Example, on transmission delays. While probabilistic model checkers exist (e.g., [3]) and can in
likeliness that it actually occurs. Doing so requires introducing probabilities in the system description,
declaring that such an execution is possible, it would be more interesting if one could analyze the
stopping as well, waiting for this processor’s data to go on with their own computation. Instead of
consequences in terms of performance as one processor being blocked can result in many others
sometimes not interesting. For example, in a large-scale system, some messages transmissions can
“combinatorial explosion” problem that makes verification feasible only for small instances of
“Heisenbugs” that are extremely difficult to reproduce.

SimGrid [1] is a software platform that provides models and APIs for simulating distributed systems;
systems has becomes a nightmare even for experts.

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Mission confiée

Scientific context

The post-doctoral researcher will be hosted by the VeriDis research group (http://veridis.loria.fr/) of
Inria Nancy Grand Est and LORIA and will interact with the teams MEXiCo (https://www.inria.fr/en/teams/mexico) of Inria Saclay and LSV and MYRIADS (http://www.inria.fr/myriads/) of Inria Rennes Bretagne Atlantique and IRISA. The objective of the VeriDis team is to contribute research on the modeling and verification of distributed algorithms and systems. VeriDis contributed to the existing model checker within SimGrid [2]. We intend to intensify our involvement in making formal verification techniques available to “real-world” programmers, and we believe that the combination of statistical model checking and simulation for performance evaluation will be fruitful. The statistical model checker COSMOS has been developed mainly by the team MEXiCo whose members are experts in probabilistic systems and their verification. The MYRIADS team is specialized in designing and implementing systems and environments for autonomous service and resource management. It hosts core SimGrid contributors.

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2018-00595 - Post-Doc Position : Statistical Verification of Distributed Programs Within SimGrid [S]

Type de contrat : CDD de la fonction publique
Niveau de diplôme exigé : Thèse ou équivalent
Fonction : Post-Doctorant

Contexte et atouts du poste

Environment of the position

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Informations générales

• Thème/Domaine : Preuves et vérification
• Ville : Villers-lès-Nancy
• Centre Inria : CRI Nancy - Grand Est
• Date de prise de poste souhaitée : 01-11-2018
• Durée de contrat : 1 an, 4 mois
• Date limite pour postuler : 06-06-2018

Contacts

• Equipe Inria : VERIDIS
• Recruteur : Merz Stephan / stephan.merz@loria.fr

L’essentiel pour réussir

Skills and profile

Required qualification: Candidates must have obtained a PhD in computer science on September 1, 2016 or later, and prior to the date of the start of the post-doctoral research. Candidates who are still preparing their PhD at the date of the application are expected to indicate the date of the PhD defense and the composition of the PhD committee.

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 meilleures 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.

Conditions 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
principle be used for analyzing such systems, they require a formal model of the system rather than C code as in SimGrid, and they again suffer from the problem of combinatorial explosion.

**Principales activités**

**Project description**

The objective of this project is to adapt and implement the technique of statistical model checking [4] within SimGrid. In this approach, instead of attempting to exhaustively compute all possible system behaviors, executions are sampled according to the probability distributions associated with the target execution platform in order to estimate the probability that a property is satisfied in the system. Beyond the analysis of Boolean properties, the same technique can provide estimates for other relevant measures such as the average number of messages in a communication buffer or the expected time for achieving a task. Such a capability would be a useful complement to the current possibilities of deterministic performance evaluation through simulation, by allowing for a range of behaviors instead of a precisely determined one. Because statistical model checking is based on sampling individual executions, there is no need to compute and store the entire state space of the system, and much more complex systems can be analyzed than what is possible using traditional (probabilistic) model checking techniques (see e.g. [5]).

The concrete objectives of this post-doctoral research proposal are listed below. The range of subjects that will actually be covered will be determined taking into account the interests of the candidate and will be adapted according to the progress of the work. The subject combines conceptual research and implementation tasks to make statistical model checking available to users of the SimGrid platform, for applications to real-life programs and platforms.

- Identify relevant probabilistic parameters and properties of interest supported by SimGrid.
- Implement a generic interface for performing statistical verification on top of SimGrid. A first experiment has been carried out within a master's thesis and enables some simple analyses, using Simgrid as a black box. An interesting extension would be to follow the work done in COSMOS [5] to obtain and exploit information generated during the execution.
- Evaluate the scalability of the technique and the expressiveness of the extensions mentioned above by applying the approach to relevant examples that have already been implemented within SimGrid.
- Study a possible coupling with performance evaluation as traditionally performed within SimGrid.

**Bibliography**


**Compétences**

We expect the candidate to be familiar with the following subjects:

- Solid knowledge on formal verification techniques, in particular model checking and/or runtime verification.
- Solid programming experience, in particular for system programming in C.
- Basic knowledge of probability theory and statistics.

We appreciate the willingness of the candidate to get involved in both conceptual research and in actual implementation of the model checking techniques within SimGrid. He or she should also be willing to visit the partner sites in Rennes and Paris.

**Avantages sociaux**

- Subsidised catering service
- Partially-reimbursed public transport
- French courses

**Rémunération**

Salary: 2653€ gross/month