Inria

Offer #2024-07730

PhD Position F/M Formal Modelling and Automated Analysis of Resource Provisioning Languages

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Fonction : PhD Position

Level of experience : Recently graduated

About the research centre or Inria department

The Centre Inria de l'Université de Grenoble groups together almost 600 people in 22 research teams and 7 research support departments.

Staff is present on three campuses in Grenoble, in close collaboration with other research and higher education institutions (Université Grenoble Alpes, CNRS, CEA, INRAE, …), but also with key economic players in the area.

The Centre Inria de l'Université Grenoble Alpes is active in the fields of high-performance computing, verification and embedded systems, modeling of the environment at multiple levels, and data science and artificial intelligence. The center is a top-level scientific institute with an extensive network of international collaborations in Europe and the rest of the world.

Context

This PhD thesis is part of a collaboration between two Inria teams (Convecs in Grenoble and Spirals in Lille).
The main location of the PhD thesis will be Grenoble (Inria Grenoble is located at Montbonnot Saint Martin).

The project is funded by the Research National Agency (ANR) in the context of the PEPR Cloud project.

Assignment

Resource provisioning languages (such as TOSCA) allow one to model resource properties and dependencies for distributed applications (for instance components interacting via a network and hosting software), but also to automate provisioning, deployment and instantiation of these resources. The resource provisioning languages provide support to the Infrastructure as Code (IaC) approach, which is widely present in the industry. These languages can also be considered as architecture description languages (ADL). The IaC approach is particularly popular and used in cloud computing in order to avoid manual tasks and thus automate as much as possible the deployment and update of applications based on services available in the cloud.

Main activities

The first objective of this PhD Thesis is to extend and improve resource provisioning languages in terms of expressiveness while providing a formal semantics to them. The plan is to study existing resource provisioning languages (including TOSCA), in order to evaluate them in terms of expressiveness and precisely identify the application lifecycles allowed by these languages. This study could lead to the definition of a new Domain Specific Language expressive enough to represent complex orchestration operators and model specific lifecycles. This new language will be equipped with a formal semantics so as to avoid ambiguity and simplify its further analysis.

The second objective of this PhD Thesis is to develop automated analysis techniques to verify behavioural and quantitative properties that must respect the applications deployed using the aforementioned languages. Several functional properties have already been identified for resource provisioning languages. To analyze these properties, a possible solution is to rely on model checking techniques. The verification of quantitative properties is also planned, particularly deployment times and costs but also the detection of undesired delays that could be avoided during the deployment or reconfiguration of a cloud application.

All the contributions made during this PhD Thesis will be validated via prototype tools and applied on realistic case studies.

Skills

Required skills and profile:

- Knowledge of cloud computing and information/data models is welcome
- Knowledge of formal methods (concurrency theory) and verification is a plus
- Candidates who enjoy programming would be appreciated, as the work will include software development
- Education: MSc/Master 2 Recherche in Computer Science
- Good command of English as the working language, French is a plus

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 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

- 1st year: 2082 euros gross salary
- 2nd & 3rd years: 2191 euros gross salary

General Information

- **Theme/Domain** : Distributed Systems and middleware
  Information system (BAP E)
- **Town/city** : Montbonnot
- **Inria Center** : Centre Inria de l'Université Grenoble Alpes
- **Starting date** : 2024-10-01
- **Duration of contract** : 3 years
- **Deadline to apply** : 2024-06-30

Contacts

- **Inria Team** : CONVECS
- **PhD Supervisor** :
  Salaün Gwen / gwen.salaun@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

- Proven communication and interpersonal relationship skills, attention to detail, methodical approach, autonomy, team player

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