

## PostDoc Position

### COMFORT – COMponed-based Model FOR opensTack

#### 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 candidate will be integrated in the ASCOLA research team localized at the Ecole des Mines de Nantes. However, we underline that the work will be tightly achieved with the AVALON research team localized in Lyon (including consequently several travels to Lyon)

#### Mission and activities

*The postdoc aims at proposing a component-based model of the OpenStack ecosystem in order to control and supervise the deployment and the reconfiguration of a Discovery infrastructure.*

The Discovery initiative is driven by the objective of proposing a *decentralized cloud architecture* composed by deploying IT resources within the core of the network. While preliminary results regarding how OpenStack can be revising in order to supervise multiple sites [1], the question of how deploying and reconfiguring through hundreds of geographical locations such a complex software stack is still an open question.

The OpenStack community gathers more than 500 organizations with groups such as Google, IBM, Intel, ... making the whole ecosystem quite veloce. Concretely, the OpenStack software platform relies on tens of services including more than 2 millions of lines of code (mainly python). This complexity is amplified by the fact that the development cycle is based on a 6-month basis. Hence, it is rather tedious to follow all changes and ensure that all developments made between the different versions are compatible and does not impact previous deployment/reconfiguration strategies.

Software component models aim in particular to capture the structure of the application. Initiated from the need to ease code re-use to improve software production [2], they have been much extended in particular to distributed computing [3]. Several models have been used to manage and reconfigure distributed applications, such as the work around Fractal [4], to more recently describe application to be deployed on cloud such as TOSCA [5] or CAMEL [6]. However, their ability to manage large-scale systems such as the Discovery platform remains open. Is their expressiveness adapted? How to handle reconfiguration at that scale of number of sites?

The objective of this postdoc position is twofold: (i) investigate whether current state of the art component models provide the necessary features to model and operate the OpenStack software ecosystem and (ii) to propose autonomous strategies to deploy and reconfigure the system by leveraging the aforementioned model.

The work will be structured around the following actions:

- Study major component-based models proposed in the literature
- Analyze the OpenStack software ecosystem
- Model OpenStack with a selected component model (including some extensions of the model if needed).

- Define autonomous strategies to deploy and reconfigure throughout the Discovery infrastructure the OpenStack system.
- Implement them using the previous defined model.

## References

- [1] A. Lebre, J. Pastor, F. Desprez, “Overcoming Major Limitations of Traditional Server-Centric Clouds by Operating Massively Distributed IaaS Facilities – The Discovery Initiative“, Inria Research RR 8779 - Report <https://hal.inria.fr/hal-01203648>
- [2] M.D. McIlroy, “Mass produced software components”, Report NATO Conference on Software Engineering, Garmisch, 138-152, 1968 Oct 7-11
- [3] Clemens Szyperski, Dominik Gruntz, and Stephan Murer. Component Software – Beyond Object-Oriented Programming. Addison-Wesley/ACM Press, second edition, 2002.
- [4] Fractal Web Site. <http://fractal.ow2.org/>
- [5] Topology and Orchestration Specification for Cloud Applications. Version 1.0. Oasis standard. Nov. 2013. <http://docs.oasis-open.org/tosca/TOSCA/v1.0/TOSCA-v1.0.html>
- [6] Cloud Application Modelling and Execution Language (CAMEL) and the PaaSage Workflow. Alessandro Rossini. In the 4th European Conference on Service-Oriented and Cloud Computing, Taormina, Italy. 2015.

## Skills and profiles

Strong programming skills (Java and Python)  
 Software Engineering, in particular (distributed) component models  
 Knowledge of Cloud environments (OpenStack knowledge will be definitely an advantage)  
 Autonomy / Curiosity

English language mandatory

## Additional information

The candidates are invited to contact Adrien Lebre or Christian Perez before applying ([firstname.name@inria.fr](mailto:firstname.name@inria.fr)).

Duration: 12 to 18 months

Location: Nantes, France

Salary: 2 621 euros gross/month

Monthly salary after taxes: around 2 127 euros (medical insurance included).