The main goal of this post-doctoral project is to extend JavaBIP with new mechanisms for resource management and self-adaptation. Indeed, the environment of modern systems is inherently highly variable. In particular, this is due to interferences among applications sharing common resources and to the migration, e.g. of cloud applications among computing units. Thus, fluctuations of resource availability become the norm rather than an exception. Instead of waiting for the resources to become available, applications adapt their behaviour to the changes in the environment. Mechanisms for speculative, asynchronous event notifications can be clearly specify and implement component coordination on a high-level of abstraction, in such a manner that self-adaptation mechanisms along with appropriate specification languages, allowing designers to envision all possible execution scenarios, synchronization errors can result in race conditions and deadlocks.

To address this concurrency challenge, we have developed JavaBIP [2]. JavaBIP is a Java adaptation of the Behavior, Interaction, and Priority (BIP) framework [3], providing two primitive mechanisms for component coordination: (i) multi-party synchronization of component transitions and (ii) asynchronous event notifications.

The main goal of this post-doctoral project is to extend JavaBIP with new mechanisms for resource management and self-adaptation. Indeed, the environment of modern systems is inherently highly variable. In particular, this is due to interferences among applications sharing common resources and to the migration, e.g. of cloud applications among computing units. Thus, fluctuations of resource availability become the norm rather than an exception. Instead of waiting for the resources to become available, applications adapt their behaviour to the changes in the environment. Mechanisms representing resource availability and dependencies must be explicitly provided in the design framework. To enable efficient coordination, components must advertise their resource requirements to the coordinating engines, which in turn must be able to combine such requirements with information about resource availability to optimise overall system performance.

Theoretical work within the project will aim to develop expressive formal models for the specification and analysis of platform capacities and application requirements for various kinds of resources, on one hand, and adaptation policies, on the hand. These models will form the foundation of a rigorous design approach—to be implemented in JavaBIP—which would provide resource management and self-adaptation mechanisms along with appropriate specification languages, allowing designers to specify and implement component coordination on a high-level of abstraction, in such a manner that behavioural properties, resource-management policies and self-adaptation strategies can be clearly stated, combined and enforced.

References

Principales activités
Main activities:
- Scientific research (definition of models, algorithms etc.; proofs)
- Implementation of prototype tools for evaluation of the proposed techniques
- Written presentation of the obtained results through papers and reports
- Oral presentation of the obtained results at scientific conferences
- Participation in the supervision of students at all levels

Additional activities:
- Strengthening of one's scientific network and definition of a career strategy
- Participation in the development of a user community
- Participation in other activities to promote the team's research to broader audiences

Compétences
- Formal methods (in particular semantic models, e.g. finite automata, Labelled Transition Systems and Petri Nets; behavioural equivalences, e.g. trace equivalence and bisimilarity)
- Verification (in particular temporal logics, e.g. LTL and CTL; tools, e.g. nuXmv, mCRL2)
- Knowledge of coordination languages, such as BIP, is a plus
- Proven experience in preparation of scientific documents (including mastery of LaTeX)
- Proven experience in software development (Java, Python)
- Excellent communication skills

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

Rémunération
Around 31 000 € yearly brutto.