2018-00728 - Analysis of replicated state machine implementations

Contract type: Internship agreement
Level of qualifications required: A levels + 2 years of higher education or equivalent
Function: Internship Research

Context
The position is within the Static Analysis by Abstract Interpretation team, acronym ANTIQUE (http://www.di.ens.fr/AntiqueTeam.html.fr), which is an Inria-Paris team located at Ecole Normale Superieure in Paris. Our group focuses on developing automated techniques to compute semantic properties of programs and other systems with a computational semantics. The team has a long standing experience in the domain of software verification, with notable successful projects such as Astree, a static analyzer used at large scale for the verification of embedded software.

Static analysis has been applied successfully on sequential code and one of the current challenges is to extend these techniques to distributed computational models, when considering networks of unbounded size.

Assignment
Fault-tolerant distributed algorithms play an important role in many critical/high-availability applications. These algorithms are notoriously difficult to implement correctly, due to asynchronous communication and the occurrence of faults, such as the network dropping messages, processes crashing or behave maliciously. Although fault-tolerant algorithms are at the core of critical applications (Zookeeper, Amazon Dynamo), there are no automated verification techniques that can deal with their complexity.

The difficulty of the verification problem does not only come from the algorithms but also from the way we think about their behaviors. In the team we investigate programming abstractions that facilitate the development of automated verification techniques.

Assignments:
With the help of Cezara Dragoi, the recruited person will be taken to develop to work on an intermediate representation for asynchronous protocols. On the implementation side the intern will work on an a code to code translation from asynchronous java code to the designed intermediate representation.

For a better knowledge of the proposed research subject:
A state of the art, bibliography and scientific references are available at the following URL http://www.di.ens.fr/~cezarad/internship.pdf.

Main activities
Main activities:

- propose solutions for an intermediate representation for asynchronous protocols,
- implement a front-end from Java to the intermediate representation.

Skills
Technical skills and level required: distributed protocols, network programming
Languages: Java, C++, Go
Relational skills: team work
Benefits package

- Subsidised catering service
- Partially-reimbursed public transport
- Flexible working hours
- Sports facilities