Optimal Planning of Next Generation Content-Centric Networks

This PhD thesis will focus on a novel network paradigm, first envisioned in the pioneering work of Van Jacobson at Palo Alto Research Center (PARC): Information Centric Networking, also known under the names of *Named Data Networking* or *Content-Centric Networking (CCN)*. The philosophy behind such revolutionary paradigm is twofold: (1) Content-Centric Networks focus on users' requests for specific objects, or *contents* (identified by a globally-routable content name), rather than on the communication between two endpoints in the Internet (which is the current philosophy underlying the IP architecture), and (2) *massive caching* is exploited in routers and, in general, in network nodes to serve such content as efficiently as possible to network users, without having to always contact the original content producer, which may lead to severe performance degradation at the Internet scale.

Several open problems still need to be addressed in such field, and the PhD student will mainly address two of them, related to network optimization and security, which are deeply intertwined, and must be tackled simultaneously in order to design efficient, next generation Content-Centric Network architectures.

More specifically, the PhD candidate is expected to:
1) Tackle the *resource allocation* and *node cooperation* problems in Content-Centric Networks, with a special attention for dynamic, mobile environments, which are particularly challenging, but at the same time, are a natural application context for CCNs; in particular, she/he should be able to develop *exact mathematical models* as well as *heuristic algorithms* (approximate algorithms) adapted to design such networks in a highly dynamic context.
2) Design efficient *security solutions*, and *privacy architectures* tailored for dynamic and mobile CCNs. The former will be used to provide a *trackable access control* to digital information diffused using CCNs, while the latter will be used to protect the identity of both the information consumer and producer, enforcing *privacy* and *confidentiality*.

The PhD candidate will evaluate the proposed solutions by simulation (for example, using ccnSim http://perso.telecom-paristech.fr/~drossi/index.php?n=Software.ccnSim , developed by one the two PhD supervisors at LTCI, and/or other well-established simulators, including ndnSim). Furthermore, depending on her/his background, real-life implementation could be envisaged using dedicated machines available in our labs (LRI and LTCI) as well as large-scale testbeds like the One Lab platform (an European platform dedicated to network experimentation, http://www.onelab.eu/).