A Concurrency-Preserving Translation from Time Petri Nets to Networks of Timed Automata

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Abstract

Real-time distributed systems may be modeled in different formalisms such as time Petri nets (TPN) and networks of timed automata (NTA). We present a paper, selected at TIME'10 [1], where we focus on translating a 1-bounded TPN into an NTA and we consider an equivalence which takes the distribution of actions into account. This translation is extensible to bounded TPNs. First S-invariants are used to decompose the net into components that give the structure of the automata, then clocks are added to provide the timing information. Although we have to use an extended syntax in the timed automata, this is a novel approach since the other transformations and comparisons of these models did not consider the preservation of concurrency.

This work is a starting point for a more advanced study of concurrency in timed systems. Indeed, concurrency in timed systems involves both causality and the time stamping of events. Transitions that appear as concurrent in an untimed model may not remain independent when time constraints are added. First, time constraints may easily force a temporal ordering between them. But, even worse, the occurrence of a transition may have consequences on apparently concurrent transitions due to time constraints. In our translation, the necessity to allow the automata to read the states of their neighbors highlights these complex dependences between different processes.

References

1. S. Balaguer, Th. Chatain, and S. Haar, "A concurrency-preserving translation from time Petri nets to networks of timed automata," in *Proceedings of the 17th International Symposium on Temporal Representation and Reasoning (TIME'10)*, N. Markey and J. Wijsen, Eds. Paris, France: IEEE Computer Society Press, Sep. 2010, pp. 77–84. [Online]. Available: http://www.lsv.ens-cachan.fr/Publis/PAPERS/PDF/BCH-time10.pdf