ADAM: An Autonomic Approach to Database Management

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Abstract

In recent years, the emergence of the Internet has resulted in a proliferation of data. This in turn has given rise to increasing demands of organizations to access accurate information swiftly and efficiently. Thus, the scope of functions for databases has expanded more than ever and the complexity of database systems has grown accordingly. Consequently, the burden on database administrators (DBAs) has increased significantly. The objective of this research is to address and propose a solution to overcome this problem of overburdened and expensive DBAs. This chapter focuses on relational database management systems in particular and proposes a novel and innovative multiagent system (MAS) that would autonomously and rationally administer and maintain databases. The proposed multi-agent system tool, ADAM (a MAS for autonomous database administration and maintenance), is in the form of a self-administering wrapper around database systems and it addresses, and offers a solution to, the problem of overburdened and expensive DBAs with the objective
of making databases a cost-effective option for small/medium-sized organizations. An implementation of the agent-based system to proactively or reactively identify and resolve a small subset of DBA tasks is discussed and the GAIA methodology is used to outline the detailed analysis and design of the same. Role models describing the responsibilities, permissions, activities, and protocols of the candidate agents, and interaction models representing the links between the roles are explained. The coordinated intelligent rational agent model is used to describe the agent architecture and a brief description of the functionalities, responsibilities, and components of each agent type in the ADAM multiagent system is presented. Finally, a prototype system implementation using JADE 2.5 and Oracle 8.1.7 is presented as evidence of the feasibility of the proposed agent-based solution for the autonomous administration and maintenance of relational databases.

Introduction

The increasing demands of today’s world and the vast variety of both traditional and online services currently being offered, resulting in datasets that are increasing enormously in diversity and volume, have rendered databases an indispensable component of daily life and have increased the complexity of databases significantly. They are no longer viewed as frills affordable only by large, rich organizations, but are now considered a mandatory component of any business, however small, that hopes to succeed and satisfy its clientele. Today, databases play a critical role in almost all areas where computers are used (Elmasri & Navathe, 2000).

Databases are growing rapidly in scale and complexity. With technological developments resulting in rapidly decreasing hardware and software costs, personnel costs have become the single most important factor contributing to the cost of ownership for database applications. To ensure the appropriate functioning of database systems, database owners are having to rely more and more on the skills of experienced database administrators who are, in turn, becoming rarer and more expensive (Lightstone, Kwan, Storm, & Wu, 2002; Lightstone, Lohman, & Zilio, 2002). This has given rise to an increasing need for self-managing, self-administering, and self-maintaining databases.

The key focus of research in the field of databases currently is on making databases intelligent enough to maintain and tune themselves for optimum performance. The objectives of this research are to make databases and the various advantages they offer available to small/medium sized organizations without forcing the organizations to incur the huge costs associated with people required to manage the databases, and to help beleaguered DBAs of large (in size or in number) databases by easing some of the burden of database administration off their shoulders.
Path Relinking with Multi-Start Tabu Search for the Quadratic Assignment Problem
Tabitha James and Cesar Rego (2013). Recent Algorithms and Applications in Swarm Intelligence Research (pp. 52-70).
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