

Preservation of timed properties during an incremental development by components

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Abstract. We are interested in the preservation of local properties of timed components during their integration in a timed system. Timed components are modeled as timed automata or timed automata with deadlines. Properties considered are all safety and liveness properties which can be expressed with the timed linear logic MITL (Metric Interval Linear Logic), as well as non-zenoness and deadlock-freedom. Integration of components is a kind of incremental development which consists in checking locally the properties of the components, before integrating them in the complete system, using some composition operator. Of course, established properties have to be preserved by this integration. Checking preservation can be achieved by means of the verification of timed τ -simulation relations. Composability, compatibility and compositionality of these relations w.r.t. composition operators are properties which allow to reduce the cost of this verification. We examine these properties when integration is achieved with two different timed composition operators: the classic operator usually taken for timed systems and which uses a CSP-like composition paradigm, and a non-blocking operator closer to the CCS paradigm.

Key-words. τ -simulations, component-based timed systems, integration of components, preservation of timed linear properties.

1 Introduction

Incremental development methods are a way to cope with the state space explosion problem of model-checking, which is increased in the case of timed systems due to the presence of timing constraints. In particular, for component-based systems, a way to develop incrementally is to use integration of components. This method is indicated for the verification of local properties of the components. It consists in checking the properties in isolation on the component before integrating it in its environment, with some parallel composition operator. Model-checking is there still applicable since the size of the components is generally small enough. Of course, this method is valid only if established properties of the component still hold after integration.