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

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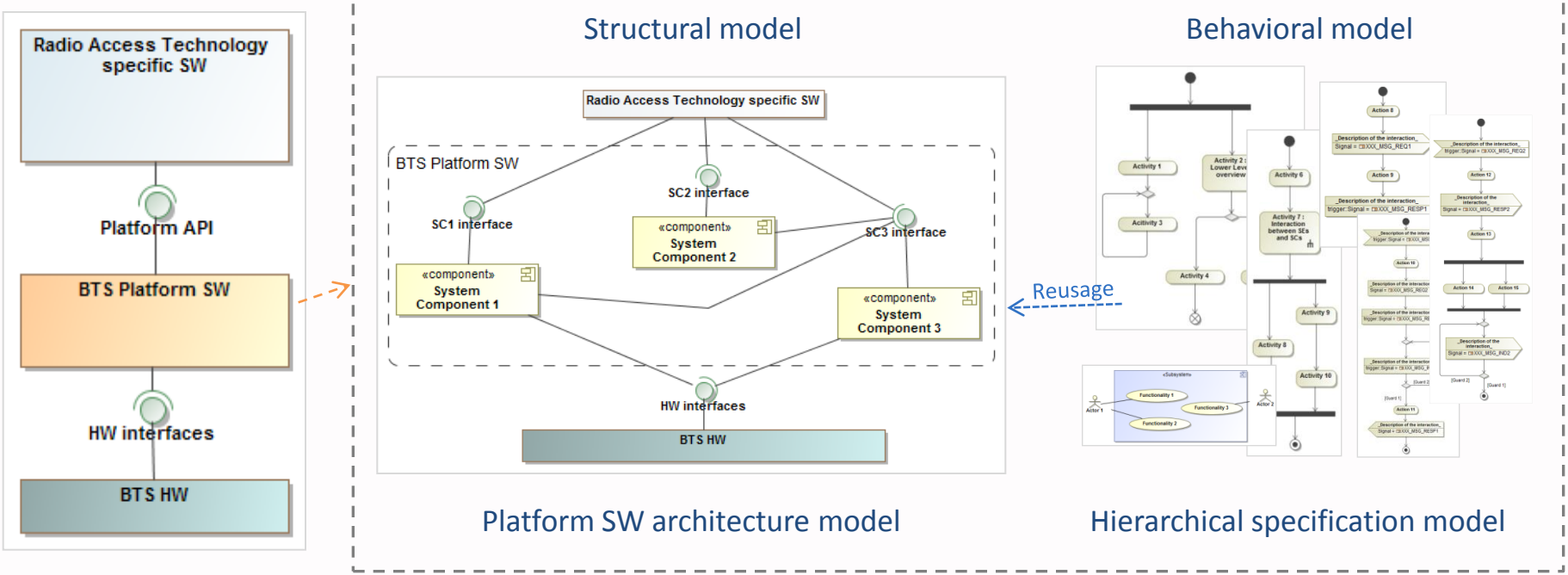
Agenda

- 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

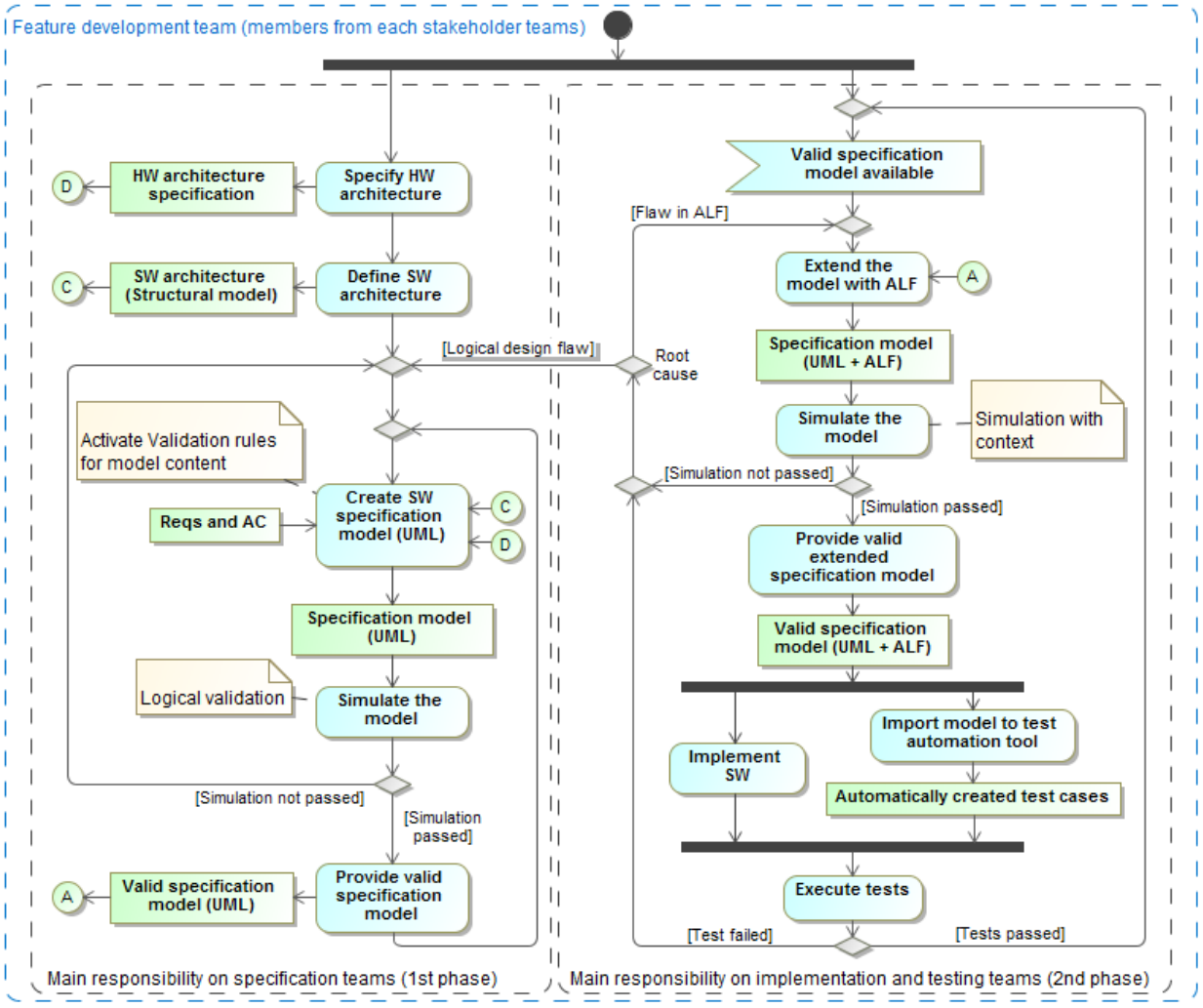
- Focusing on HW related platform SW in Nokia Base Transceiver Station (BTS).
- The key objective is to automatically generate test cases from UML specification models.



Motivation and general approach

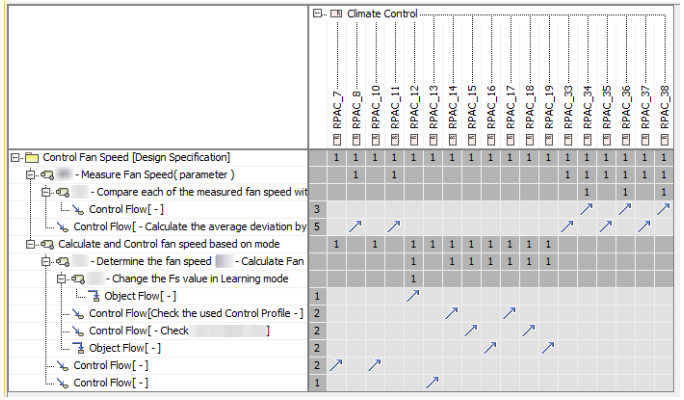
- The change from textual specification to model-based specification has **improved the quality and readability** of specification.
- While targeting to MBT we focus on **testing earlier** and **common way of working** to get **MDD & MBT** to be an **integral and efficient part** of the development process. 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



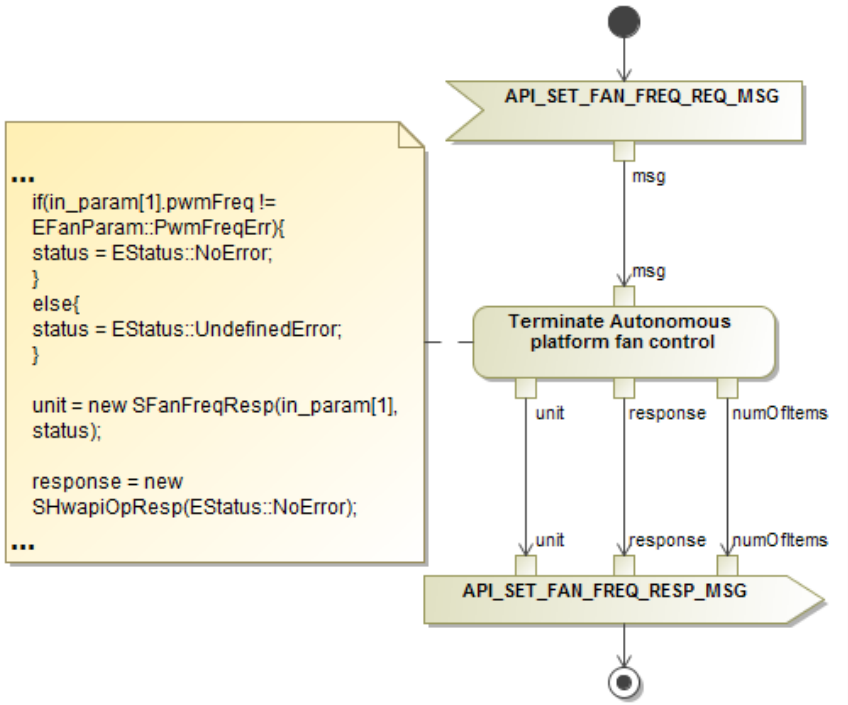
Model verification against requirements

- 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.

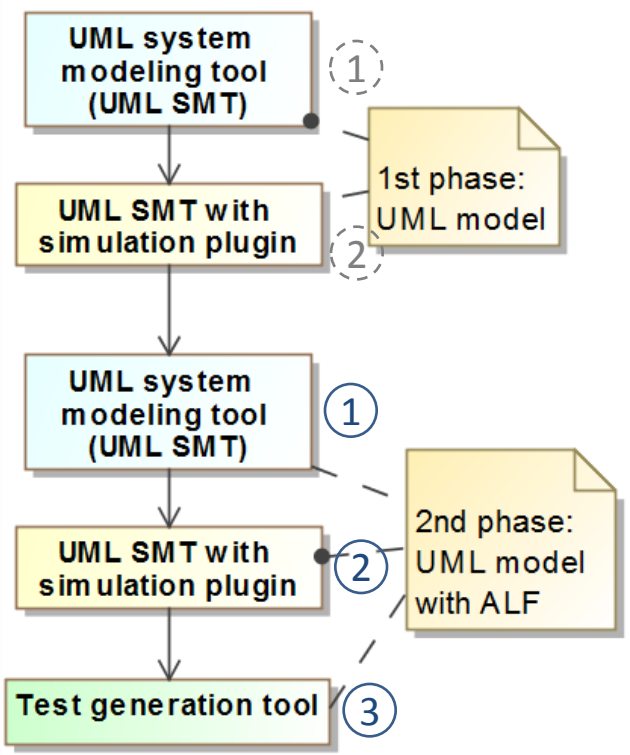


Requirements for tool chain

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.