**2023-05866 - PhD Position F/M**

**Experimental evaluation of sliced cellular networks**

**Type de contrat :** CDD  
**Niveau de diplôme exigé :** Bac + 5 ou équivalent  
**Fonction :** Doctorant

### Mission confiée

With the advent of softwareization in networks, and in next generation cellular networks in particular, the current trend is to validate network solutions over emulated testbeds that have the advantage to be flexible and easily deployed. The emulation can be done either on one physical machine like Mininet, or on a cluster of physical machines like Maxinet and DistriNet. The main challenge with network emulation is to make sure that the emulation has well passed, and was not bottlenecked by the underlying network conditions or the compute resources. Realism (or fidelity) of an emulation is a sufficient condition for reproducibility of the experiment. We aim in this thesis to propose a new framework for verifying emulation realism in the context of next generation cellular networks with the consideration of network slicing, multi-technologies and multi-actors.

This project will then tackle the important question of verifying the correctness of a cellular network emulation and pinpointing the origins of any degradation. A correct emulation is an important step in the validation of the performance of new network solutions and protocols such the quality of service of deployed slices. It is also a sufficient condition to ensure the reproducibility of network experiments. We therefore believe that this work will greatly contribute to strengthening the scientific and innovation processes in the field of next generation cellular technologies.

### Principales activités

Network emulation can be disturbed by several phenomena such as a saturation of the underlying network, or a lack of computing resources on the physical machine(s). Verifying if an emulation has well passed is a challenging task as there is no a priori knowledge on what should be the output of the experiment itself. Monitoring the underlying infrastructure can bring some hints, but in many cases such monitoring is not made possible to the experimenter (case of a cloud experiment) and even when made possible, it does not involve a direct link between the infrastructure performance metrics and the experiment itself (the experiment itself can cause congestion of the infrastructure, which is deemed to be normal). In another context in the Diana team, we are working on a framework for ensuring the reproducibility of network experiments. We therefore believe that this work will greatly contribute to strengthening the scientific and innovation processes in the field of next generation cellular technologies.
emulation validation of wired networks using packet-level measurements at the emulated link level. We aim in this thesis on extending this framework to sliced cellular networks embracing different technologies (edge, core) and actors (e.g., operators, cloud providers), and validating its performance in detecting and troubleshooting emulation anomalies. These heterogeneous cellular networks include a higher number of details as compared to wired networks given the complexity of their wireless part (e.g., shared medium, multi-path fading), and they are also subject to more perturbing phenomena such as the interference of other wireless devices. Moreover, the experimental evaluation of disaggregated sliced radio networks involves several components that can also be emulated such as a gNodeB physical layer or a large number of UEs for scalability. The thesis will propose and implement a framework for emulation realism verification that allows (i) to establish reference models of what should be the behavior of a cellular experiment, (ii) to collect measurements about the emulation and build performance metrics that can be compared to their reference values, (iii) detect if the emulation has encountered any problem and identify the parts of the network that are responsible of the degradation, and (iv) propose solutions to remedy from the emulation problems. We will work on testing the proposed framework over wireless platforms, and in particular, the SophiaNode platform, based on R2lab, which allows running reproducible experiments in an anechoic environment.

Compétences
Strong knowledge in network protocols, mobile networks, network measurement, data analytics.

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 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
- Contribution to mutual insurance (subject to conditions)

Rémunération
Gross Salary per month: 2051€ brut per month (year 1 & 2) and 2158€ brut per month (year 3)