Sujet de recherche

Titre

Implementation of Rendezvous in Real-Time Distributed Systems

Encadrant

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Description du sujet

Formal models for real-time systems, like timed automata [AD94] and time Petri nets [MF76], have been extensively studied and have proved their interest for the verification of real-time systems. On the other hand, the question of using these models as specifications for designing real-time systems raises some difficulties. One of those is to detect models that allow non-realistic behaviors like Zeno executions. Robustness issues were studied for instance in [BLM +11, BMR06].

Here we focus on the problem of implementation on distributed architectures. Consider for instance the formalism of networks of timed automata: it naturally extends timed automata to a distributed setting where each automaton models a sequential component, and the communications are described as synchronizations on common actions, also called rendezvous. But actually implementing rendezvous on a distributed architecture is a nontrivial problem even without real-time constraints, since in general the components that initiate a rendezvous cannot be sure that the other participants are ready to synchronize. [Bag87, SCV91, PS96] propose algorithms to solve this problem. By formal verification, Evrard and Lang [EL13] found a deadlock in Parrow’s protocol [PS96].

But adapting these algorithms to a real-time setting does not seem obvious since communications required to establish the rendezvous take some time and could delay the desired synchronization, which may completely change the behaviour of the system.

In a discrete time setting, the problem of distributed implementation of high-level component-based models was addressed for instance in [BBQ11] and [PBdSST09]. To our knowledge the implementation of distributed models with dense time is still an open problem and we expect that the techniques to deal with dense time will be very different from those used in discrete time, as it is usually the case with this kind of formal models.
The subject of this work is to design algorithms to implement formal models of (dense) real-time distributed systems on distributed architectures. By implementation we do not necessarily mean actual implementation to hardware, but rather transformation to lower-level real-time models that do not use the high-level rendezvous mechanism.

Références


