Finding your way into MBT

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The Dutch e-passport

New passport introduced around 2009-2010

- Machine readable passport (MRP, e-passport)
- Contact-less
- Storage of picture, fingerprints, iris scan, ...
- Access to data protected by encryption and new protocol

Our assignment: testing of the Dutch e-passports

- Emphasis on access protocol
- Exchange of request-response between passport and reader
- Security: test error messages on illegal instructions



Model-based testing of the Dutch e-passports



Simple model of the access protocol







MBT for e-passports - Results

Tested

- Basic Access Control (BAC)
- Extended Access Control (EAC)
- Active Authentification (AA)
- Data reading

Tested up to about 1,000,000 test events

- Complemented with manual tests

No error found at that time

Some recent success stories

- Axini
 - ETIS/ProRail: <u>https://bits-chips.nl/artikel/model-based-testing-in-safety-critical-scaled-agile/</u>
 - Thermo Fisher Scientific: <u>https://bits-chips.nl/artikel/thermo-fisher-scientific-develops-an-appetite-for-modeling/</u>
- Smartesting:
 - Allianz & XRAY
 - <u>https://www.getxray.app/blog/xray-success-case-with-allianz</u>
- Supported by partners

Three dimensions of Model-Based Testing

The modelling perspective

- From the user or tester perspective
- From the system under test perspective

The level of automation

- Manual no automation
- Generation of test cases
- Generation of test procedures
- On-the-fly generation and execution



The type of models

- Pure data
- Process models
- Reactive systems
- Non-deterministic systems

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Models for data – Pension premium specification

```
def kapitaal(t)
  if t == 0
    startkapitaal
  else
    (kapitaal(t - 1) + premie(t - 1)) * (1 + netto_rendement(t - 1))
  end
end
```

end

Test case24915VerdictpassedTest run started at2023-10-16 08:58:41Test case started at 2023-10-16 10:58:43Description

Input

name	value
deeltijdpercentage	76
salaris	32729
startkapitaal	2159
geboortedatum	1977-07-25
aanvangsmoment	2002-02-17

i upin 200 i		
+ mei 2004		
— juni 2004		
pensioengevend inkomen	34051.25	34051.25
franchise	12306.89	12306.89
pensioengrondslag	21744.36	21744.36
premie percentage	9,0%	9,0%
premie	123.94	123.94
verwacht rendement (netto)	0,237%	0,237%
opgebouwd kapitaal	5813.19	5813.19
+ juli 2004		
+ augustus 2004		

axini

Models for processes or also called transactions



Models for states – Single state machines



Models for states – Composition of models





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Manual Model Based Testing



Test case generation





GUI Testing Automation



On-the-fly automatic testing

axini

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prespective



https://www.linkedin.com/feed/update/urn:li:activity:6777501092046528512/

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How to start and evolve – Baby steps after baby steps !



Thanks !

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Insights you can act on

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Testing – ISTQB Definition

The process consisting of all life cycle activities, both static and dynamic concerned with planning, preparation, and evaluation of software products and related work products to determine that they satisfy specified requirements, to demonstrate that they are fit for purpose and to detect defects.

A lot more than just running tests:

- Test planning
- Analyzing, designing, and implementing tests
- Reporting test progress and results
- Reporting defects
- Validating requirements

Model-Based Testing – ISTQB Definition

Model-Based Testing (MBT) is an advanced test approach using models for testing. It extends and supports classic test design techniques such as equivalence partitioning, boundary value analysis, decision table testing, state transition testing, and use case testing. The basic idea is to improve the quality and efficiency of the test design and test implementation activities by:

- Designing a comprehensive MBT model, typically using tools, based on project test objectives.
- Providing an MBT model as a test design specification. This model includes a high degree of formal and detailed information that is sufficient to automatically generate the test cases directly from the MBT model.

MBT and its artifacts are closely integrated with the processes of the organization as well as with the methods, technical environments, tools, and any specific lifecycle processes.

Benefits and costs of Model-Based Testing

Benefits

- Efficiency Early defect detection
- Improved communication
- Reduced and controlled complexity in design and testing

Costs

- Tools
- Learning & training

Model-Based Testing

" testing based on or involving models" (ISTQB Glossary)

"Draw pictures whenever possible to explain what you are doing or going to do, and use it to create and maintain your testware" (ISTQB Model-Based Testing Essentials)

General Model-Based Testing Architecture

