RHEINISCH-
WESTFÄLISCHE
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CHAIR OF
COMPUTER SCIENCE 2
SOFTWARE MODELING
AND VERIFICATION
(MOVES)

- BSc/MSc Thesis -

Model Checking Continuous-Time Markov Chains

What is quantitative model checking all about?

In times of ever more complex system designs, it becomes increasingly diffcult and often even impossible to manually analyze systems. Yet, for certain systems, e.g. safety-critical ones or ones for which the repair of previously undetected errors may be very cost-intensive, it is crucial to determine whether they behave correctly with respect to the requirements that they are intended to fulfill. Model checking is a fully automated technique to verify properties on a model of the system in a mathematically rigorous way.

Most often real-world models tend to involve stochastic behavior. For example, hardware components inside the system may fail with a given probability or it might be of crucial interest that the system satisfies certain timing constraints. Quantitative model checking extends convential model checking in a way that enables formal analysis of models involving quantitative aspects.

What is to be done?

Continuous-Time Markov Chains (CTMC) are models that capture probabilistic behaviour and timed-behaviour at the same time. For example, it is possible to verify properties like "the probability that the system goes down within a certain time is below 0.001" or "it is very likely that a message can be send over a lossy channel in less than 3 seconds". In order verify these properties on a given model, numerical techniques have to employed. In this thesis, we like you to

1. implement model checking for CTMCs in our model checker,

2. survey recent literature and implement promising additions/performance enhancements for model checking CTMCs,

3. show that your implementation is on par with state-of-the-art solvers for these models.

Optimally, you should...

- be motivated to outperform other tools,
- have some programming experience,
- have basic knowledge in automata theory,
- be capable of working independently.

All other knowledge/skills can be obtained on-the-fly.

We offer...

- a task that requires you to understand the theoretical background of model checking complex models as well as turn your knowledge into an implementation that performes well in practice,
- work at the interface of theory and application,
- a nice coffee machine.

Contact

Christian Dehnert, dehnert@cs.rwth-aachen.de, Tel. 0241/80-21203.