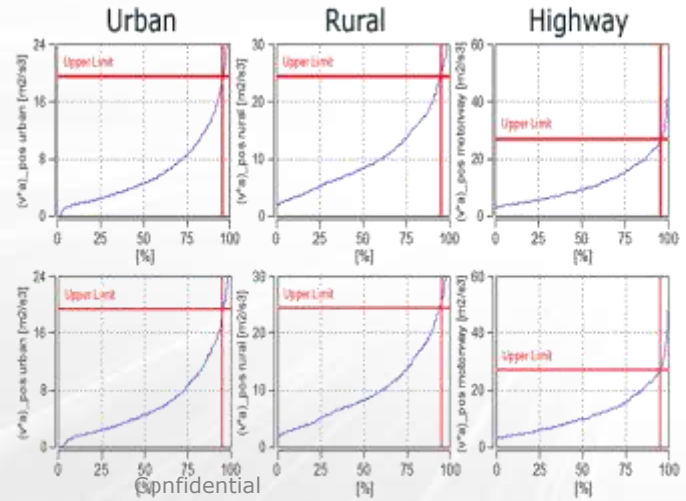
AVL Testbed with AVL PUMA Open 2™

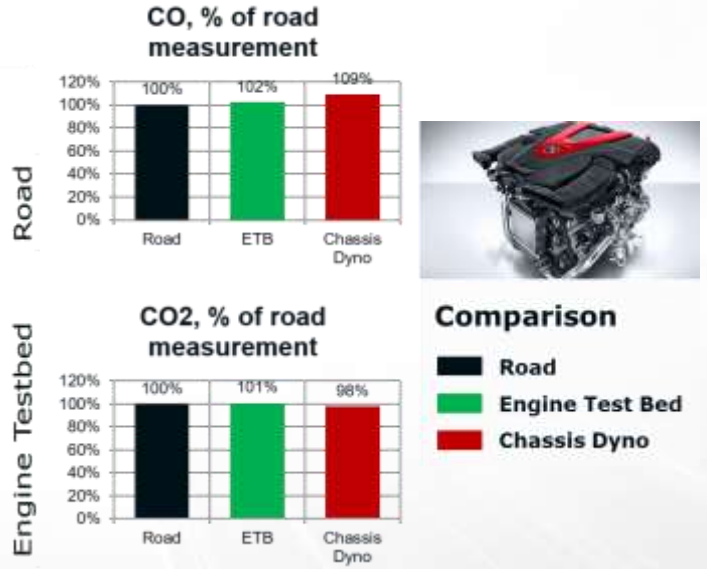
Customer Reference
German OEM: RDE - Real Driving Emissions

Reproduce and analyze emissions-relevant driving cycles on the Engine Testbed

ROAD → ENGINE TESTBED



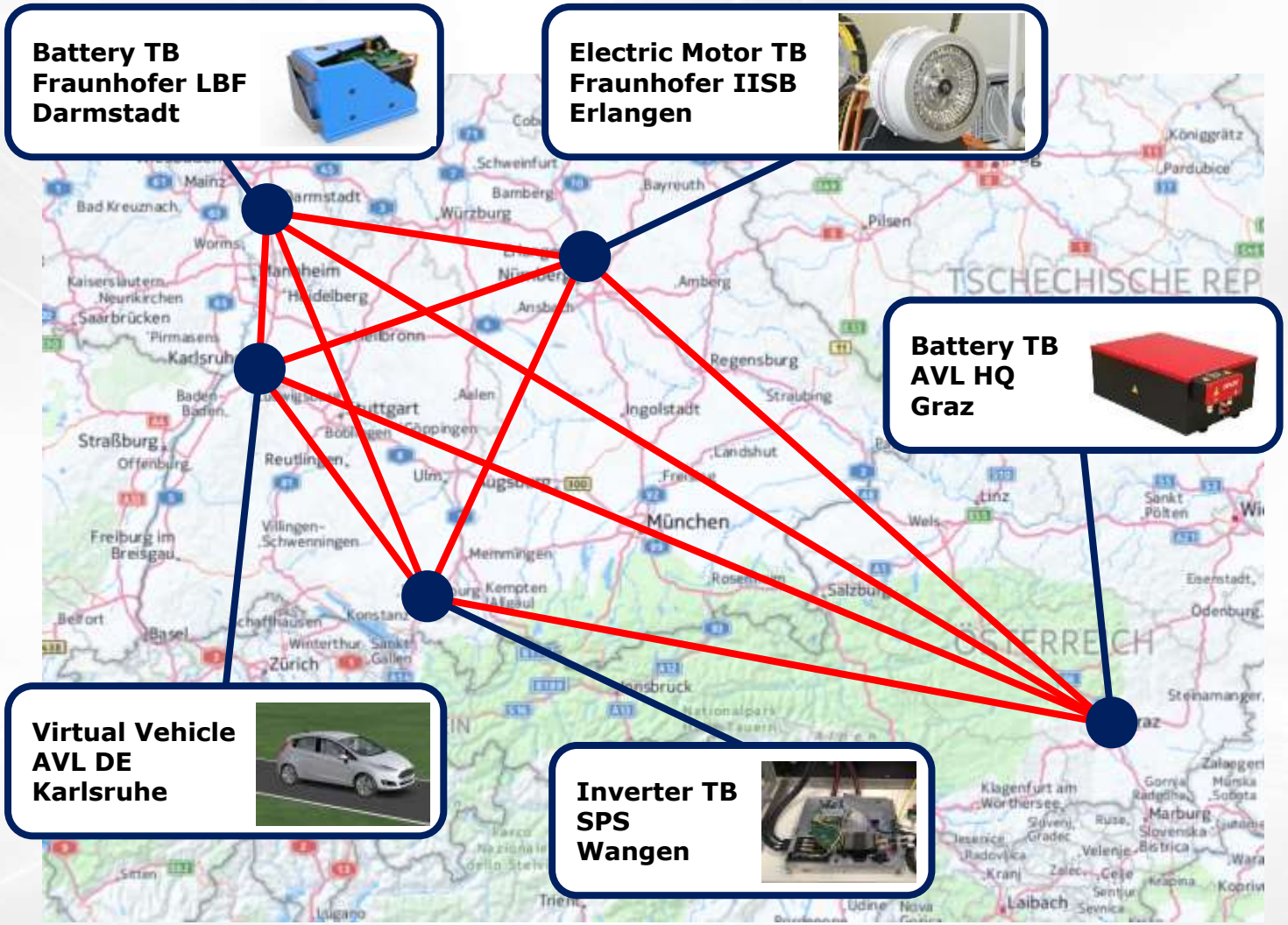




Proven Benefits

Reduction of development and testing time	▪ **High automation** - 24/7 (168 hours a week) ▪ **Repeatability** between dyno measurements high (same driving style) ▪ Higher tests/time rate with **rapid cooldown**
Reduction of cost	▪ Potential to **increase prototype usage** by factor 12 ▪ Less manpower for testing due to automation ▪ Reuse of data for drive mode calibration
Increased product quality	▪ **Higher testing coverage** leading to higher product quality ▪ Road and maps (e.g. Google, Here) based cycles ▪ Reproducibility Road → Engine Testbed high

Distributed Testing – Research Project



Comprehensive Test Driving
at any time from anywhere

Virtual test tracks
- Acceleration / Braking
- Circular driving
- Sinus steering
- Slalom
- Lane change
- mu-Split / mu-Jump
- Handling course
- Rough road

Virtual public roads
- Urban driving
- Highway driving
- Mountain driving

Value proven in many use cases

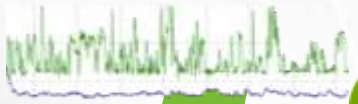
Data Connecting Solutions

Data.CONNECT

Time series data

Data.CONNECT

Time series data



Measurement files

AVL Santorin MX

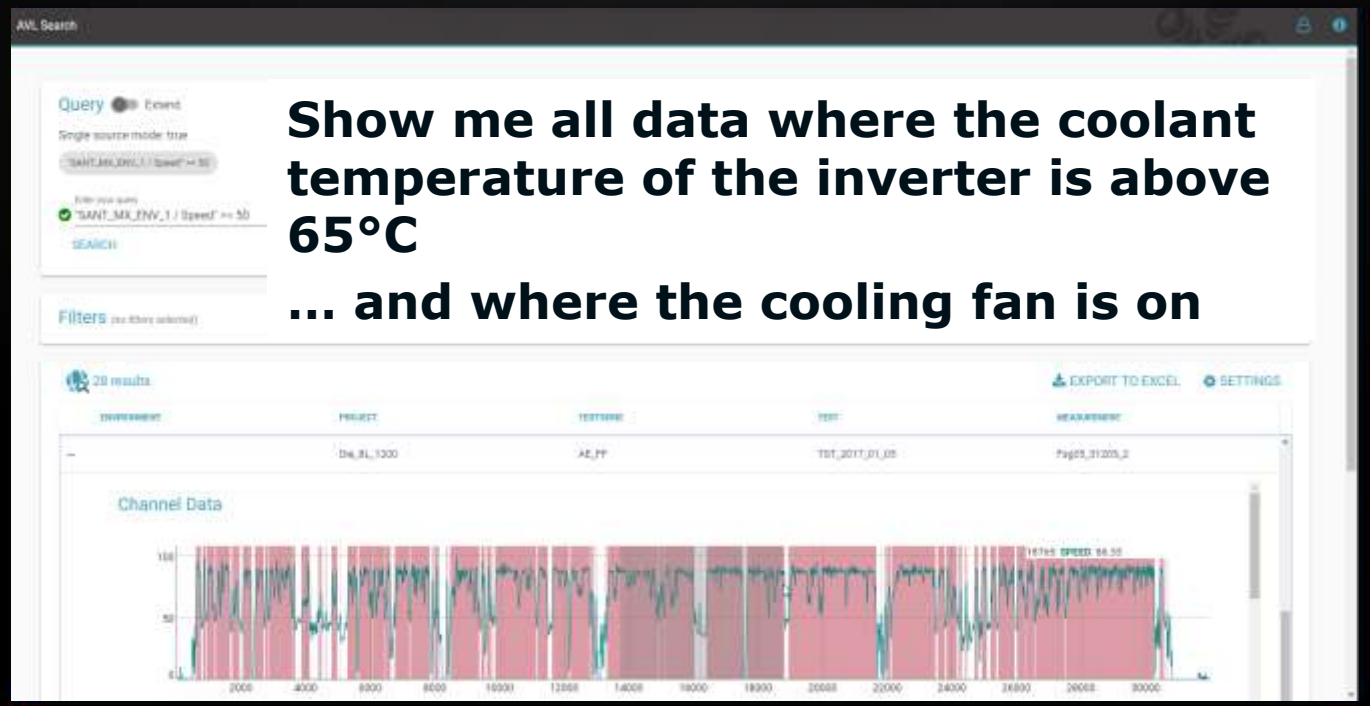
Calculated signals

Data transport & preprocessing

Convert to BigData formats for analytics

Prepr
Rand

Search and Explore



First step towards predictive analysis

Simulation

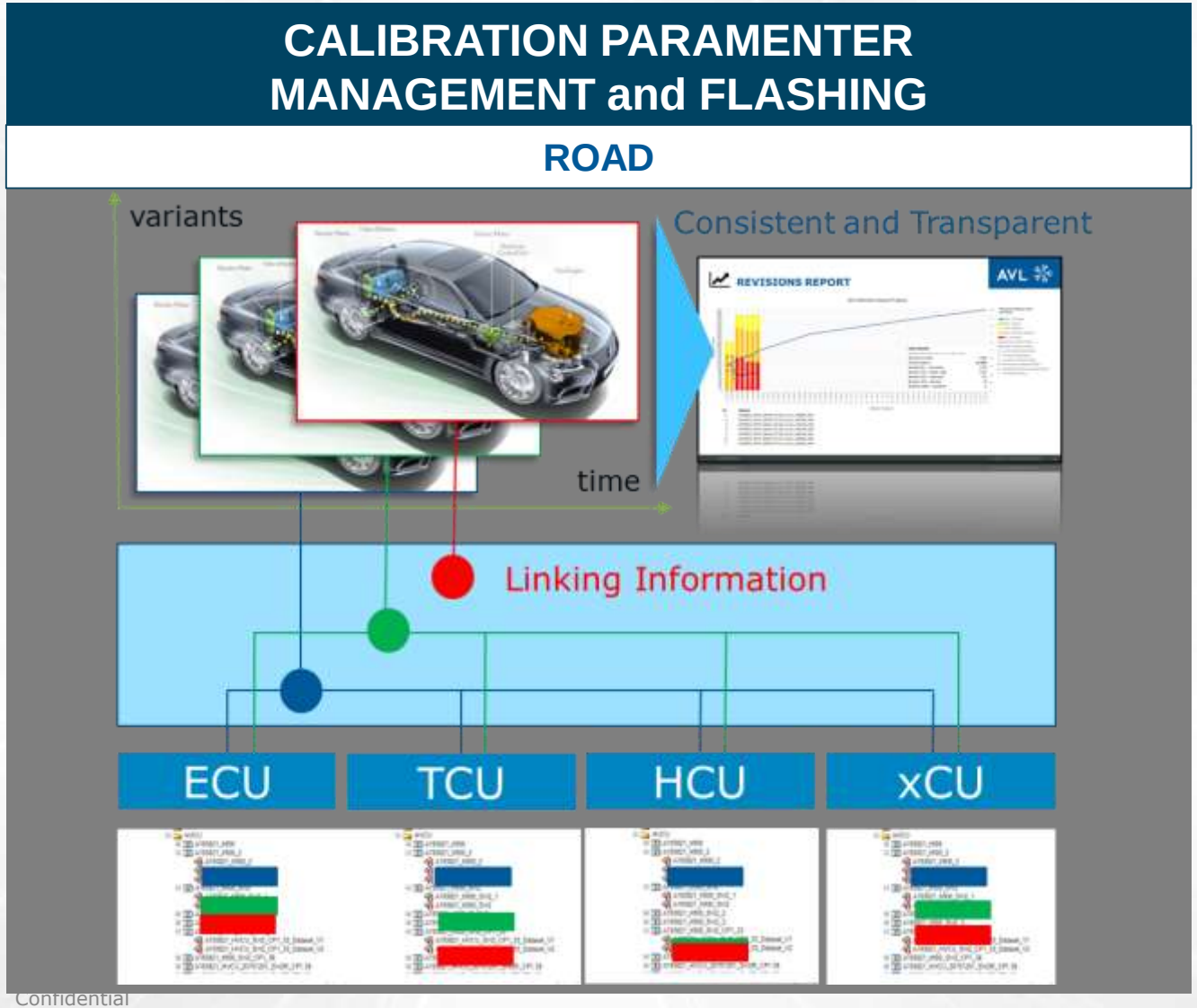
Testbed

Vehicle

Scalable analytics

Internal Customer Reference

AVL Calibration: Consistent Flash sets for test vehicle



Proven Benefits

Reduction of development and testing time	▪ Significant reduction of time for **finding the right combination of xCU software** versions (data sets)
Reduction of cost	▪ **Avoiding, repeating of calibration work** because of wrong xCU software combinations (data sets); (**up to 30%** MP costs savings)
Increased product quality	▪ Consistent and transparent process for **evaluating maturity of calibration over time**

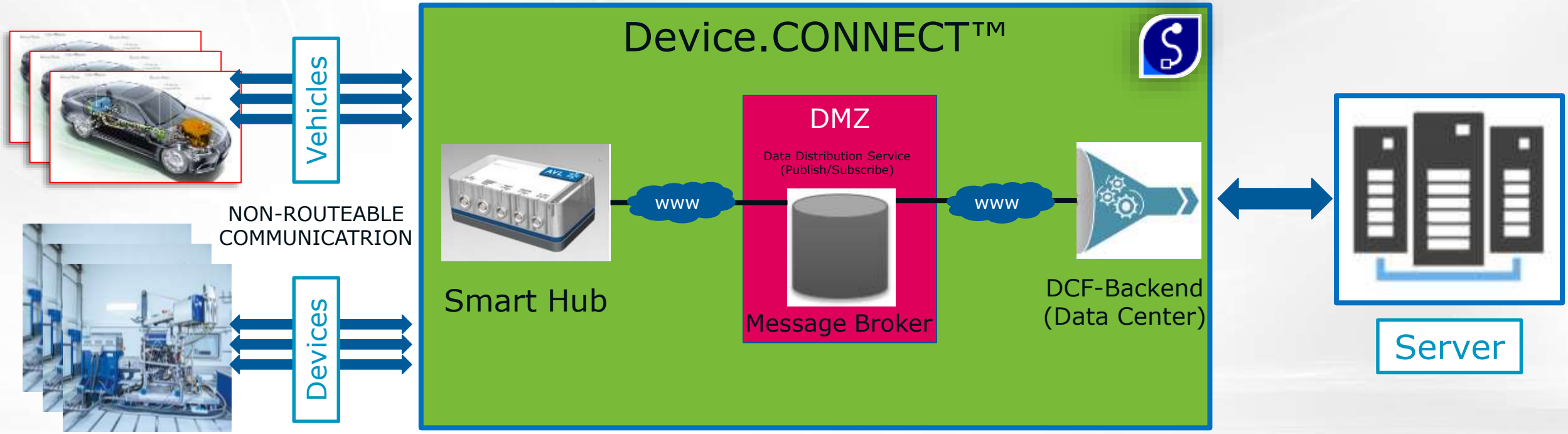
Device.CONNECT™

Bridge the trust gap

Your Benefits

- Enables **highly secure**, hardware protected connectivity
- Enhances intelligence at your devices with the **Smart Hub**
- **Full control** over data exchange
- Highest standards in data transport and **theft protection**
- No compromises to **product safety**
- Designed under **ISO 270xx/IEC62443** consideration

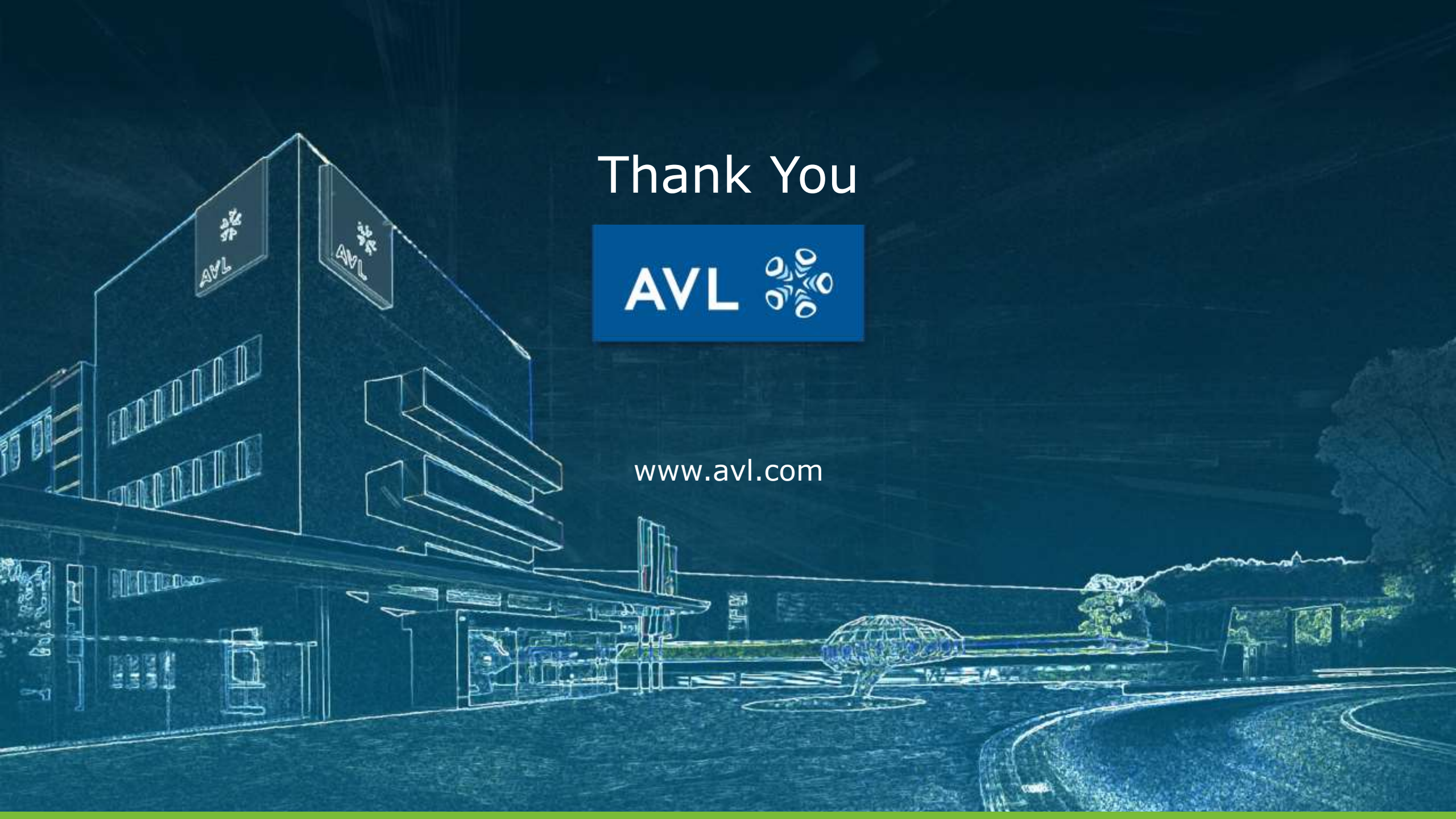
Device.CONNECT



DEVICES | INTERNET | CORPORATE NETWORK

DATA EXCHANGE WITHOUT COMPROMISES ON SECURITY


AVL
AUTO
PARK
IODP
AI
ABC
EMPOWER
VIRTUALIZATION


Thank You
AVL
www.avl.com