

Offre n°2019-01659

Statistical-oriented predictability of cyber-physical systems

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

Type de contrat :Stage

Contrat renouvelable :Oui

Niveau de diplôme exigé :Bac + 5 ou équivalent

Fonction :Stagiaire de la recherche

Niveau d'expérience souhaité :Jeune diplômé

Contexte et atouts du poste

What a defibrillator, a car or an airplane have in common? They all share the same property of being a cyber-physical system (CPS). A CPS is an integration of computation with physical processes whose behavior is defined by both cyber and physical parts of the system [1]. An increased pressure is pushing the designers of these systems to make them as autonomous as possible. This pressure is translated at program level by the implementation of smarter algorithms that are tested on the only processors available on the market today: the multicore processors. Indeed, due to the pioneer utilization of multicore processors by the smartphone market as well as the impressive expansion of this later market, the microprocessor industry has evolved towards general purpose processors with complex architectures that are not time predictable. Their lack of time predictability is due to features like several cores, multiple levels of caches and pipelines, speculative branching, communicating through shared memory or/and through a network on chip, etc. While smartphone clients are willing to charge often their phones or to re-boot regularly their applications to compensate for the bad design of the phones on multicore processors, the rest of the CPS industry is facing the open problem of time predictability of programs on multicore processors if they want to provide to their clients applications that are stable and have low-energy consumption.

Unfortunately bounding the execution time of a program on multicore processors is known to be an open problem. For instance, there is no program ensuring the autonomic behavior of an airplane executed on multicore processors today because of the unbounded execution time of the programs on such processors [2].

[1] R. Baheti and H. Gill. Cyber-physical systems. IEEE, 2011

[2] P. Parkinson. Towards avionics safety certification on multi-core processor architectures. TechTime, Elec-

tronics and Technology News, 2016.

Mission confiée

The queueing model of interest has types of processes: type 1, type 2, ..., and type N process. The priority increases from type 1 process to type N process, with type 1 process having the lowest priority and type N process the highest priority. Queueing systems with process priorities and queueing systems with process transfers have wide applications in manufacturing, computer networks, telecommunication systems, and vehicle traffic control. Existing works mainly address issues related to system stability, computational algorithm design, optimal scheduling, routing, or performance analysis.

The main motivation for this traineeship is the predictability of cyber-physical systems and especially the execution time on multi-core processors. The first part of the work will be a review of the mathematical literature on this subject. A focus on bounding time and probability of extremal events will be of particular interest. Previous work as [3, 4] may be considered as a starting material.

Collaboration :

The recruited person will be in connection with the two supervisors Avner Bar-Hen and Liliana Cucu-Grosjean as well as the members of the Kopernic team.

[3] L. Cucu-Grosjean, L. Santinelli, M. Houston, C. Lo, T. Vardanega, L. Kosmidis, J. Abella, E. Mezzetti, E. Quinones, and F.J. Cazorla. Measurement-based probabilistic timing analysis for multi-path programs. In the 24th Euromicro Conference on Real-time Systems (ECRTS), 2012.

[4] C. Maxim, A. Gogonel, I.-M. Asavoae, M. Asavoae, and L. Cucu-Grosjean. Reproducibility and representativity - mandatory properties for the compositionality of measurement-based WCET estimation approaches. In the 9th International Workshop on Compositional Theory and Technology for Real-Time Embedded Systems (CRTS), 2016.

Principales activités

Main activities:

- Updating the state of the art;
- Proposition of a new statistical model taking into account the evolution of the execution times;
- Writing a short paper on the achievements of the internship;
- Participating to team meetings and other scientific events.

Compétences

Technical skills and level required : MSc level in Statistics

Languages : English required for written English (possibility of lectures within Inria to improve the fluency)

Relational skills : Team working

Avantages

- Subsidized meals
- Partial reimbursement of public transport costs
- 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

Informations générales

- Thème/Domaine : Systèmes embarqués et temps réel
Système & réseaux (BAP E)
- Ville : Paris
- Centre Inria : [Centre Inria de Paris](#)
- Date de prise de fonction souhaitée : 2019-09-02
- Durée de contrat : 4 mois
- Date limite pour postuler : 2019-07-06

Contacts

- Équipe Inria : [KOPERNIC](#)
- Recruteur :
Cucu Liliana / liliana.cucu@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

Passionate about statistics applied to Computer Science. Ready to work within an International team.

The internship may be continued with a PhD thesis on the same topic, so priority will be given to applicants wishing to prepare a PhD thesis.

The Inria interns are benefiting of stipends of around 450 euros/month and partially subvention for meals. The internship may start as soon as September 2019 for at least 4 months.

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.