

Call for Applications for Engineer/Post-doc in Wireless networks models for sustainable energy-efficient 5G and beyond systems

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1 Context

The proposed subject is for a 1 year contract, possibly extended to 18 months, destined for an Engineer/Post-Doc at IMT Atlantique in the IRISA lab. The context is a collaborative project entitled “**Just Enough Networks**”, part of the PEPR “5G et Réseaux du futur” funded by the French government (France 2030).

This part of the project considers the orchestration of energy saving mechanisms (multi-level sleep modes, among other) in the context of 5G and 6G networks and the proposal of energy indicators and interaction with the mobile network users.

1.1 ABOUT IRISA and IMT Atlantique

IMT Atlantique is a new technological university under the aegis of the Ministry of industry, born on January 1st, 2017, from the merger between the former Telecom Bretagne and École des Mines de Nantes technological universities. IMT Atlantique focuses on digital technology, energy and the environment with the objectives of contributing to economic development and ecological and societal transition through education, research and innovation. IMT Atlantique is internationally recognised as a Technological University, as attested by its rankings: among the top 500 universities in the world in the Times Higher Education World University's 2024 ranking. IMT Atlantique has a strong research activity with more than 260 tenured research professors and between 270 and 300 PhD students in its laboratories, more than 30% of which are working based on industrial co-fundings.

The position is open on the campus of Rennes within the [SRCD \(Network Systems, Cybersecurity and Digital Law\) department](#). The SRCD Department involves about 60 people, including 27 permanent teacher-researchers, working in six research teams (Adopnet, DSN, E4SE, Ermine, OCIF and SOTERN) within the [IRISA laboratory](#).

IRISA is today one of the largest French research laboratories (more than 850 people) in the field of computer science and information technologies. Structured into seven scientific departments, the laboratory is a research center of excellence with scientific priorities such as bioinformatics, systems security, new software architectures, virtual reality, big data analysis and artificial intelligence.

2 PROJECT OBJECTIVES

5G systems have been designed with energy efficiency targets. Unfortunately, the wish to drastically increase the data rates eliminates the energy savings if no special effort is provided for this purpose [1].

This project aims to propose new concepts and models for 5G and beyond systems, considering resource use and performance indicators, while taking into account users' needs and behavior, for energy-efficient mobile networks. Capacity, dimensioning issues and tradeoffs are other important aspects of the envisaged studies. Model development and simulations are used for the analysis and validation.

Among other, the use of sleep modes is an important tool for energy savings. Machine learning algorithms can be used, such as in [2], for good results of sleep modes w.r.t. energy efficiency, service availability and performance level.

In the perspective of 6G cellular systems, an update of energy models and energy consumption figures are realized for different environments. In order to push for sustainability and sobriety, new wireless networks indicators will be proposed. In the complex environment of renewable-energy fed [3], these indicators will be included in radio resource algorithms for energy efficiency, that will be proposed in this work, allowing the construction of models, taking into account energy consumption models.

The project will also address the use of renewable energy sources, associated batteries and their life cycles.

The Postdoc/engineer will be co-supervised by Loutfi Nuaymi and Anne-Cécile Orgerie. He or she will cooperate with the other partners of JEN project and attend the project physical and online meetings in order to contribute to the common project results.

3 REQUIRED SKILLS

We expect the candidate to have an expertise of wireless models, wireless networks systems and radio access and good knowledge in mathematics and signal processing. Strong backgrounds in simulations and programming are also required for the candidate. We also expect the candidate to have good skills of research techniques (documenting and reporting, team spirit and creativity).

4 HOW TO APPLY

Candidates are encouraged send their resume along with references to the following email addresses : loutfi.nuaymi@imt-atlantique.fr and anne-cecile.orgerie@irisa.fr

REFERENCES

[1] : C. Ware, M. Coupechoux, E. Hossain, C. Mas-Machuca, V. Sharma, and A. Tzanakaki, "Introduction to the Special Issue: 5+G Network Energy Consumption, Energy Efficiency and Environmental Impact", Annals of Telecommunications, 2023.

[2] : A El-Amine, M Iturralde, HAH Hassan, L Nuaymi, "A distributed Q-Learning approach for adaptive sleep modes in 5G networks", IEEE WCNC 2019

[3] : HAH Hassan, D Renga, M Meo, L Nuaymi, "A novel energy model for renewable energy-enabled cellular networks providing ancillary services to the smart grid" IEEE Transactions on Green Communications and Networking, 2019.