The UML 2.0 Testing Profile

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Outline

• Introduction
• The Testing Profile Concepts
• An Example
• The Definition of U2TP
• Outlook
Introduction

Developer

Integrator

Systems integrator

Testing throughout the process

Heterogeneity increases

Introduction: Balanced View

Developer

Integrator

Systems integrator

Testing tight to Development
e.g. JUnit

Testing tight to Services
e.g. TTCN-3
An Answer: Modell-Based View

UML and Testing

- UML-based test generation, e.g.
  - Integration testing, Siemens, 2000
  - Component test framework (TINA), FOKUS, 2000
  - Component testing (COTE), INRIA, 2001
- UML-based test notation, e.g.
  - Agedis, EC IST project
  - TeLa, COTE project
  - UML Testing Profile, OMG
UML and Testing

- Model Driven Architecture as new OMG strategy
  - One objective of UML 2.0 is executable UML meaning
    - code generation
    - simulation
    - validation
    - test generation
  - "..., the expanded role of the OMG must be built on rock-solid testing, certification and branding. …"

Goals of the UML Testing Profile

- Definition of a testing profile to capture all information that would be needed by different test processes
  - To allow black-box testing (i.e. at UML interfaces) of computational models in UML
- A testing profile based upon UML 2.0
  - That enables the test definition and generation of structural (static) and behavioral (dynamic) aspects of UML models in an implementation independent manner, and
  - that is capable of inter-operation with existing test technologies for black-box testing
U2TP Partners

- A consortium of testers, UML vendors and users dedicated to make UML applicable for software testing

- Submitters
  - Ericsson
  - IBM
  - FOKUS
  - Motorola
  - Rational
  - Softeam
  - Telelogic
  - University of Lübeck

- Supporters
  - iLogix
  - ScapaTechnologies
  - IRISA

The Testing Profile Roots

- Test control
- Wildcards
- Defaults
- Test components

- Arbiter
- Validation actions
- Data pools

Graphical Format of TTCN-3

UML 2.0
MSC-2000
UML 1.x
SDL-2000

Software Testing like Unit, TE, etc.
Concepts of the Testing Profile

- Test architecture
  - Test structure, test components and test configuration
- Test data
  - Test data and templates used in test procedures
- Test behavior
  - Dynamic aspects of test procedures
- Test time
  - Time quantified definition of test procedures

An Example

System-level tests

System-integration level tests
An Example

System Test

ATM

HWControl

Bank

Money

SWIFTNetwork

System Level Test

Test component

"Test package" with test cases

ATM

Test suite

Test component

BankEmulator

IBank

IAccount

Test component

HWEmulator

IATM

IHardware

Miscellaneous

"Test package"
Test Configuration

```
<testSuite>
  class ATMSuite
  ...
  atm : BankATM
  ...
</testSuite>
```

```
Utility property
SUT property
Test component property
```

Test Control (Execution of Test Suite)

```
Referring test case behaviors
```

```
<testSuite>
  ATMSuite
  ...
  verdict : Verdict
  ...
  verdict = invalidPIN
  ...
</testSuite>
```
A Test Case

SUT and Test Component Lifelines

invalidPIN

storeCardData(current)

display("Enter PIN")

isPinCorrect(invalidPIN)

display("Invalid PIN")

display("Enter PIN again")

Mapping Action

pass

A Test Case with Default (Extract)

Default application

validWiring

amount = acceptMoney

display("Transaction Accepted")

selectOperation : true

DisplayDefault

pass
The U2TP Definition: Metamodels

- The UML-based profile
  - Used by UML tools to provide test specification via profiled UML elements

- The MOF-based standalone metamodel
  - Used by MOF-based tools and repositories to manage and manipulate artifacts created using the profile
The U2TP Definition: Mappings

• To enable the direct execution of U2TP specifications by reusing existing test infrastructures

• Mappings to
  • The JUnit test framework
    • An open source test technology for Java
    • Black-box tests on unit level
    ➢ Only selected concepts of U2TP can be mapped
  • The Testing and Test Control Notation TTCN-3
    • A generic test technology by ETSI/ITU-T
    • Black-box/grey-box tests on unit, component, integration and system level
    ➢ Almost all concepts can be mapped

➢ The mappings define possible, but not the only mappings
Summary

- UML Testing Profile provides specification means for test artifacts of systems from various domains
- Enhances UML with concepts like test configuration, test components, SUT, verdict and default
- Seamlessly integrates into UML: being based on UML metamodel, using UML syntax

➢ Direct support for test design
➢ Integration with the system development process
➢ Being realized by IBM/Rational, Telelogic, and others

Thank you for your attention!

→ www.fokus.fraunhofer.de/u2tp

Questions?