

PostDoc Position 2

Application model expressiveness and placement computing complexity for Fog/Edge infrastructures

About Inria

Inria, the French national institute for research in computer science and control, is dedicated to fundamental and applied research in information and communication science and technology (ICST). Inria has a workforce of 3,800 people working throughout its eight research centers established in seven regions of France.

The Postdoctoral researcher will be integrated into the Avalon research team localized in Lyon (LIP, ENS Lyon), and the Corse research team localized in Grenoble. He/She will be co-supervised by Christian Perez (Avalon) and Frédéric Desprez (Corse).

Mission and activities

This postdoctoral position aims at making progress at the interface of two research directions being done within the Discovery initiative, i.e. component model for describing, deploying, and reconfiguring applications on Fog/Edge Computing infrastructure and algorithms to compute an actual placement or reconfiguration. A first objective is to study the relationships between the features of the component models (and thus their expressiveness) and the complexity of computing a placement (in particular based on existing solutions). A second objective is to participate to the building and evaluation of use cases based on the acquired expertise.

The widespread of on-demand resources, first with Clouds, and now with Fog/Edge computing, has reinforced the need of automatically provisioning and deploying applications on distributed infrastructures. On one hand, several works have focused on defining models to let a user describe the application to be deployed. Most of these works are based on component models such as TOSCA [1], CAMEL [2], AEOLUS [3], HLCCM [4], etc. A particular point of variation of these models is the level of expressiveness such as the management of component cardinality, the complexity of connectors, their support of generic programming, etc. This variability generates a large variation in the complexity of induced placement problem. On the other hand, a lot of work has dealt with the computing of a solution to the placement (and/or reconfiguration) of an application on a set of resources. Existing solutions consists of constraint based solvers, meta-heuristics, and heuristics. These solutions also presents a lot of variability in their expressiveness of the application model to be deployed, the resource model, the type of constraints, and of course their scalability in term of application or resource elements.

The work will be structured around two main actions:

- Study the relationships between the features of component models (and thus their expressiveness) and the complexity of computing a placement.
- Participate to the building and evaluation of use cases based on the acquired expertise

References

- [1] *Topology and Orchestration Specification for Cloud Applications Version 1.0*. 25 November 2013. OASIS Standard.
<http://docs.oasis-open.org/tosca/TOSCA/v1.0/os/TOSCA-v1.0-os.html>
- [2] *The Cloud Application Modelling and Execution Language (CAMEL)*. Rossini, Alessandro & Kritikos, Kiriakos & Nikolov, Nikolay & Domaschka, Jörg & Griesinger, Frank & Seybold, Daniel & Romero, Daniel & Orzechowski, Michal & Kapitsaki, Georgia & Achilleos, Achilleas. (2017). 10.18725/OPARU-4339.
- [3] Aeolus: A component model for the cloud. Roberto Di Cosmo, Jacopo Mauro, Stefano Zacchiroli, Gianluigi Zavattaro, *Information and Computation*, Volume 239, 2014, Pages 100-121, ISSN 0890-5401, <https://doi.org/10.1016/j.ic.2014.11.002>.
- [4] High Performance Computing: From Grids and Clouds to Exascale. Julien Bigot, and Christian Pérez., *chap. On High Performance Composition Operators in Component Models*. – *Advances in Parallel Computing*, vol 20, pp 182-201, IOS Press, 2011.

Skills and profiles

Strong programming skills (Python and C++)
Experimentation skills (simulations and experiments such as with Grid'5000)
Knowledge of Cloud environments and networking (OpenStack)
Knowledge of programming abstractions (component model / architecture description language)
Autonomy / Curiosity

English language mandatory

Additional information

The candidates are invited to contact Christian Perez or Frédéric Desprez before applying (firstname.name@inria.fr).

Duration: 12 months

Location: Lyon, France

Salary: 2621 euros gross/month

Monthly salary after taxes: around 2172 euros (medical insurance included).