Chapter 18

A Software Tool and a Network Simulation for Improving Quality of Service Performance in Distributed Database Management Systems

Ismail Omar Hababeh
United Arab Emirates University, UAE

Muthu Ramachandran
Leeds Metropolitan University, UK

ABSTRACT

The efficiency and effectiveness of Quality of Service QoS performance methods in a Distributed Database Management System DDBMS environment are measured by their successfully simulation on the real world applications. To achieve the goals of the simulation modules and to analyze the behaviour of the distributed database network system and the QoS performance methods of fragmentation, clustering and allocation, an integrated software tool for a DDBMS supported by the OPNET is designed and presented. It is developed to wisely distribute the data among several sites on a database network system, effectively enhance the QoS performance at lower cost, successfully provide reliability to the DDBMS in case of site failure, and efficiently increase the data availability where multiple copies of the same data are allocated to different sites. The integrated software tool supply the database administrators with a software that is friendly use, easy to navigate, comprehensive, and expandable that simulate the techniques of database fragmentation, clustering network sites, and fragment allocation and replication in a DDBMS. The tool performs the database transactions operations efficiently and effectively through reliable forms that allow the database administrators to control over their operations and follow up the system improvements and QoS enhancements. The performance evaluation and simulation results indicate that the proposed methods significantly improves the QoS performance in the DDBMS even with manageable extra information, network sites, communication and processing cost functions.

1. INTRODUCTION

During recent years, the interest in DDBMS applications has increased steadily. This interest is mainly due to the large communication costs between network sites and the huge number of transactions that need to be executed throughout database systems. From this point of view, simulation models are adequate tool for understanding and evaluating the QoS methods in DDBMS.

To achieve the goals of the simulation models and to analyze the behaviour of the techniques proposed by Hababeh, Ramachandran, and Bowring (2007A, 2008), a software integrated tool for a DDBMS is developed to wisely distribute the data among several sites on a database network system, effectively enhance the system performance at lower cost, successfully provide reliability to the DDBMS in case of site failure, and efficiently increase the data availability where multiple copies of the same data are allocated to different sites if possible.

The proposed tool presents integrated user-friendly application software used for database fragmentation, clustering network sites, and fragment allocation and replication in a DDBMS. It has been developed to support fragmentation of global relations into pair-wise disjoint fragments to accomplish the benefits of allocating each fragment independently at each site. Some fragments may be allocated to multiple sites in order to achieve some constraints such as availability, consistency, and integrity.

The software tool is tested on a heterogeneous database system that has several types of computers distributed at various network sites which have different processing and communication costs. Within such a tool, experiments can be set up to test the proposed techniques of database fragmentation, clustering network sites, and fragment allocation in a DDBMS environment and verify the comprehension degree in each method.

The following sections and subsections will discuss the importance of DDBMS applications, describe the tool architecture, address the tool network requirements, process global relations, define the transactions processing cost functions, and simulate the performances of the database network system.

2. THE DDBMS APPLICATIONS IN THE LITERATURE

The increasing success of relational database technology in data processing is due, in part, to the availability of nonprocedural languages, which can significantly improve application development and end-user productivity Ozsu and Valduriez (1999).

Apers (1988) addressed the necessity of supplying a Database Management System DBMS with tools to efficiently process queries and to determine allocations of the data such that the availability is increased, the access time is decreased, and/or the overall usage of resources is minimized.

Hoffer, Prescott, and McFadden (2004) have investigated a comparison between different types of database systems and described the results in terms of reliability, expandability, communications overhead, manageability, and data consistency. They conclude that there has been an increase in the demand for DDBMS tools that interconnect databases residing in a geographically distributed computer network.

Greene et. al (2008) noted that the National Virtual Observatory (NVO) Open SkyQuery portal allows users to query large, physically distributed databases of astronomical objects. Queries can be generated through a simple forms-based interface or through an advanced query page in which the user generates a SQL-type query. The portal provides both a simple form and advanced query interface for users to perform distributed queries to single or multiple SkyNodes. However, Open SkyQuery currently limits the number of matches to 5000, data duplication is still available between

23 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/software-tool-network-simulation-improving/37037

Related Content

Smart Contract-Based Secure Decentralized Smart Healthcare System
Anu Rajand Shiva Prakash (2023). *International Journal of Software Innovation (pp. 1-20).*
www.irma-international.org/article/smart-contract-based-secure-decentralized-smart-healthcare-system/315742

Adressing Special Educational Needs in Classroom with Cyber Physical Systems
Aneta Atanasovaand Aleksandra Yosifova (2019). *International Journal of Cyber-Physical Systems (pp. 71-90).*
www.irma-international.org/article/adressing-special-educational-needs-in-classroom-with-cyber-physical-systems/239868

Lowering Coupling in Distributed Applications With Compliance and Conformance
José Carlos Martins Delgado (2020). *Applications and Approaches to Object-Oriented Software Design: Emerging Research and Opportunities (pp. 35-77).*
www.irma-international.org/chapter/lowering-coupling-in-distributed-applications-with-compliance-and-conformance/249320

Online Fraud Detection Using Machine Learning Algorithms and Quantum Annealing Solvers
B. Akshaya, Agnimita Das Bakshiand Annie Micheal A. (2024). *Spectrum and Power Allocation in Cognitive Radio Systems (pp. 159-166).*
www.irma-international.org/chapter/online-fraud-detection-using-machine-learning-algorithms-and-quantum-annealing-solvers/353252

Disciplined Teams vs. Agile Teams: Differences and Similarities in Software Development
Antonio Alexandre Moura Costa, Felipe Barbosa Araújo Ramos, Dalton Cézane Gomes Valadares, Danyllo Wagner Albuquerque, Emanuel Dantas Filho, Alexandre Braga Gomes, Mirko Barbosa Perkusichand Hyggo Oliveira de Almeida (2021). *Balancing Agile and Disciplined Engineering and Management Approaches for IT Services and Software Products (pp. 151-166).*
www.irma-international.org/chapter/disciplined-teams-vs-agile-teams/259176