

Offre n°2019-01571

PhD Position F/M Integration of Additional Services and Requirements in Existing Communication Networks

Le descriptif de l'offre ci-dessous est en Anglais

Type de contrat :CDD

Niveau de diplôme exigé :Bac + 5 ou équivalent

Fonction :Doctorant

A propos du centre ou de la direction fonctionnelle

Grenoble Rhône-Alpes Research Center groups together a few less than 800 people in 35 research teams and 9 research support departments.

Staff is localized on 5 campuses in Grenoble and Lyon, in close collaboration with labs, research and higher education institutions in Grenoble and Lyon, but also with the economic players in these areas.

Present in the fields of software, high-performance computing, Internet of things, image and data, but also simulation in oceanography and biology, it participates at the best level of international scientific achievements and collaborations in both Europe and the rest of the world.

Contexte et atouts du poste

This PhD position is opened within the collaboration between INRIA and the TU-Berlin in the areas of Information Sciences and Systems. The project is named Integration of Additional Services and Requirements in Existing Communication Networks -TRANSISTOR-.

The Phd Student is fully funded by INRIA and hosted in France by the Laboratoire CITI in the scientific campus of Lyon. Mobility between the Laboratoire CITI and TU-Berlin is expected.

The PhD student will be supervised by Prof. Samir M. Perlaza (INRIA). The research topic lies in the broad intersection of information theory, game theory, and artificial intelligence. The starting date of the PhD is September 2019.

Mission confiée

TRANSISTOR addresses foundational questions pertinent to existing communication networks that need to be modified to allow for new services or requirements including privacy, security, covertness, energy transmission, etc. Hereby, only transmitters are allowed to be modified while some of the receivers must remain untouched.

This context is motivated by applications such as broadcast systems that are currently deployed and thus, only the transmitters and a few set of receivers, often those that can be added later, can be manipulated. Essentially, the original coding scheme must be altered to generate a new code, often referred to as induced code, that preserves the old functionality, i.e., the message to be broadcast is still decodable at the deployed receivers probably at a higher decoding error probability, but allowing new capabilities at the new receivers (or those that can be modified).

Typical scenarios in which only some of the network devices can be replaced comprehend the Internet of Things (IoT) and Cyber-Physical Systems (CPS) in both civil and military applications when the systems are deployed in hard-to-reach locations, e.g., remote geographical areas, concrete structures, human bodies, or disaster/war zones. In this context, an effective remedy is upgrading the system without requiring to modify the existing devices.

This problem was formalized by the French group in [1] for the case in which a two-receiver broadcast code is modified to let the transmitter to send an additional message to one of the receivers while the other receiver is kept unable to detect such transmission (even with an optimal detector). This feature is known as covert communications, c.f., [2] and [3]. In [1], it is shown that modifying an existing broadcast code to implement covert communications is feasible under certain conditions. Despite that the rate does not linearly scale with the duration of the communication (in channel uses), the amount of information that can be covertly transmitted is not negligible. This result is rather optimistic given that

covert communications is a very strong constraint. This lead to imagine that other capabilities, considered less constraining, might lead to rates that might scale linearly with the transmission duration at the cost of a tolerable loss of reliability. From this point of view, as long as the trade-off between the gains in performance on the new capability and the losses in reliability on the pre-existing capabilities are well understood, the idea of modifying existing codes to implement new capabilities is well justified and rises as a promising theoretical foundation for this kind of problems. Nonetheless, for the moment, this is only speculation as this problem has never been studied for the case of implementing a capability other than covert communications in a very simple channel model, e.g., symmetric discrete memoryless channels.

[1] D. Kibloff, S. M. Perlaza, and L. Wang, "Broadcast codes can be enhanced to perform covert communications," INRIA Grenoble - Rhône-Alpes, Tech. Rep. 9249, Jan. 2019.

[2] M. Bloch, "Covert communications over noisy channels: A resolvability perspective," IEEE Transactions on Information Theory, vol. 62, no. 5, pp. 2334–2354, May 2016.

[3] L. Wang, G. Wornell, and L. Zheng, "Fundamental limits of communication with low probability of detection," IEEE Transactions on Information Theory, vol. 62, no. 6, pp. 3493–3503, Jun. 2016.

[4] R. F. Schaefer, H. Boche, A. Khisti, and H. V. Poor, Eds., *Information Theoretic Security and Privacy of Information Systems*. Cambridge, UK: Cambridge University Press, 2017.

Principales activités

The general objective of TRANSISTOR is to study the feasibility of implementing capabilities such as covert communications, physical layer security and simultaneous information and energy transmission by modifying an existing code. Under the assumption that these new capabilities can be described by information measures, the objective is to determine the fundamental limits on such measures for any possible given code.

Compétences

Candidates are expected to have a strong background in mathematics. Abilities in algorithm design and computer programming are also essential. Previous knowledge on information theory, game theory and signal processing is desirable. The candidate must have a provable level of written and spoken english. Skills in french language are not required.

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

Gross monthly salary for the first and second year : 1982€

Gross monthly salary for the third year : 2085€

Informations générales

- Thème/Domaine : Réseaux et télécommunications Systèmes d'information (BAP E)
- Ville : Lyon
- Centre Inria : [Centre Inria de l'Université Grenoble Alpes](#)
- Date de prise de fonction souhaitée : 2019-09-02
- Durée de contrat : 3 ans, 1 mois
- Date limite pour postuler : 2019-06-30

Contacts

- Équipe Inria : [MARACAS](#)
- Directeur de thèse : Medina Perlaza Samir / samir.perlaza@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.

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.

Consignes pour postuler

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.