**2020-02421 - PhD Position F/M Design of a novel context aware opportunistic forwarding strategy (M/F)**

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

---

A propos du centre ou de la direction fonctionnelle

The Inria Lille – Nord Europe Research Centre was founded in 2008 and employs a staff of 360, including 300 scientists working in sixteen research teams. Recognised for its outstanding contribution to the socio-economic development of the Hauts-de-France region, the Inria Lille – Nord Europe Research Centre undertakes research in the field of computer science in collaboration with a range of academic, institutional and industrial partners.

The strategy of the Centre is to develop an internationally renowned centre of excellence with a significant impact on the City of Lille and its surrounding area. It works to achieve this by pursuing a range of ambitious research projects in such fields of computer science as the intelligence of data and adaptive software systems. Building on the synergies between research and industry, Inria is a major contributor to skills and technology transfer in the field of computer science.

Contexte et atouts du poste

The Inria FUN research group investigates solutions to enhance programmability, adaptability and reachability of FUN (Future Ubiquitous Networks) composed of RFID, wireless sensor and robot networks. Limited resources, high mobility and high security level evolving in distrusted environments characterize the objects that compose FUN. They communicate in a wireless way. To be operational and efficient, such networks have to follow some self-organizing rules. Indeed, components of FUN have to be able to distribute and energy-efficient way to discover the network, self-deploy, communicate, self-structure in spite of their hardware constraints while adapting the environment in which adapting the environment in which they evolve. For additional information on the FUN research group, please see http://team.inria.fr/fun/

A PhD position is available within the Inria FUN. The position is for three years. The successful candidate will be based in the Inria Lille Nord Europe premises, France.

Mission confiée

---

**-- Research scope --**

In Low & Middle Income Countries, and in particular those situated in Sub-Saharan Africa, communication technologies have not yet delivered their potential. The lack of infrastructures is considered as one of the major problems that still prevent economical development [1].

In this context, communication technologies, in particular opportunistic communications, are seen as the catalytic power that will foster the development of these developing countries. The literature brings interesting insights in the domain of opportunistic forwarding [2,3]. Nevertheless, we argue that the challenged context above-mentioned requires more than handling communication outages but also to adapt to the specific context of individual nodes and to the requirements of the different contents to be forwarded. In particular, content delivery strategies in mobile opportunistic networks do not usually consider particularities of nodes' spatial and contextual conditions (speed, direction, resources, geographical locations, etc) [2].

---

**-- Research objective --**

Specifically, the successful candidate will work on the design and evaluation of a novel context-aware data forwarding strategy in wireless opportunistic networks. In particular, the novel protocol should take into consideration the forwarding decision the environmental dynamics and heterogeneity of devices in terms of mobility features, external unexpected events (weather of traffic conditions, etc) and hardware constraints but also the content requirements.

The research fellow will have the opportunity to work with both synthetic and real-world datasets of mobile traffic, with the goal of evaluating and validating the design of the solution. At last, a real in-situ scenario will be defined for validating the results over a real use case.

---

**-- Time Schedule --**

M1-M6 : The PhD student will survey the different mobility models and extract some recognizable patterns to allow a fast and lightweight identification mechanism.

M7-M10 : Based on the above mentioned analysis, the PhD will propose a novel mobility aware data forwarding mechanism. The new approach will be validated at least by experimentation.

M10-M12 : Deep analysis of the cost and gains of the proposed mechanism. This analysis will be realized both theoretically and through experimentations.

At the end of the first year, the student will have a first data forwarding solution that will have been properly characterized and evaluated.

M13-M18 : The proposed data forwarding will be enhanced with data priority awareness features.

M18- : Experimental validation. Analysis under real scenarios.

M25-M30 : The proposed data forwarding will be enhanced with the analysis of the selection of data to send.

M31-M34 : Integration and experimental validation.

M34-M36 : PhD report

---

Informations générales

- **Thème/Domaine :** Réseaux et télécommunications  
  Infrastructure (TIC) (BAP E)  
- **Ville :** Villeneuve d’Ascq  
- **Centre Inria :** CRI Lille - Nord Europe  
- **Date de prise de fonction souhaitée :** 2020-10-01  
- **Durée de contrat :** 3 ans  
- **Date limite pour postuler :** 2020-04-22

Contacts

- **Equipe Inria :** FUN  
- **Directeur de thèse :** Mitton Nathalie / Nathalie.Mitton@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 200 équipes-projets, en général communes avec des partenaires académiques, impliquent plus de 3500 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 180 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.

Consignes pour postuler

CV + application letter + recommendation letters + school transcripts

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.

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

Le traitement des candidatures adressées par d’autres canaux n’est pas garanti.
Combining Spatial and Social Awareness in D2D Opportunistic Routing, Ivan O. Nunes ; Clayson Celes ; Igor Nunes ; Pedro O. S. Vaz de Melo ; Antonio A. F. Loureiro, IEEE Communications Magazine (Volume: 56 , Issue: 1 , Jan. 2018)

L. Amaral et al. Oi!-opportunistic data transmission based on wi-fi direct, Infocom workshop 2016

Principales activités
The PhD student will be in charge of:
- Realize a survey of human mobility model and extract some efficient patterns
- Design a predictive approach able to dynamically categorize a movement
- Design a novel context-aware opportunistic forwarding strategy
- Implement and test the designed solution on real hardware platform

Compétences
We are looking for candidate that owns a Master degree in computer science, with a major in wireless networks and mobile systems, who is creative in proposing solutions and capable of critical analysis of results. We demand the student:

1) to have excellent skills in scripting and programming (e.g., python, C/C++, Java) as well as previous experience with simulation tools;
2) to have a strong background in mobile networks and forwarding protocols;
3) to be familiar with solutions related to D2D or DTN;
4) to have a good experience with data analysis techniques and statistical tools;
5) to be fluent in spoken and written English with strong communication and presentation skills;
6) Experience with mobility modeling, resource management for wireless networks are considered a plus.

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 (after 6 months of employment) 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
- Social security coverage

Rémunération
1st and 2nd year: 1 982€ Gross monthly salary (before taxes)
3rd year: 2085€ gross monthly salary (before taxes)