

PostDoc Position

Where should be deployed Fog/Edge global services?

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 Corse Research Team localized in Grenoble, and the Ascola Research Team localized in Nantes. He/She will be co-supervised by Frederic Desprez (Grenoble) and Adrien Lebre (Nantes).

Please note that some interactions with the TASC Research Team (Nantes) are expected (Charles Prud'homme, Xavier Lorca).

Mission and activities

The Postdoctoral position aims at investigating placement challenges related to Fog/Edge Computing infrastructures such as the ones envisioned by the Discovery initiative [1]¹. Questions we would like to answer are: Where micro DCs should be deployed in order to meet users' requirement while minimizing the global cost of the infrastructure? Once the infrastructure has been deployed, where should be deployed global control services? At what scale? Can we use answers of those initial questions to propose a generic placement framework for any kind of Fog/Edge services?

While the model of Cloud computing capabilities provided by a few mega data centers still prevails, the advent of new usages related to Internet of Things applications (IoT) [2], Mobile Edge Computing (MEC) [3] and Network Function Virtualization (NFV) [4] is today strongly challenging this approach.

To cope with this usage change, Cloud and network communities are now advocating for going towards massively distributed small sized infrastructures that are deployed at the edge of the network, thus closer to end- users and their related devices, and applications [5]. Referred to as the Fog/Edge paradigm, this model is attracting growing interest as it also improves services agility. For instance, IoT applications can benefit from the deployment of edge nodes to perform real-time analysis while preserving central data centers for in-depth data analytics. Other applications include CDN (Content Distribution Networks) or even augmented reality [6].

In addition to identifying where “edge clouds should be deployed, the drivers of such a (r)evolution lay in the development of appropriate management systems that will enable, on the first hand, an operator to aggregate, supervise and expose such massively distributed resources and, on the other hand, to implement new kinds of services that may be deployed and managed by the operator itself or by third-party users. However, designing a well-suited management system is a challenging task because Fog/Edge infrastructures significantly differ from traditional Cloud ones regarding heterogeneity, dynamicity and the potential massive distribution of resources and networking environments.

The objective of this postdoc position is to investigate the placement-related questions of a massively distributed edge cloud infrastructure.

¹ <http://beyondthecLOUDS.github.io>

The work will be structured around the following actions:

- Propose a model to capture infrastructure specifics as well as applications/user's requirements
- Propose placement algorithms that can satisfy QoS' expectations while optimizing different objectives (minimization of the infrastructure cost, reliability in presence of network partitions...). First in an offline manner, second by considering online scenarios and finally by taking into account the dynamicity of the infrastructure.
- Evaluate and compare proposed algorithms through simulations by leveraging the SimGrid toolkit. According to the progress made by the postdoctoral researcher, this last action can be extended to in-vivo experiments on top of Grid'5000 using the OpenStack software suite.

References

- [1] A. Lebre, J. Pastor, A. Simonet and F. Desprez. Revising OpenStack to Operate Fog/Edge Computing Infrastructures. *Proceedings of IEEE International Conference on Cloud Engineering (IC2E) 2017*, April 2017.
- [2] L. Atzori, A. Iera, and G. Morabito, "The internet of things: A survey," *Computer networks*, vol. 54, no. 15, pp. 2787–2805, 2010.
- [3] A. Ahmed and E. Ahmed, "A survey on mobile edge computing," in *2016 10th International Conference on Intelligent Systems and Control (ISCO)*, Jan 2016, pp. 1–8.
- [4] R. Mijumbi, J. Serrat, J.-L. Gorricho, N. Bouten, F. De Turck, and R. Boutaba, "Network function virtualization: State-of-the-art and research challenges," *IEEE Communications Surveys & Tutorials*, vol. 18, no. 1, pp. 236–262, 2015.
- [5] F. Bonomi, R. Milito, J. Zhu, and S. Addepalli, "Fog computing and its role in the internet of things," in *Proceedings of the first edition of the MCC workshop on Mobile cloud computing*. ACM, 2012, pp. 13–16.
- [6] S. Yi, C. Li, and Q. Li, "A survey of fog computing: Concepts, applications and issues," in *Proceedings of the Workshop on Mobile Big Data*, ser. Mobidata '15. ACM, 2015.

Skills and profiles

Strong programming skills (Python and Java)

Knowledge of Cloud environments

Knowledge of Mathematical Programming (Constraint Programming will be definitely an advantage)

Autonomy / Curiosity

English language mandatory

Additional information

The candidates are invited to contact Adrien Lebre or Frederic Desprez before applying (firstname.name@inria.fr).

Duration: 12 months

Location: Grenoble, France

Salary: 2 621 euros gross/month

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