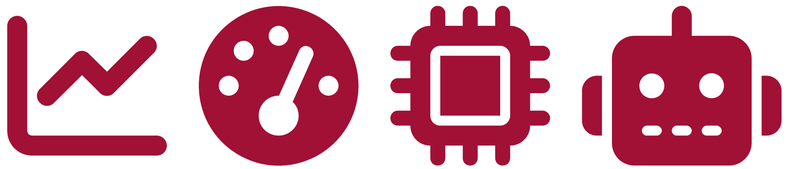
Software Modeling and Verification Chair

RWTH AACHEN UNIVERSITY

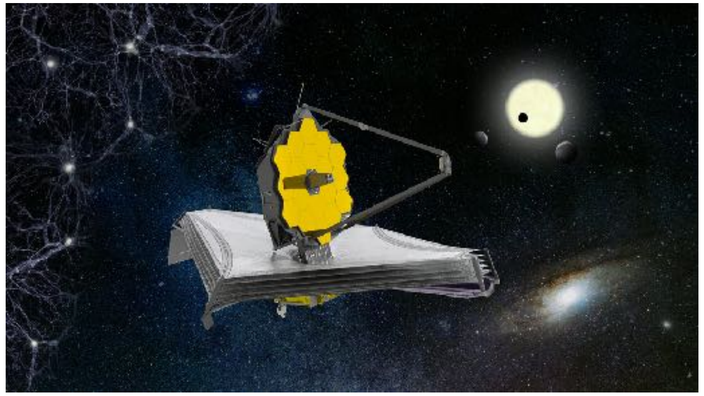
Seminar
Trends in Model Checking

SS25 — Introduction

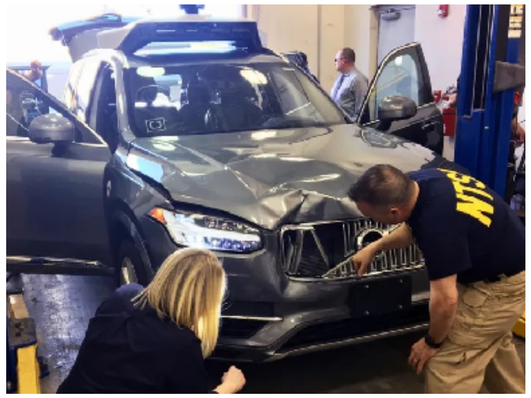


Tim Quatmann

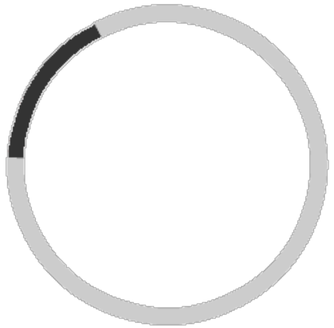
https://moves.rwth-aachen.de/teaching/ss-25/mcseminar/



Software Systems are everywhere!



Software Failures are everywhere!



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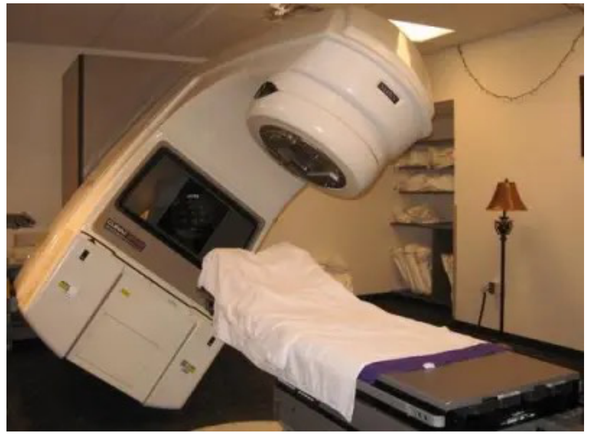
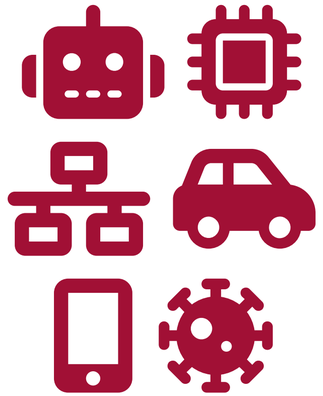


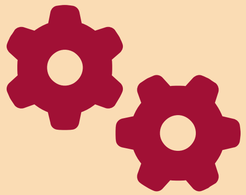
How to prevent such failures?

System Model



System Property

Model Checking

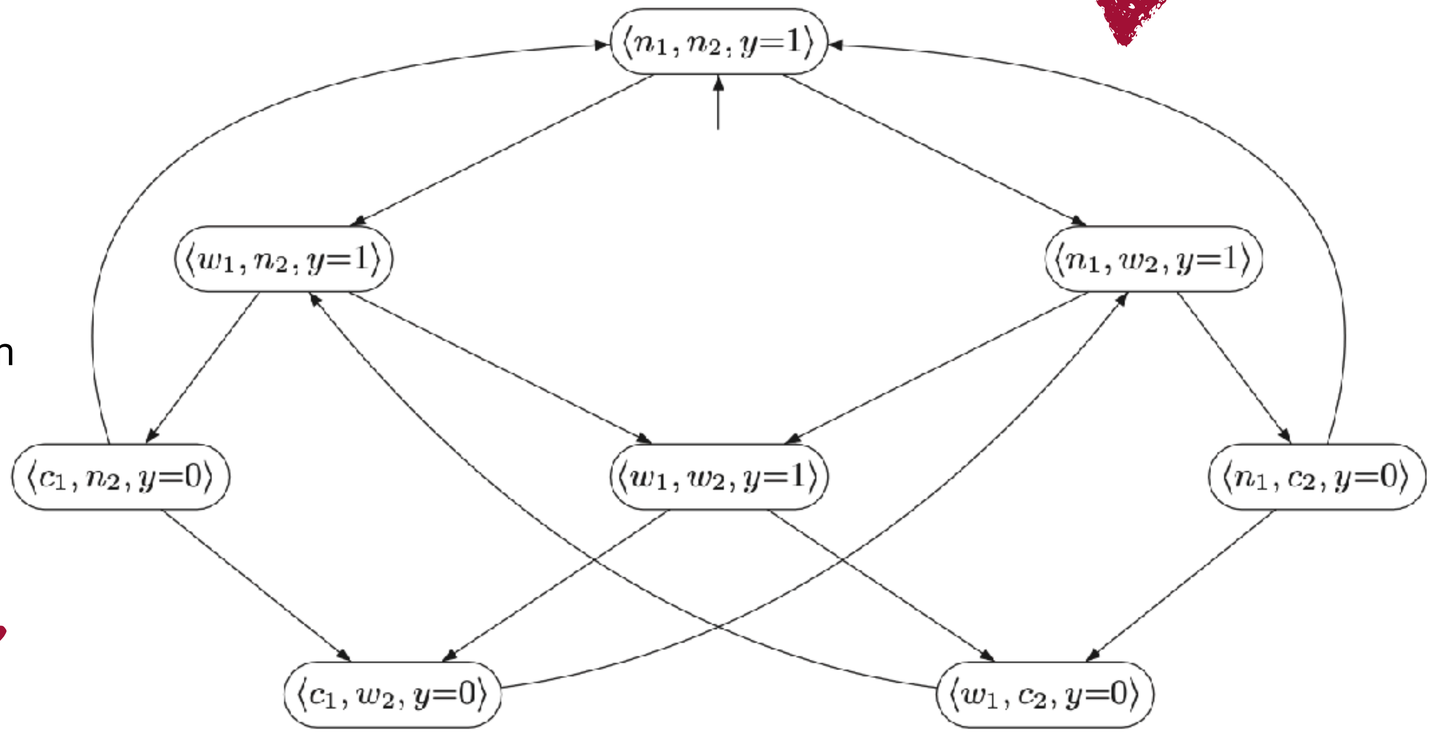


Scalable Algorithms

- Graph Theory,
- Automata Theory,
- Logics,
- ...

Model Checking - Example

- **Model:** Two processes with a shared semaphore y
  - Each process i performs either noncritical actions n_i, waits w_i, or performs critical actions c_i



- **Properties**:
  - $\neg \Diamond (c_1 \wedge c_2)$

"do not each a state in which both processes are in their critical section

  - $\Box \Diamond w_i \implies \Box \Diamond c_i$

"if process i waits infinitely often, it infinitely often enters its critical section"

Objectives of this Seminar

- **Independent understanding** of a scientific research article
- Describe the **problem(s)** considered in the article and the necessary **background**
- Explain relevant **research results** using an **adequate level of detail**
- Acquire, read, and understand **related literature**

Write a **report** and give an oral **presentation** covering the above points

- Assume fellow students as target audience

Requirements on Report

- Independent writing of a report of **12 – 15 pages**
  - Font size: **12pt** with "standard" page layout (LaTeX template on website)
  - Do not stretch the content, e.g., with overly sized figures

- First milestone: detailed **outline** + **one page** of content
  - Provide overview of structure (section headers, main definitions/theorems)
  - Be specific — "*1. Introduction / 2. Main part/ 3. Conclusions*" is not enough!
  - Also write one page of actual content (in a main part of the report)

- **Complete** and **correctly cited** set of references to all consulted literature
  - **Plagiarism**: taking text blocks (from literature or web) without source indication causes **immediate exclusion from this seminar**

- Correct **spelling** and **grammar** is required; use german or english
  - More than 10 errors per page lead to abortion of correction

Requirements on Talk

- **Total duration**: 30 minutes (25 minutes presentation time + 5 minutes for Q&A)
  - Finish in time — Overtime is bad

- Focus your talk on the **audience**, abstract away from details as necessary

- Descriptive slides (LaTeX template on website, can also use other software)
  - ≤ 15 lines of text per slide,
  - use (base) colours in a useful manner
  - number your slides

- Correct spelling! (German or English)

- Prepare for expected questions, e.g., with backup slides

Soft Requirements and Hints

- Get an understanding of the **practical** and **theoretical(!)** aspects of the article
  - **Reminder:** this is a seminar in theoretical computer science

- Find the right **level of detail**
  - Your report and talk should be **self-contained** and **understandable** by people not familiar with the original article
  - Focus on **core ideas**, omit too specific details (e.g., related work or optimisations)
  - Provide more extensive explanations, **examples**

- Discuss contents / ideas / problems with your **supervisor**
  - Contact them on time, prepare the meetings

- **Take your time**
  - Seminar yields 4 credit points
  - Officially, this translates to around 4 * 30 = 120 hours of work
  - Do not expect to write the report / prepare the talk in a single day ...

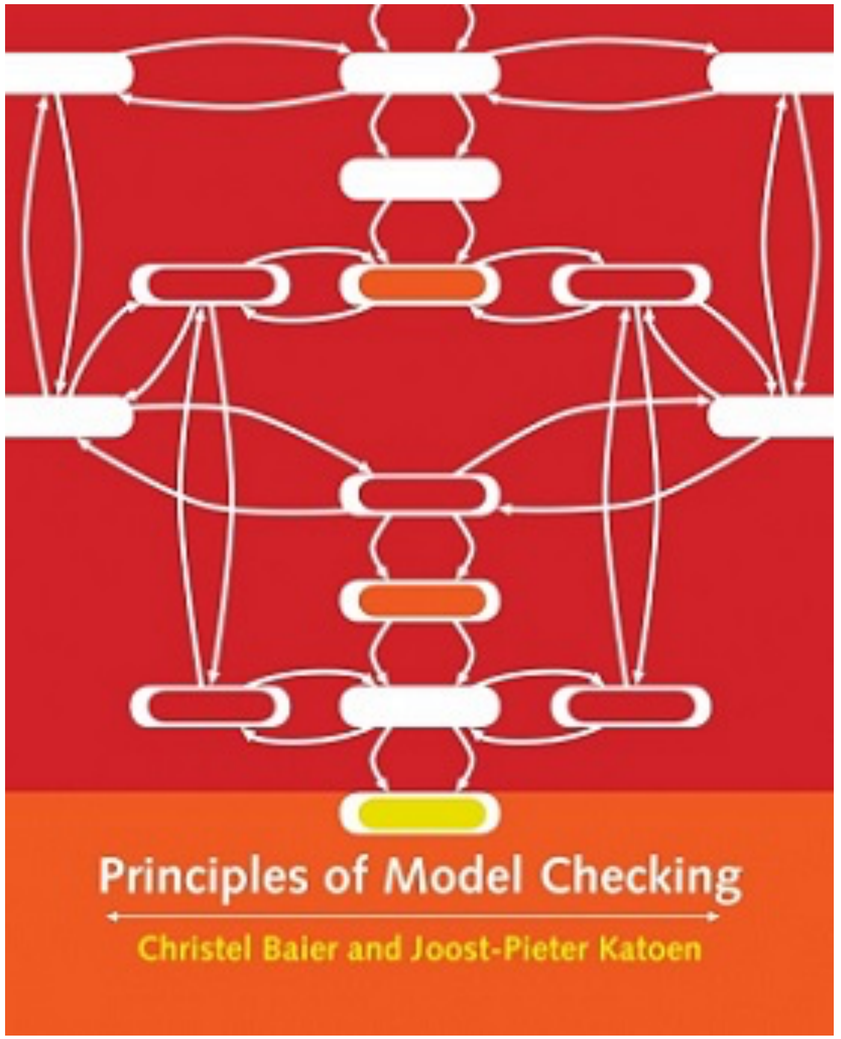
Literature

- See references in research article

- For general background:

  - Baier & Katoen:
    Principles of Model Checking

  - Lectures (approach us for Moodle access):
    - Model Checking
    - Modeling and Verification of Prob. Systems



Important Dates

11.04.2025, 10:30: Topic preferences due (**Friday**); see last slide

05.05.2025: Detailed outline and one page of content due

02.06.2025: Full report due

30.06.2025: Presentation slides due

07.07. to 10.07.2025: Seminar talks (precise date will be announced soon)

Withdrawal

- You have **one week (!)** to refrain from participating in this seminar

- Later cancellation (by you or by us) causes a not passed for this seminar and reduces your (three) tries by one.

Missing a deadline causes immediate exclusion from the seminar
Please notify us if you decide to quit

Topics

Selecting your Topic

- **Enter the poll** in the link you received via email
  - https://terminplaner4.dfn.de/.....
  - Do this until **Friday 11.04.2025, 10:30**

- We do our best to find a *good* topic-student assignment
  - It helps when you indicate multiple topics

- Topic assignment will be announced on **Friday**

We wish you success and look forward to an enjoyable and high-quality seminar!