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Title of Paper

A Maturity Model for Model-based Testing

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Instructional Level

O Introductory **X** Intermediate **O** Advanced

Target Group

Software and Test Managers, ,QA Managers, Test Process Managers

Keywords

❒ Model-Based Testing

❒ Test Process Improvement

❒ Maturity Models

Abstract

In systems and software development processes, the idea of model-based development gets more and more awareness, since it promises to gain efficiency in producing systems with increasing complexity and functionality in shorter development time using less resources.

To the same degree, test managers and test designers face the necessity to adopt similar techniques in order to keep pace with the speed of development.

The basic idea of model-based testing is to derive certain test ware (e.g. test cases) from an abstract and formal model of the test objects instead of creating this test ware manually. There are a number of **disciplines** (i.e. approaches, methods and tools) available that support that basic idea of model-based testing, covering different types of test ware and using different modelling techniques and generation mechanisms. To exploit them, various requirements on organisation, infrastructure, processes and people have to be fulfilled. Thus, there is on the one hand a high potential for improvement of the testing process and it's efficiency, but on the other hand a high risk for (sich zu übernehmen/zu scheitern).

As a guideline for introduction of model-based testing into a project or organisation, we designed a step-by-step model.

The model follows three targets:

- to **assess** an actual project or organisation that shall be subject to introduction of model-based testing disciplines.
- to **classify** a certain model-based discipline according to it's potential **benefit** to the project and the **requirements** for it's use.
- to suggest an **improvement roadmap** for the introduction of the disciplines that supports a smooth transition from traditional testing process to a full-sized model-driven integrated testing environment.

The parts of this topic-specific maturity model are mapped to the well-known general model TPI®[1] for test process improvement, thus allowing a test process manager experienced in TPI to incorporate model-based testing discipline in his strategic process improvement roadmap.

The model is based on the following aspects:

- requirements/preconditions for introduction of a discipline. These are similar to the TPI *checkpoints* and can be used to assess the project's or organisation's capability to use the discipline.
    - organisational requirements: which organisation structure (roles, responsibilities, information/communication channels) has to be established to allow introduction of the discipline?
    - process requirements: which phases, activities and deliverables have to be defined in the life cycle of the development and testing project to support the discipline?
    - infrastructure requirements: which changes to the tester's workplace (e.g. tools) are necessary or at least recommended to implement the discipline?
    - skill requirements: which know-how/hard skills are required for which of the roles of the testing team to exploit the discipline? Which soft skills are helpful?
- General structure of the discipline – how can the discipline be described?
    - Kind: is the discipline implemented as a process or method, or is it manifested in a tool (or both)?
    - Scope: which aspect of the testing process and of the test objects is covered by the discipline?
    - Effort: which amount and kind of work is consumed by using the discipline? What are the scaling factors for the amount of work?
    - Effect: what is the actual benefit of the discipline , based on e.g. kind of defects to be found, type of information to be generated?
    - Efficiency: how does the discipline's effect scale with the effort spent? How does it benchmark against other disciplines causing the same or a similar effect?
    - Documentation: to which extent and in which form is documentation about the discipline available? Are there formal proofs or industrial case studies for successful use?
- Introduction suggestions: these are also similar to the TPI *improvement suggestions* and can be used to support introduction of the discipline.

As an example for the use of the assessment and classification model, a set of known and available disciplines is described and arranged to an „exemplar improvement model" consisting of six improvement stages which are loosely mapped to the ISO 15504 (SPICE) capability levels:

- no modelling – there is no evidence of model-based disciplines to be used in the project; test ware is created mainly ad hoc or based on experience.
- informal modelling – the test team uses certain modelling disciplines (based on experience and informal techniques) to gain knowledge about the test objects. This knowledge is used in a systematic way to derive parts of the test ware (e.g. test specifications, test scripts etc), but there is no or few use of formal methods, languages or tools.
- formal modelling – for certain testing activities, models are constructed using a formal description method (language). The formal model is used as a basis to produce parts of the test ware by reproducible and documented methods. Test management is aware of the modelling disciplines and plan their use and monitor their effectiveness.

- model-centered: modelling disciplines are not only used for test generation, but also for test planning and monitoring (e.g. by defining target coverage criteria on model level). Infrastructure, processes and team are selected using well-defined criteria based on the modelling disciplines. There is a standard selection process between modelling and non-modelling test techniques.

- model-driven: modelling disciplines form the backbone of the testing process. There is a defined way from requirements to test results that is based on model-to-model transformations. Models are also used to measure test effectiveness and efficiency and to predict the results of the testing activities according to well-defined project goals. Measurements and predictions are used in all projects of the organisation and stored to gain historical data.

- multi-modelling/optimized model-driven: different model-based testing disciplines are established for all test levels and phases. Historical data, planning, prediction, monitoring and selection of modelling disciplines are regularily used to steer and to monitor the efficiency of the testing process and to adapt or exchange the modelling disciplines in a flexible way to continually improve the testing process according to well-defined project, process and organisation level goals.

The presentation also covers short introductions of several state-of-the-art model-based testing tools, giving the audience a survey of the bandwidth of available solutions for their project contexts.

Biography

Thomas Rossner is one of the founders of imbus AG, a german company founded in 1992 and specialising in software quality assurance.

He is Chief Technology Officer of imbus, being responsible for the company's product and service development and for the research programme.

He has been working as a test manager and test process improvement specialist in different business areas, including telecommunications, medical devices, automotive devices, public authorities and finance. He is iNTACS certified competent ISO/IEC 15504 assessor and ISTQB certified tester (advanced level test manager).

Thomas Rossner led different research projects of imbus participating in international (EU research framework) and national (german SE 2006 initiative) research programmes, especially in the sectors of software reliability (projects PETS and TestBalance) and model-based testing (projects AGEDIS and MODELWARE).

Thomas Rossner is co-author of the book „Software Testing Practice: Test Management" (dpunkt, 2006 and Rocky Nook, 2007) the study „Software Testmanagement" (Heise, 2006)

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