

Praxis der Forschung – Master/Bachelor Thesis

Relational Debugging for Scalable Algorithms

Background. In contrast to functional properties, relational properties are universally quantified over multiple program runs. This allows the specification of complex properties. For example:

- the absence of information flow from confidential input to public output,
- the equivalence of two programs under the same input, or
- the numerical stability in scalable algorithms with floating points.

If a relational property is violated, the developer needs investigation tools to find the reason. For functional properties, the tools of choice are debuggers, that allow a coarse or fine-grained stepping through a program run and inspection of the internal variable assignments. For relational properties, the developer needs to be able to step through multiple program runs simultaneously.

Goal. The goal of this thesis is to develop a full-featured debugger for relational properties applicable for *real* programming languages and *real-sized* software! We need to develop and deploy several features to handle the increased complexity of simultaneously debugging, like relational synchronization points, relational invariants, or user annotations.

Task. Your task is to develop a relational debugger.
This includes concepts of

- embedding of user annotation and specification,
- integration of (semi-)formal methods to aid the user,
- visualization and user interaction.

This thesis should result into a working prototype.

Your Profile. Programming skills in Java are required. Furthermore, you should be interested in programming languages and Model Checking. You should have completed the Formal Methods (Formale Systeme) Course at KIT or equivalent.

Kontakt

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