Offer #2025-09211

PhD Position F/M Foundational Verification of Interactively Optimized Programs

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Fonction : PhD Position

Level of experience : Recently graduated

Context

Part of ANR-OptiTrust project.

Assignment

Producing formally verified code is a challenging, time-consuming task. Producing highly optimized code is another challenging, time-consuming task. The OptiTrust project aims at developing code that features both high performance and formal verification.

The OptiTrust approach is based on interactive compilation, whereby the programmer explicitly indicates what optimizations to apply and where to apply them in the code. The key idea is to preserve formal invariants throughout a sequence of source-to-source transformations.

The aim of the PhD is to provide foundational guarantees to the approach.

Main activities

Concretely, we aim to ultimately produce Rocq proofs of correctness for the code optimized using OptiTrust. We will investigate the following aspects.

1. Extend OptiTrust to make its internal language support high-level code, including non-executable specifications.

2. Formalize in Rocq the semantics of this extended internal language.

3. Develop an extraction from typed OptiTrust programs into proof terms in a standard separation logic, shallowly embedded in Rocq.

4. Develop a formally verified translation from OptiTrust's langage into the input language of a formally verified compiler such as CakeML.

Skills

Concretely, the candidate will contribute to the design of the framework, its implementation in OCaml, to the development of the case studies, but also to the writing and presentation of research papers on the work produced.

The candidate must have a strong experience in a functional language, ideally OCaml.
experience in programming and basic notions of program optimization.
In addition, the candidate must have a Master in computer sciences, focused covering topics of the semantics and typechecking of programming languages, and have good english skills.

Benefits package

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Remuneration

2200 € brut/mois

General Information

- **Theme/Domain :** Architecture, Languages and Compilation
  Software engineering (BAP E)
- **Town/city :** Villers lès Nancy
- **Inria Center :** Centre Inria de l'Université de Lorraine
- **Starting date :** 2025-10-01
- **Duration of contract :** 3 years
- **Deadline to apply :** 2025-08-23

Contacts

- **Inria Team :** CAMUS
- **PhD Supervisor :**
  Charguéraud Arthur / Arthur.Chargueraud@inria.fr

About Inria

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Instruction to apply

Defence Security :
This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST).Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

Recruitment Policy :
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