

Runtime Monitoring of Timed Software Systems

Proposal for Semester / Diploma / Master's Thesis
at the IBM Zurich Research Lab and at the ETH

1 Project Description

Runtime monitoring of software systems is concerned with the following idea: Given a correctness property ϕ , usually expressed in a propositional linear temporal logic such as LTL, a runtime monitor is generated that recognizes all state traces violating ϕ . The system to be monitored as well as the generated monitor are then executed in parallel. State changes are communicated to the monitor as events such that the behavior of the system can be observed and constrained.

Our focus lies on timed software systems and first-order logic. We thus specify desirable system properties using a subset of Metric First-Order Temporal Logic (MFOTL), a highly-expressive language to describe static and dynamic system properties. In spite of this expressivity, the runtime monitoring problem for MFOTL is decidable [1]. This makes runtime monitoring applicable to many interesting areas such as regulatory compliance, usage control, business activity monitoring, automated stock trading, or the checking of dynamic integrity constraints for temporal databases. With these exciting applications in mind, we are looking for an motivated student interested to implement, improve, and validate existing MFOTL runtime monitoring approaches. The main tasks include but are not necessarily limited to:

1. Implementation of the monitoring algorithm given in [1]. This should be done either based on standard technology such as Java and DB2 or, alternatively, based on a functional programming language.
2. Experimental validation of complexity results by investigating the performance of the decision algorithm for typical formula classes.
3. Improvement of the algorithm and contribution to open theory problems (optional).
4. Documentation of results.

2 Requirements

The optimal candidate for this topic has a well-balanced interest in both systems and theory. In particular, we expect:

- Advanced practical programming skills.
- Knowledge of and interest in first-order logic.

3 Our Offer

The student selected for this project will work with a small team of researchers at the IBM Zurich Research Laboratory and at ETH. He or she will have the opportunity to contribute to open research problems, learn more about IBM products and tools, and work in a friendly, multi-cultural atmosphere.

4 Contact

Please direct your questions or your electronic application to:

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References

- [1] D. Basin, F. Klaedtke, S. Müller, and B. Pfitzmann. Runtime monitoring of metric first-order temporal logic properties. Technical Report RZ 3702, IBM Research and ETH Zurich, February 2008.