Holistic Model-Based Testing of Business Information Systems

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Software Quality Lab

Research
- foundations ("pro-active")
- application-oriented ("re-active")

Challenges / Risks
- technological
- cultural

Technology Transfer
- win-win cooperations with industry

Teaching
- concepts
- skills
- practice-oriented

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Software Quality Lab

Application Area
- Information Systems
- Automotive Systems
- Smartcard Systems

Software Quality

Competencies
- Domain Knowledge
- Market Knowledge

Software Engineering Know-how
- Concepts
- Languages
- Architectures
- Models
- Analysis Diagnostics Tools
- Techniques
- Tools

Technological Know-how
- Programming Languages
- Modeling Languages
- Platforms
- Development Tools
- Standards
Model-Based Testing is...

„Automation of test design“ Utting & Legeard

„The idea of model-based testing is to use explicit behavior models to encode the intended behavior“ Pretschner & Philipps

„Approach that bases tasks such as test case generation and test result evaluation on a model“ El-Far & Whittaker
Typical problems

(Test) Model

generate

Test Cases

???
Test Case Explosion

Pretschner et al.
> 6000

Vieira et al.
> 7000

Mingsong et al.
> 33000

Zhang et al.
> 41000
Test Case Explosion

For each test case:

- Execute
- Evaluate
- Maintain

Time
Costs

System Testing (functional, manual)

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Reuse of design models

Test Model

Test Cases

Güldali, Mlynarski Vergleich von Prozessmodellen für MBT aus Managementsicht, Sofwaretechnik-Trends, 1/2010 (to be published)
Reuse of design models

Requirements ➔ Test Model ➔ Test Cases

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Reuse of design models

Test Cases  →  Test Model  →  Test Cases

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Reuse of design models

Test Model

Test Cases

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Reuse of design models

Design Models → Test Model → Test Cases

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Reuse of design models

Typical design models

Test Cases
Holistic reuse of design models

Typical design models

Test Cases
What is the solution?
Model-based test specification process

Assumptions

- Functional System Testing
- UML 2.0 models (Analysis Model)
- Business Information Systems
- Clear associations between models
- Test designer has modeling knowledge
- No code generation from design models!
Step 1: Annotation

- Behavioral models
- Test purposes (Ledru et al. or AGEDIS Project)
- Test selection criteria based on control-flow
Step 2: Transformation

- Design Model described with UML
- Test Model described with the customized UML Testing Profile
- Mapping and Transformation Rules
How to use several models?
Step 3: Extension

- Test Cases described with UML Activity Diagrams
- Information from other models
- Extension with test data
- Review
Step 4: Generation

XML → model2text → HTML

JUnit*

XML

DB
How about tools?
Tools
What will happen?
Summary & Outlook

• Further work on the holistic model analysis
• Tuning of the prototype
• Pilot project @ Capgemini sd&m to evaluate the approach
• Comparison between single and holistic model-based test generation
Discussion
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