DAIMLERCHRYSLER

# Using TTCN-3 in an Automotive Context

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# Overview

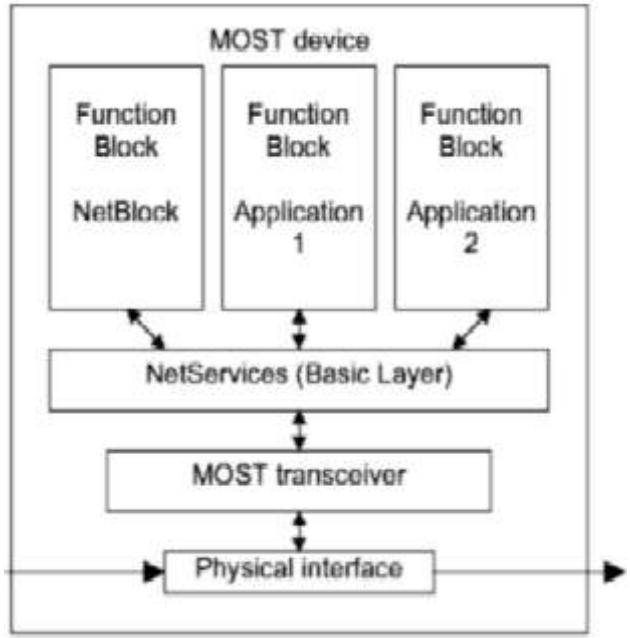
- System Under Test: Telematics Application
- Specifying Functional Behaviour
- Test Case Design & Execution using TTCN-3
- Test System: Hardware and Software
- Test Requirements (Telematics Department)
- Other Application Fields at DC
- Future Extensions

# System Under Test
# Architecture of Telematics Application

- Telematics Applications
  - Audio (CD / Radio)
  - Telephone
  - Navigation
  - Video
  - Speech Recognition
  - Short Messaging (SMS)
  - User Interface for Body Electronic

# System Under Test
# Functional Details

- Network of embedded devices
- Bus system: MOST, CAN

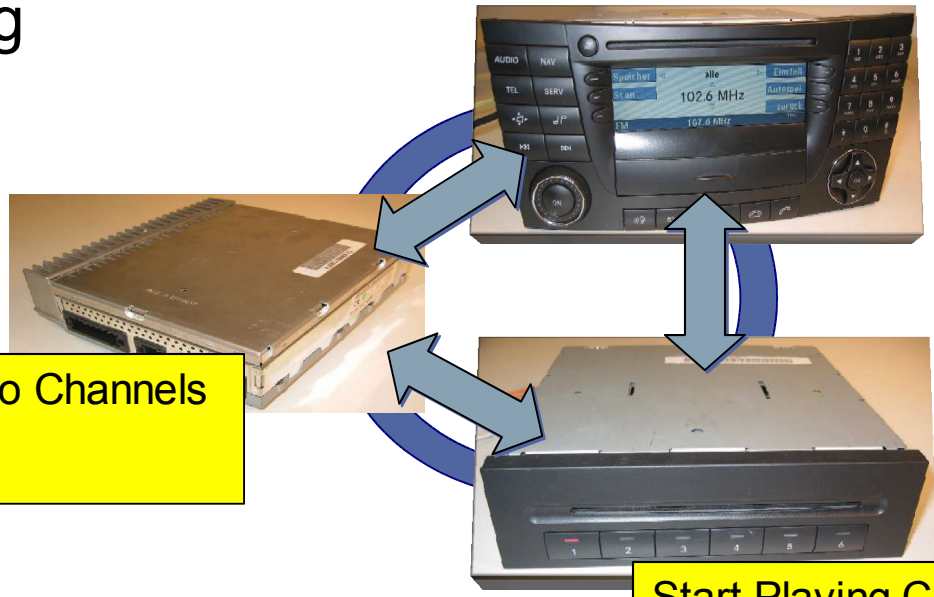




- Applications implemented by many devices
- Logical separation of behaviour into FunctionBlocks

# Specifying Functional Behaviour
# A Telematics Application

## Audio Application

- Three devices interacting
  * CD Changer
  * Audio Gateway
  * Head Unit



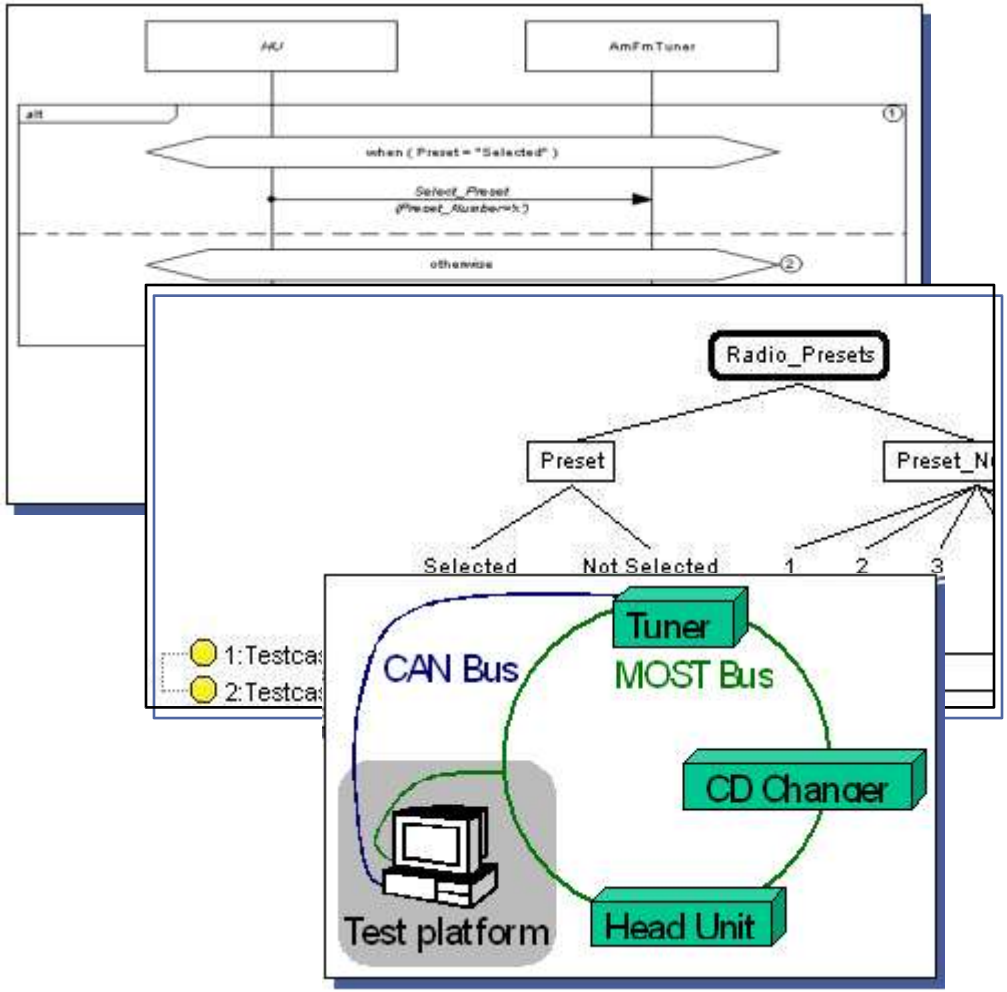

## Example:

„Switch from Radio to CD“

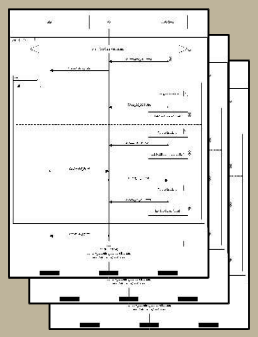
- 15 messages in this use case
- interactions with other events like mobile phone

# Test Case Design & Execution Constraints

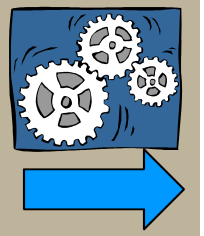
- Specification-based tests
  250+ complex MSCs
  for the next car model
- Each MSC describes
  a single scenario
- Parallelism described by
  textual documentation

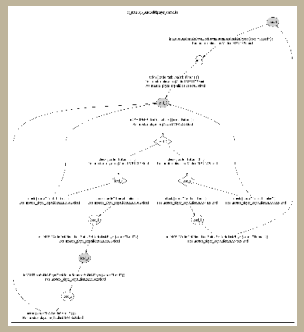


# Test Case Design & Execution Using TTCN-3

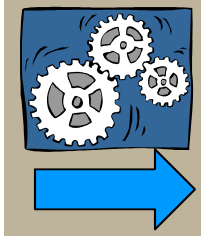


MSC Specifications

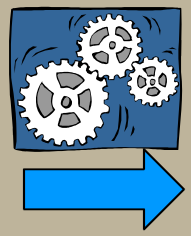




Behavioural model

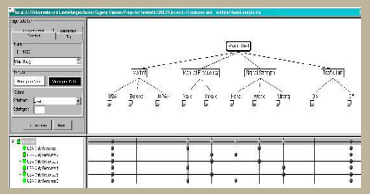


Scripts

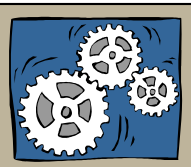


Test execution

Classification-Tree Method

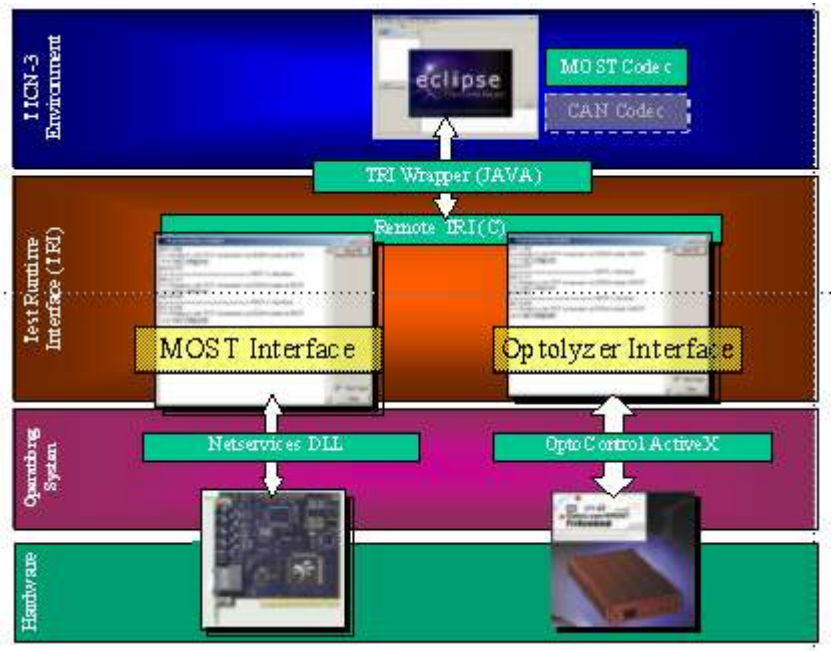


Test data



# Test System
# Hardware Environment

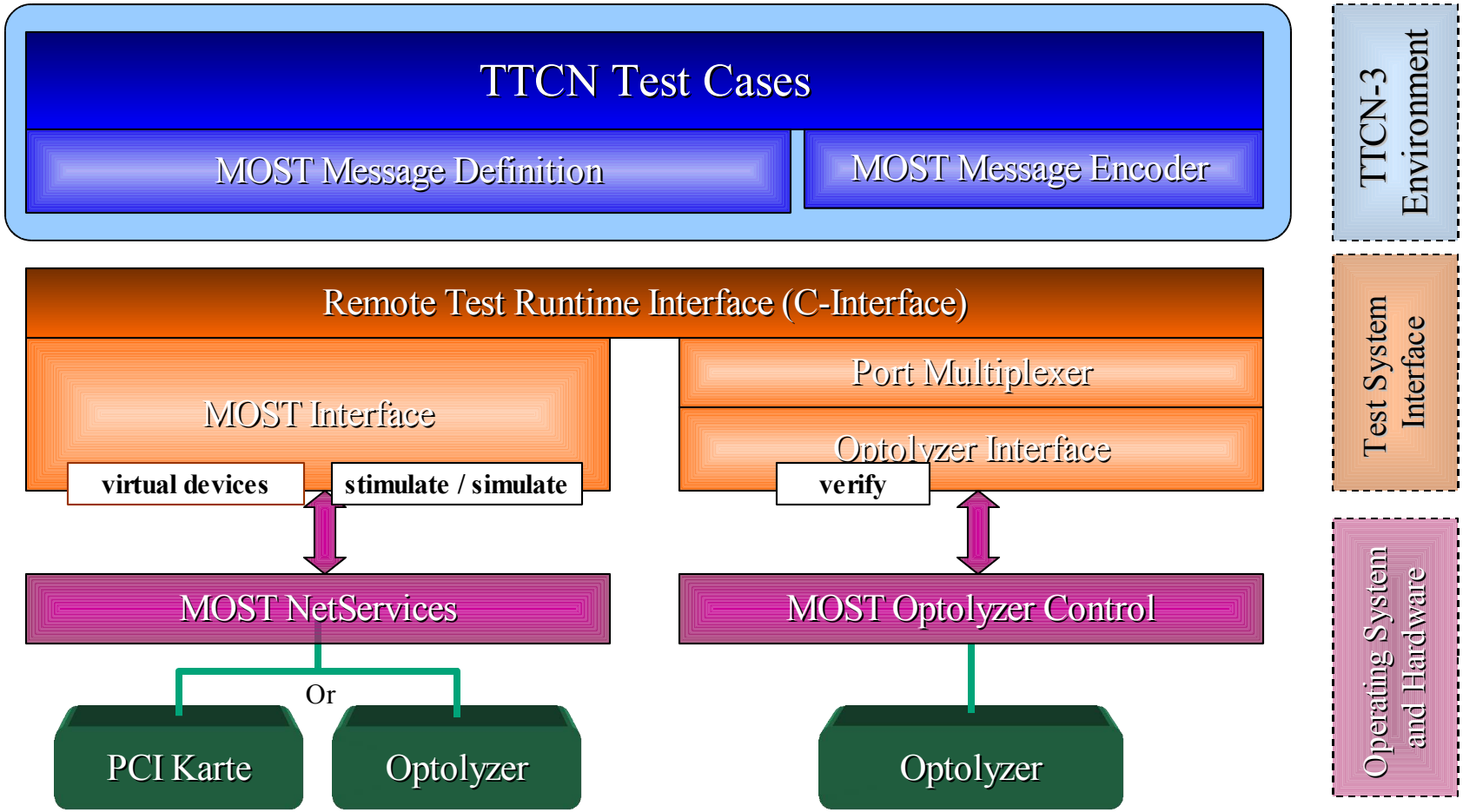
*„Debug the message flow, and find the incorrectly behaving control unit...“*




**Test Setup**
**Early Integration**

- Message Tracing Monitor (Filter & Recording)
- Automatic Validation

# Test System Software Architecture



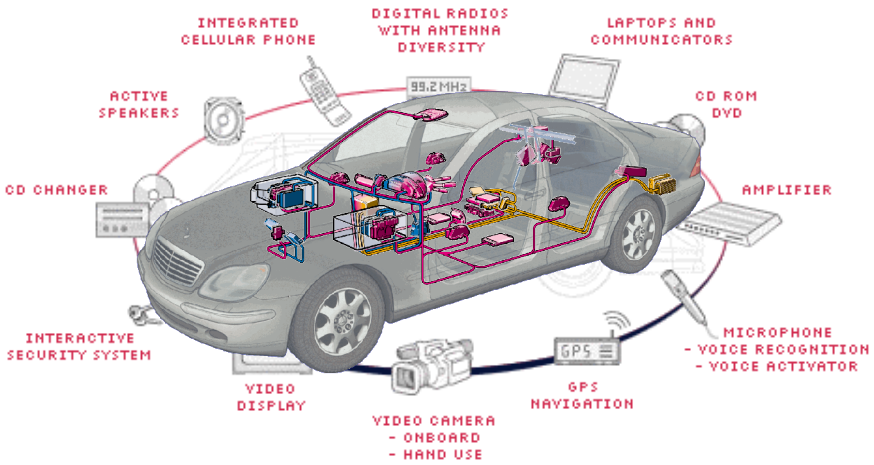
# Test Requirements
# DC Telematics Departments

- Abstract definition of the tests
  at the same level as the specification (graphically)
- Graphical tracing of test results
  Comparing of specification and test result has to be simple to save time and effort
- Re-Use of test scripts
  across integration phases and test types
  (functional vs. robustness tests)
- Standardized test middleware for co-operation with component suppliers
  to automate acceptance test

# Application Fields
# In the Automotive Context

## Characterisation

- embedded means hard to debug
- many components interact
- over different networks (most, can)
- overlapping functionality




## Real Time Environments

- motor controller (petrol & diesel engine)
- electronic gear shifting, car body control (pneumatic shock absorption)
- environmental electronics (e.g. window heating, air conditioning unit)

# Future Extensions

- Continuous signals
  - wait for signal level X
  - send a signal ramp with speed Y
  - One solution: state based modelling of tests, continuous behaviour defined for each state
- Fully Qualified Test Specification
  - Focus on test case design rather than on scripting
  - Put the test documents and test code together
  - Not only single test cases
- Recording of Test Cases ?