



Offre n°2024-07478

PhD Position F/M Energy-efficient QoE-aware Beyond 5G Future Mobile Networks

Type de contrat : Fixed-term contract

Niveau de diplôme exigé : Graduate degree or equivalent

Fonction : PhD Position

A propos du centre ou de la direction fonctionnelle

The Inria centre at Université Côte d'Azur includes 37 research teams and 8 support services. The centre's staff (about 500 people) is made up of scientists of different nationalities, engineers, technicians and administrative staff. The teams are mainly located on the university campuses of Sophia Antipolis and Nice as well as Montpellier, in close collaboration with research and higher education laboratories and establishments (Université Côte d'Azur, CNRS, INRAE, INSERM ...), but also with the regional economic players.

With a presence in the fields of computational neuroscience and biology, data science and modeling, software engineering and certification, as well as collaborative robotics, the Inria Centre at Université Côte d'Azur is a major player in terms of scientific excellence through its results and collaborations at both European and international levels.

Contexte et atouts du poste

Within the framework of a partnership

- collaboration between 2 Inria teams: COATI and DIANA,
- public with French National Research Agency (ANR), PEPR 5G

Mission confiée

For a better knowledge of the proposed research subject :

Muhammad Jawad Khokhar, Thibaut Ehlinger, Chadi Barakat, "From Network Traffic Measurements to QoE for Internet Video", in proceedings of IFIP Networking, Warsaw, Poland, May 2019. where we develop a methodology to collect all data needed to estimate the QoE, but it specific to youtube videos, there should be a way to extend it to your local videos.

Mathilde Jay, Vladimir Ostapenko, Laurent Lefèvre, Denis Trystram, Anne-Cécile Orgerie, et al.. An experimental comparison of software-based power meters: focus on CPU and GPU. CCGrid 2023 - 23rd IEEE/ACM international symposium on cluster, cloud and internet computing, May 2023, Bangalore, India. pp.1-13, 10.1109/CCGrid57682.2023.00020 . hal-04030223v2

Muhammad Umair Khan, Shanza Abbas, Scott Uk-Jin Lee, Asad Abbas, Measuring power consumption in mobile devices for energy sustainable app development: A comparative study and challenges, Sustainable Computing: Informatics and Systems, Volume 31, 2021,

Collaboration :

The recruited person will be in connection with Chadi Barakat, Frédéric Giroire, Joanna Moulherac and Thierry Turletti.

Principales activités

The upcoming beyond 5G networks (B5G) will be enabler for a plethora of new applications that are known to be computing intensive, bandwidth greedy and delay sensitive, such as video streaming, virtual reality, gaming, autonomous driving, and video surveillance. The resource and energy consumption of these applications will depend on their demand and design but also on the way they are managed within the network (e.g. where to put the computing and network functions, the management of communication patterns, the coding/transcoding for video and audio). This management will determine the amount of resources utilised and energy consumed, but will also determine the Quality of Experience perceived by the users of an application. The challenge here is to manage the network in an efficient and intelligent way taking into account the requirements of the application while utilising the available resources in the most efficient way. This will first pass by modelling the computing and network requirements of new applications in the context of B5G networks, and then will rely on establishing the link between their requirements and needs, and the perceived Quality of Experience by the end users. We propose to establish this link by experimenting with an application in various network setups and

various loads, then building models relating resource utilisation to network traffic following a machine learning and data-driven approach. The next phase will be to showcase how the built models can help better tune the network to efficiently utilise its resources, and consequently the consumed energy, without sacrificing the end users Quality of Experience.

In this PhD, we will explore this topic by focusing on popular services such as gaming, virtual reality, web browsing and video streaming. We will browse the literature for relevant work on modelling their quality of service and quality of experience, and design an experimental framework to run the services in a controlled environment where we can measure and analyse the consumed energy and the quality of experience at the application and user level. Our aim is to understand the balance between the two performance metrics (energy and QoE), and find optimal configurations of both network and services that lead to the best possible gain: minimising energy consumption without considerably losing in terms of end user quality of experience. We will then use the result of this study for an optimal placement of network functions and appropriate adaptation of their traffic that allow to reach the optimal balance alongside the two studied dimensions.

This project fits within a larger collaborative project, the PEPR 5G and next generation networks, involving a large number of French research laboratories working on networking. This will be a unique opportunity to collaborate within the networking community. Experimentation will be carried out on our local platforms R2Lab and SophiaNode, and the upcoming Slices European platform.

Compétences

Technical skills and level required : Networking skills, programming and experimentation

Languages : english

Avantages

- Subsidized meals
- Partial reimbursement of public transport costs
- 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 (after 6 months of employment) 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
- Social security coverage

Rémunération

Duration: 36 months

Location: Sophia Antipolis, France

Gross Salary per month: 2100€ brut per month (year 1 & 2) and 2190€ brut per month (year 3)

Informations générales

- **Thème/Domaine :** Networks and Telecommunications
System & Networks (BAP E)
- **Ville :** Sophia Antipolis
- **Centre Inria :** [Centre Inria d'Université Côte d'Azur](#)
- **Date de prise de fonction souhaitée :** 2024-10-01
- **Durée de contrat :** 3 years
- **Date limite pour postuler :** 2024-06-30

Contacts

- **Équipe Inria :** [COATI](#)
- **Directeur de thèse :**
Mouliérac Joanna / Joanna.Moulierac@inria.fr

A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 start-up. L'institut s'efforce ainsi de

répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

Attention: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n'est pas garanti.

Consignes pour postuler

Sécurité défense :

Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du recrutement.

Politique de recrutement :

Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.