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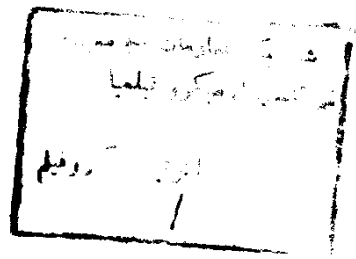
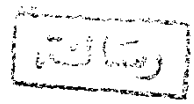


Distributed Database Systems Performance Analysis

by
Eng. Mohamed Abdel Kader Salem



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in Computer Engineering

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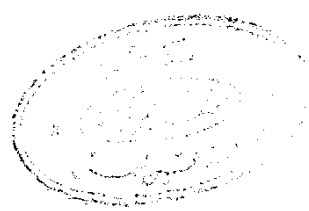
Cairo 1993



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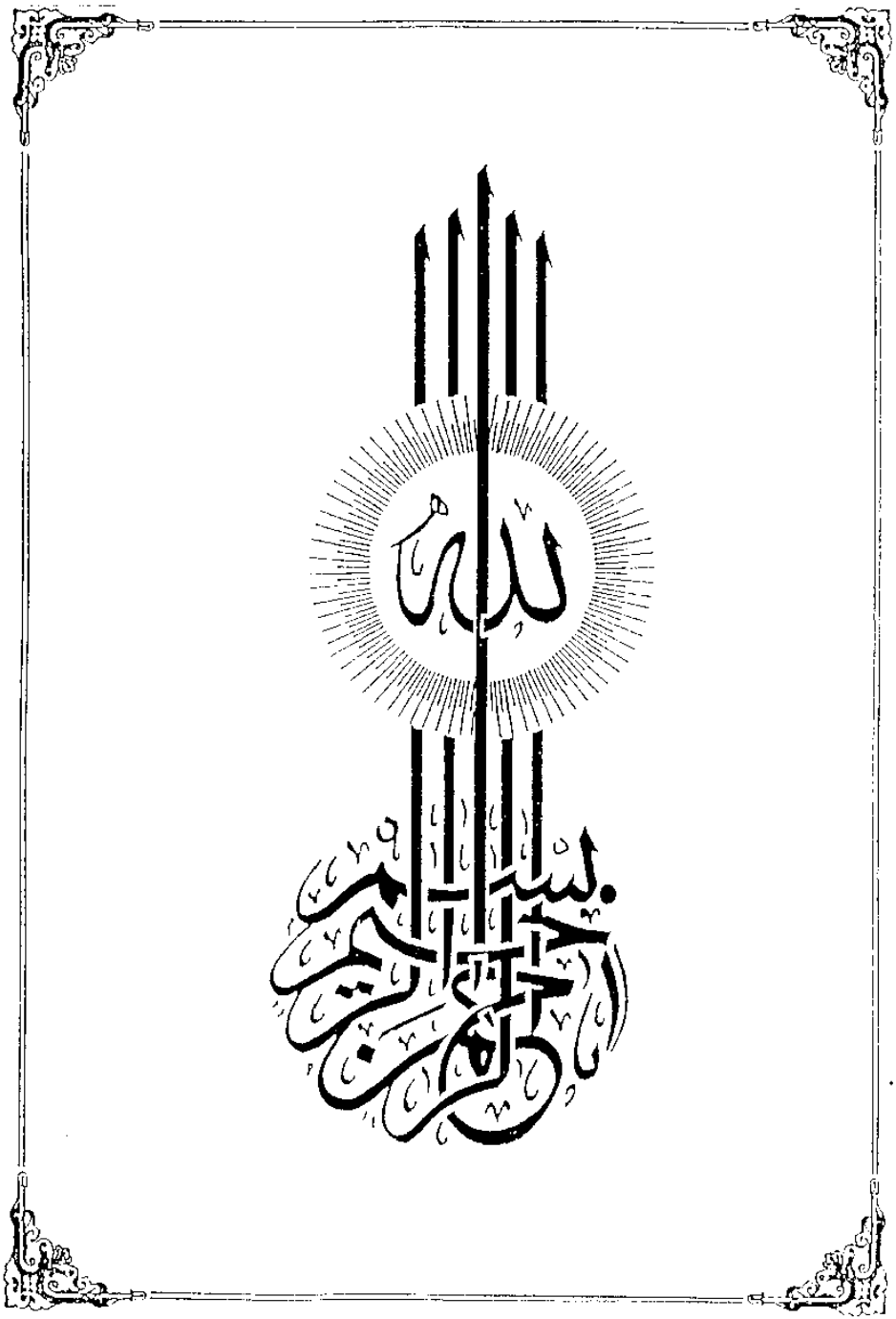

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Distributed Database Systems - Performance Analysis

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Statement

This dissertation is submitted to Ain Shams university for the degree of Master of science in computer Engineering.
The work included in this thesis was carried out by the author in the department of computers and system engineering, Faculty of Engineering, Ain Shams university, from 9/1990 : 9/1993.
No part of this thesis has been submitted for a degree or a qualification at any other university or institute.

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Distributed Database Systems Performance Analysis

Abstract

Performance analysis is considered one of the most important operations which is carried out on any new technologies, because it gives the best results with minimum cost and time frame.

In the field of Distributed Database Systems, and as a result of the huge and continuing progress in this field, and because of its speedy, accurate and low cost methods, ***Performance Analysis*** has become may be the leading method in dealing with those systems problems .

Using Simulation for performance analysis gives deep insight in the Distributed Database systems as well as accurate results.

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Thesis Construction

In this study different areas have been surveyed and analyzed, so many programs were written starting from the very simple analytic level up to the main model which was made simple enough to reflect the essential goal of the study, comprehensive enough to cover all the environments of the real-life system and most accurate to achieve the best results available. The study consists from three chapters and a conclusion with the necessary figures, graphs, tables and appendices.

the background study of this work includes Distributed Database systems concepts, structure as well as simulation and analytic modeling techniques including Queuing Network Modeling and Simulation Modeling.

A survey for Performance Analysis in Distributed Database Systems have been carried out, using Queuing Network Modeling a simple primitive analytic models have been constructed, implemented and used for verification of the main simulation model.

A simulation model to study Query Processing in Distributed Database Systems has been constructed. An application package was analyzed, designed and implemented using C programming language and Object Oriented techniques in C++ to the solve the model. A deep detailed study of the effect of database file organization is carried out, the results of this study is included in the model parameters.

The simulation model successfully ran, followed by gathering and

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analyzing the results, the conclusion and recommendation were given.
The following is a brief description of the thesis chapters.

Chapter #1 is a highly tutorial one and this contribution was meant to be so for two reasons, the first came from the research thesis objective to study the distributed database systems from all aspects, the second was to give the interested reader in that topic a short concentrated logical summery of that area.

This chapter covers the Distributed Database Systems definition, concepts, structure, advantages which lies in the fact that it mirrors the real life system, disadvantages and always complexity was the main problem of the that sort of systems. Following that the chapter calls for the fundamental principles of a distributed database system like, local autonomy, location transparency, replication transparency, distributed query processing and some more rules which are presented in this chapter. The chapter moves after that to the main problems of the distributed database systems like query processing, recovery control, concurrency control, update propagation and catalog management together with a very brief suggested solutions of some of these problems.

Chapter #2 focuses the light on Performance Analysis generally and in Distributed Database specifically.

It starts by discussing the techniques of Performance Evaluation namely Measurement, Analytic Modeling and Simulation. The chapter goes through those techniques in brief, touches some sort of comparison between these techniques and branches after that into two main sections, Queuing Network Modeling and Simulation Modeling which had been discussed in details in

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addition to some Analytic and Simulation models that had been presented and discussed to complete the idea of that sort of performance evaluation.

A definition of Queuing Network Modeling is presented followed by the reason why it was decided to work with queuing network modeling rather than Queuing theory. The next part describes how to construct a queuing network model going through its definition then parameterization and evaluation of that model to determine the behavior through out the alternatives and specifying to what extent the model behavior is the same manner as the real system. Following to that the section calls for queuing network basic definitions, basic quantities and basic laws. A case study was considered for the reason of construction and validation the main simulation model. The case study was discussed from the very basic concepts of open and closed models, single and multiple classes and centers. All the relevant relations and laws were overviewed before starting discussing a multiple classes multiple centers open queuing network model which was written in C programming language. Inputs were proposed output were analyzed, all the necessary flow charts, output graphs and tables were presented.

Moving to section II, it starts by defining simulation modeling, then it goes for the types of simulation then describing the mechanics of constructing and executing a simulation model whether it is an event or time driven. Being one of the most important phases of simulation; gathering observation, was discussed from the point of view of methods of gathering these observations, namely Replication, subintervals and cycles method.

Dealing with the amount of observations gathered needed some rules of sampling, and that was the reason for over viewing sampling theory which had

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been used as a tool for dealing with the gathered data. Many simulation models were designed and implemented for the possible combinations, starting from the simple open single class single server, up to multiple classes multiple centers models so a comprehensive case study one could be studied. A case study was considered, its results were analyzed for the purpose of determining some values of the inputs that was used in designing the main simulation model.

Chapter #3 is dedicated for the simulation model. It details the model in a progressive manner that starts from the model construction, representation then it proceeds to the model objectives, following to that, it calls for the model characterization and description.

Being one of the basic concepts of the model, deep analysis had to be done starting from the very beginning and that was the reason of detailing the customer arrival/departure routine with its two major events, arrival and departure. After what could be called base description, the query itself follows, and related items are descriped going through paths overview, model assumptions, environments, inputs, centers description, databases and outputs.

The model design primarily presented by the model flowchart, path optimization comes next with the relevant basic file system organization, different performance relationships, service time calculations for each path for the used file organizations in the model.

It is worthwhile mentioning in this point that many models (analytic and simulation) had been designed and implemented for the purpose of reaching the best available form used for the principle model verification & validation as well

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as using the most realistic data to get at the end the highest accurate results. Model solution starts from this point, presenting the results with all the relevant graphs for detailed description of the obtained data. Model validation uses two techniques, which by applying these techniques the model will prove its true representation of the real life system and then by using the statistical rules of confidence test the model will prove with no doubt that it has a high degree of accuracy.

Chapter #4, is the conclusion chapter, it contains the final analysis and conclusions as well as the recommendation of the study.

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