



System modeling - Introduction

Anastasija Nikiforova

Institute of Computer Science



系统建模

- 介绍

阿纳斯塔西娅·尼基福罗娃
计算机科学研究所

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**.

客观的

本课程旨在传授建模知识

软件密集型系统的语言。

该课程还将传授使用方法论技能

用于分析、开发、测试和模拟软件的模型

系统，并将学会批判性反思

足够的抽象级别来描述不同的

软件系统的各个方面。

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*

会发生什么？

该课程以 16 个研讨会的形式进行，每个研讨会 4 学时。研讨会包括讲座时间和课堂作业/实践实验室。

讲座 - 现场*

什么时候？周二。 14.15 - 16.00 ， 第 2-16 周

在哪里？纳尔瓦月 18 - 1019

实用实验室 – 在线*

什么时候？做。周二下午 4:15 - 下午 6:00 第 2 周至第 16 周，下午 6.15 点至

晚哪里？在线环境 – Discord

****本周 (6/09) 两组各进行一次实验，时间为 16:15**

* 模式可能会发生变化

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*

讲师或期待谁？

Anastasija Nikiforova (anastasija .nikiforova @ut.ee*) – 协调员、讲师

Ishaya Peni Gambo (ishaya .gambo @ut.ee) - 助教 (实践)
实验室, 组#1)

Chioma Jessica Nkem -Eze (助理, 实用实验室, 第 2 组)

马龙·杜马斯 - 客座讲师

来自业界的专家作为客座讲师*

*如果您通过电子邮件与我联系, 但超过 2 个工作日没有收到我的回复, 请重新发送您的请求, 即, 我收到的所有电子邮件通常会在数小时内得到处理

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)

回到课程.....会怎么样?

每周实践实验和作业 – 40%

学期内提交 3 次“作品集”进行评分（强制）

此外，我们还有机会每周获得反馈和预期成绩（非强制性）

考试 – 作品集和开放式问题（实际实施和文档 + 口试 – 基于作品集和/或预定义开放式问题列表的 1-2 个问题） – 60%

所有组件都是强制性的。所有的截止日期都很严格。

完成学期期间宣布的可选/非强制性作业或由学生选择并经课程协调员同意的作业将有机会获得奖励积分

为了通过课程，学生必须获得至少 51 分（E 级），并从常规练习和项目中获得至少 50%（不少于 21%（满分 40%）家庭作业分数和 30%（满分 60%）来自项目的分数）。

期末考试 20 分或以下的成绩将被视为不及格 (F)。

最终成绩（满分 100 分）将根据作业和期末考试得分的总和计算。

最终成绩将使用标准大学等级映射到 A 和 F 之间的等级。

为了通过课程，学生必须获得至少 51 分（E 级），并从常规练习和项目中获得至少 50%（不少于 21%（满分 40%）家庭作业分数和 30%（满分 60%）来自项目的积分）

LET'S START!

开始吧!

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**.

The Open University

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

什么是系统？

系统是组件的集合，以有组织的方式连接在一起。

组件在系统中的存在会受到影响，如果离开系统，组件也会发生变化。

组件的组装会产生一些作用。

该集会已被某人识别为感兴趣的集会。

开放大学

尝试考虑一下系统。什么？ **WHO?** 为什么？很重要（对象、关系、活力、利益相关者.....）

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

什么是建模?

“使用数学模型 (= 系统或过程的简单描述) 进行计算或预测可能发生的情况的活动:

- ❖ 气候模型表明夏季降雨量将会减少。
- ❖ 计算机模型显示了如何产生热量
爆炸会将颗粒带到 50 英尺或更远的空中”

剑桥词典

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.*

什么是（系统）模型？

定义。1: “为了在构建某物之前理解它而对某物进行抽象

布拉哈和朗博

某人或团体对某种情况的看法的简化表示，旨在帮助以系统的方式处理该情况

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即地图、平面图、建筑师和工程师的图纸、草图、图表和表格——所有这些都是我们在日常生活中使用的模型。

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.

什么是（系统）模型？

定义。I: “为了在构建某物之前理解它而对某物进行抽象
布拉哈和朗博)

虽然总的来说“是”，但事实上“不仅”!!! □

系统模型可以以不同的方式用作以下过程的一部分：

增进对情况的了解，包括但不限于改善与客户的沟通；识别问题或制定机会；支持决策；何时/还有什么目的

?

建模可以支持所有这些——通过预测系统行为、预测干预结果或提供讨论或对话的基础。

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

什么是模型？

“为了在构建某物之前理解它而对其进行抽象”

布拉哈和朗博

更多是手段，而不是目的.....

模型有一个目的

不同的目的 □ 不同型号

模型的详细程度取决于其目的

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



建模的目的

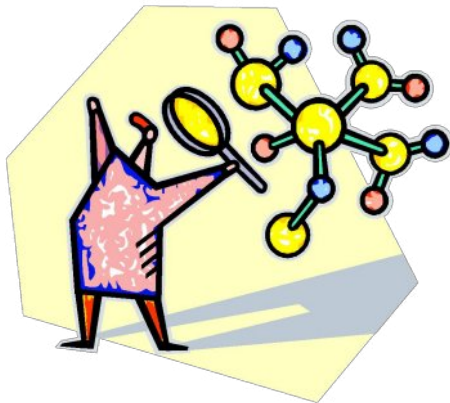
在构建真正的工件之前测试一个想法

在构建成熟的系统之前构建一个原型来测试系统的有用性/
可行性/ 适用性通常会更便宜



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

建模的目的

作为沟通神器

建筑师构建模型向客户展示



掌握复杂性

现象可能是危险的或
甚至无法到达

科学家使用模型来描述/ 讨
论它们

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

软件工程中的模型

业务流程模型

例如：业务流程模型和符号 (BPMN)

信息流模型

例如：结构化分析与设计技术 (SADT)

软件设计模型

Exs：静态类图、状态和序列 UML 图

用户交互模型

例如：用例图

离散事件模型

例如：Petri 网、排队网络

软件过程成熟度模型

例如：CMM 或 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...

要点

什么是系统？

模型是什么？

什么是系统建模？

设计模型时需要考虑哪些关键点？

一种还是多种型号？

待续...