



Internship proposal: Mobile Edge Computing and augmented reality for the “augmented technician”

Background

The recent *Edge computing* paradigm is increasingly becoming an effective alternative to existing cloud computing technologies [1]. Although the cloud is still the dominant paradigm, edge solutions allow (i) high reliability, (ii) ultra low latency, (iii) energy efficiency. Edge systems have been initially designed under the supervision of the ETSI working group on Mobile Edge Computing (MEC) with a focus on mobile users. However, we observe nowadays that the interest has shifted towards other ICT domains [2]. In particular, Edge computing has been identified as a potential key factor to achieve the performance and reliability offered by 5G and next generation networks. Thanks to the proximity between the allocated resources and the users, it is possible to obtain very high-speed data communication and ultra-low latency, which enable high-performance for advanced services. In this context, placement algorithms for resource optimization are of utmost importance, and the adoption of artificial intelligence on the edge is becoming a reality [3].

Internship description

In this internship, the candidate will study the state-of-the-art of Edge systems, and implement one or more solutions for distributed computation and resource access [4, 5]. The target use case is the “augmented technician”: in this scenario, an operator uses an augmented reality device to obtain detailed information about their surroundings. Furthermore, they can perform some actions in real time by connecting to a remote tool. The internship can be an introductory step for a Ph.D. thesis. The intern student will have to deploy an edge computing prototype within a real 5G private network, hosted by Telecom Paris lab. In parallel, they will have to work on distributed orchestration systems (e.g., Kubernetes) and computation units (e.g., containers) in a specific environment hosted by EDF, the largest electricity provider in France and Europe. Finally, they will have to deploy an existing augmented reality application by EDF to be transposed towards a containerized or VM-based application.

Tasks During this 6-month internship, the main tasks are :

T1: Network Communication between the augmented-reality device and a local/remote server, via WiFi or Bluetooth.

T2: MEC Analyze the data processing pattern and propose an optimal placement (local or remote) of the resources to reduce the latency required for the computation.

T3: Orchestration Proposition of an intelligent scheduling of the computation to satisfy the constraints in terms of temporal (latency), spatial (proximity to users) or energy consumption.

T4 Demo Participate to the evaluation of a prototype deployed on a 5G network.

Candidate profile The ideal candidate will have the following profile:

- Good knowledge of information and communication systems
- General knowledge of fixed networks and 4G/5G mobile networks
- Software development experience: C/C++, Java or Python

- Docker and Kubernetes experience
- Familiarity with Linux/Unix operating systems
- Languages: English (writing) and French (mostly writing, but speaking will be better)
- Autonomy

General info

Co-supervision Télécom Paris / EDF

Duration: 6 months

Location: Paris area – 19 place Marguerite Perey, 91120 Palaiseau (France)

Contacts

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References

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[2] Taleb T. et al., "On Multi-Access Edge Computing: A Survey of the Emerging 5G Network Edge Cloud Architecture and Orchestration" - IEEE Communications Surveys & Tutorials, Vol. 19, No. 3, - 2017

[3] Zhou Z. et al., "Edge Intelligence: Paving the Last Mile of Artificial Intelligence With Edge Computing" - Proceedings of the IEEE, Vol. 107, No. 8 - 2019

[4] Santos J. et al., "Towards Network-Aware Resource Provisioning in Kubernetes for Fog Computing applications" - IEEE Conference on Network Softwarization (NetSoft) 2019

[5] Goethals T. et al., "FLEDGE: Kubernetes Compatible Container Orchestration on Low-resource Edge Devices" - International Conference on Internet of Vehicles 2019