Distributed timed automata

N. Sabadini and R.F.C. Walters

Dipartimento di Scienze CC. FF. MM., Università degli Studi dell'Insubria, Como,
Italy

Abstract. In the context of the span model [3,4] we define a notion of
automaton in which actions have duration. We define a compositional al-
gebra of such automata. Comparison is made with the non-compositional
theories of timed automata of Alur, Dill [1] and of Lanotte, Maggiolo-
Schettini, Peron [2].

There are a variety of models of automata in which a notion of time is
added, notably that of Alur and Dill in which state-transitions are annotated
with timing constraints using finitely many realvalued clocks. The model is not
distributed or compositional; actions are instantaneous. A model based on Alur
and Dill but introducing communicating components is described in [2]. This
model is again non-compositional. The aim of this paper is to describe an exten-
sion of the Span(Graph) model in which actions have duration. These automata
form a compositional algebra. Expressions in the algebra describe systems of
communicating automata in which actions have duration, and protocols of syn-
chronization between components may be specified. Model checking of timing
constraints may be carried out in such systems.

Mathematically the algebra is a mild extra structure added to the category
Span(Graph). Light is thrown on the meaning of asynchrony in the Span(Graph)
model.

References

[1] R. Alur, D.L. Dill. A Theory of Timed Automata. in: Theoretical Computer Science
Vol. 126, No. 2, (1994) 183-236.
[2] R. Lanotte, A. Maggiolo-Schettini, A. Peron, Timed Communicating Automata,
Fundamenta Informaticae, 43 (2000) 153-173.
[3] P. Katis, N. Sabadini, and R.F.C. Walters, Span(Graph): A categorical algebra of
transition systems, Proceedings Algebraic Methodology and Software Technology,
Lecture Notes in Computer Science, Springer Verlag, **1349** (1997), 307–321.
[4] P. Katis, N. Sabadini, and R.F.C. Walters, On the algebra of systems with feedback
and boundary, Rendiconti del Circolo Matematico di Palermo Serie II, Suppl. **63**
(2000), 123–156.