2018-00459 - Multi-clock reconfigurable architectures

Contract type: Public service fixed-term contract
Level of qualifications required: PhD or equivalent
Fonction: Post-Doctoral Research Visit
Level of experience: Recently graduated

Context

In avionic or automotive fields, critical real-time embedded systems coordinate iterative and/or sporadic tasks that may vary during system operation due to external conditions (e.g., flight phases of an airplane, or operation phases of a car...) or/and internal ones (for example degraded mode). In the end, for some systems, we can imagine hot reconfigurations, motivated by error corrections, changes in their environment, or evolution of functionalities. But these architectural evolutions should be made while preserving security properties linked to the criticality of these systems.

In the particular case of the streamed dataflow model of computation, a higher-order, purely functional domain-specific language such as CAPH has been proposed for programming stream-processing applications on reconfigurable hardware such as FPGAs.

On the other hand, synchronous languages (and among them Signal, which also allows a design with independent or weakly constrained clocks) make it possible to guarantee security properties in a static architecture framework.

The proposed Post Doctoral aims to take advantage of both the generality of the dataflow model as it is taken into account by CAPH and the properties of the synchronous languages (and in particular Signal) to define a new language, or model, adapted for multi-clock reconfigurable architectures.

This model could be an extension of the polychronous model of the Signal language and of the CCSL standard, allowing a more powerful language than usual Signal, but preserving its safety properties.

The designed language or model will be provided with a rich type system including behavioral properties considered as types: refinement types. Its formal (operational) and type semantics will be defined, along with type transformation operations (casting operations in the form of interface synthesis) will be provided.

References


Assignment

Assignments:

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For a better knowledge of the proposed research subject:

A state of the art, bibliography and scientific references are available at the following URL, do not
hesitate to log in: https://team.inria.fr/tea/

**Collaboration:**
The recruited person will be in connection with Thierry Gautier who works for Jean-Pierre Talpin.

**Main activities**
The proposed Post Doctoral aims to take advantage of both the generality of the dataflow model as it is taken into account by CAPH and the properties of the synchronous languages (and in particular Signal) to define a new language, or model, adapted for multi-clock reconfigurable architectures.

**Benefits package**
- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave

**Remuneration**
Monthly gross salary amounting to 2653 euros