Towards Fault Tolerance For Multiagent Systems

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ABSTRACT

There is a growing need for improving the fault tolerance in multiagent systems (MASs). In this thesis, we investigate it in two parts. The first part presents a monitoring approach which detects whether the design and implementation of a MAS is correct. The second part introduces agent-oriented architectures which aim to maximise multiagent survivability. We then present several heuristics to measure the survivability of a given MAS.

Categories and Subject Descriptors

I.2.11 [**Artificial Intelligence**]: Distributed Artificial Intelligence—*Multiagent systems*

General Terms

Algorithms, Performance, Reliability

Keywords

Monitoring, Survivability, Replication, Heuristics

1. MOTIVATION

Recent years have seen an increasing number of multiagent systems developed within various agent platforms and frameworks. In this thesis, we address two problems that may arise in the development of a MAS: firstly, in the *design* stage, a major problem is to verify that implemented agents collaborate well to reach the goal. Therefore we propose a method to *monitor collaborative agents* in order to ensure the correctness of the MAS design; secondly, in the *deployment* stage, a major problem is the deployed MAS can easily crash due to external events. Thus we study how to *ensure the survivability of a MAS deployment.*

2. MONITORING AGENTS

For the first problem, we consider the situation where the environment is fixed and static, however the design or implementation of a MAS might be incorrect. We describe agent collaboration as an action theory. Action sequences reaching the goal are determined by a planner, whose compliance with the actual behaviour of agents allows to detect possible collaboration failures [1]. In this way, the approach can be applied to aid offline testing as well as online monitoring. The proposed method is independent of the agent platform and planning system. The implementation of an example has been carried out within the multiagent platform $IMPACT$, and the planner $DLV^{\mathcal{K}}$.

3. MULTIAGENT SURVIVABILITY

For the second problem, we investigate the survivability of MASs in changing environments. Given a multiagent application and a dynamic network, we study how to deploy agents over the network such that the survivability is maximised. Our approach is based on the idea of replicating agents on the network. In contrast to centralised and static models, we introduce agent-oriented models that are completely distributed and can redeploy agents when there is a need to re-evaluate the survivability of agents due to external events [2]. The proposed distributed algorithms can be built on top of any centralised survivability algorithm(CSA). We assess three distributed algorithms by experiments.

We then study how to develop the proper CSAs with the assumption that we know the independence of node failures in the network [3]. We show that computing survivability in this environment is still intractable. We also present various heuristics to compute the survivability of a given MAS deployment. We have implemented and tested all these heuristics and reported on the advantages and disadvantages of them in different environmental settings.

4. REFERENCES

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