SEMINAR »VERIFICATION AND TESTING OF COMPLEX SYSTEMS«

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Topic Overview
## Topic Overview

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Topic 1: Testing and Test Control Notation 3 (TTCN-3)

- **Subject**
  - Standardized testing language
  - European Telecommunication Standards Institute (ETSI)
  - Supports automated and distributed testing

- **Objectives**
  - Present the key concepts of the test language
  - Develop sample test suite in TTCN-3
    - Use case: Bank withdrawal, account balance request
  - Analyze tool support (Eclipse Titan)

- **References**
  - http://www.ttcn-3.org
  - https://projects.eclipse.org/projects/tools.titan
Topic 2: Jnario – Executable Specifications for Java

- **Subject**
  - Testing, specification, and documentation framework
  - Executable unit, integration, and acceptance specifications
  - Orchestration of specifications
  - Developed at BMW Car IT

- **Objectives**
  - Present the key concepts of Jnario
  - Explain how Domain Specific Languages (DSLs) can be defined with Xbase/Xtext
  - Live demonstration based on self-defined use case

- **References**
  - [http://jnario.org/](http://jnario.org/)
  - [https://github.com/sebastianbenz/Jnario/issues/168](https://github.com/sebastianbenz/Jnario/issues/168)
  - [https://github.com/borisbrodski/Jnario/tree/no_xtend_xtext2.9](https://github.com/borisbrodski/Jnario/tree/no_xtend_xtext2.9)
Topic 3: SAT-Based Formal Verification

- Subject
  - SAT-based formal verification (propositional logic)
  - How to use SAT solvers for model checking
  - Formulating a verification problem as a SAT problem

- Prerequisite:
  - Knowledge of math. logic & complexity theory

- Objectives
  - Understand, present & explain new results

- References
Topic 4: Continuous Integration & Automated Testing

- **Subject**
  - Continuous integration - integrate code early and often into code mainline
  - Automated regression testing

- **Objectives**
  - Explain how testing can be coupled with continuous integration

- **References**
Topic 5: Testing Grid and Cloud Infrastructures

- **Subject**
  - Testing of grid and cloud infrastructures

- **Objectives**
  - Present the specific requirements for testing cloud/grid computing environments
  - Present work on standardized test framework

- **References**
Topic 6: Test Generation Based on Finite State Machines

Subject
- Finite State Machines to model specifications
- Various methods to derive test cases
  - addressing fault models
  - minimizing the size of test cases

Objectives
- Describe the underlying assumptions and constraints
- Present different approaches to generate tests based on FSMs
- Provide examples

References
Topic 7: Model-Based Testing With Spec Explorer

Subject
- Testing environment developed by Microsoft Research
- Reactive Systems = Non-deterministic

Objectives
- Understand & present key ideas

References
Subject
- Semi-automatic unit test generation
- “Tests for full conformance to a lazy specification, which is inferred on-the-fly from the code, by static and dynamic analysis, and from hints supplied by the programmer”

Objectives
- Understand & present approach
- Showcase »JWalk«

References
- Journal and conference publications at http://staffwww.dcs.shef.ac.uk/people/A.Simons/jwalk/

Note:
- Request academic license from author in time!
Topic 9: Mobile Testing as a Service (MTaaS)

- **Subject**
  - Validation of mobile Apps and SaaS applications on mobile web
  - High complexity due to diversity of mobile devices and computational resources

- **Objectives**
  - Provide a survey of the challenges, technologies, approaches, and infrastructures

- **References**
  - A. Malini; N. Venkatesh; K. Sundarakantham; S. Mercyshalinie: Mobile application testing on smart devices using MTAAS framework in cloud. International Conference on Computer and Communications Technologies (ICCCT), 2014
Topic 10: Regression Test Selection

Subject
- Regression testing as an expensive maintenance activity
- Test selection based on control flow graphs for a (modified) program

Objectives
- Present the concepts and provide examples

References:
Topic 11: Practical Application of Model Checking

- **Subject**
  - Use model checking to find serious errors in file systems
  - Find corner-case errors by exploring the system’s state space
  - File systems as a use case:
    - Errors are most serious
    - Hard to test whether a systems recovers after any crash

- **Objectives**
  - Introduce basic concepts of model checking
  - Describe the techniques and tools applied
  - Summarize the findings of the use case

- **References**