2018-00801 - Application model expressiveness and placement computing complexity in a Fog/Edge context

Level of qualifications required: PhD or equivalent
Function: Post-Doctoral Research Visit

About the research centre or Inria department
Grenoble Rhône-Alpes Research Center groups together a few less than 800 people in 35 research teams and 9 research support departments.

Staff is localized on 5 campuses in Grenoble and Lyon, in close collaboration with labs, research and higher education institutions in Grenoble and Lyon, but also with the economic players in these areas.

Present in the fields of software, high-performance computing, Internet of things, image and data, but also simulation in oceanography and biology, it participates at the best level of international scientific achievements and collaborations in both Europe and the rest of the world.

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

This position is within the context of the IPL Discovery.

Assignment
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 infrastructures 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 platforms, 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], HLCM [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 have 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 present 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.

References

Main activities
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.

Skills
Knowledge of scheduling/mapping algorithms.
Strong programming skills (Python and C++ knowledge will be definitely an advantage).
Experimentation skills (simulations and experiments such as with the Grid’5000 instrument)
Knowledge of Cloud environments and networking.

Knowledge of programming abstractions (component model / architecture description language) will be a plus

Autonomy / Curiosity

English language mandatory

Benefits package

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Flexible working hours
- Sports facilities

Remuneration

Gross income: 2653 €