The successful candidate will engage in explorative scientific research in the field of decentralized computer architecture and compilers. The recruited post-doctoral researcher should focus on embedded real-time systems for safety-critical real-time systems, because they include complex micro-architectural elements (cache hierarchies, branch, stride and value predictors) meant to improve average-case performance, and for which worst-case performance (worst-case execution times, WCET) is difficult to predict.

Some architectures were designed with both performance and predictability in mind, and are good candidates to run critical real-time software. Examples of such architectures are the Kalray MPPA many-core architecture (http://www.kalrayinc.com) or the Recore many-core hardware (http://www.recoresystems.com/).

**Contexte et atouts du poste**

**Scientific context**

Safety-critical systems (e.g. avionics, medical devices, automotive, ...) have so far used simple uni-core hardware systems in order to control cost, footprint, power, and safety. In order to meet the increasing constraints (i.e. cost, power) and to improve performance, academic and industrial groups have started to develop multi-core architecture and compilers. These new architectures are designed with both better performance and predictability in mind, and are good candidates to run critical real-time software. Examples of such architectures are the Kalray MPPA many-core architecture (http://www.kalrayinc.com) or the Recore many-core hardware (http://www.recoresystems.com/).

**Keywords**

Compilers, Real-time, Multi-core, Computer architecture, Worst-case execution time estimation

**Involved groups**

The post-doc will be supervised by people from the PACAP group (Isabelle Puaut) and the Cairn group (Steven Derrien)

**Mission confiée**

The objective of this position will be to design and implement techniques, enabling the calculation of tight Worst-Case Execution Time (WCET) estimates on many-core architectures. Proposed techniques will optimize existing mapping/scheduling techniques to better control the hardware with the objective of reducing the WCET estimate of parallel applications. In particular, special attention will be paid to the reduction of interference on shared resources (bus access, memory banks, NoC) and management of the hierarchy (on-chip memory and caches). Among others, we foresee two research directions that look promising, not yet fully explored in the literatures and which worst-case performance is difficult to predict. For which worst-case performance (worst-case execution times, WCET) is difficult to predict.

- Automatic mapping of data structures on memory banks to avoid contentions
- Configuration of Network on Chip (NoC) to reduce data transfer time (e.g. application specific routing, static calculation of TDMA slots to reduce worst-case end-to-end data transfer latency)

The supervisors will be members of the Pacap and Cairn research groups (Pacap for expertise on WCET computation, computer architecture and compilers, Cairn for automatic parallelization, computer architecture and compilers). The techniques developed by the postdoc will be experimented on the architectures and tools available in the Cairn and Pacap groups and within the H2020 Argo project (e.g. GeCos source-to-source optimization environment, Heptane WCET estimation tool, mapping and scheduling tools developed in both groups).

**References**


**Principales activités**

The successful candidate will engage in explorative scientific research in the field of decentralized computer architecture and compilers. The techniques developed by the postdoc will be experimented on the architectures and tools available in the Cairn and Pacap groups and within the H2020 Argo project (e.g. GeCos source-to-source optimization environment, Heptane WCET estimation tool, mapping and scheduling tools developed in both groups).

**Informations générales**

- **Thème/Domaine**: Architecture, langages et compilation
- **Ville**: Rennes
- **Centre Inria**: CRI Rennes - Bretagne Atlantique
- **Date de prise de fonction souhaitée**: 2018-11-01
- **Durée de contrat**: 3 ans, 4 mois
- **Date limite pour postuler**: 2018-07-31

**Contacts**

- **Equipe Inria**: PACAP
- **Recruteur**: I. Puaut (isabelle.puaut@irisa.fr)

**A propos d’Inria**

Inria, institut de recherche dédié au numérique, promeut « l’excellence scientifique au service du transfert technologique et de la société ». Inria emploie 2700 collaborateurs issus des meilleurs universités mondiales, qui relèvent les défis des sciences informatiques et mathématiques. Son modèle ouvert et agile lui permet d’explorer des voies originales avec ses partenaires industriels et académiques. Inria répond ainsi efficacement aux enjeux pluridisciplinaires et applicatifs de la transition numérique. Inria est à l’origine de nombreuses innovations créatrices de valeur et d’emplois.

**L’essentiel pour réussir**

The recruited post-doctoral researcher should hold a PhD in Computer Science, with ideally a focus on embedded real-time systems for multi-core platforms. The candidate should be a driven and creative individual, with an interest in innovative and paradigm-changing technologies.

**Conditions pour postuler**

- **Please submit online**: your resume, cover letter and letters of recommendation eventually
- **For more information**, please contact Isabelle Puaut (isabelle.puaut@irisa.fr)

**Sécurité défense**

Ce poste est susceptible d’être affecté dans une zone à régime restrictif (ZR), 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 ZR 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.
systems and algorithms, with focus on browser-based deployment and application.

Compétences
- Ability to conduct research autonomously in a collaborative setting.
- Self-initiative, curiosity and experimental rigor.
- Excellent ability to express oneself clearly and convincingly in both written and oral English.
- A genuine drive to expand one’s knowledge and horizons.
- Excellent experimental and programming skills.
- A good grasp of current research questions in distributed systems and/or distributed algorithms research.

Avantages sociaux
- Subsidised catering service
- Partially-reimbursed public transport

Rémunération
Post-doc: monthly gross salary amounting to 2653 euros