WAY OF WORKING TRANSFORMATION TO INTEGRATED MODEL DRIVEN DEVELOPMENT (MDD) AND MODEL-BASED TESTING (MBT)

Tiina Rantala (tiina.rantala@nokia.com), Pekka Tuuttila (pekka.tuuttila@nokia.com)
Agenda

- Hierarchical model for test generation
- Motivation and general approach
- Integrated way of working of MDD and MBT
- Model verification against requirements
- Activity diagrams and ALF
- Requirements for tool chain
- Lessons learned
Hierarchical model for test generation

- Focusing on HW related platform SW in Nokia Base Transceiver Station (BTS).
- The key objective is to automatically generate test cases from UML specification models.
Motivation and general approach

• The change from textual specification to model-based specification has **improved the quality and readability** of specification.

• While targeting to MBT we focus on **testing earlier** and **common way of working** to get **MDD & MBT** to be an **integral and efficient part** of the development process. The presented approach drives towards **tight co-operation** between specification, implementation and testing.

• From the modeling point of view the target has been to get a **common model** to support both, specification work and testing. This can be achieved by improving the existing specification models, activity diagrams, with **layered model hierarchy** and **extensions made with** Action Language for Foundational UML (ALF).

• To achieve the needed **modeling maturity** for MBT and to support **high quality** specification work model **simulation** is used.
Integrated way of working of MDD and MBT

Feature development team (members from each stakeholder teams)

- HW architecture specification
- SW architecture (Structural model)
- Define SW architecture
- Activate Validation rules for model content
- Reqs and AC
- Create SW specification model (UML)
- Logical validation
- Simulate the model
- Provide valid specification model
- Valid specification model (UML)
- Main responsibility on specification teams (1st phase)

- SW architecture (Structural model)
- Define SW architecture
- Specifying HW architecture
- HW architecture specification
- Main responsibility on implementation and testing teams (2nd phase)

- Valid specification model available
- Extend the model with ALF
- Specification model (UML + ALF)
- Simulation with context
- Provide valid extended specification model
- Valid specification model (UML + ALF)
- Implement
- Import model to test automation tool
- Automatically created test cases
- Execute tests
- Test results
- Provide valid specification model
- Test results
- Execute tests
- Test results

User Conference on Advanced Automated Testing
Model verification against requirements

- Specification is done based on requirements (reqs) which are verified against acceptance criteria (AC).

- In the first phase it is crucial to be able to verify that given requirements has been take into account during specification work. This is achieved by indentifying that AC are linked to the specification model.

- In the second phase AC are made verifiable by linking them with ALF to corresponding internal data and executing model in simulation with context.
Activity diagrams and ALF

- For efficiency and scalability reasons activity diagrams have turned out to be the most efficient way to specify a specification model over several functional domains and to get clear understanding about the overview of a certain functionality.

- ALF is a textual modeling language which is used to express behavior of a UML model more precisely.

- Thus ALF is used to define details, like parameterization, instead of graphical notations which will in many cases make the model too complicated to accomplish model execution.
Requirements for tool chain

The selected approach has brought about the following requirements for used tools:

1) UML system modeling tool with ALF support and ALF syntax checker.

2) Support for model simulation with ALF execution in UML system modeling tool.

3) Activity diagram and ALF support in test generation tool.

These requirements are already implemented in minimal level by tool vendors.
Lessons learned

- The presented approach enables parallel and iterative way of working between specification and implementation & testing.
  - All findings and changes are shared via one model to all stakeholders.
- Two-step simulation improves quality and enables testing earlier.
  - Simulation with parameterization increases coverage, and observation of inconsistencies and deadlocks in a model.
  - Model-based test specifications become available earlier (during model extension).
- The selected approach has brought about new requirements for tool vendors to support the use of activity diagrams with ALF extension for MBT.
- Improved tool chain need to be evaluated and piloted thoroughly before this approach can be deployed wider in organizations.
Thank you.
Questions?