

Software Design, Modelling and Analysis in UML

Lecture 23: Wrapup

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 - Lecture 2: Semantical Model
 - Lecture 3: Object Constraint Language (OCL)
 - Lecture 4: Object Diagrams
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 - Lecture 21: Inheritance II: Behavioral Features, Behavioral Inheritance II
 - Lecture 22: Meta-Modelling, Inheritance III
 - Lecture 23: Wrapup & Questions

Content

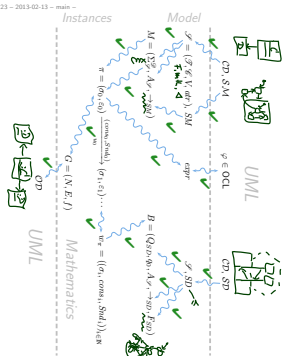
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Wrapup: Motivation

Lecture 1:

- Educational Objectives:** you should
 - be able to explain the term **model**
 - know the idea (and hopes and promises) of **model-driven** SW development.
 - be able to explain how **UML** fits into this general picture
 - know **what we/could** we've done in the course, and **why**.
 - thus be able to decide whether you want to stay with us...
- Homework 23!**
- Educational Objectives:** Capabilities for following tasks/questions.
 - How can UML help with software development?
 - Where is which sublanguage of UML useful?
 - For what purposes? With what drawbacks?

Course Path: Over Map



- Motivation
- Semantical Model
- OCL
- Object Diagrams
- Class Diagrams
- State Machines
- Live Sequence Charts
- Real-Time
- Components
- Inheritance
- Meta-Modelling
- (MDA, MDSE)

Wrapup: Examining Motivation

- what is a model? for example?
- "a model is an image or a preimage" — of what? please explain!
- when is a model a good model?
- what is model-based software engineering?
- MDA? MDSE?
- what do people hope to gain from MDSE? Why? Hope Justified?
- what are the fundamental prerequisites for that?
- what are purposes of modelling guidelines?
- could you illustrate this with examples?
- how can we establish/enforce them? can tools or procedures help?
- what's the qualitative difference between the modelling guideline all association ends have a multiplicity? and all state-machines are deterministic? ?
- ...

- what is UML (definition)? why?
- what is it (definition) not? why?
- how does UML relate to programming languages?
- what are the intentions of UML?
- what is the history of UML? Why could it be useful to know that?
- where can (what part of) UML be used in MBSE?
- for what purpose? to improve what?
- we discussed a notion of “UML mode” by M. Fowler
- what is that? why is it useful to think about it?

- what kinds of diagrams does UML offer?
- what is the purpose of the X diagram?
- what do the diagrams X and Y have in common?
- what is a UML model (our definition)? what does it mean?
- what is the difference between well-formedness rules and modeling guidelines?
- what is metamodelling?
- could you explain it on the example of UML?
- what is a class diagram in the context of meta-modelling?
- what benefits do people see in meta-modelling?
- the standard is split into the two documents, “infrastructure” and “superstructure”, what is the rationale behind that?
- in what modelling language is UML modelled?

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Lecture 2:

- **Educational Objectives:** Capabilities for these tasks/questions:
 - Why is UML of the form it is?
 - Shall one feel bad if not using all diagrams during software development?
 - What is a signature, an object, a system state, etc.?
 - What’s the purpose in the course?
 - How do Basic Object System Signatures relate to UML class diagrams?

Lecture 3:

- **Educational Objectives:** Capabilities for these tasks/questions:
 - Please explain/read out this OCL constraint. Is it well-typed?
 - Does this OCL constraint hold in this (concrete) system state?
 - Can you think of a system state satisfying this constraint?
 - Please underline all abbreviations in this OCL expression.
 - In what sense is OCL a three-valued logic? For what purpose?
 - How are $\exists^{\perp}()$ and \exists_{\perp} related?

Lecture 4:

- **Educational Objectives:** Capabilities for following tasks/questions:
 - What is an object diagram? What are object diagrams good for?
 - When is an object diagram called partial? What are partial ones good for?
 - How are system states and object diagrams related?
 - What does it mean that an OCL expression is satisfiable?
 - When is a set of OCL constraints said to be consistent?
 - Can you think of an object diagram which violates this OCL constraint?
 - Is this UML model \mathcal{M} consistent wrt. $\text{Inv}(\mathcal{M})$?

Lecture 5:

- **Educational Objectives:** Capabilities for following tasks/questions:
 - What is a class diagram?
 - For what purposes are class diagrams useful?
 - Could you please map this signature to a class diagram?
 - Could you please map this signature to a class diagram?
 - What is a stereotype? What does it mean? For what can it be useful?

Lecture 6:

- **Educational Objectives:** Capabilities for following tasks/questions:
 - Is this OCL expression well-typed or not? Why?
 - How/In what form did we define well-formedness?
 - What is visibly good for? Where is it used?

Lecture 7 & 8:

- **Educational Objectives:** Capabilities for following tasks/questions:
 - Please explain/illustrate this class diagram with associations.
 - Which annotations of an association arrow are (semantically) relevant in what sense? For what?
 - What’s a role name? What’s it good for?
 - What’s “multiplicity”? How did we treat them semantically?
 - What is “reading direction”, “navigability”, “ownership”, ...?
 - What’s the difference between “aggregation” and “composition”?

Lecture 9:

- Educational Objectives: Capabilities for following tasks/questions.
 - What are purposes of modelling guidelines? (Examples?)
 - When is a class diagram a good class diagram?
 - Discuss the style of this class diagram.

Lecture 20 & 21:

- Educational Objectives: Capabilities for following tasks/questions.
 - What's the effect of inheritance on System States?
 - What does the Lakou Substitution Principle mean regarding structure?
 - What is the subset, what the uplink semantics of inheritance?
 - What's the idea of Meta-Modelling?

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- Lecture 17: Live Sequence Charts I
- Lecture 18: Live Sequence Charts II
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- Lecture 20: Introduction to Behavioral Features, Inheritance II
- Lecture 21: Behavioral Features, Behavioral Inheritance III
- Lecture 22: Meta-Modelling, Inheritance III
- Lecture 23: Wrapup & Questions

Main and General:

- Educational Objectives: Capabilities for following tasks/questions.
 - What does this State Machine mean?
 - What happens if I inject this event?
 - Can you please model the following behaviour. (And convince readers that your model is correct.)

Lecture 10:

- Educational Objectives: Capabilities for following tasks/questions.
 - What's the difference between reflective and constructive descriptions of behaviour?
 - What's the Basic Causality Model?
 - What does *dispatched* say about the dispatching method?
 - What is (mutually) a run-to-completion step?

Lecture 11:

- Educational Objectives: Capabilities for following tasks/questions.
 - Can you please model the following behaviour.
 - What is: trigger, guard, action?
 - Please unambiguously this abbreviated transition annotation.
 - What is an *either*? Example? Why did we introduce it?
 - What's the difference: signal, signal event, event, trigger, reception, consumption?
 - What's a system configuration?
 - When is an object stable (inactively, formally)?

Lecture 12 & 13:

- Educational Objectives: Capabilities for following tasks/questions.
 - What is a transformer? Example? Why did we introduce it?
 - What is a reuse semantics? What of the framework would we change to go to a non-reuse semantics?
 - What labelled transition system is induced by a UML model?
 - What is: discard, dispatch, commencing?
 - What's the meaning of stereotype: *Signal.err*?
 - Does environment interaction necessarily occur?
 - What happens on "division by 0"?

Lecture 14:

- Educational Objectives: Capabilities for following tasks/questions.
 - What is a step (definition)? Run-to-completion step (definition)? Microstep (inuition)?
 - Do objects always finally become stable?
 - ~~What is the difference between state machines and components?~~

Lecture 15:

- Educational Objectives: Capabilities for following tasks/questions.
 - What's a kind of a state? What's a pending-state?
 - What's a region? What's it good for?
 - What is: entry, exit, do, internal transition?
 - What's a completion event? What has it to do with the ether?

Lecture 16:

- Educational Objectives: Capabilities for following tasks/questions.
 - What's a state configuration?
 - When are two states orthogonal? When consistent?
 - What's the depth of a state? Why care?
 - What is the set of enabled transitions in this system configuration and this state machine?

Lecture 21:

- Educational Objectives: Capabilities for following tasks/questions.
 - What's a history state? Deep vs. shallow?
 - What is junction choice termination?
 - What is the idea of "deferred events"?
 - What is a passive object? Why are passive reactive objects special? What did we do in that case?
 - What's a behavioural feature? How can it be implemented?

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- Lecture 18: Live Sequence Charts II
- Lecture 19: Live Sequence Charts III
- Lecture 20: Performance
- Lecture 21: Designing Behavioural Features, Inheritance II
- Lecture 22: Meta-Modelling, Inheritance III
- Lecture 23: Wrapup & Questions

Lecture 17, 18, & 19:

- Educational Objectives: Capabilities for following tasks/questions.
 - Is each LSC description of behaviour necessarily reflective?
 - There exists another distinction between "inter-object" and "intra-object" behaviour. Discuss in the context of UML.
 - What does the LSC mean?
 - Are this UML model's state machines consistent with the interaction?
 - Please provide a UML model which is consistent with this LSC.
 - What is activation (mode condition), hot/cold condition, pre-chart, cut, hot/cold location, local invariant, legal exit, hot/cold chart etc.?

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- Lecture 15: Hierarchical State Machines II
- Lecture 16: Methods, Live Sequence Charts I
- Lecture 17: Live Sequence Charts II
- Lecture 18: Live Sequence Charts III, Inheritance I
- Lecture 19: Inheritance II, Meta-Modelling I
- Lecture 20: Meta-Modelling II, Inheritance II
- Lecture 21: Wrapup & Questions

Lecture 20 & 21:

- Educational Objectives: Capabilities for following tasks/questions.
 - What's the effect of inheritance on LSCs, State Machines, System States?
 - What's the Likov Substitution Principle?
 - What is commonly understood under (behavioural) sub-typing?
 - What is the subject, what the object, semantics of inheritance?
 - What is late/early binding?
 - What is the idea of Meta-Modelling?

Meta

Hmm...

- Open book or closed book...?