

PhD Proposal :

Monitoring and Control of Large Distributed Systems

Location : IRISA, Rennes (35), Distribcom team

Subject : One of the biggest challenges to modern computer science concerns the size and complexity of systems that appear around us today. Either on the hardware side (telecommunication network, grid architecture, system on a chip, etc.) or on the software side (P2P network, web services, web scale application, etc.), the number of interacting components generates combinatorial explosions that kill traditional approaches to analysis, verification, monitoring and control. For such objects, it simply becomes impossible to assume the system perfectly known and to process it globally.

Nevertheless, in the last years, the Distribcom team has developed a theoretical framework to solve some of the difficulties raised by large distributed systems. It relies on the idea that a distributed system should be monitored by an architecture that is itself distributed. This takes the form of a network of local supervisors, one per (group of) component(s), that coordinate their work in order to achieve a global objective. This idea has been successfully implemented to diagnose in a distributed manner failures occurring in a telecommunication network, in collaboration with an equipment supplier.

The proposed thesis subject aims at extending this approach to capture features that appear in current distributed systems, namely:

- dynamicity: how to model and supervise systems which structure evolves as they run, for example P2P networks, or web services, or networks where connections appear and disappear continuously;
- robustness: how to deal with imperfectly known systems, or partially observed systems;
- hierarchical reasoning: how to build different levels of abstraction of a given system in order to monitor it at different granularities, or according to different views;
- distributed control: how to build distributed controllers, in particular in the case of stochastic distributed systems.

This research domain is at the intersection of computer science, automatics and optimal control theory. Moreover, the subject requires both theoretical developments and test implementations, possibly related to an industrial application. Therefore there is space to adjust the subject to the preferences and skills of the selected candidate.

Ideal profile : Masters in computer science or mathematics, skills in distributed algorithms, optimal control and probabilities will be appreciated.

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Bibliography :

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- E. Fabre, **Distributed diagnosis based on trellis processes**, in proceedings of Conf. on Decision and Control, Sevilla, Dec. 2005, pp. 6329-6334.
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