ODX-Based Testing With OTX

Stuttgart, 22nd July 2010

In2Soft GmbH
Ralf Ramrath

Agenda

- Welcome and Introduction
- ODX – a Diagnostic Requirement Specification?
- Test Case Generation
- Conclusion, Q & A

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- ODX – a Diagnostic Requirement Specification?
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Your Speaker

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Main Aspects of Activity

- Customer Project Management in the Field of Diagnostics With Main Focus on ODX and OTX
- Network Topics (FlexRay)
- Standardization (ASAM / ISO)

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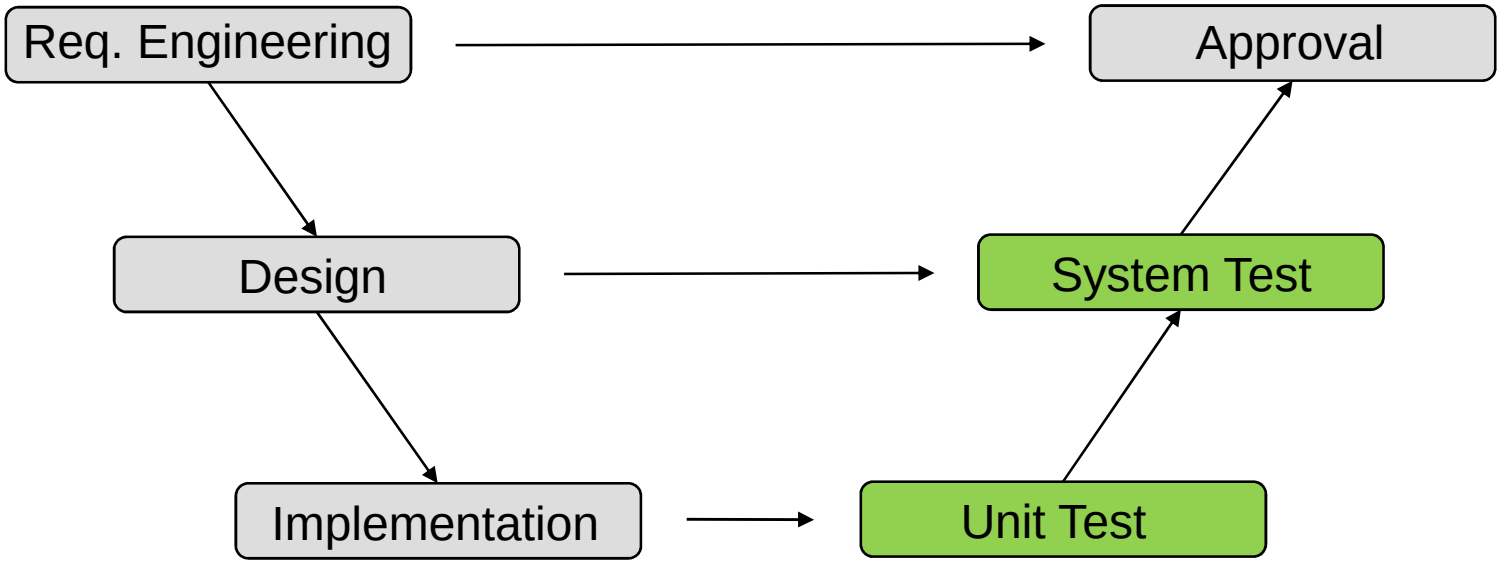
V-Model (simplified)



Tests →

V-Model for ODX

Req. Engineering	Definition of ECU-specific measurement values, fault codes, …
Design	Structuring of generic diagnostic data in ODX (typ. OEM task)
Implementation	Coding of ECU-specific measurement values, fault codes, … in ODX
Unit Test	Testing of single diagnostic services with test data on a test board
System Test	Testing of requirements with test data in test environment
Approval	Testing of requirements in customers environment

ODX Specifies…

… Good Cases

- Session / Service relationship (not standardised in ODX 2.0.1)
- Security level / service relationship (not standardised in ODX 2.0.1)
- Services, NRCs (negative response codes)
- Position in PDU, e.g. byte position 3 (high byte) and 4 (low byte)
- Computational information, e.g. for RPM:
  - 16-bit value sent from ECU
  - Valid range [0..9000]
  - Invalid ranges, e.g. 65535 → value not plausible
  - Conversion function: f(x) = 0.1x
  - Unit: 1/s
  - Fractional digits: 1
  - …

ODX Does Not Specify…

… Bad Cases

- Which NRC has to be sent, e.g. when to send NRC $13 or NRC $31…
- What shall happen if a not supported (and not defined in ODX!) data identifier is requested.

Beside ODX, Diagnostic Protocol Information is Needed!

- If a tester request has not the correct length → send NRC $13
- „Suppress Positive Response“ mechanism
- …

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Test Cases *General Aspects*

Combine ODX and knowledge of the diagnostic protocol (e.g. UDS) in order to generate (good and bad) test cases with the following strategy:

1. set *expectations, e.g.*
   - number of responses
   - state of response (positive or negative)
   - content (bytes) of each response
2. set request parameters
3. execute diagnostic service
4. compare expectations to actual (received) values
5. if comparison fails → throw an exception!

→ **No exception has been thrown ←→ test case was executed successfully!**

Test Cases *Example 1*

Test if the (UDS) ECU´s behaviour on a $ 10 01 request is $50 01 ** ** ** ** (* = don‘t care, here: P2 timings)

1. set *expectations*
   - number of responses → 1
   - state of response (positive or negative) → positive
   - content (bytes) of each response → $50 01 ** ** ** **
2. set request parameters → $10 01
3. execute diagnostic service
4. compare expectations against actual (received) values → ECU‘s response is $50 01 00 64 03 E8
5. if comparison fails → throw an exception! → No exception has been thrown!

→ **Test succeeded!**

Test Cases *Example 2*

Test if the (UDS) ECU´s behaviour on a $ 10 05 request is $7F 10 12 (NRC = subfunction not supported)

1. set *expectations*
   - number of responses → 1
   - state of response (positive or negative) → negative
   - content (bytes) of each response → $7F 10 12
2. set request parameters → $10 05
3. execute diagnostic service
4. compare expectations against actual (received) values → ECU‘s response is $50 05 00 64 03 E8
5. if comparison fails → throw an exception! → exception has been thrown!

→ **Test failed!**

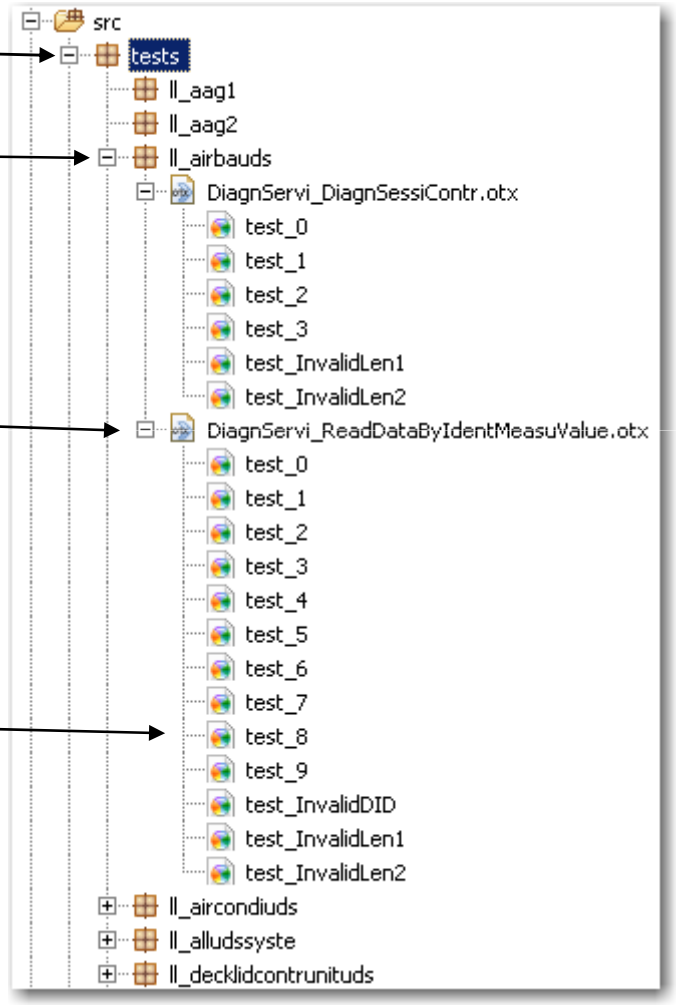
Test Cases *Structuring*

Test Package Level

Logical Link Level

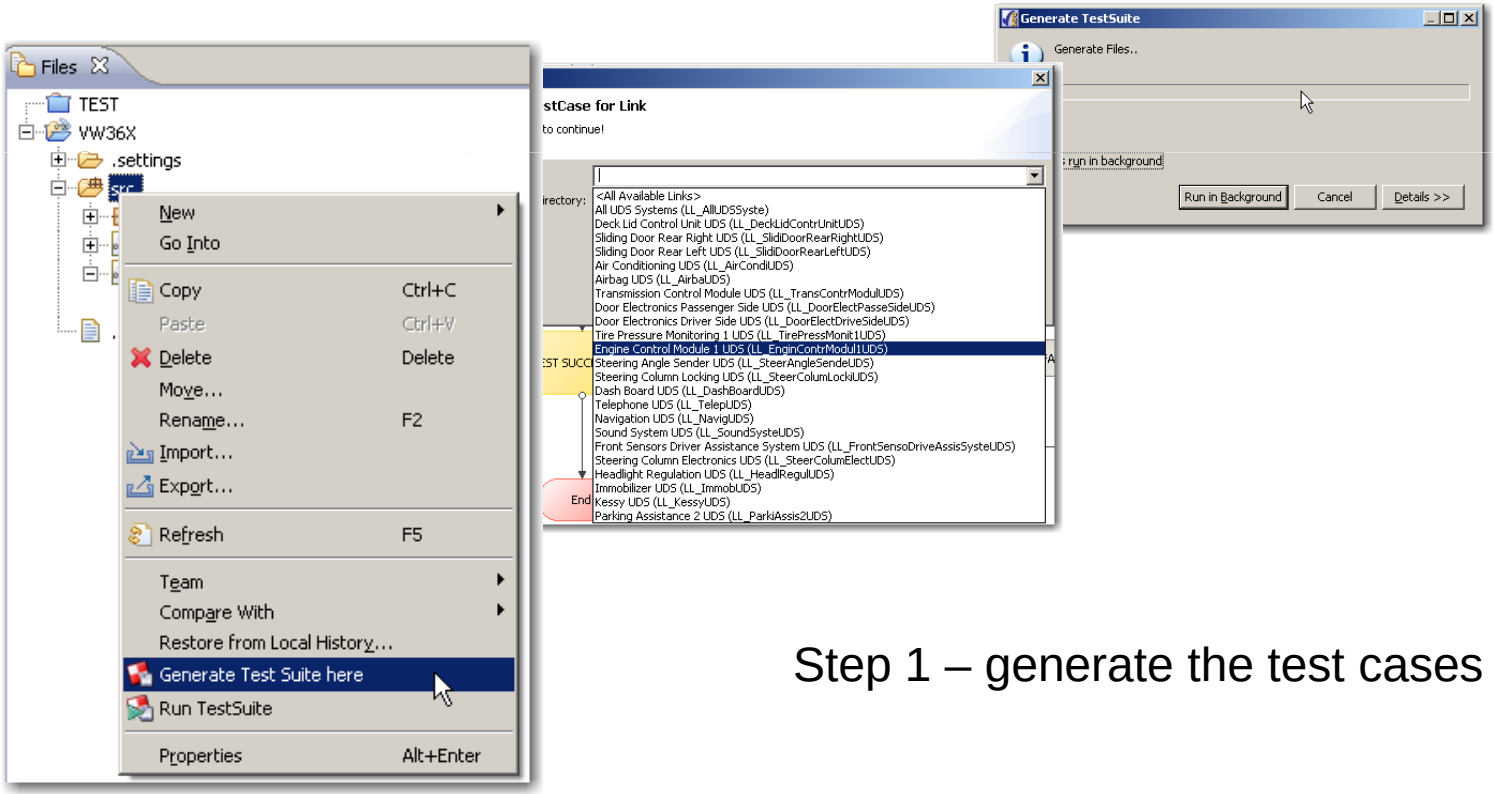
Diagnostic Service Level

Various Parameterisations Level



Test Cases *Generation and Execution*

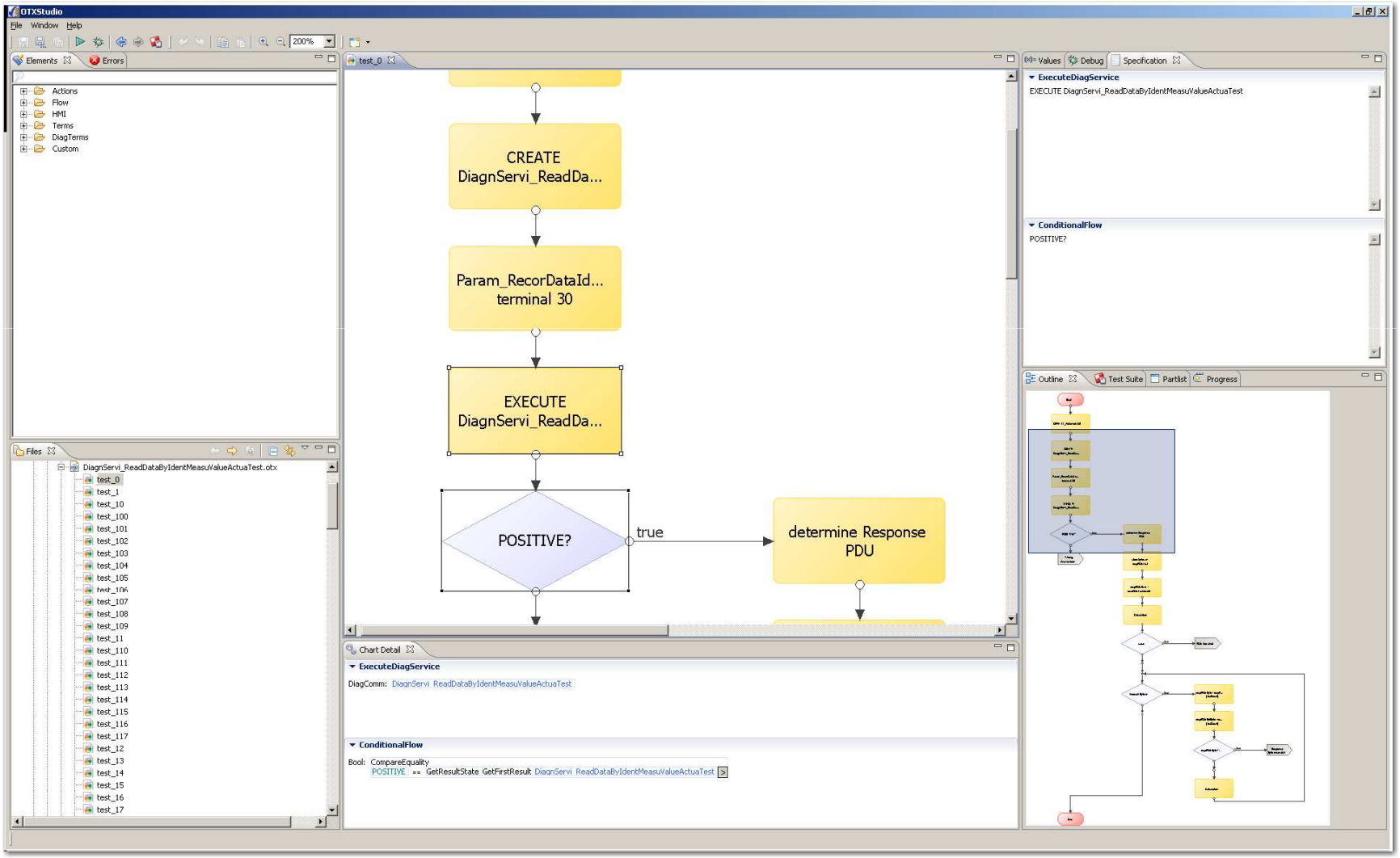
With the OTXStudio - the In2Soft OTX Editor - we provide an integrated environment which enables you to generate, modify, execute and exchange test cases based on the standards ODX, OTX and MCD-3D!



Step 1 – generate the test cases

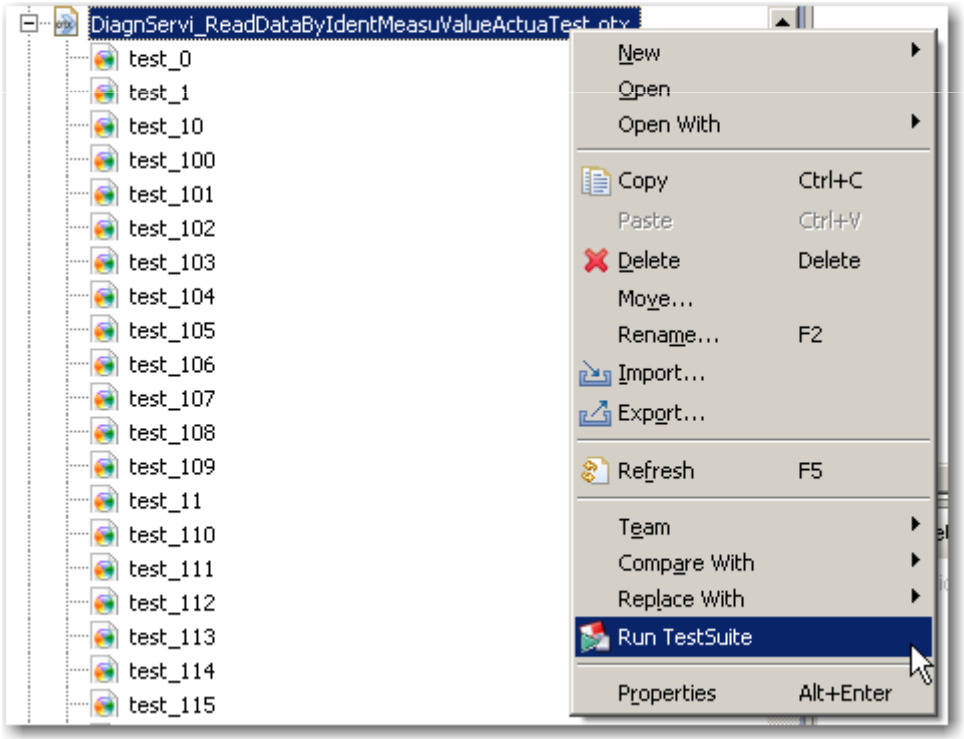
Test Cases *Generation and Execution*

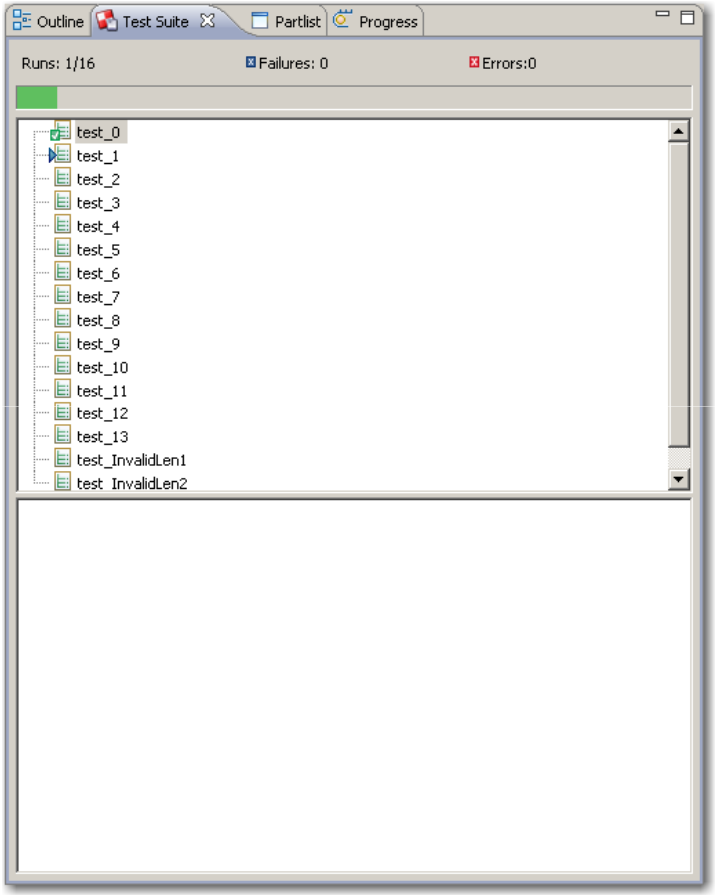
Step 2 – view / modify the test cases



Test Cases *Generation and Execution*

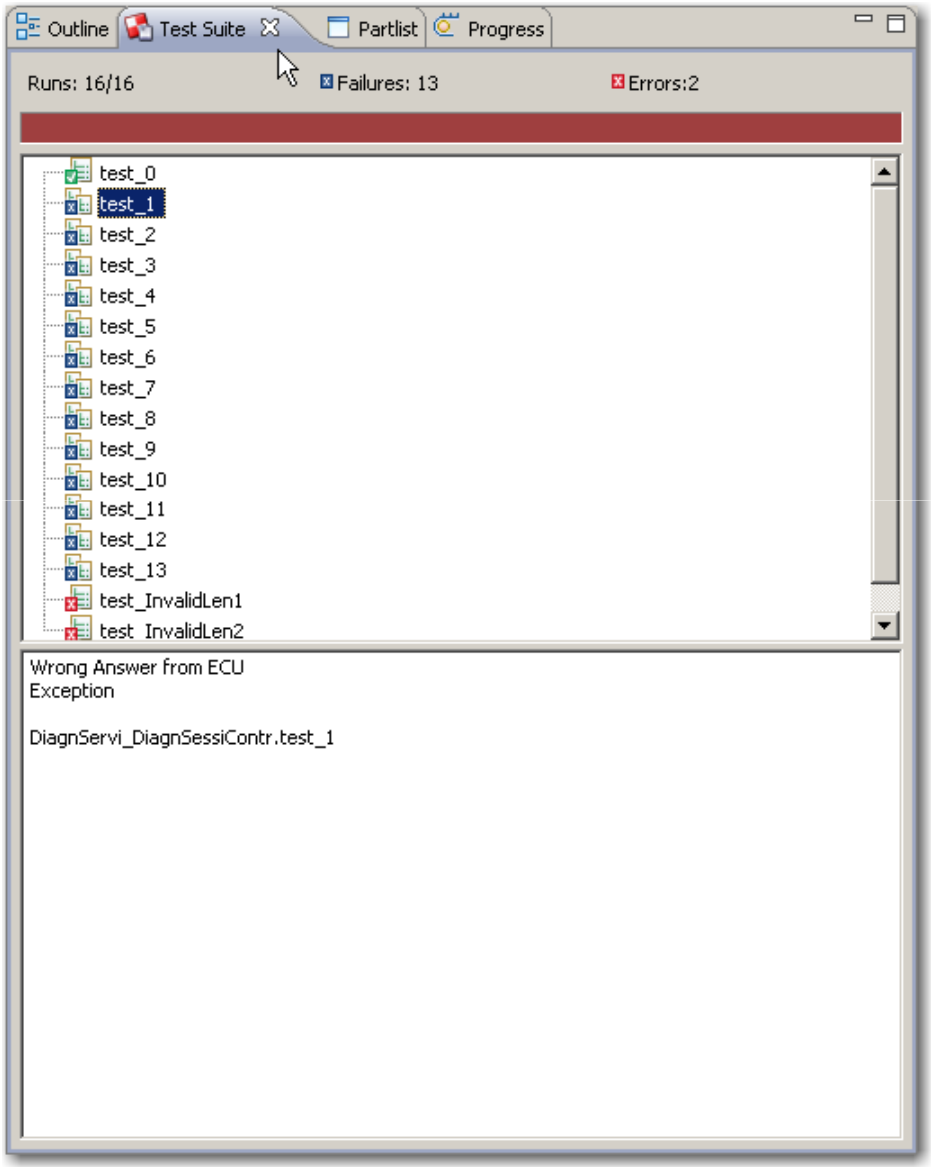
Step 3 – execute the test cases





Test Cases *Generation and Execution*

Step 4 – view the results



Enhancements & Extensions…

Extend Configuration…

- Define for which diagnostic services to generate test cases
- Describe test on physical domain
- Configure extended pre-conditions

Test More Aspects…

- read - write - read relations
- Configure extended pre-conditions
- Diagnostic protocol timings
- …

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Benefits & Highlights

Automated generation of test cases in an integrated environment	Automated Generation
Since the approach is based on standards in use the test cases can be easily exchanged, modified and executed with every standard compliant tool	Based on Standards ODX, OTX, MCD-3D
For the execution of the test cases an integrated MCD-3D Server is used	Integrated Execution
During authoring & execution time of OTX sequences, a special binary format of ODX is used that allows extremely fast access	Fast & Sophisticated Access to ODX Data

Thank You for Your Attention!

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ODX-Based Testing With OTX

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