Tutorial proposal - SAC 2006

Tutorial title: **Model-Based Testing – From Theory to Industrial Applications**

Author:

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Tutorial objectives: The main objective of this tutorial is to introduce the techniques of automated functional black-box test generation from formal models and to show on the basis of industrial applications how it is effective to validate critical software.

Duration: Half-day

Abstract:
After two decades of intensive research in using formal models for test generation purpose, these techniques reach a first maturity level: various successful experiments have been realized and environments start to be available both academics and commercials. Indeed, formal model-based testing really breaks the traditional practices in functional black-box testing and offers new solutions to face the growing complexity of the systems to be validated. More precisely, it offers the opportunity to give a rational for better covering the requirements and it allows reducing the cost of test design. In this tutorial, we introduce the formal model-based techniques and we show on the basis of various industrial application presentations the advantages, difficulties and drawbacks of such techniques. This tutorial takes benefit from the experience of the authors in developing the formal model-based generator BZ-Testing-Tools, now industrialized by the company Leirios Technologies and using it in several industrial applications in various domains of critical software (Smart Card, Automobile software, urban systems, …) .

Outline:
1. What is formal model-based testing?
2. How is it cost effective?
    a. How can it reduce the cost of test designing?
    b. How can it improve the quality and coverage of the functional test cases?
    c. How can it reduce the time to market?
3. How to model the system under test for testing purpose?
    a. Modeling for testing

    b. Level of abstraction regarding the test objectives
    c. Considering the points of control and observation
    d. Verifying and validating the formal model
    e. Scalability issues
4. Difficulties of formal model-based testing
5. Specification-based test coverage criteria:
    a. Control-flow based coverage criteria,
    b. Data oriented coverage criteria,
    c. Transition system oriented coverage criteria
6. Strategies for automated test and oracle generation from the formal model:
    a. Cause-effect testing
    b. Boundary testing
    c. All behavior coverage
7. Example of formal notations use for test generation:
    a. Using Pre/Post condition notations
    b. Using precise UML models
8. Controlling the test case explosion:
    a. Multiple conditions in decisions
    b. Boundary values
9. From abstract generated test cases to executable test scripts
10. Case-studies
    a. The Smart Card GSM 11-11 Standard case-study,
    b. A Bank Card transaction payment device validation application,
    c. An automobile wiper controller application.
11. Available methods and tools – academic and commercial
12. Further considerations
    a. Non regression testing
    b. Introducing formal model-based testing in an industrial process
    c. Acceptance by test engineer
13. Conclusion

Expected background of the audience: The tutorial only requires understanding of the basic notions and techniques of computer science. No prior knowledge of modeling for test generation is required.

Biographical sketch of the presenter: Dr. Bruno Legeard is Professor of Software Engineering at the University of Franche-Comté, France. He has worked in the computer software industry, holding consulting position in software validation. Currently, he leads the Software testing and formal methods group and is one of the authors of the BZ-Testing-Tools automated test generation method and tool. He has several experiences applying automated test case generation from specifications in the area of critical software. He is a co-founder of LEIRIOS, which is one of the world-wide leading providers of Model-Based Testing tools and technologies (www.leirios.com).