### PhD position (M/F) – Thesis offer
(Reference offer: CM_NN_PhD_Coherent_May2015)

<table>
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<th>Research topics</th>
<th>Software defined networking (SDN) for 5G networks</th>
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<td>Department</td>
<td>Mobile communication</td>
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<td>Issue date</td>
<td>May 2015</td>
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<td>Start date</td>
<td>Position to be filled as soon as possible</td>
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The Mobile Communications department of EURECOM invites applications for a PhD position in the area of software defined networking (SDN) for future cellular networks. Existing cellular systems, such as LTE, are built upon expensive proprietary equipment and complex control-plane protocols, and thus do not offer enough flexibility to program the network, and quickly adapt:

- the routing of application traffic according to the current network status, and
- the network topology according to the spatio-temporal traffic fluctuations

The goal of this position is a flexible and cost-effective cellular system design capable of providing a fine-grained network-wide measurement and control to the operator, user and application as well as an end-to-end realtime network adaptation and optimization. Software-defined networking (SDN) and network function virtualization (NFV) - i.e. separation of control plane from data plane, and hardware from software - are applicable to the next generation cellular systems and are seen as the key facilitators to achieve the required flexibility and cost-effectiveness [2][3]. The work will be carried out in the framework of the European project Coherent. The Coherent project aims at building programmable network for 5G systems, and its consortium comprises strong industrial partners as well as a number of world-class universities. It is funded by the European Commission under the H2020 Framework Program. The candidate will actively participate to the progress of the project.

Specifically, the focus of this position will be around the topics of: (i) Abstractions for programmability of mobile networks, (ii) Modeling, abstraction and coordination of wireless access and control of user cooperation, and (iii) Radio Access Sharing for virtual ISPs. First, appropriate theoretical abstractions and methodologies will be developed to provide a simplified but sufficiently informative view of the network state and behavior of different underlying mobile networks. These will be used for advanced control and resource coordination. Network abstraction will significantly reduce the signaling overhead, enable more flexible spectrum management, and will facilitate the design of scalable control solutions among heterogeneous radio access networks. Second, based on the abstracted network view, common control interfaces and software-development kits (SDK) will be developed to enable programmability in controlling and coordinating heterogeneous radio access networks.

Finally, this thesis has also an experimental aspect. The above-mentioned SDK will be developed for the OpenAirInterface LTE/LTE-A platform (potentially also leveraging existing platforms [5][6][7]). OpenAirInterface is an open-source hardware/software wireless technology platform and open-forum for innovation in the area of digital radio communications, wireless systems and networking. The platform is designed to provide large-scale system emulation, and real-time indoor/outdoor RF experimentation and demonstration. It comprises the entire protocol stack from the physical to the networking layer, including both standard-compliant (Rel-8 and a subset of Rel-10) implementations of the 3GPP-LTE access-stratum for both eNB and UE and a subset of the 3GPP-LTE evolved packet core protocols.
It has a rich software development environments and provide methods for protocol validation, performance evaluation and pre-deployment system test. The candidate is expected to use this platform and its environments for experimentation and performance evaluation as well as to contribute to its development.


Requirements

Education Level / Degree: Master degree

Field / specialty: Computer science, electrical engineering, telecommunications, or applied mathematics

Technologies: A very good background in LTE radio access protocols (EUTRAN). Good knowledge in SDR, SDN, or NFV is highly appreciated

Language / Systems: Past experience in C and python programming Knowledge in Linux OS

Other skills / specialties: Good analytical and performance analysis skills,

Other important elements: Strong communication skills and keen to operate in a multidisciplinary team Fluent in English (speaking, writing)

Application

The application must include (I, II and III):

• I- Curriculum Vitae
• II- Motivation letter of two pages also presenting the main past achievements and perspectives of research.
• III- 3 recommendation letters

Applications should be submitted by e-mail to navid.nikaein@eurecom.fr, spyropou@eurecom.fr and secretariat@eurecom.fr with the reference : CM_NN_PhD_Coherent_May2015

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EURECOM is a French graduate school and a research center in communication systems based in the international science park of Sophia Antipolis, which brings together renowned universities such as Télécom ParisTech, Aalto University (Helsinki), Politecnico di Torino, Technische Universität München (TUM), Norwegian University of Science and Technology (NTNU), Vietnam National University Ho Chi Minh Ville (VNU) and Chalmers University (Sweden). The Principality of Monaco is a new institutional member. The Institut Mines-Télécom is EURECOM’s founding member.
EURECOM benefits from a strong interaction with the industry through its specific administrative structure: Economic Interest Group (kind of consortium), which brings together international companies such as: SFR, Orange, ST Microelectronics, BMW Group Research & Technology, Symantec, Monaco Telecom, SAP, IABG.

EURECOM deploys its expertise around three major fields: Networking and security, Multimedia Communications and Mobile Communications. EURECOM is particularly active in research in its areas of excellence while also training a large number of doctoral candidates. Its contractual research is recognized across Europe and contributes largely to its budget.

Thanks to its strong ties set up with the industry, EURECOM was awarded the “Institut Carnot” label jointly with the Institut Telecom right from 2006. The Carnot Label was designed to develop and professionalize cooperative research. It encourages the realization of research projects in public research centers that work together with socioeconomic actors, especially companies.