Real-time Model Checking
— Open problems —

Patricia BOUYER-DECITRE, Kim G. LARSEN, Nicolas MARKEY

March 3, 2010
Algorithms and datastructures

- **Fully symbolic exploration** of timed automata:
  - BDD-like representation of transitions;
  - Clock Difference Diagrams, but no canonical form...

- **Zone-based implementations** for the verification of priced-timed automata:
  - optimal infinite runs;
  - multi-priced timed automata;
  - energy timed automata and games...

- **Algorithms and implementations** for model-checking linear-time properties.

- **Partial-order reductions** for timed automata.

- **Bounded model-checking** for timed automata using SAT solvers.
Timed games

- **Non-zero-sum games:**
  - multi-player timed games;
  - instead of computing winning strategies, we look for equilibria.

- **Partial observability:**
  - minimal set of observations needed to ensure controllability
  - CEGAR approach to incomplete information.

- **Probabilistic timed games:**

**Weighted timed automata and games**

- Priced timed games with two clocks
- Optimal infinite runs with safety
- Timed automata with exponential observers and even richer dynamics
- Energy timed games with several clocks.
Implementability issues

- Timed automata are not implementable!
  - computers are digital;
  - communications are not instantaneous;
  - different clocks have (slightly) different rates.

- Modified semantics
  - tube semantics
  - probabilistic semantics
  - guard enlargement (robustness)

- Zone-based algorithms for robustness checking

- Robust model-checking of weighted timed automata.

- Robust control:
  - synthesis of implementable controllers.