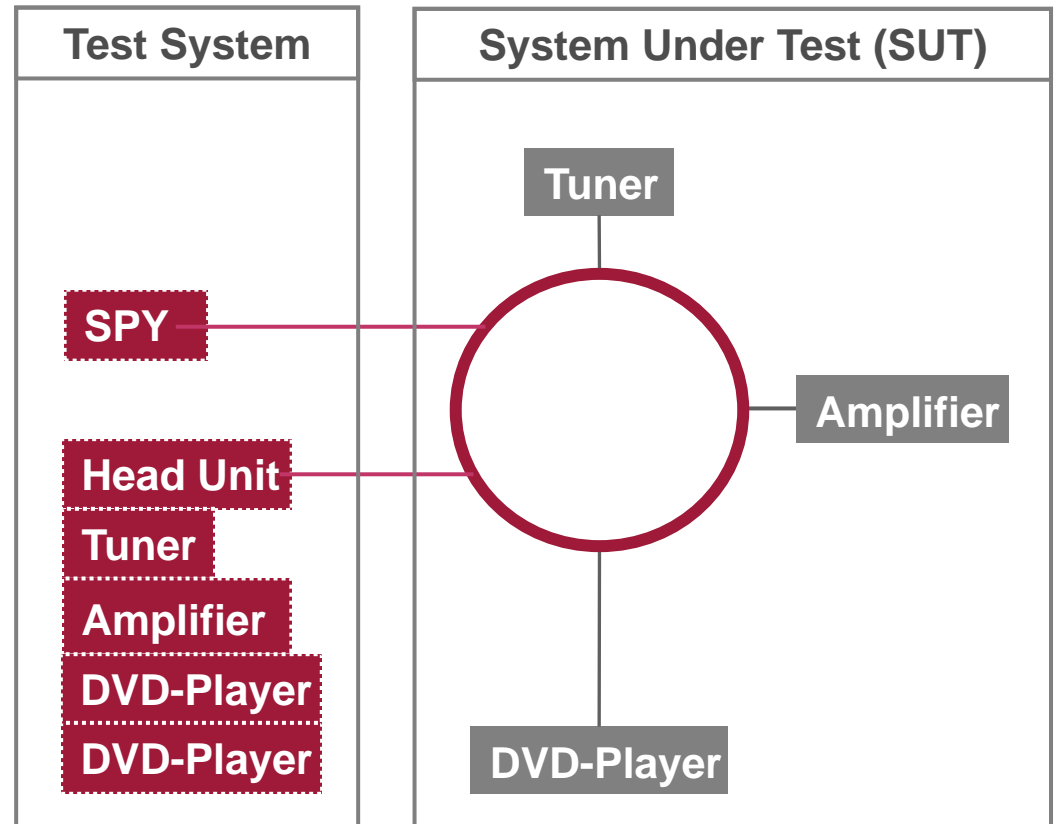# Testing Automotive Technologies

MOST, CAN

TTplugin MOST

- For MOST25, MOST50 ePHY and MOST150 projects

- Simulation and testing of any MOST device on application level

- Stand-alone or in the network

- SPY functionality

- Ready to run MOST Profile Compliance test suites for Connection Management and AuxIn

Test System

SPY

Head Unit
Tuner
Amplifier
DVD-Player
DVD-Player

System Under Test (SUT)

Tuner

Amplifier

DVD-Player

TTplugin MOST Benefits

- Standards-based testing according to MOST specifications

- Easy test definition with graphical presentation format

- Reusable test cases for device, system integration and quality testing

- Scalable test scenarios

- Fast and simple test execution and analysis

- Repeatability of tests and full support of test automation

- Supported by RUETZ System Solutions as a certified MOST Compliance Test House

TTplugin MOST Features (1)

- Full MOST Bus administration
  - Power management
  - Networkmaster and Networkmaster Shadow
  - Central Registry and Decentral Registry

- Synchronous channel support
  - Simulation of sinks
  - Simulation of sources

TTplugin MOST Features (2)

- **MOST control channel ports for TTCN-3**
  - fblockPort addresses FunctionBlocks
  - fblockSimPort simulates FunctionBlocks
  - amsPort addresses devices
  - spyPort enables SPY functionality

- **MOST administrative ports for TTCN-3**
  - acPort to control the BUS
  - syncPort enables synchronization functionality

- **Additional Functions**
  - Filter for MOST control channel ports
  - Dispatcher for received messages
 - Broadcast / groupcast

TTplugin MOST Features (3)

- Reporting
  - Reporting on different levels of detail in MOST analysis style
  - Summary of test results

- Supported MOST Bus interfaces
  - Optolyzer Standard Plus
  - Optolyzer Professional
  - MOST PCI Board
  - MOST PC Card Interface
  - Optolyzer G2 3025o, G2 3050e

Test Case Development

MOST
FCat
Tuner

Types and
Templates

MOST
Sequence
Catalog
Tuner

Behavior
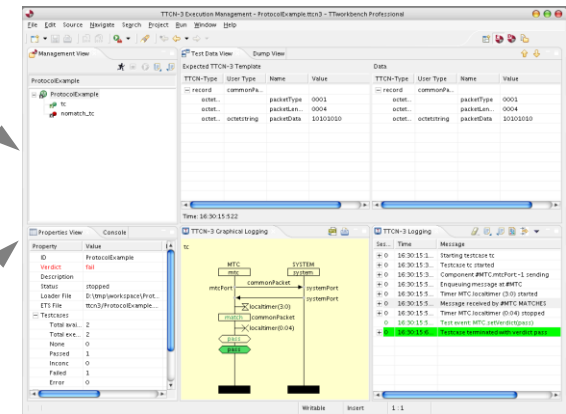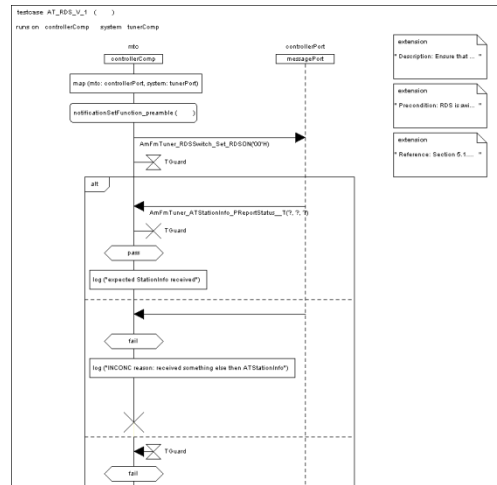
TTCN-3 Executable

MOST FCat Language Support

- Direct import of XML definitions in TTCN-3
  - ▶ `import from <FBlockName> language "MOST" all;`

- Including automatic codec generation while compilation

- Extension selectors
  - ▶ Module, Project, File, Release, DeviceName, InstanceId
  - ▶ `import from AmFmTuner language "MOST" all`
    `with {`
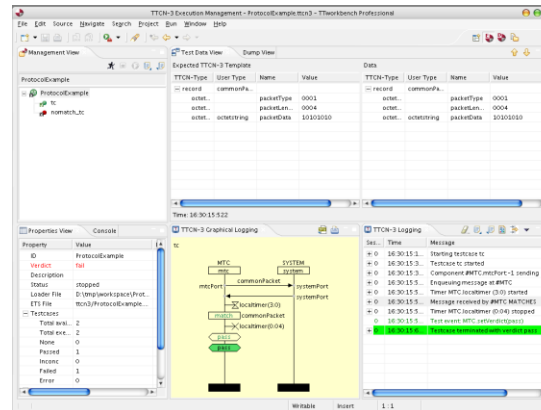   `    extension „File:AllFBlocks.xml";`
    `}`

TTworkbench Template Wizard

- Message templates automatically created in compilation phase

- Complex parameter maybe necessary
  - Definition of inline template
  - Creation of new templates
    - Manually
    - Support via template wizard – the easy way!

Architecture

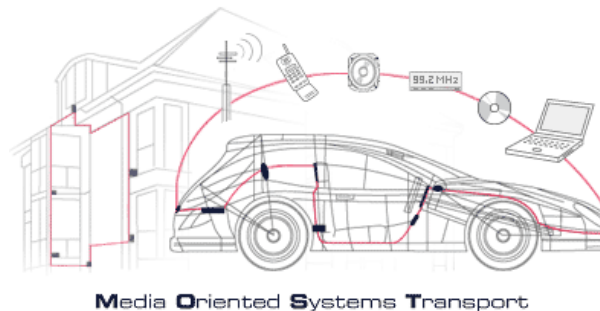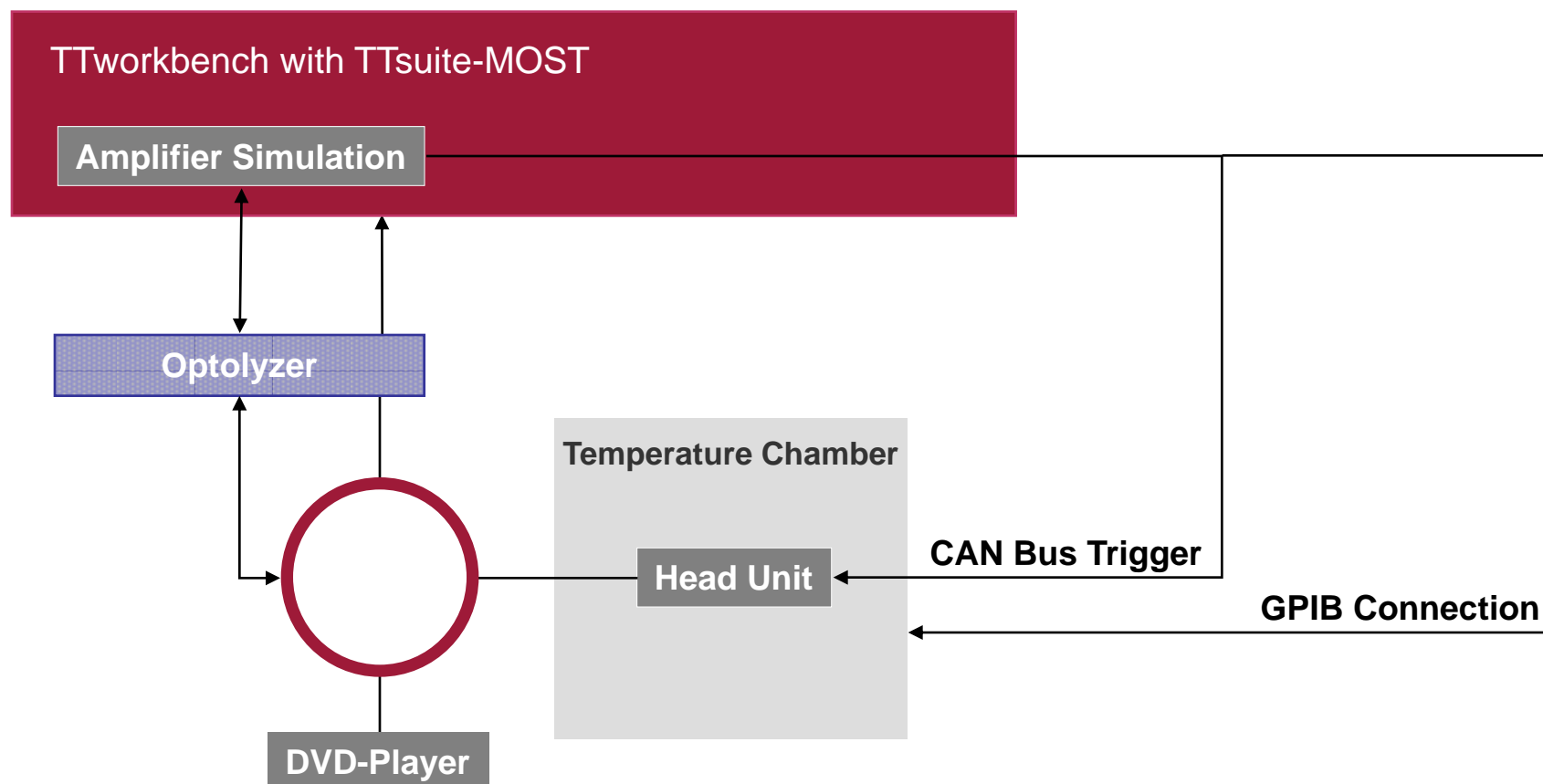TTCN-3
Executable

TRI

e.g. Testerlyzer

MOST

MOST
Device

Media Oriented Systems Transport

TTplugin MOST Application Example

System Under Test

Port Plugins for Automotive

- MOST

- CAN

- Ethernet

- GPIB

- RS485

- RS232

- UDP

- TCP

MOST Compliance Testing

- MOST ConnectionMaster Test Suite
  - ▶ Test suite for MOST profile compliance connection management

- MOST AuxIn Test Suite
  - ▶ Test suite for MOST profile compliance AuxIn

- MOST HIGH Test Suite
  - ▶ Executable test suite based on TTplugin MOST
  - ▶ According to the MOST Extended Core Compliance Test Specification MOST High Protocol

- Offered via partner Ruetz System Solutions
  - ▶ More info at http://www.ruetz-system-solutions.com/documents/ttsuite_most_en_web.pdf

TTplugin CAN (Controller Area Network)

- Asynchronous, serial bus system

- Allows microcontrollers and devices to communicate with each other

- Sending and receiving CAN messages

- Filter mechanisms for CAN messages

- Multiple test components and multiple-port mapping

- Freely combinable with additional test access (TTplugins)

TTplugin CAN

TTCN-3 Executable
(TTworkbench)

TRI

Vector CANcardX
Vector CANcardXL*

*Registered trademarks of Vector Informatik GmbH

CAN

CAN Devices
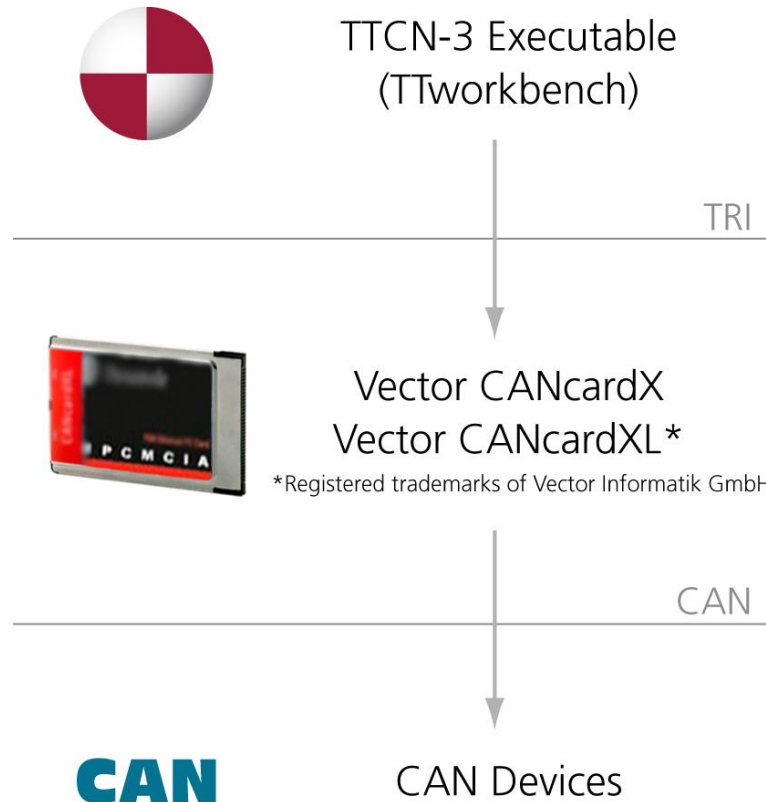
Testing Automotive Technologies

Projects: AUTOSAR, Car2X, D-Mint, TEMEA

AUTOSAR Conformance Test Specifications

- AUTOSAR pilot for TTCN-3 based conformance test specifications for BSW and RTE in 2006
  - Basically software unit testing
  - Consortium: Carmeq, TCS, Testing Tech
  - Success of the pilot was basis for CTSpec project

- TTCN-3 CTSpec project
  - Autosar BSW and RTE specification R3.0/R4.0

- Results can be used for BSW and RTE testing and certification

AUTOSAR Based Applications Testing

- Volcano Vehicle Systems Tester (VST)

- AUTOSAR test framework

- Direct import of AUTOSAR Software Component Templates in TTCN-3 specification

- Adaptation via existing RTE

- Offered via partner Mentor Graphics
  - More info at http://www.mentor.com/products/vnd/autosar-products/volcano-system-tester/
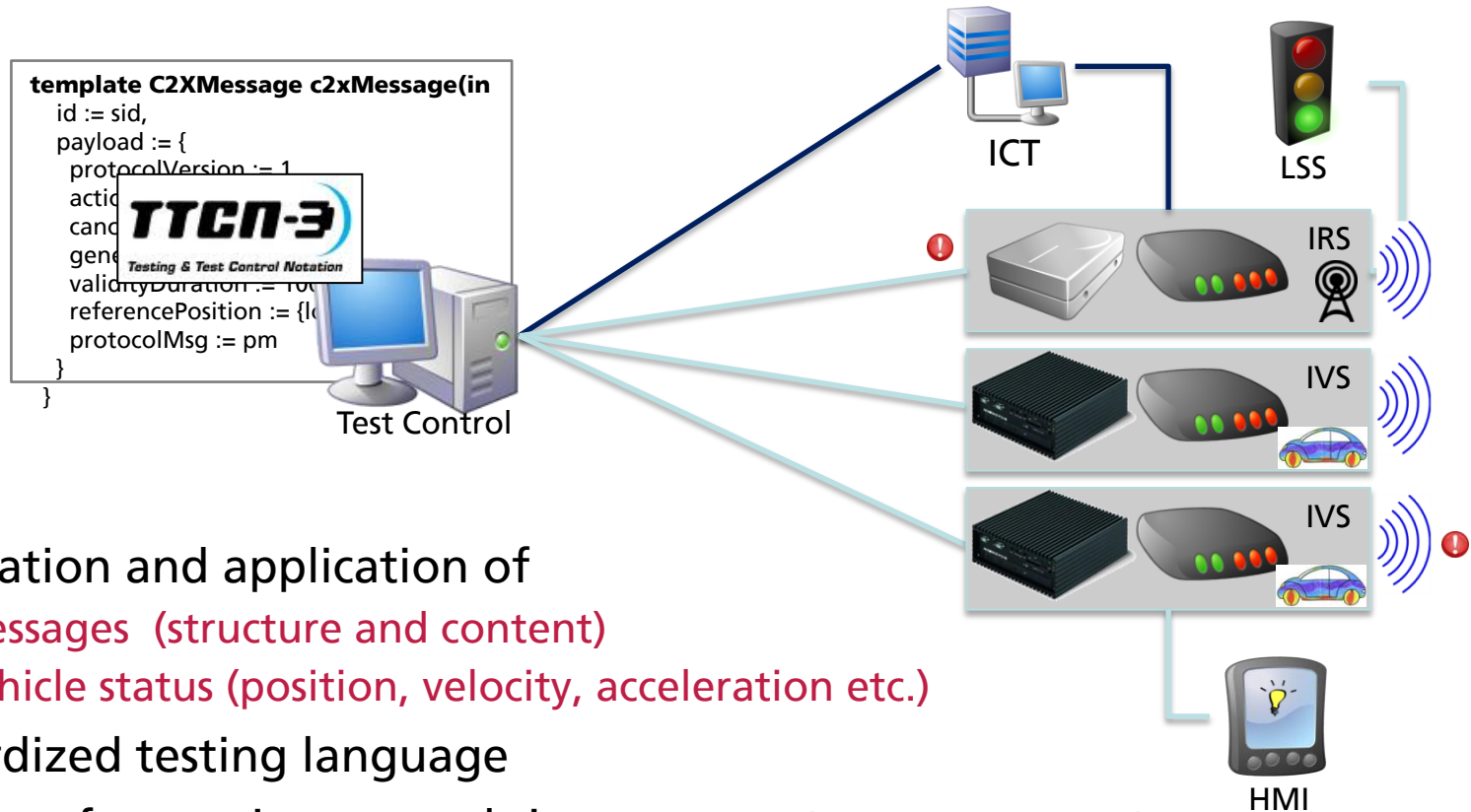
Car2X – Testing Vehicular Ad-hoc Networks

- Participation in Germany-wide project simTD

- TTworkbench part of the official simTD test stand

- TTCN-3 based test cases for approval of IVS/IRS

- More information at http://www.simtd.de

TTCN-3 & TTworkbench in simTD

- **Standardized technology enables**
  - Availability of established technologies and tools
  - Clear test specifications with well defined syntax and semantic (textual and graphical)
  - Access to long lasting test experience within different contexts and domains
  - Access to educated stuff and experts

- **Standardized data integration & execution interfaces allow**
  - Reusing existing data specifications
  - Automatic generation of runtime codecs
  - Differentiation of „What to test" and „How to test"
  - Compatibility and extensibility
    - TTworkbench Runtime Plugin Concept
  - Integration of existing test management and continuous build systems (QualityCenter, Hudson, ...)

Formalized Validation of Countermeasures

A V2X Test Environment based on TTCN-3


```
template C2XMessage c2xMessage(in
  id := sid,
  payload := {
    protocolVersion := 1
    actio
    cand
    gene
    validityDuration := 10
    referencePosition := {lc
    protocolMsg := pm
  }
}
```

TTCN-3
Testing & Test Control Notation

Test Control

ICT

LSS

IRS

IVS

IVS

HMI

- Specification and application of
  - ▸ Messages (structure and content)
  - ▸ Vehicle status (position, velocity, acceleration etc.)
- Standardized testing language
- Extensions for continuous real time systems (www.temea.org)
- Integration with traffic simulation

D-MINT – Deployment of Model-Based Technologies to Industrial Testing

- European research project on model based testing (ITEA2) (predecessor of TT-Medal)

- German consortium among others
  - ▶ Daimler as automotive case study provider
  - ▶ Testing Tech as tool provider

- Automotive case study uses (among others)
  - ▶ UML Test Profile based test development
  - ▶ Execution of test cases with TTworkbench

- www.d-mint.org

TEMEA – Better Software Quality in the Automobile Industry

- Developing a TTCN-3 based, uniform test specification technology that addresses the requirements of automotive industry
  - Discrete and continuous systems
  - Real-time systems

- Applying the technology to AUTOSAR

- January 2008 – June 2010

- www.temea.org

- Fraunhofer FOKUS/FIRST, IT Power Consultants, Testing Technologies, Fourth Project Consulting, University of Göttingen