



System modeling - Introduction

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Objective

- This course aims at imparting knowledge of modelling languages for software-intensive systems.
- The course will also impart methodological skills for using models **to analyse, develop, test and simulate software systems**, as well as will **learn to critically reflect on adequate abstraction levels to describe different aspects of software systems**.

What to expect?

- The course is delivered in the form of 16 workshops of 4 academic hours each. A workshop includes **lecture** time and **classwork / practical labs**.

 - Lectures - onsite*
 - When? Tue. 14.15 - 16.00, week 2-16
 - Where? Narva mnt 18 - 1019

 - Practical labs – online*
 - When? Tue. 16.15 - 18.00 & Tue. 18.15 - 20.00, week 2-16**
 - Where? Online environment – Discord
- **This week (6/09) one lab for both groups at 16:15**
-
- ** the mode is subject to change*

Lecturers or who to expect?

- Anastasija Nikiforova (anastasija.nikiforova@ut.ee*) – coordinator, lecturer
- Ishaya Peni Gambo (ishaya.gambo@ut.ee) - teaching assistant (practical labs, group#1)
- Chioma Jessica Nkem-Eze (assistant, practical labs, group#2)
- Marlon Dumas - guest lecturer
- experts from the industry as guest lecturers*

**if you contact me via email and do not hear from me back more than 2 working days, please, resend you request, i.e., ALL emails I receive are typically processed in hours*

Back to the course... How it will be?

- **Weekly practical labs and assignment – 40%**
 - «portfolio» submission 3 times during the semester to be graded (**mandatory**)
 - additionally, there is an opportunity to get a feedback and prospective grade on a weekly basis (**non-mandatory**)
- **Exam** – portfolio and open-ended question (practical implementation & documentation + oral exam – 1-2 questions based on the portfolio and/or from the list of pre-defined open ended questions) – **60%**
- **All components are mandatory. All deadlines are strict.**
- There will be an opportunity to get **bonus points** for completing **optional / non-mandatory assignments announced during the semester OR selected by the student and agreed with the course coordinator**

- In order to pass the course, the student must have at least 51 point (grade E) in total and get at least 50% from regular exercises and project (no less than 21% (out of 40%) homeworks points and 30% (out of 60%) points from the project).
- A grade of 20 points or less in the final exam will be mapped into a fail grade (F).
- The final grade (out of 100) will be calculated as the sum of the points earned from the homeworks and the final exam.
- The final grade will be mapped to a grade between A and F using the standard University scale.
- In order to pass the course, the student must have at least 51 point (grade E) in total and get at least 50% from regular exercises and project (no less than 21% (out of 40%) homeworks points and 30% (out of 60%) points from the project)

LET'S START!

What is a system?

- **A system is an assembly of components, connected together in an organised way.**
- The components **are affected** by being in the system and are changed if they leave it.
- The assembly of components **does something**.
- The assembly has been **identified by someone as being of interest**.

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Try to think about the system. What? Who? Why? is important (objects, relationships, dynamism, stakeholders...)

What is a modelling?

“the activity of using mathematical models (= simple descriptions of a system or process) to make calculations or predict what might happen:

- ❖ *Climate modelling suggests summer rainfall will decline.*
- ❖ *Computer modelling showed how the heat generated by the explosion would carry the particles 50ft or more into the air”*

Cambridge Dictionary

What is a (systems) model?

*Def. I: “**Abstraction** of something for the purpose of understanding it before building it”*

Blaaha & Rumbaugh

*Def. II: “**A simplified representation** of some person's or group's view of a situation, constructed to assist in working with that situation in a systemic manner”*

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- *I.e., maps, plans, architects' and engineers' drawings, sketches, graphs and tables - all are models we use in everyday life.*

What is a (systems) model?

*Def. I: “Abstraction of something for the purpose of understanding it **before building it**” (Blaha & Rumbaugh)*

Although in general «**yes**», in fact «**not only**»!!! □

- systems models may be used in different ways as part of a process for:
 - improving understanding of a situation, including but not limited to an improved communication with your customer;
 - identifying problems or formulating opportunities;
 - supporting decision making;
- *When / for what else?*

Modelling can support all of these – by predicting system behaviour, by predicting the outcome of an intervention or by providing a basis for discussion or dialogue.

What is a model?

“Abstraction of something for the purpose of understanding it before building it”

Blaha & Rumbaugh

- A model is a means, not an end...
- A model has a purpose
 - Different purposes □ different models
 - Level of detail of model depends on its purpose

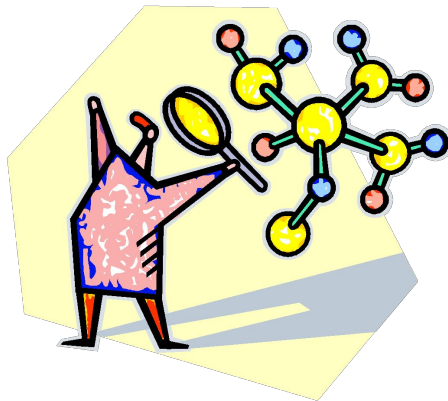
Purposes of modeling

- Testing an idea before building the real artifact
- It is usually cheaper to build a prototype to test the usefulness/feasibility/suitability of a system before building the full-fledged one



Purposes of modeling

- As communication artifacts
 - Architects build mock-ups to show their customers



- To master complexity
 - Phenomena may be dangerous or even inaccessible
 - Scientists use models to describe/discuss about them

Models in Software Engineering

- **Business process models**
 - Ex: Business Process Model and Notation (BPMN)
- **Information flow models**
 - Ex: Structured Analysis and Design Technique (SADT)
- **Software Design models**
 - Exs: Static class diagrams, state and sequence UML diagrams
- **User interaction models**
 - Ex: Use case diagrams
- **Discrete Event Models**
 - Ex: Petri nets, queuing networks
- **Software process maturity models**
 - Ex: CMM or SPICE

Key takeaways

- What a system is?
- What a model is?
- What a system modelling is?
- *What are key points to consider when designing a model?*
- *One or many models?*

To be continued...