



Offer #2024-07457

## Post-Doctoral Research Visit F/M Mobility-aware Edge Computing for 5G

**Contract type** : Fixed-term contract

**Level of qualifications required** : PhD or equivalent

**Fonction** : Post-Doctoral Research Visit

### About the research centre or Inria department

The Inria Saclay-Île-de-France Research Centre was established in 2008. It has developed as part of the Saclay site in partnership with Paris-Saclay University and with the Institut Polytechnique de Paris since 2021.

The centre has 39 project teams, 27 of which operate jointly with Paris-Saclay University and the Institut Polytechnique de Paris. Its activities occupy over 600 scientists and research and innovation support staff, including 54 different nationalities.

### Context

A post-doctoral fellowship is available in the Inria TRiBE team at the Saclay Center. This position is funded in the context of the National French PEPR projects on "Networks of the Future" and "Mobility Digitalization". The post-doctoral fellow will collaborate with Dr. Aline C. Viana (<https://pages.saclay.inria.fr/aline.viana/>) and Nadjib Achir (<https://nadach.github.io>) from the TRiBE team and Razvan Stanica (<http://perso.citi.insa-lyon.fr/rstanica/>) from the Inria Agora team.

### Assignment

A direct consequence of hosting resources in a distributed way at the Edge is their exposure and sensitivity to the heterogeneity, massiveness, and uncertainty in mobility and demands of smart devices, leading to non-optimal edge usage in the long run. We aim to deal with such impacting factors in device behaviors by bringing (i) perceptive and aware mobility/demand quasi-in-time anticipation, (ii) uncertainty handling, and (iii) self-adaptation to device-edge resource management.

In particular, the focus will be on smart devices, where perceptiveness and awareness of needs and behaviors (where, when, and for what resources are required) of users and applications dictate decision, reaction/action, and allocation/management at the edge. Previous knowledge of TRiBE and AGORA on modeling, uncertainty profiling, interpretative predictability, and personalized anticipation of mobility behaviors [1],[2],[3],[4] as well as of resource demands [5],[6][7] of networking users, will be leveraged. The **first goal** will be to design a **framework for quasi-in-time anticipation of spatial-temporal resource demands**.

The **second goal** will be the design of perceptive mobility-aware offloading policies and adaptive allocation strategy according to the quasi-in-time anticipation of spatial-temporal resource demands. The quasi-in-time anticipation will limit service interruptions due to networking uncertainties or overload. The **third goal** concerns the evaluation of the designed framework, policies, and strategies. Besides, the benefits and tradeoffs of decisions that are taken based on quasi-in-time spatiotemporal anticipation of demands will also be analyzed (e.g., energy or resource loss/gain).

### References

[1] D. Do Couto Teixeira, A. Carneiro Viana, J. Marques Almeida, and M.S. Alvim, "The Impact of Stationarity, Regularity, and Context on the Predictability of Individual Human Mobility", ACM Transactions on Spatial Algorithms and Systems, vol. 7, no. 4, June 2021.

[2] D. Do Couto Teixeira, A. Carneiro Viana, J. Marques Almeida. On estimating the predictability of human mobility: the role of routine. EPJ Data Science, 2021, 10 (1).

[3] L. Amichi, A. C. Viana, M. Crovella, A. A. F Loureiro. Revealing an inherently limiting factor in human mobility prediction. IEEE Transactions on Emerging Topics in Computing, 2023. In press.

[4] L. Amichi, A. C. Viana, M. Crovella, A. A. F Loureiro. Understanding individuals' proclivity for

novelty14seeking. ACM SIGSPATIAL 2020.

[5] Pedro Cruz, Nadjib Achir, Aline Carneiro Viana. On the Edge of the Deployment: A Survey on 16 Multi-Access Edge Computing. ACM Computing Surveys, 55 (5). 2022.

[6] H. Mazouzi, N. Achir, and K. Boussetta. DM2-ECOP: an efficient computation offloading policy for 18 multi-user multi-cloudlet mobile edge computing environment. ACM Transaction on Internet Technology, 20219, 19(2).

[7] H. Mazouzi, K. Boussetta, and N. Achir. Maximizing mobile energy saving through tasks optimal 21 offloading placement in two-tier cloud: A theoretical and an experimental study. Elsevier Computer 22 Communication, 144:132–148, 201

## Main activities

- Literature and code review of the team's previous works and design of the framework for quasi-in-time anticipation of spatial-temporal resource demands
- Design perceptive mobility-aware offloading policies and an adaptive allocation strategy. This design will leverage mobility, resource anticipation, and ML strategies to capture the dynamics of the whole system (user behaviors, application demands, and network conditions).
- Evaluate designed solutions, mainly through emulation tools or experimental platforms, following the recommendations of ETSI MEC architecture to mimic realistic MEC infrastructures.
- Quantify benefits and tradeoffs of quasi-in-time spatiotemporal anticipation on energy, resource usability, network management, etc.
- Analyse performance gains obtained when perceptive-to-needs policies and adaptive allocation strategies are implemented.

## Skills

- A Ph.D. degree in wireless networks, mobile networks, or data-related topics.
- a solid understanding of networking principles, protocols, and architectures is essential.
- ability to write and debug (student) code in Python is an important requirement.
- proficiency in programming languages commonly used in AI and networking research.
- Experience with relevant libraries and frameworks is also valuable.
- Ability to design and implement algorithms for solving complex problems.
- Familiarity with optimization techniques.
- Excellent written and verbal communication skills for presenting research findings, writing academic papers, and collaborating with peers.
- The ability to work effectively as part of a research team, collaborate with colleagues from diverse backgrounds, and contribute positively to group dynamics
- A good personal and project management skills are required to function in this multi-disciplinary multi-team project.

## Benefits package

- Subsidized meals
- 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

## Remuneration

According to profile

## General Information

- **Theme/Domain** : Networks and Telecommunications System & Networks (BAP E)
- **Town/city** : Palaiseau
- **Inria Center** : [Centre Inria de Saclay](#)
- **Starting date** : 2025-02-01
- **Duration of contract** : 12 months
- **Deadline to apply** : 2024-12-31

## Contacts

- **Inria Team** : [TRIBE](#)
- **Recruiter** : Achir Nadjib / [Nadjib.Achir@inria.fr](mailto:Nadjib.Achir@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

The post-doctoral fellow will design new perceptive mobility-aware offloading policies and adaptive allocation strategies and test them on an experimental platform with large mobile network datasets.

The recruited person is expected to write reports and give presentations to academic and industrial partners (e.g., network operators). A special attention will be given to the visualization of results and their presentation to stakeholders and the general public.

**Warning :** you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

## Instruction to apply

CV

Cover letter

Letter(s) of recommendation, where applicable

### **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.