

- Diploma / Master Thesis -

Compositional Abstraction

pushing theory towards practice

What is it all about?

In recent years, verification techniques like [model checking](#) have received quite some attention. Still, when it comes to the verification of more complex systems embracing [stochastic](#) and [nondeterministic](#) behavior on the one hand and consisting of several [interacting components](#) on the other hand, techniques currently available are often not feasible. The main reason for this is the infamous [state space explosion problem](#) for which [abstraction](#) is considered to be an important countermeasure.

For example, when composing three independent workers, modelled as [interactive Markov chain \(IMC\)](#) in Figure 1, the resulting monolithic model consists of 512 states. Replacing the three instances of the concrete model by the abstract one shown in Figure 2 yields a reduction of almost 58%. By exploiting the [symmetries](#), further reductions can be achieved; in this example, the resulting abstract model has about 89% less states than the original one.

While for this simple example, abstraction seems to work nicely, for other models the results are unsatisfactory. The [goal of this thesis](#) is to investigate different models and to improve the available compositional abstraction technique in order to get better results.

What is to be done?

1. Investigate a recently developed [compositional abstraction](#) technique for [interactive Markov chains \(IMCs, see Figure 1\)](#) with respect to its practical use.
2. Most likely, substantial [extensions](#) of the abstraction framework have to be developed (in a formally rigorous manner).
3. A prototypical [implementation](#) of the extensions should show the practical use of the developed extensions.

Requirements

- An active interest in theoretical aspects of computer science is mandatory.
- Basic knowledge in modelling concurrent and probabilistic systems and on model checking are helpful.

Contact

For additional information, please contact us:

- Joost-Pieter Katoen, katoen@cs.rwth-aachen.de
- Daniel Klink, klink@cs.rwth-aachen.de

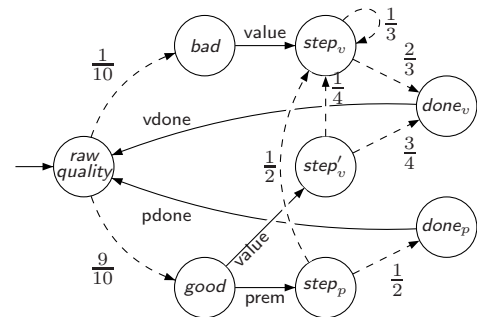


Figure 1: An IMC model of a single worker, producing premium and value items.

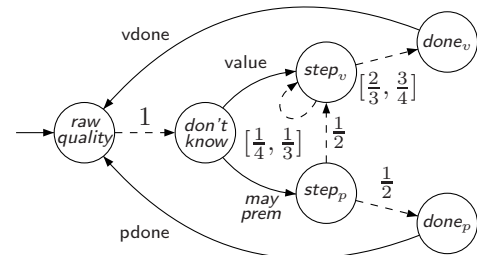


Figure 2: An abstraction of the worker model shown in Figure 1.