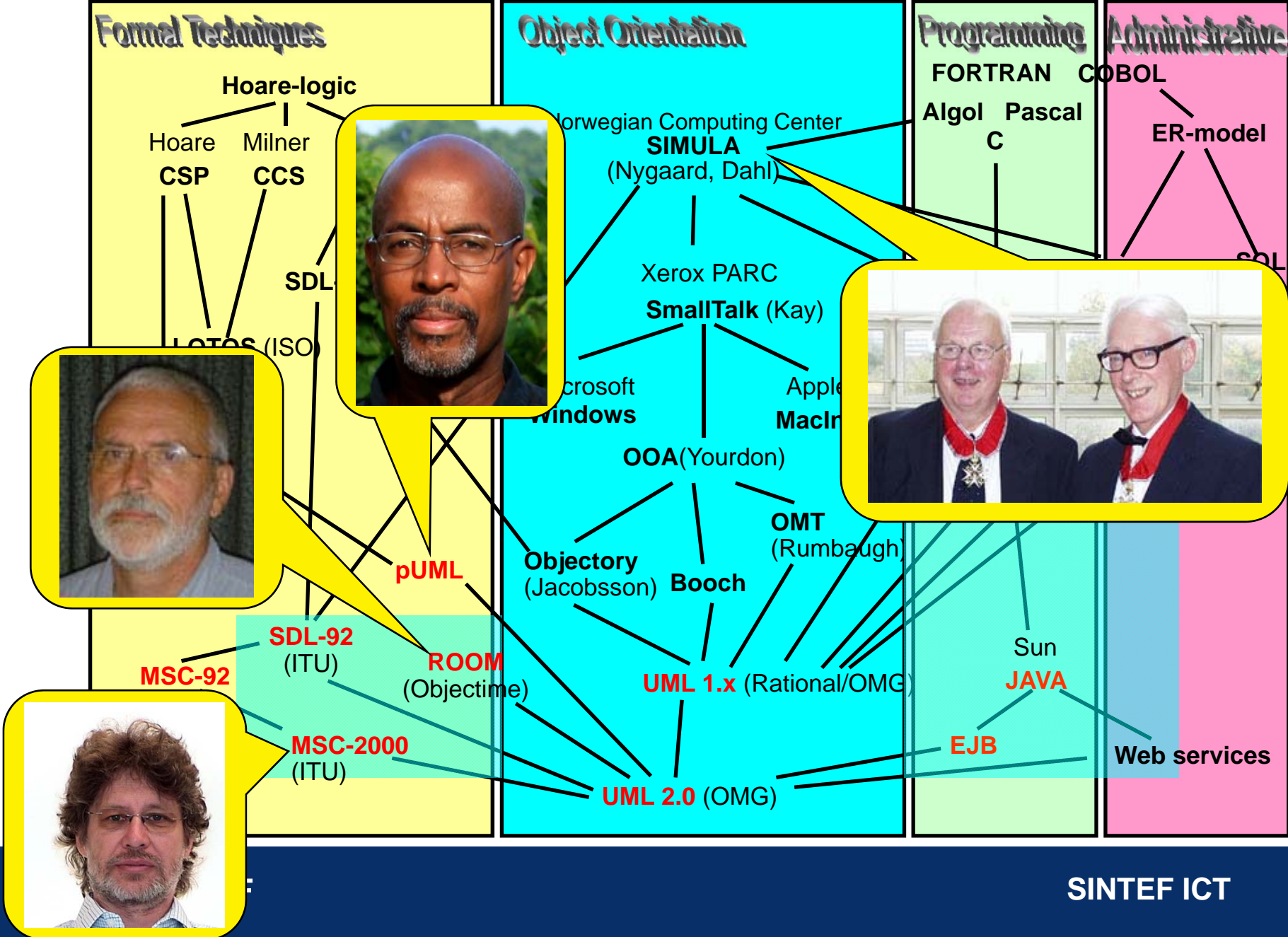# Modeling – back to the future?

Øystein Haugen
MODELS 2011
Modeling Visions
invited talk
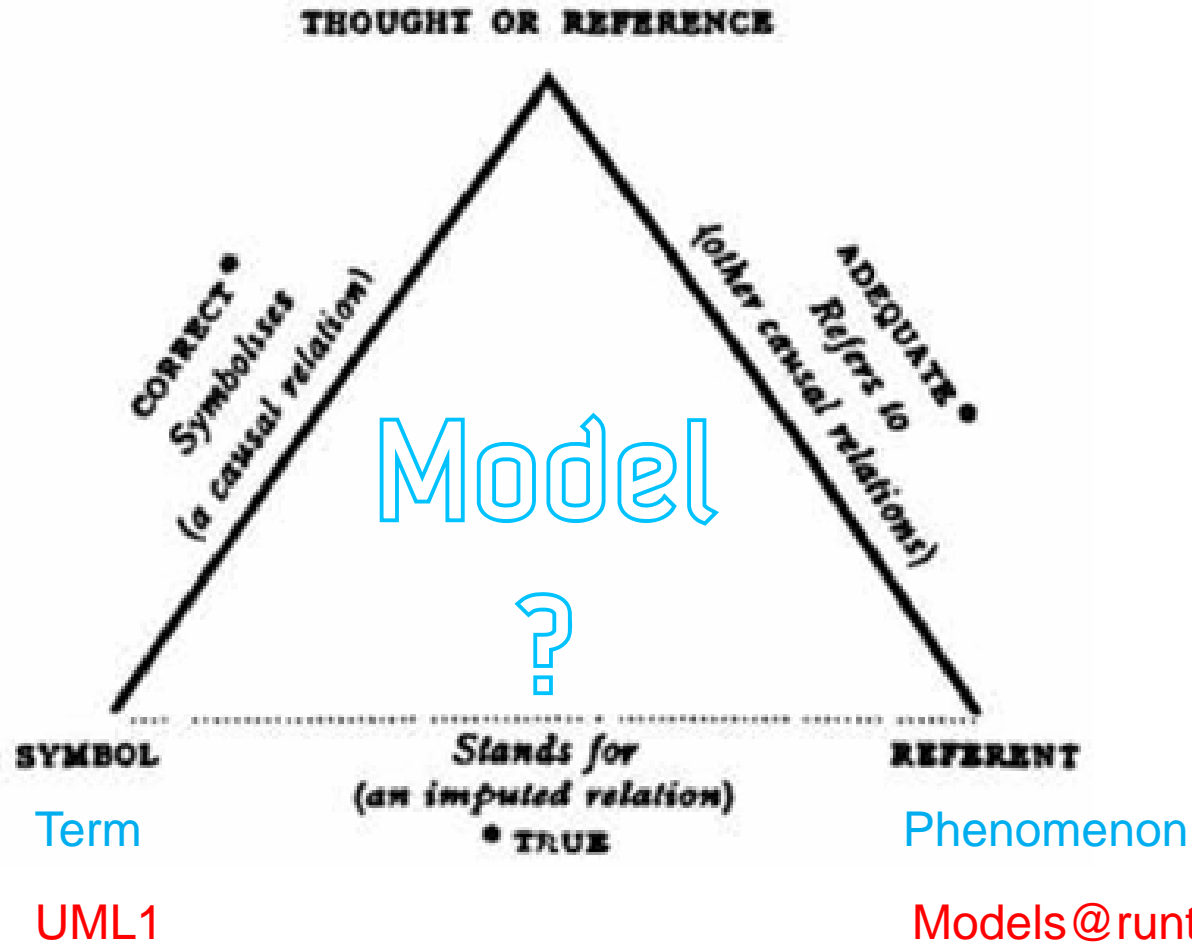
A small and biased history of languages

What's a Model?
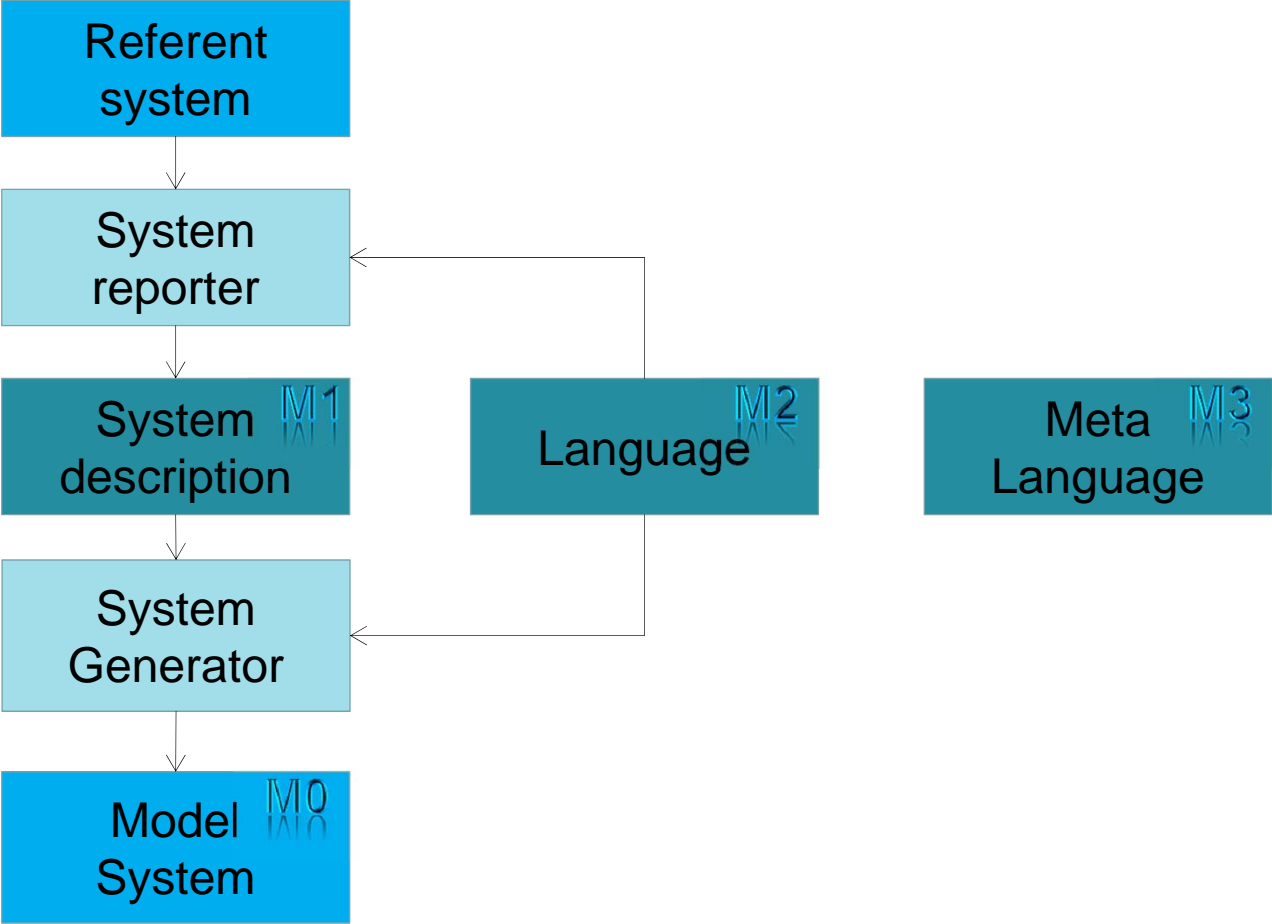
Mathematics and Physics

Concept

THOUGHT OR REFERENCE

CORRECT • Symbolises (a causal relation)

ADEQUATE • Refers to (other causal relations)

Model ?

SYMBOL   Stands for (an imputed relation)   REFERENT
                          • TRUE

Term   Phenomenon

UML1   Models@runtime

Modeling a system

- A <u>system</u> is a part of the world
  - <u>which we choose to regard as a whole</u>, separated from the rest of the world during some period of consideration, <u>a whole which we choose to consider as containing a collection of components</u>, each characterized by a selected set of associated data items and patterns, and by actions which may involve itself and other components

- Mental systems
  - Systems existing in the human mind, physically materialized as states of the cells of our brains

- Mental and manifest models
 - when a limited set of properties is selected from a system

Modeling levels revisited

The Dinosaurs: Dead Ends of Modeling

Reference Models

- Loads of concepts that pretend to hang together
  - but don't
- Almost as bad as ontologies
- No precision, not executable
 - lots of politicking
  - deceiving

The UML Instance Model

- Confuses the distinction between concept and phenomenon
  - cf. Ogden's Triangle
  - Is an instance a phenomenon or a concept?
  - What are properties then?
- Confuses the meta levels
- Introduces a set of unnecessary concepts
 - Composite structures with constraints suffices
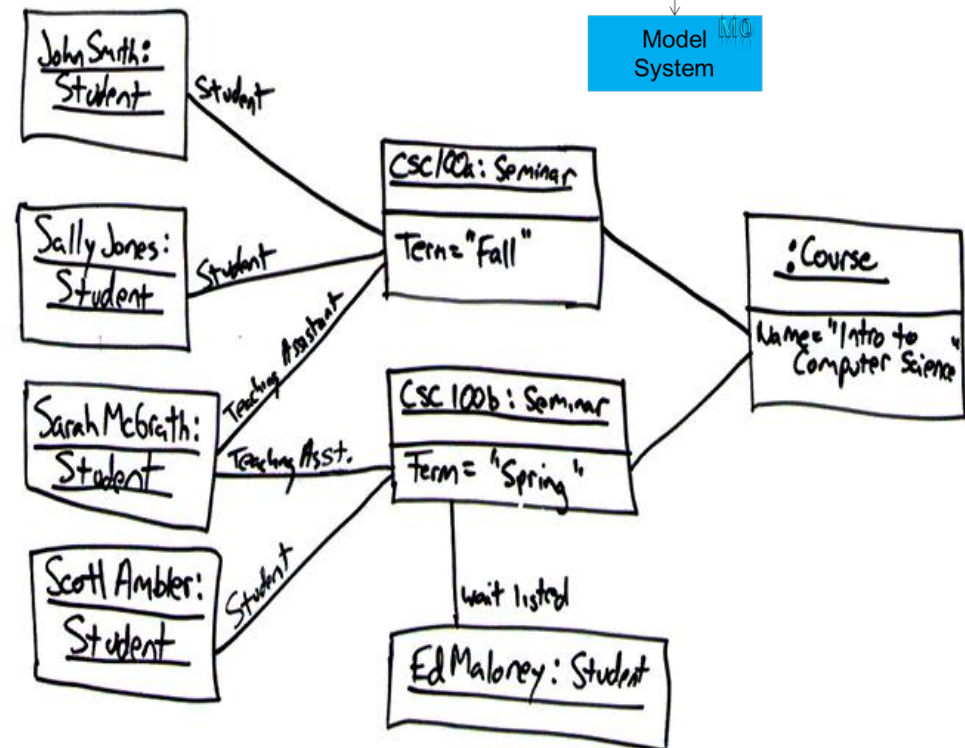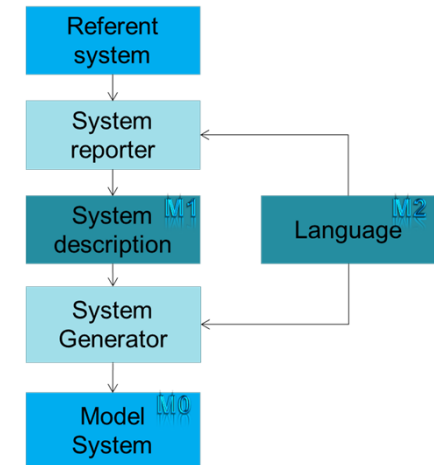
Inheritance of Behavior

- Augmenting the set of transitions in state machines
- Augmenting the set of traces of a sequence diagram
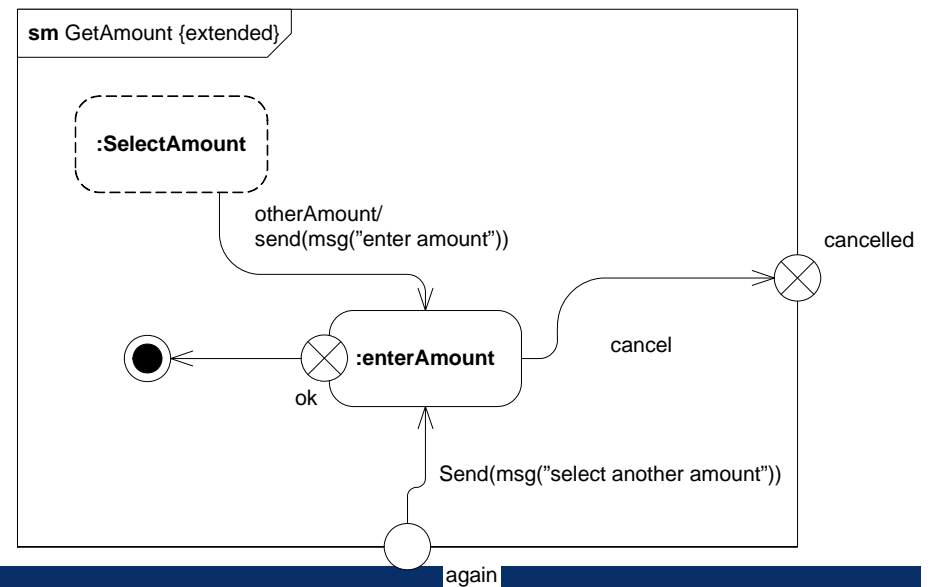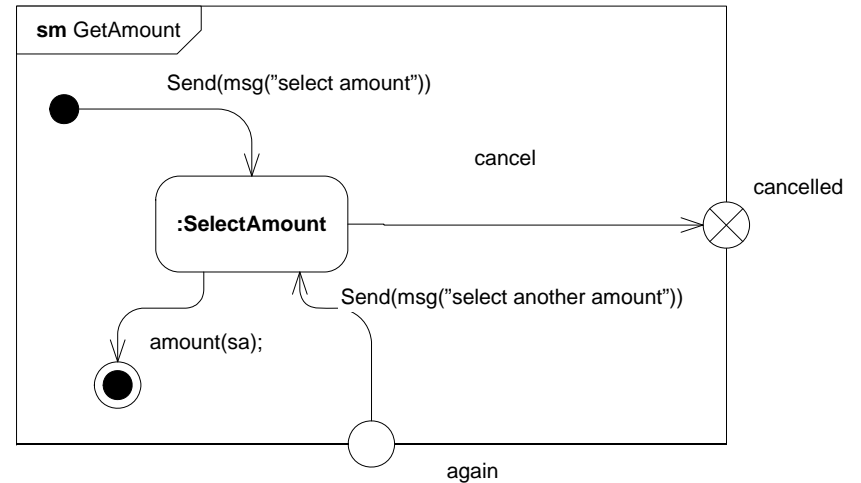
UML Profiles

- where there is a multitude of stereotypes such that UML becomes totally hidden behind new concepts

- Is the profile is consistent with its UML base?

- Piggybacking on syntax with proprietary semantics

- Grow up! Make a real DSL!
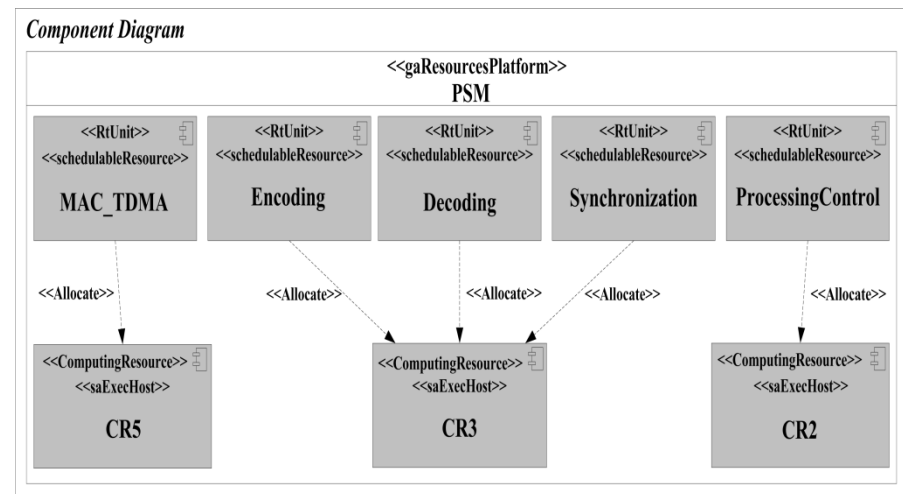
Aspect Oriented Modeling

- The modern macros:
  - you can do fantastic things,
  - but nobody else understands what you have done
  - not even you without performing the weaving
  - and you do not since that would defy the purpose
- The two pitfalls
  - perceived simple, but wrong
  - perceived complicated, but correct

The Modeling Future

- Modeling opportunities
  - What can modeling gain from modern technology
  - and what should modeling give back

- Modeling means
  - What should still remain on the modeling scene?
  - What should be the guiding principles of future modeling approaches?

Modeling opportunities

- Concrete syntax and tool behavior will merge

- Changes in description should be directly visualized with local simulation

- Descriptions will be continuously updated while it is executing

- We must reach a concept of abstract tool description

- Symbolic execution on the fly

- Verification, testing and certification concurrently – applying product line technology

Modeling Means

- The Classics – The Modeling Hall of Fame
    - Inheritance
        - with overriding?
    - State Machines
        - with hierarchical states?
    - Sequence Diagrams
        - with combined fragments?
- The MAGIC of abstraction – a taxonomy
    - M: Meta - constructs modifying other models, reflection
    - A: Aggregate - constructs for grouping and containment
    - G: Generation - constructs for dynamics of objects
    - I: Identity - constructs for defining identity relations
    - C: Concepts - constructs for typing and reuse

Modeling Needs – It's simplicated

- Must be simple yet modeling complicated matters
- Must be precise but capture fuzzy requirements
- Must be visual while modeling invisible properties
- Must be lightweight even when modeling Airbus 380
- Must combine domain specific with general, proprietary with standardized
- Must be executable and compete with programming
- Must be dynamical and adaptable at runtime
- Must be suited for V&V through empirics and analytics
- Must have tooling that is worth the money
- Must be taught with enthusiasm and dedication
- Must be applied by industry especially in times of financial crisis

SINTEF