

# Performance Analysis by Model Checking

Joost-Pieter Katoen  
RWTH Aachen, Germany

Continuous-time Markov chains (CTMCs) are omnipresent. First and foremost, they are at the heart of classical performance analysis. They provide a natural semantics of queueing networks, stochastic Petri nets, stochastic process algebras, and systems biology. My lectures will focus on the analysis of CTMCs using model checking. We consider the foundations for reachability, timed reachability, as well as timed automata objectives. Practical examples show its applicability. Abstraction techniques will be introduced enabling the verification of huge Markov chains.

## References

- [1] Ch. Baier, B.R. Haverkort, H. Hermanns, J.-P. Katoen. *Performance Evaluation and Model Checking join Forces*. Communication of the ACM. Vol. 53(9), pp. 76-85; 2010.
- [2] Ch. Baier, J.-P. Katoen. *Principles of Model Checking*. MIT Press, chapter 10; 2008.
- [3] T. Chen, T. Han, J.-P. Katoen, A. Mereacre. *Model Checking of Continuous-Time Markov Chains Against Timed Automata Specifications*. Logical Methods in Computer Science, Vol: 7(1); 2011.
- [4] Ch. Baier, B. R. Haverkort, H. Hermanns, J.-P. Katoen. *Model-Checking Algorithms for Continuous-Time Markov Chains*. IEEE Transactions on Software Engineering, Vol: 29(6), pp. 524-541; 2003.
- [5] D. Klink, A. Remke, B. R. Haverkort, J.-P. Katoen. *Time-bounded Reachability in Tree-structured QBDs by Abstraction*. Performance Evaluation, Vol. 68(2), pp.105-125; 2011.