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TECHNICA ENGINEERING

Creating the Automotive Future

Q4 2019

TECHNICA ENGINEERING

CREATING THE AUTOMOTIVE FUTURE

01.
Who we are

About us
Our history, partners, facts and figures

02.
What we do

All in one
Problems in automotive, needs and our solution

03.
Challenges

Testing Levels and Challenges
Basic testing concepts and biggest challenges with regards to Automotive Ethernet

04.
Solutions (in a nutshell)

Products and Services
How Technica's different product categories address today's challenges and how our decade-long experience is available as Engineering Consulting Services

05.
Contact

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How to contact us for any further questions and information

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1 ABOUT US
WHO WE ARE

TECHNICA ENGINEERING

FROM PIONEERS TO CREATORS

2008

Technica Engineering started as a **one-man company** as consultant for electronic development in automotive environments at BMW. The focus of the early years was in the classic test tasks directly at the OEM.

2019

More than **400 employees** currently work at Technica Engineering with branches, distributors and partners in **5 continents** all over the world. We offer the whole Autmotive Industry **all-in-one solution designs** with own **Hardware and Software products**, supporting the innovation process from **problem analysis to solution and validation**.

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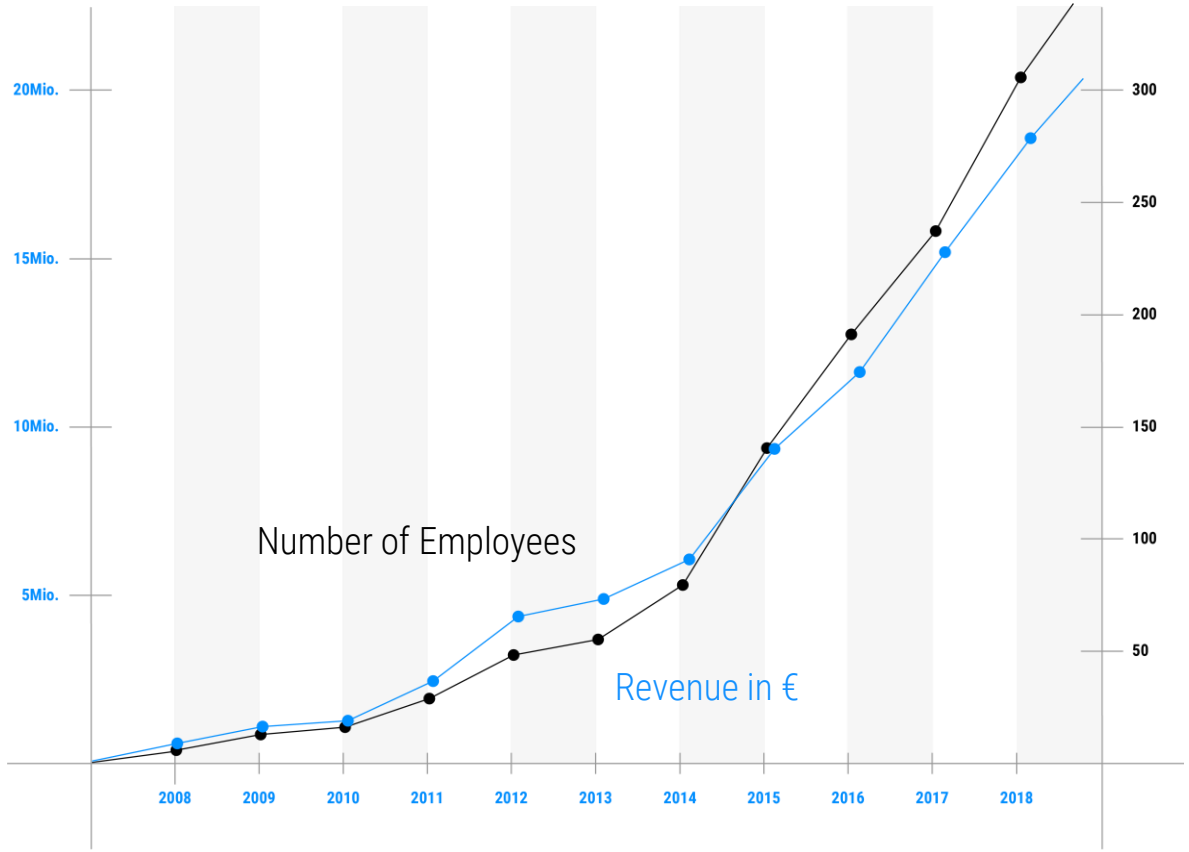
THE COMPANY

BUSINESS DATA AT A GLANCE



400+

More than 400 employees currently work at Technica Engineering – with an upward trend.

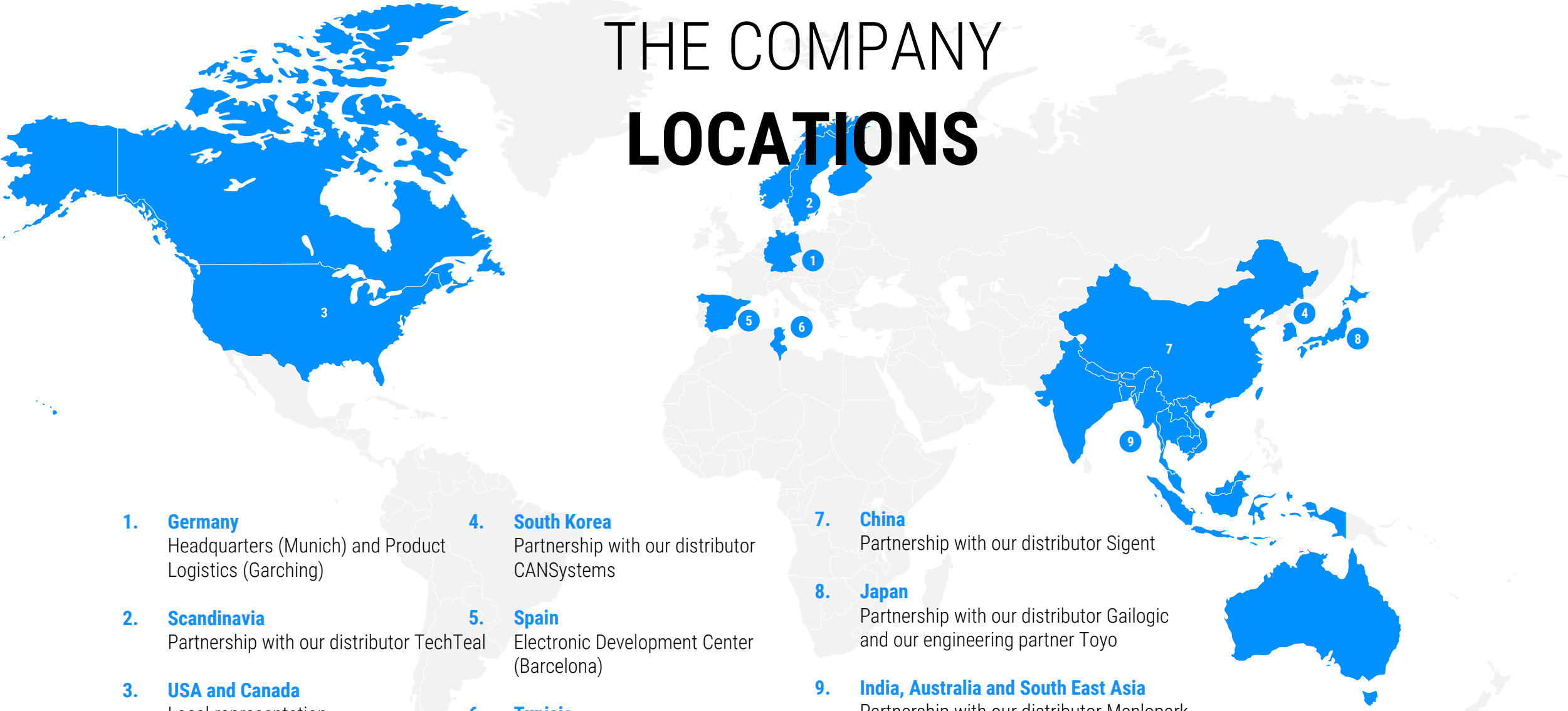
95%

More than 95% of employees hold an academic title.

5

Technica Engineering is represented with branches, distributors and partners in 5 continents all over the world.

THE COMPANY
LOCATIONS



1. **Germany**
   Headquarters (Munich) and Product Logistics (Garching)

2. **Scandinavia**
   Partnership with our distributor TechTeal

3. **USA and Canada**
   Local representation

4. **South Korea**
   Partnership with our distributor CANSystems

5. **Spain**
   Electronic Development Center (Barcelona)

6. **Tunisia**
   Offshore Development Center (Sfax)

7. **China**
   Partnership with our distributor Sigent

8. **Japan**
   Partnership with our distributor Gailogic and our engineering partner Toyo

9. **India, Australia and South East Asia**
   Partnership with our distributor Menlopark

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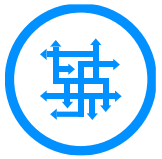
2 ALL IN ONE
WHAT WE DO

THE TRANSITION IN AUTOMOTIVE
GLOBAL NEED AND MARKET

Problems of the Automotive Industry

Time to Market
Without reuse, the deployment time will not be met



Complexity
Increasing complexity creates a competence problem at the OEMs

Costs
The cost of controlling the complexity will explode

Needs required by these problems

New development models needed

New integration models needed

New value added Chain needed

New strategies of testing needed

COMPANY SERVICES

ALL-IN-ONE SOLUTION DESIGN

System Engineering
Ethernet Networks
ADAS
Body Electronics
Specifications for communication systems
GW Specifications + Test Concepts
Protocols: AVB, NM, SOME IP, TSN

Testing Services
Test Management
Test Specification
Test Implementation
Test Execution
Test Reporting
ISTQB Enabled / extern

Product & Test Solution
Ethernet Media Converters
Ethernet Media Gateways
Ethernet Capture Modules
ANDi Tool – RBS
Ethernet Test Suite
ADELA

Research & Development
Rapid Prototyping
Test Racks and Test Systems
HW & Firmware development
Design for Build to Print
A-Samples ECUs Engineering
Automotive Sound Design

Experience from different sectors boosts customer benefit and quality, leading to a faster response to customer requests

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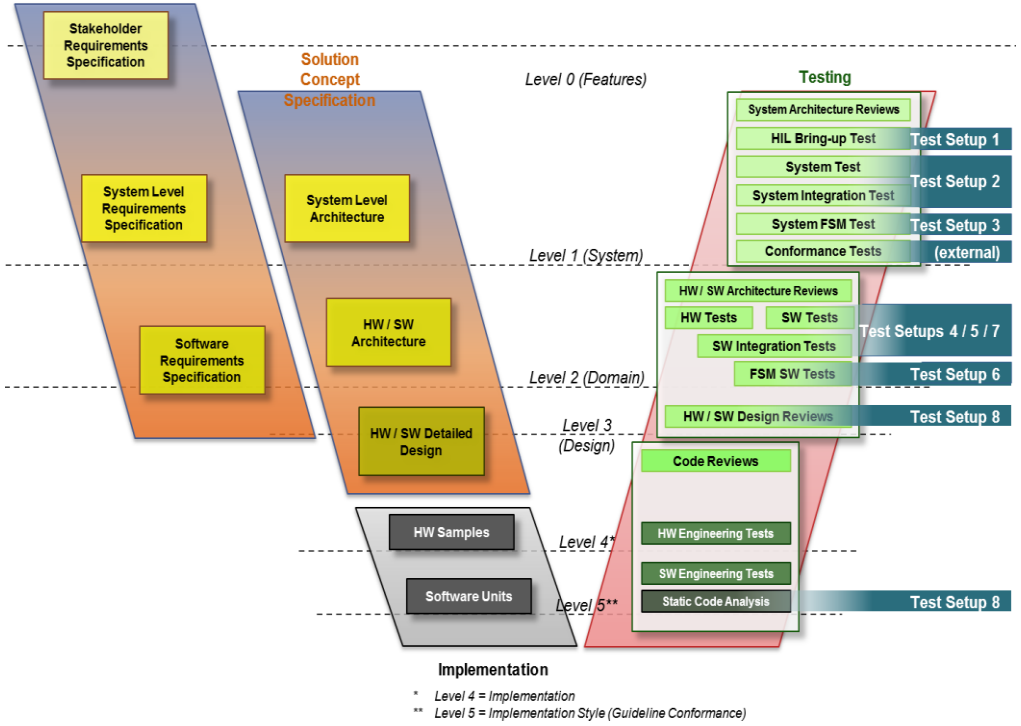
3 TESTING LEVELS AND CHALLENGES

AUTOMOTIVE

TEST LEVELS

- **Process**
  - Testing is closely interrelated to development
  - Most common development process in automotive: V-Model
  - Functional Safety: ISO 26262
- **General testing levels**
  - (Notice: after compliance tests passed!)
  - Software Component Test – SiL, MiL
  - Component Test – HiL
  - System Integration Tests
  - Full Vehicle Test



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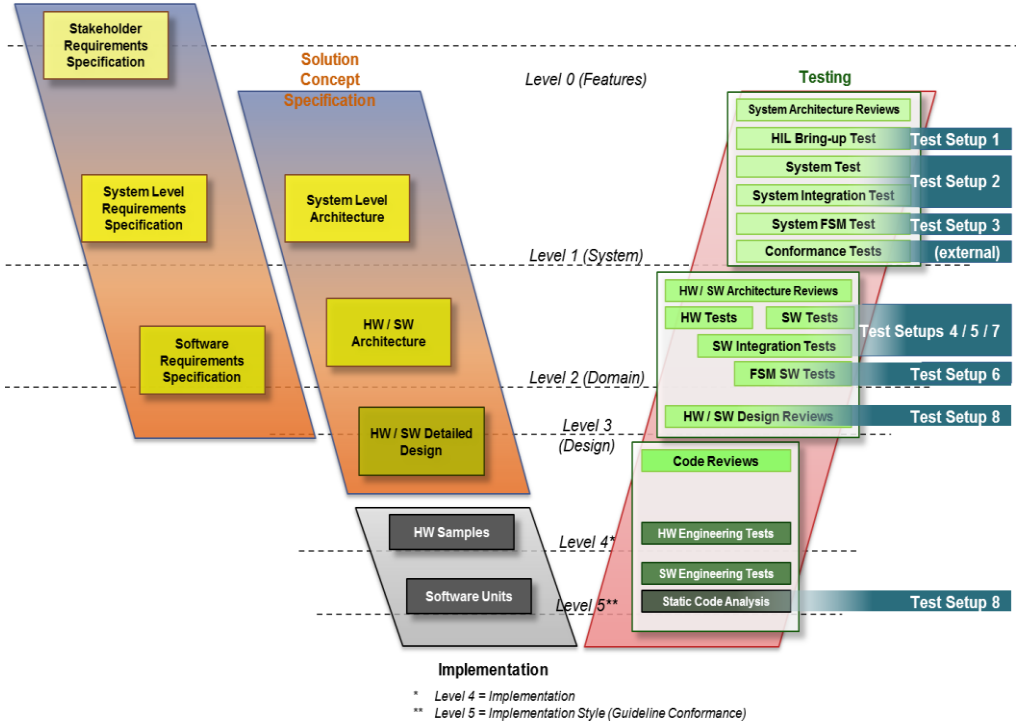
AUTOMOTIVE

TEST LEVELS

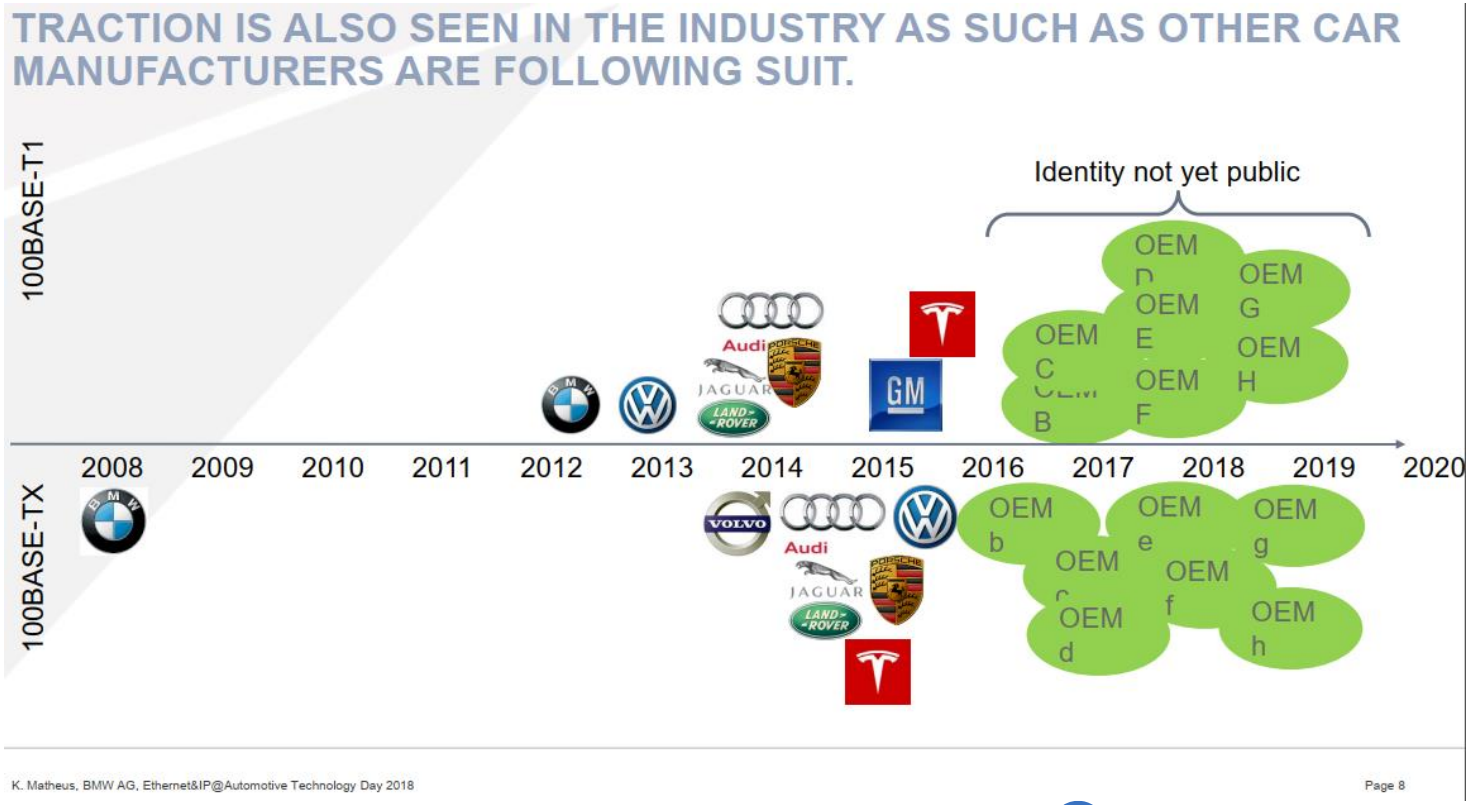
- **Test scope**
  - Basic functions
    - start-up, partial networking, shut-down
    - Diagnostics
    - re-programming
  - Component-specific functions (including interaction with network components)
  - Functional Safety components (ISO 26262)
- **Important: execution on every test level!**
  - Software Component Test – SiL, MiL
  - Component Test – HiL
  - System Integration Tests
  - Full Vehicle Test



KEY DRIVER OF CHANGE

AUTOMOTIVE ETHERNET

- **Market adoption**
  - OPEN Alliance (est. 2011) standardization via IEEE



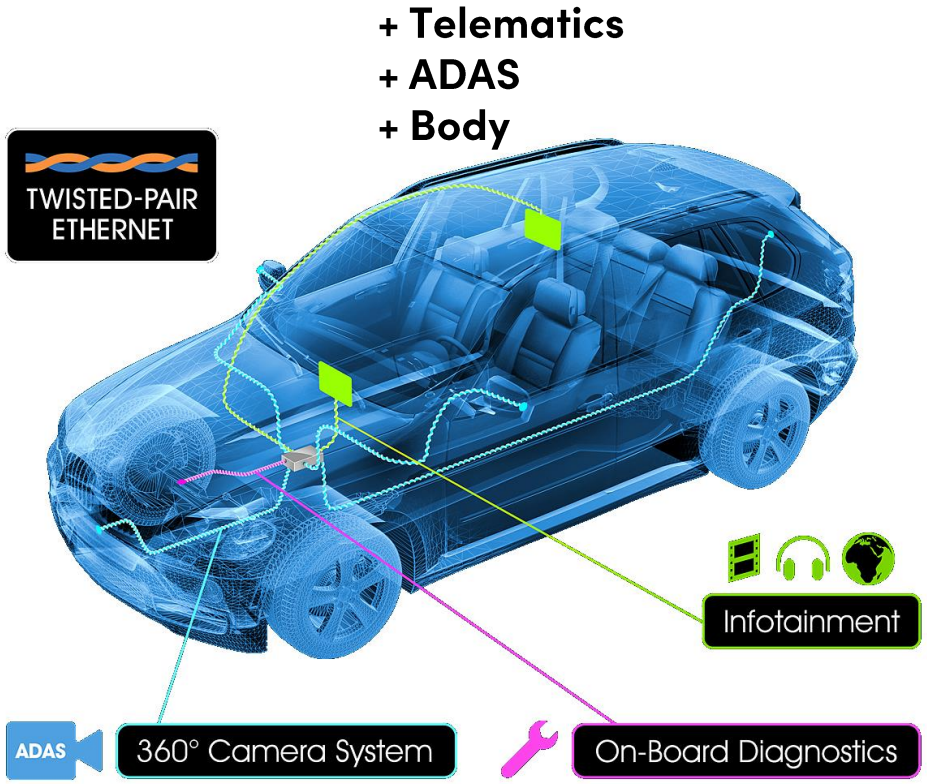
- **Advantages**
  - State-of-the-art Software Architecture
  - Maintainability
  - Scalability
  - Flexibility
  - Upgradeability

- **Legacy issue**
  - Need of new-generation **Gateways**
  - Need for “**service-based**” communication design

AUTOMOTIVE ETHERNET NETWORK TESTING

CHALLENGES

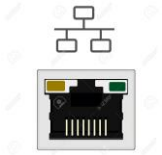
- **Changes in Automotive Network Architecture: Mindset change!!**
  - OEMs have developed E/E architectures based mostly on CAN and LIN technologies, some have also used FlexRay, MOST, LVDS and similar technologies
- **Challenge**
  - Toolchain, architecture design, mindset are still “signal-based”
  - Physical Layer and protocol considerations are mandatory (switch!)
- **Situation**
  - IT-based know-how necessary to meet the challenge: how does Ethernet work? Client-Server communication… (not typical for automotive)
  - Most OEM started slowly to realize and react
  - Management generally underestimates the necessity and importance of “training” and “learning”



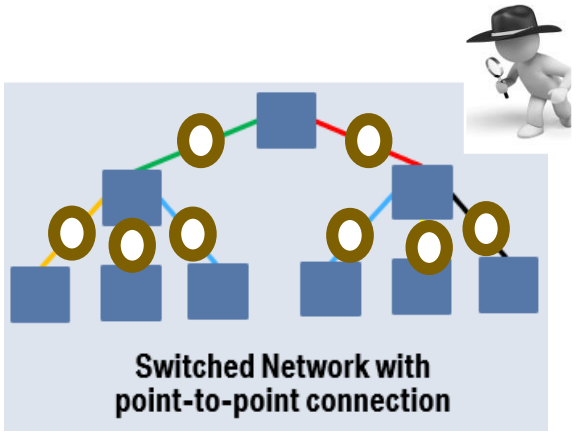
AUTOMOTIVE ETHERNET NETWORK TESTING

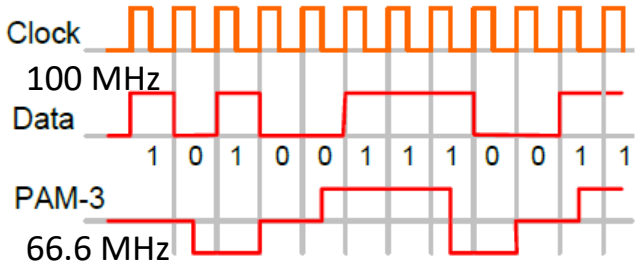
CHALLENGES

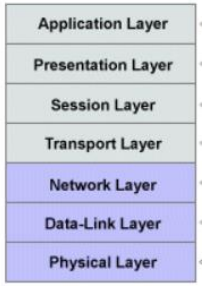
- **CAN, LIN, FlexRay vs. Automotive Ethernet:**
  - Physical Layer (Bus vs. Switched-Network)
  - Protocols
  - Functional Testing

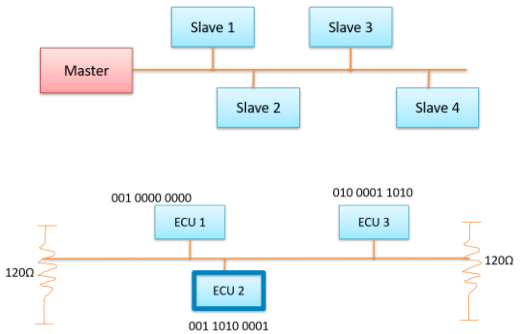


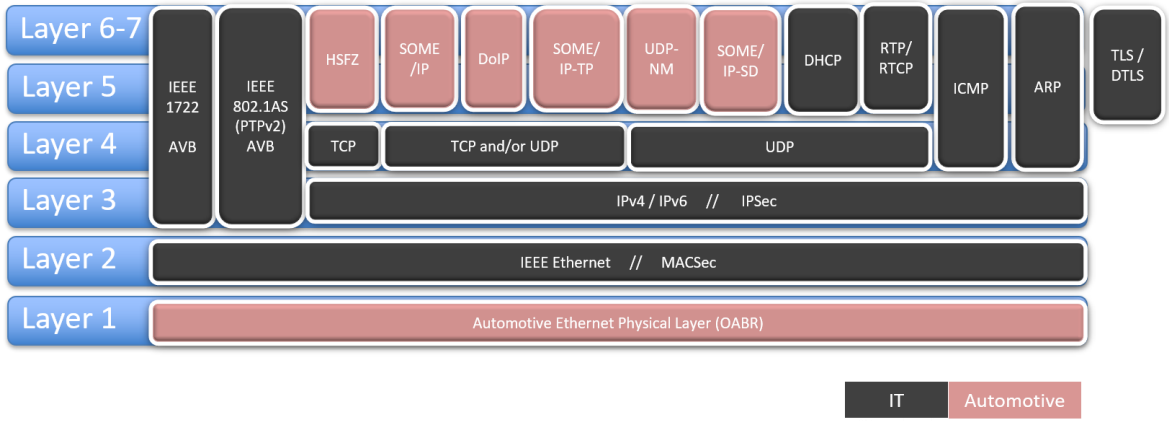
vs.











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4 PRODUCT PORTFOLIO
OUR SOLUTIONS

OUR PORTFOLIO

HARDWARE PRODUCTS

CONVERTERS

100BASE-T1 MEDIACONVERTER_BCM
100BASE-T1 MEDIACONVERTER_NXP
1000BASE-T1 MEDIA CONVERTER

USB-100BASE-T1 CONVERTER

100BASE-T1 MEDIACONVERTER_EMC SET
1000BASE-T1 EMC Converter

100BASE-T1 SFP MODULE
1000BASE-T1 SFP MODULE

SWITCH BASED

MEDIA GATEWAY
UNIVERSAL EMC DEVICE

TAPS

100BASE-T1 SPY-12 PORT
1000BASE-T1 SPY MINI

** will be substituted by Capture Modules*

IVN 2 ETHERNET

CAPTURE MODULES:
CM 1000 HIGH
CM 100 HIGH
CM ETH COMBO
CM CAN COMBO
CM LIN COMBO

INTEROPERABILITY

GOLDEN DEVICE 100BASE-T1

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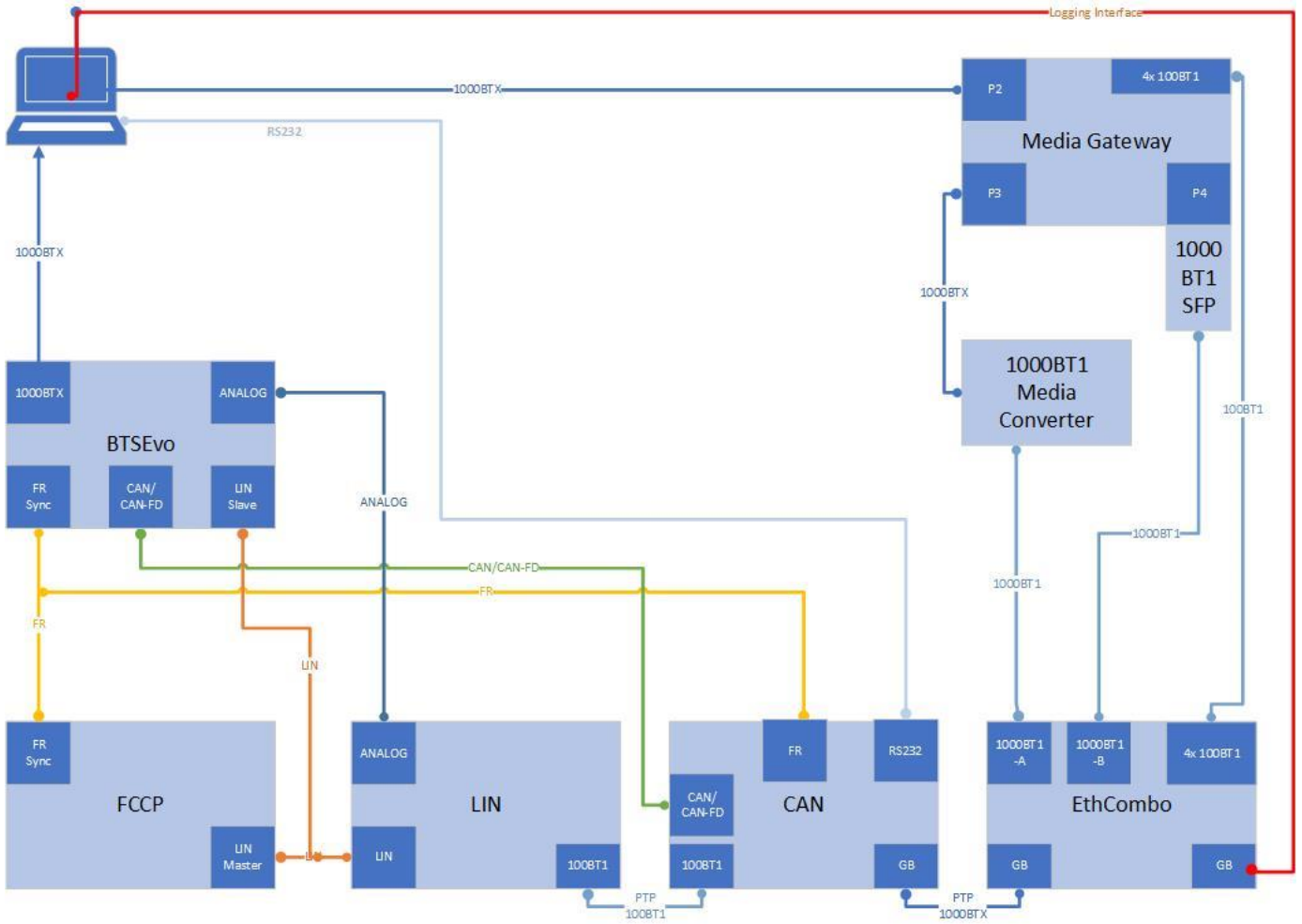
Capture Modules

Demo Example

1. Car-traffic generation via
   - PC (ANDi Tool)
   - MediaGateway
   - 1000BASE-T1 SFP Module
   - 1000BASE-T1 Converter
   - BTS Evo (CAN, CAN-FD, LIN, FlexRay, Analogue)
   - FCCP (FlexRay, LIN)

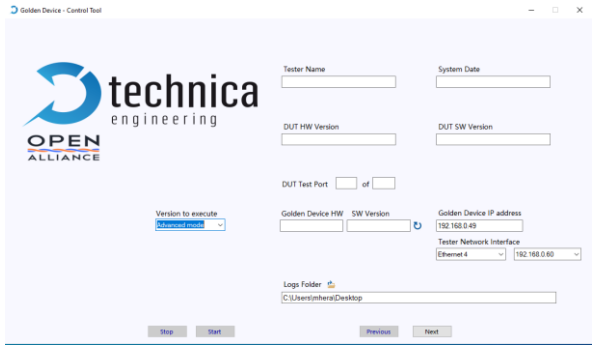
2. Traffic capture via
   - CM LIN Combo
   - CM CAN Combo
   - CM Eth Combo

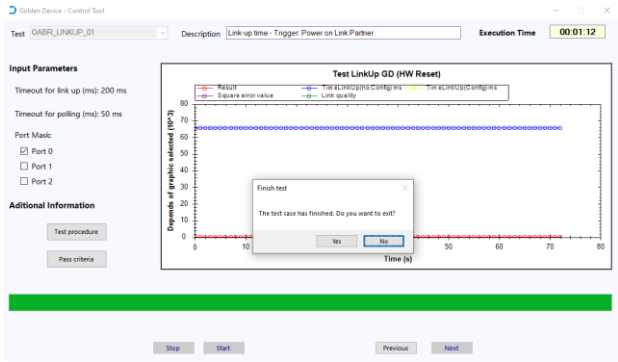


OUR SOLUTIONS

GOLDEN DEVICE

- **Reference circuit for standardization of 100BASE-T1**
  - Based on the original circuit used by the OPEN Alliance (TE product)
- **Guided Gui (Wizard) for test execution**
  - ANDi Tool – based ANDi GD Add-on (can run on Rohde & Schwarz RTO)
  - Step-by-step guidance on the use of external circuits for different test cases
  - Automatic Report generation
- **Integrated circuits for IOP test execution**
  - Execution of OPEN TC8 IOP v1 tests without need of additional external components
  - Possible execution of current OPEN TC8 IOP v1 tests with ROHDE&SCHWARZ Automotive components, synchronized with ANDi
- **Execute the OPEN Alliance IOP tests**
  - Link-up time, Signal Quality, Cable Diagnostics





OUR PORTFOLIO

SOFTWARE PRODUCTS

ANDi
AUTOMOTIVE NETWORK DIAGNOSER

The simple test and simulation environment for Ethernet controllers and bus systems. **ANDi** is a test and simulation environment for Ethernet electronic control units (BASE-T1) and also for the CAN/CAN-FD, LIN and FlexRay bus systems. The first-ever evaluation tool for SOME/IP, -SD

ADELa
AUTOMOTIVE DATABASE EDITION AND LAYOUT

The user-friendly automotive database tool that works perfectly with ANDi. **ADELa** is an automotive database edition tool that provides visualization and validation features of Fibex and ARXML automotive databases, primarily for Automotive Ethernet but also for CAN.

OBSERVER
AUTOMOTIVE ETHERNET TRAFFIC ANALYZER

Observer is an ANDi add-on feature that analyzes Ethernet traffic automatically by using different testing modules simultaneously. It is especially useful when having large and complex traffic captures.

ETHERNET TEST SUITE
AUTOMOTIVE ETHERNET TESTING TOOL

Ethernet Test Suite is a testing tool that includes all the specific Ethernet Tests:
Basic TCP/IP, SOME-IP, Enhanced Testability Service (ETS), Service Discovery (SD), Stress tests, etc.

EVA
AUTOMOTIVE ETHERNET VIDEO ANALYZER

The Ethernet Video Analyzer is an application for displaying, recording and checking of Ethernet video-data of 100BASE-T1 cameras.

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AUTOMOTIVE ETHERNET
TESTING STRATEGIES

CONFIDENTIAL DATA

Is OPEN Alliance TC8 "enough"? → No!

- TC8 is only entry-level testing
- TC8 covers basic conformance (via Test House: certificate)
- Much deeper testing must follow at OEM / Tier 1 development cycle:
  - Component communication test (e.g. **Ethernet Test Suite**)
  - Application level test (e.g. HiL level)
  - System integration test
  - Application level test in the system

→Technica assists BMW on SOME/IP component test solution since the invention of SOME/IP

→All BMW Tier 1 providers of Automotive Ethernet ECUs are customers

→Technica proposes migrating our solution to other OEMs (requires prior evaluation of their test specification!)

70% application and integration test (both component and system level)
→ Tier 1 + OEM with different HiL and other test benches; in some cases Tier 2, like Technica Engineering

20% component communication test
→ e.g. **Ethernet Test Suite** (Technica)

10% TC1/TC8 compliance
→ Test House (certificate)
→ Prior to that, pre-test in-house at OEM and Tier 1 with joint solution from Technica (IOP), R&S (PMA), Spirent (protocols) is available

What does the Ethernet Test Suite need for execution?

- Windows PC running the latest ANDi tool version and a valid Ethernet Test Suite license
- Corresponding OEM database with ECU descriptions, services, etc. (Fibex or ARXML)
- External hardware setup with customer-specific interfaces (Technica hardware products can be used if needed)
- OEM version of Ethernet Test Suite

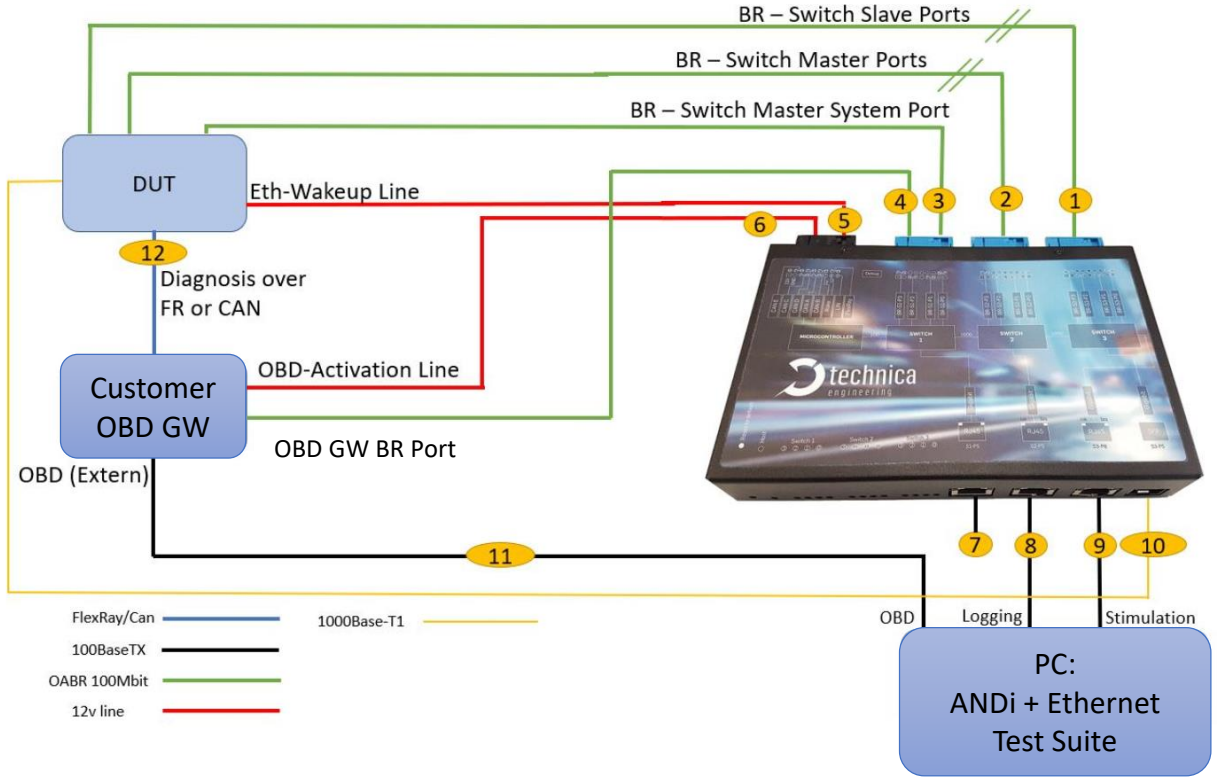


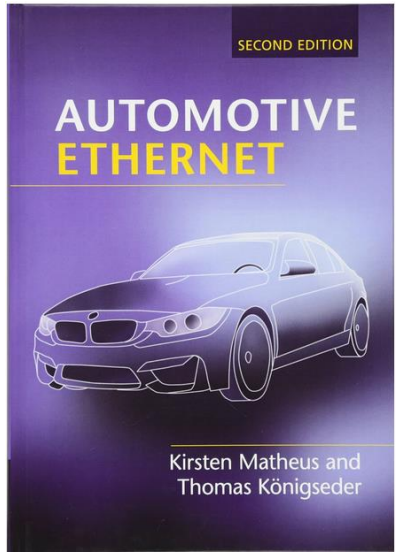
FIGURE - EXAMPLE OF TEST SETUP

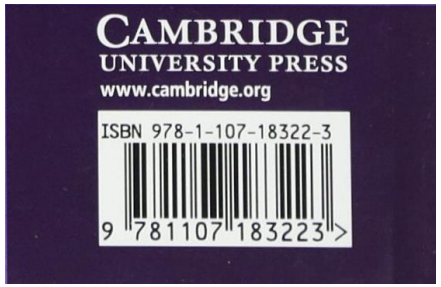
OUR SOLUTIONS

INFORMATION AND TRAINING

- **The original book by our CTO, Thomas Königseder (formerly BMW)**

(Third edition expected Q2 – 2020)





Basic Automotive Ethernet Training

- **Motivation:**
  - Automotive Industry
  - Electronic Control Units
  - Existing Technologies
  - Ethernet as a System Bus
  - Difference between Ethernet and Automotive Ethernet
- **OSI Model:**
  - Basic Terms
  - Layering
  - Frame Formation
  - Protocols Overview
- **Layer 1:**
  - Signals and Encoding
  - Standards
- **Layer 2:**
  - Functions
  - Modes of Communication
  - Protocols
    - Ethernet 802.3 Frame
      - Ethernet as MAC Layer
      - Virtual Local Area Networks (802.1Q)
        - Single Tag
        - Double Tag
  - Switching: How does a switch work
- **Layer 3:**
  - Basic Terms and Functions
  - Protocols
    - Internet Protocol (IPv4)
    - Internet addressing
    - IPv4 vs IPV6
    - Address Resolution Protocol

Advanced Automotive Ethernet Training

- **Layer 4:**
  - Basic Terms and Functions
  - Protocols:
    - Transmission Control Protocol (TCP)
    - User Datagram Protocol (UDP)
    - Internet Control Message Protocol (ICMP)
- **Layer 5,6 and 7:**
  - Basic Terms and Functions
  - Protocols:
    - Dynamic Host Configuration Protocol (DHCP)
    - Diagnostic Over Internet Protocol (DoIP)
      - Overview
      - Applications
      - Communication Example
    - SOME/IP
      - Overview and Usage
      - Header
      - Data Types
    - SOME/IP-SD (Service Discovery)
      - Header
      - Entries
      - Start-up & Shut down
      - Reboot detection
    - SOME/IP-TP (Transport)
    - UDP-NM (Network Management)
- **Quality of Service:**
  - Problems and Solution
  - Traffic Formation
  - Protocols:
    - Real Time Protocol (RTP)
    - RTP Control Protocol (RTCP)
    - Audio Video Bridging (AVB) / Time Sensitive Networking (TSN)
      - Concepts
      - Time Synchronization
      - Traffic Shapers
- **Security:**
  - Basics and Terminology
  - Trusted Platform Module (TPM)
  - HSE
  - Secure Socket Layer (SSL) / Transport Layer Security (TLS)
  - Certificates
- **Autosar:**
  - Overview
  - Layers
  - Versions
- **Testing:**
  - Motivation
  - Test Types
- **Databases:**
  - Fibex

OUR SOLUTIONS

HW PRODUCTS: LOOK INTO THE FUTURE

- **1000BASE-T1 next-gen test device**
- **ECU/GW prototyping platform**
- **10BASE-T1S testing solutions**
- **MultiGig testing solutions**

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5 CONTACT
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