

Proposition de stage de Master (M2)

Where: Laboratoire Spécification et Vérification
École Normale Supérieure de Cachan
61, avenue du Président Wilson
94235 Cachan CEDEX
<http://www.lsv.ens-cachan.fr>

Title: Synthesis of Distributed Real-Time Systems

Description:

Timed automata are a well-studied formalism to describe reactive systems that come with timing constraints. When modeling *distributed* real-time systems where several components communicate with one another, one usually assumes that the time of any local component evolves according to a global clock that it shares with all other components. A local clock, however, often depends on several external factors such as temperature and workload so that it might evolve differently from other local clocks. Recently, a model of distributed real-time systems has been proposed, which takes into account that local clocks may run at different speed [1].

As the precise evolution of local clock rates is often too complex or even unknown, the model comes with several semantics. The *existential semantics* exhibits all those behaviors that are possible under *some* time evolution. The *universal semantics* captures only those behaviors that are possible under *all* time evolutions. While emptiness and universality of the universal semantics are in general undecidable, the existential semantics is always regular and offers a way to check a given system against safety properties. A decidable underapproximation of the universal semantics, called *reactive semantics*, is introduced to check a system for liveness properties.

During the internship, the *synthesis problem* should be studied: For which (global) specifications \mathcal{S} , say, given as a regular word language, can we generate a distributed timed system \mathcal{A} (over some given system architecture) such that the reactive semantics of \mathcal{A} equals $L(\mathcal{S})$? In this context, it will be favorable to have partial-order based specification languages and a partial-order semantics for distributed timed systems.

Contact:

Benedikt BOLLIG, Paul GASTIN et Marc ZEITOUN
Tél: 01 47 40 - 75 38/75 60/77 87
Email: [\(bollig|gastin|mz\)@lsv.ens-cachan.fr](mailto:(bollig|gastin|mz)@lsv.ens-cachan.fr)
Web: [http://www.lsv.ens-cachan.fr/~\(bollig|gastin|zeitoun\)](http://www.lsv.ens-cachan.fr/~(bollig|gastin|zeitoun))

References

- [1] S. Akshay, Benedikt Bollig, Paul Gastin, Madhavan Mukund, and K. Narayan Kumar. Distributed timed automata with independently evolving clocks. In *Proceedings of the 19th International Conference on Concurrency Theory (CONCUR'08)*, volume 5201 of *Lecture Notes in Computer Science*, pages 82–97, 2008. Springer.