

Post-doctoral position – PerfRESO project

Position

This announce is for a post-doctoral position at IPParis – Télécom SudParis and Télécom Paris.

The position will be open at the fall (September – December 2019) and is for a duration a 18 months.

To apply, send your curriculum vitæ and cover letter by email to:

Mounia Lourdiane <mounia.lourdiane@telecom-sudparis.eu> and **Cédric Ware** <cedric.ware@telecom-paris.fr>.

Context

Optical networks have played a critical role in making possible the global communication revolution that has brought the world together, enabled emerging countries to join the digital world economy and improved the quality of life for people all around the globe. Their raw capacity enabled applications such as video on demand and cloud computing. But future needs such as the deployment of 5G, immersive telepresence and remote control, and quantum-based high-security communications, will require transformational changes.

The challenges are threefold. First, as always, the users' ever-increasing capacity needs must be met while simultaneously meeting new requirements, notably curbing the energy consumption's uncontrolled growth in data networks, and slashing end-to-end latency by orders of magnitude. Since the numerous required optical-to-electronic conversions are a bottleneck on both issues, optical functionalities (OFs) have been proposed, such as all-optical wavelength conversion or packet switching. However, their decades-old promise to solve these challenges has not materialized outside research labs, because they are too complex to handle from the network's point of view. This dovetails with the second challenge: handling the complexification of the network due to the emergence of new services such as network slicing and network function virtualization. The commonly-accepted answer to the latter is the software-defined network (SDN) ecosystem. However, SDN mostly doesn't concern itself with the physical layer; even recent control interfaces such as TAPI deal with the feasibility of a data connection between nodes, not the physical impairment details that would be required to manage optical functionalities. And, thirdly, a strong push is underway to integrate quantum key distribution (QKD) into the network as a physics-based security function. QKD, as a class of OFs, is likely to hit the same obstacles that prevented the general deployment of other OFs.

Our overall approach to tackle all three challenges is to redefine the abstractions in which networks are expressed so as to accomodate optical network functions, moving away from the classical layered-network model which cannot accommodate the nonidealities of, and physical impairments due to, optical functionalities. This new model, likely built on the SDN ecosystem, would take into account optical functions' full benefits and constraints both, encapsulating their nonidealities whenever convenient—just like managing a complex software problem by pushing the complexity into small units with generic interfaces such as device drivers or object-oriented frameworks.

Work description

This post-doctoral position takes place in the context of the collaboration between LTCI's Optical Telecommunications team (GTO) and Télécom SudParis' Telecommunication Services and Network department (RST), as well as the European project CiViQ, led within LTCI by the Quantum Information and Applications team (IQA) with GTO participation. Our institutes are among the top-3 leading academic players in France in the topic of optical communications and networks, including state-of-the-art experimental platforms in high-bit-rate transmissions.

We have an ongoing collaboration on network performance evaluation and cross-layer approaches to making optical functionalities practical and the position that we propose has the following specific objectives:

- Complete the integration of the physical (optical) impairments in our Impairment-Aware Routing and Wavelength Assignment (IA-RWA) simulator, notably to handle OFs such as wavelength converters and continuous-variable QKD.
- Assess our existing simulators in order to unify them, emerging the relevant network-management abstractions, and interfacing to the SDN ecosystem.

- Use the existing and upcoming simulators to study test cases and evaluate the network performances of relevant OFs.

Background and professional experience

- A PhD degree is mandatory.

- A first post-doctoral experience would be appreciated.

Required skills

The candidate needs a strong background in at least two of the following:

- Network architecture.
- Physics of optical communications.
- Software development using a variety of languages and tools.

The candidate has also to be able to :

- Take the lead of the required work and suggest innovative solutions.
- Present the results of his/her work.
- Contribute to the supervision of undergrad students in their projects and/or internships.

In addition to these mandatory skills, it would be appreciated if the candidate has knowledge/interest on the following topics :

- Network performance evaluation.
- Optical network energy consumption.
- Quantum key communication and distribution.