



Offer #2023-06679

PhD Position F/M Optimizing multi-domain E2E services orchestration

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Fonction : PhD Position

About the research centre or Inria department

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.

Context

Within the framework of a partnership :

- national program PEPR 5G Network of the future (NoF)

Assignment

Multiple entities such as Infrastructure Providers (InPs), Mobile Virtual Network Operators (MVNOs), Over-the-Top Providers (OTTs), Content Providers (CPs), Service Providers (SPs), Backhaul Operators (BOs), and Vehicular Content Providers (VCPs) have become critical industry players in 5G and beyond slice networks. To build a multi-tenant service management framework for 5G/6G networks, actors and providers need to cooperate, coordinate, and share data and resources with each other, while maintaining a large degree of independence. Moreover, slices may be deployed in a multi-party mode, implying several infrastructures belonging to competing actors [1],[2]. The business processes, policies, and rules defined in different Service Level Agreements (SLA) and contracts of this multi-party context need to govern the framework and drive the networks and infrastructures to realize complex E2E services. In particular, building an end-to-end multi-tenant and multi-party service while respecting its constraints implies to gather highly confidential information from the actors involved, such as their topology or their performance.

The goal of this thesis is to optimize the mapping of multi-actors service requirements to available resources in a multi-party global service architecture while avoiding the exchange of confidential information. To do so, we propose to study the impact of exchanging only abstractions of each domain on the service establishment [3]. A trade-off must then be found between the precision of the information exchanged and the respect of the confidentiality property. The information exchanged must be sufficiently precise to ensure the respect of the service constraints while preventing the deduction of the topology or the performance of a domain. Network abstractions have been studied in the past to reduce the complexity of routing optimization [4][5], focusing on the link resources of the network. This is clearly not addressing slice placement problems that need to consider also node resources. We will investigate how to abstract the network and evaluate the consequence of exchanging network abstractions for the orchestration of services that needs to guaranty E2E QoE, energy consumption, and security. To do so, we will investigate several solutions to abstract a topology using graph theory for example.

Collaboration with Prof. G. Texier, IMT Atlantique, Rennes.

of Network Services Embedding Costs over Public and Private Clouds. ICOIN 2020 - 34th International Conference on Information Networking, Jan 2020, Barcelone, Spain.

[2] Cedric Morin, Géraldine Texier, Christelle Caillouet, Gilles Desmangles, Cao-Thanh Phan. VNF placement algorithms to address the mono- and multi-tenant issues in edge and core networks. CLOUDNET 2019 : 8th IEEE International Conference on Cloud Networking, Nov 2019, Coimbra, Portugal.

[3] Fang Zhou, et al. Methods for network abstraction. 2012. <http://urn.fi/URN:ISBN:978-952-10-8158-3>

[4] Piet Van Mieghem. "Topology information condensation in hierarchical networks." Computer networks 31.20 (1999): 2115-2137.

[5] M. Scharf, T. Voith, M. Stein and V. Hilt, "ATLAS: Accurate Topology Level-of-Detail Abstraction System," 2014 IEEE Network Operations and Management Symposium (NOMS), Krakow, Poland, 2014, pp. 1-5, doi: 10.1109/NOMS.2014.6838357.

Main activities

- Research
- Present the works' progress to partners of the PEPR 5G NoF
- Feed other PEPR initiatives with the results of this work, especially those producing measurement tools and systems to support energy efficiency and sobriety, resilience and security

Skills

Skills :

- Networking
- Algorithmic
- Optimization
- Programming skills (Java, C, C++ or Python)

Benefits package

- 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

Remuneration

Location: Sophia Antipolis, France

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

General Information

- **Theme/Domain** : Networks and Telecommunications
System & Networks (BAP E)
- **Town/city** : Sophia Antipolis
- **Inria Center** : [Centre Inria d'Université Côte d'Azur](#)
- **Starting date** : 2024-09-01
- **Duration of contract** : 3 years
- **Deadline to apply** : 2024-06-30

Contacts

- **Inria Team** : [COATI](#)
- **PhD Supervisor** :
Molle Christelle / christelle.caillouet@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.

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

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.