2018-00421 - [Campagne CORDI-S - CRI Paris] : Distributed coordination algorithms in dynamic networks

Contract type : Public service fixed-term contract
Level of qualifications required : Graduate degree or equivalent
Fonction : PhD Position
Level of experience : Recently graduated

Context
The Delys group (previously Regal) <http://team.inria.fr/regal/> is a joint team of Inria and Sorbonne University whose research topics cover the whole spectrum of distributed systems and multicore systems. Our research topics span the whole spectrum between theoretical aspects of distributed systems, such as possibility and impossibility results, consensus or fault detectors, to the design and implementation of highly efficient algorithms and systems, such as an extreme-scale geo-replicated database minimising synchronisation. We publish in the best venues across the spectrum, such as PODC, DISC, SSS, OPODIS, JPDC, OSDI, EuroSys, Middleware, SRDS, DSN, IFDPS, EDCC, OSR, Systor, ASPLOS, POPL, etc.

Delys is located at LIP6, the Informatics research laboratory of Sorbonne University, in the Latin Quarter of Paris.

Assignment
Distributed algorithms are traditionally conceived for message-passing distributed environments which are static and whose membership is known. However, new environments such as ad-hoc mobile wireless network (MANET) or sensor wireless network (WSN), peer-to-peer networks, and opportunistic grids or clouds provide access to services or information regardless of node location, mobility pattern, or global view of the system.

These new systems are dynamic, which means that the communication graph evolves over time, processes might join or leave the system, or crash and recover during the run. Additionally these systems are unknown, which means that processes do not initially know the membership of the system, and only discover it during the run. Therefore, distributed algorithms that run on top of these new systems cannot use prior distributed models for static known systems.

Main activities
This thesis focuses on building block algorithms for distributed systems in dynamic topologies, studying fundamental problems such as consensus [1,2] and mutual exclusion [3]. For modeling the dynamics of the system and evolving communication between nodes, we will exploit the formalism of the Time-Varying Graphs (TVG) [4]. Delys has also been interested in failure detector (FD) [5] which is a fundamental abstraction for distributed algorithms. FDs have been widely used to solve agreement and locking problems in asynchronous systems prone to crash failures, but usually conceived for static environments and known network topologies. Hence, the objective in this thesis is also to propose efficient FDs algorithms for dynamic unknown networks which will be used to solve agreement and mutual exclusion problems.

Proposed algorithms will be evaluated both on simulation using OMNet ++ tool and in real mobile sensor testbeds using FIT platform.

References
Skills
The candidate should have knowledge in distributed systems and theoretical aspects of distributed algorithms as well as strong development skills since interest in experimental research is also requested.

Benefits package
- Subsidised catering service
- Partially-reimbursed public transport

Remuneration
Gross Salary per month: 1 982 € the first 2 years and 2 085 € the last year