



Offer #2024-07718

PhD Position F/M First Class Optimisations: Code Transformations as Libraries with Partial Evaluation and Analytic Macros

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Fonction : PhD Position

About the research centre or Inria department

The Inria research centre in Lyon is the 9th Inria research centre, formally created in January 2022. It brings together approximately 300 people in 16 research teams and research support services.

Its staff are distributed at this stage on 2 campuses: in Villeurbanne La Doua (Centre / INSA Lyon / UCBL) on the one hand, and Lyon Gerland (ENS de Lyon) on the other.

The Lyon centre is active in the fields of software, distributed and high-performance computing, embedded systems, quantum computing and privacy in the digital world, but also in digital health and computational biology.

Context

The PhD will take place in the CASH team, in LIP, Lyon, France. It will be supervised by Gabriel Radanne, Inria researcher, specialist in compilation of high level languages. It will be made in collaboration with Richard Membarth, Professor at DFKI-Saarbrücken, Germany.

Main activities

Abstract

Domain-Specific Languages (DSL) are instrumental in exploring new complex use cases through novel programming techniques. DSLs have been at a forefront of recent computer science innovations, from blockchains (contract languages) to quantum computing (Quipper, Q#, \dots), including machine learning (TensorFlow, ...). For High Performance Computing (HPC). Unfortunately, designing such custom optimisations is a difficult task. It requires extending an existing compiler, or even more difficult: creating a new language from scratch.

Some languages, such as AnyDSL (<https://anydsl.github.io/>), make defining "Domain Specific Libraries" easier, by leveraging partial evaluation. While this provides a convenient user interface, writing complex code transformations in such a context is still difficult.

This project aims to propose *first class optimisations*, which allow to define optimisations and program transformations as first class objects of the language, similarly to function. Such first class optimisations can be defined by the user for a specific purpose, composed with other transformations, and then packaged as libraries and distributed to other users of the language.

Full topic:

<https://www.ens-lyon.fr/LIP/CASH/wp-content/uploads/2024/05/these-DSL-opti.pdf>

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 (90 days / year) 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
- Complementary health insurance under conditions

Remuneration

1st and 2nd year: 2 100 euros gross salary /month

3rd year: 2 190 euros gross salary / month

General Information

- **Theme/Domain** : Architecture, Languages and Compilation Software engineering (BAP E)
- **Town/city** : Lyon
- **Inria Center** : [Centre Inria de Lyon](#)
- **Starting date** : 2024-09-01
- **Duration of contract** : 3 years
- **Deadline to apply** : 2024-10-23

Contacts

- **Inria Team** : [CASH](#)
- **PhD Supervisor** :
Radanne Gabriel / gabriel.radanne@inria.fr

About Inria

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

The keys to success

The candidate should ideally be familiar with formal approaches in programming languages and compilation. The candidate should also ideally have a taste for creating high performance programs. From the practical point of view, a basic experience in software programming and usage of collaborative tools such that git. Knowledge of C++ would be preferable.

Warning : you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

Instruction to apply

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Processing of applications sent by other channels is not guaranteed.

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 :

As part of its diversity policy, all Inria positions are accessible to people with disabilities.