Finite-Trace Analysis of Stochastic Systems with Silent Transitions

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Teaching and Research Area of Business Process Management Foundations and Engineering

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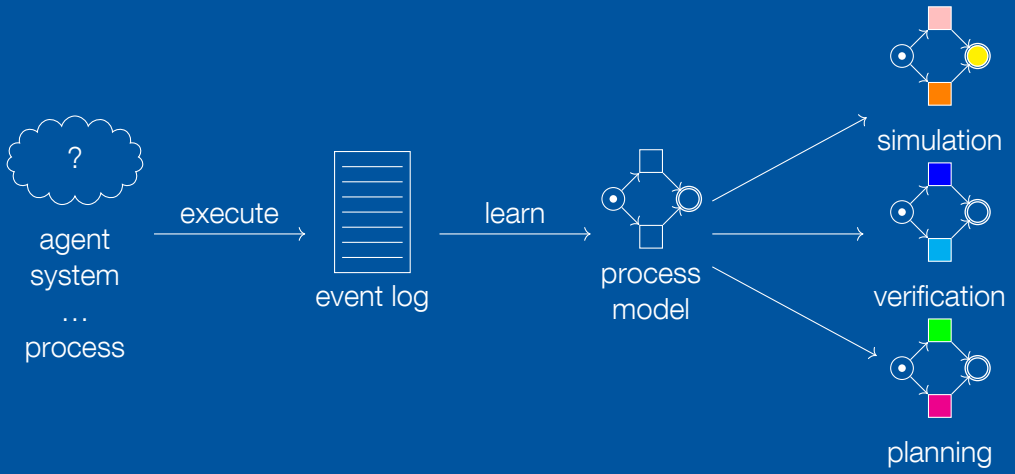
Systems

system

Process Mining

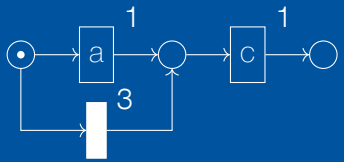


Event logs

$$L_1 = [\langle \text{register}, \text{check}, \text{accept} \rangle^{10000}, \langle \text{register}, \text{check}, \text{reject} \rangle^{10000}, \langle \text{register}, \text{accept} \rangle^{1}, \langle \text{accept}, \text{register} \rangle^{1}]$$

$$L_2 = [\langle \text{register}, \text{check}, \text{accept} \rangle^{9500}, \langle \text{register}, \text{check}, \text{reject} \rangle^{9500} \langle \text{register}, \text{accept} \rangle^{1002}]$$

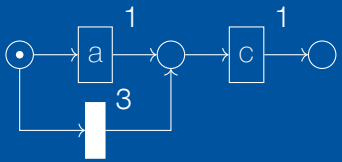
Stochastic Petri nets

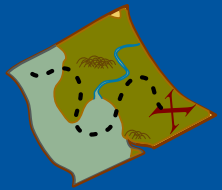


Stochastic language:

$$[\langle a, c\rangle^{0.25}$$
$$\langle c\rangle^{0.75}]$$

The probability problem

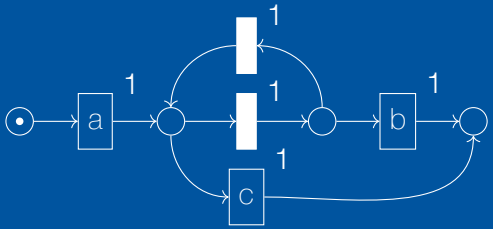




Specification
LTLf
…

When the Petri net produces a trace, what is the probability that this trace adheres to the specification?

An example

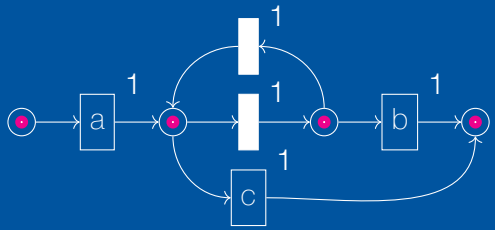


$\langle a, b \rangle$

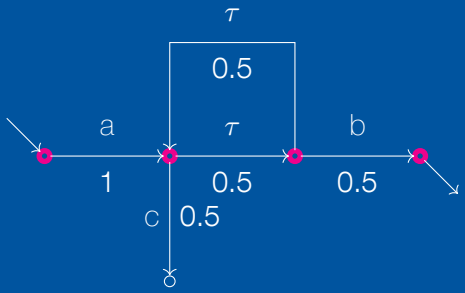
Sum of all paths satisfying the specification.

There are infinitely many such paths…

Solving the probability problem



- Stochastic product automaton



- What is the probability that we end up in the target state?

Standard Markov chain analysis ($\frac{1}{3}$)

You have been watching…

- Process mining
- Stochastic Petri nets
- The probability problem

Future work

- Stochastic model checkers
- Exact answers

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