



Offre n°2024-07527

Doctorant F/H Plan de contrôle et routage dans les réseaux quantiques par intrication F/H

Type de contrat : Fixed-term contract

Niveau de diplôme exigé : Graduate degree or equivalent

Fonction : PhD Position

A propos du centre ou de la direction fonctionnelle

The Inria research centre in Lyon is the 9th Inria research centre, formally created in January 2022. It brings together approximately 300 people in 16 research teams and research support services.

Its staff are distributed at this stage on 2 campuses: in Villeurbanne La Doua (Centre / INSA Lyon / UCBL) on the one hand, and Lyon Gerland (ENS de Lyon) on the other.

The Lyon centre is active in the fields of software, distributed and high-performance computing, embedded systems, quantum computing and privacy in the digital world, but also in digital health and computational biology.

Contexte et atouts du poste

Quantum networks have emerged very recently and are at the heart of a booming research activity. They are at the confluence of networks and one of the most surprising branches of physics, namely quantum mechanics. In particular, quantum networks are based on the strangest phenomenon in quantum physics, namely quantum entanglement. Aside from the application of these exciting concepts to the field of networks, the subject of this thesis is part of an abundant and highly competitive research activity carried out by some of the world's leading laboratories. The combination of knowledge of networks - and in this respect Orange is a very favorable environment - and physics should enable us to lay the foundations for the design of large-scale quantum networks. This ambition is also at the confluence of several fields, in particular security (Quantum Key Distribution) and quantum computing. The thesis is part of a stimulating and highly promising framework for the networks of the future.

The PhD student will be financed by Orange as part of a CIFRE thesis, and will therefore be an Orange employee.

Mission confiée

Your role is to carry out thesis work on "Control plane and routing in entangled quantum telecommunication networks". More specifically, the thesis focuses on the development of a control plane for entangled quantum communications networks, with the aim of increasing the size of these networks. Research in this field is currently booming, as evidenced by the numerous publications of D. Towsley's group. This research topic is still at a very preliminary stage and not yet ready for operational implementation by operators. However, experiments have been carried out over relatively short distances, for example with Orange's participation in the France QCI network. Numerous studies are also being carried out in the USA and China, where the transmission of qubits over several thousand kilometers is being explored, although this requires thorough verification. This research has given rise to an abundance of specialized literature. At the same time, we're seeing the emergence of start-ups specializing in networks and quantum computing, complementing the big players such as IBM, Google, and other major players in the sector.

Collaboration :

The candidate will be supervised by Fabrice GUILLEMIN (Orange) and Claire GOURSAUD (MARACAS).

Principales activités

The aim of the thesis is to study the performance of entangled quantum networks and to develop a

control scheme for these networks (including routing and information distribution between quantum switches/repeaters). The thesis will focus on understanding the physical limitations of quantum networks. In particular, it will analyze physical limitations such as decoherence, qubit storage capacity, Bell state measurement, fidelity and purification, and then assess the impact of these limitations on the control scheme, taking into account constraints such as small storage memories and limited qubit lifetime. The thesis will then focus on developing algorithms for qubit propagation. In particular, the aim will be to design suitable algorithms for qubit propagation, integrating their physical constraints. This work should lead to the creation of a large-scale quantum network simulator capable of reproducing complex environments, in particular physical constraints.

Compétences

Skills (scientific and technical) and personal qualities required by the position

- Knowledge of networks (Internet, routing, dimensioning)
- Stochastic processes and queuing theory
- Resource allocation, congestion control, admission control in networks
- Knowledge of physics (especially quantum physics)

Desired experience (internships, ...)

- Internship in networks or physics

Avantages

- Voir offre publiée sur le site emploi d'Orange :

<https://orange.jobs/jobs/v3/offers/134513?lang=fr>

Rémunération

Voir offre publiée sur le site emploi d'Orange :

<https://orange.jobs/jobs/v3/offers/134513?lang=fr>

Informations générales

- **Thème/Domaine** : Networks and Telecommunications System & Networks (BAP E)
- **Ville** : Lannion
- **Centre Inria** : [Centre Inria de Lyon](#)
- **Date de prise de fonction souhaitée** : 2024-09-01
- **Durée de contrat** : 3 years
- **Date limite pour postuler** : 2024-05-31

Contacts

- Équipe Inria : [MARACAS](#)
- **Directeur de thèse** :
Goursaud Claire / claire.goursaud@inria.fr

A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

L'essentiel pour réussir

Education required (master's degree, engineering diploma, doctorate, scientific and technical field, etc.)

- Master's degree in mathematics or physics
- Engineering degree with a background in computer science and mathematics or physics

Attention: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des

Consignes pour postuler

Voir offre publiée sur le site emploi d'Orange :

<https://orange.jobs/jobs/v3/offers/134513?lang=fr>

Sécurité défense :

Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du recrutement.

Politique de recrutement :

Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.