MEASUREMENT & EVALUATION OF DATA NETWORK PERFORMANCE

THESIS

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By

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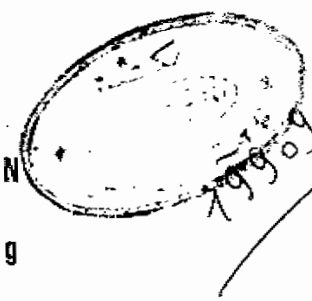
for



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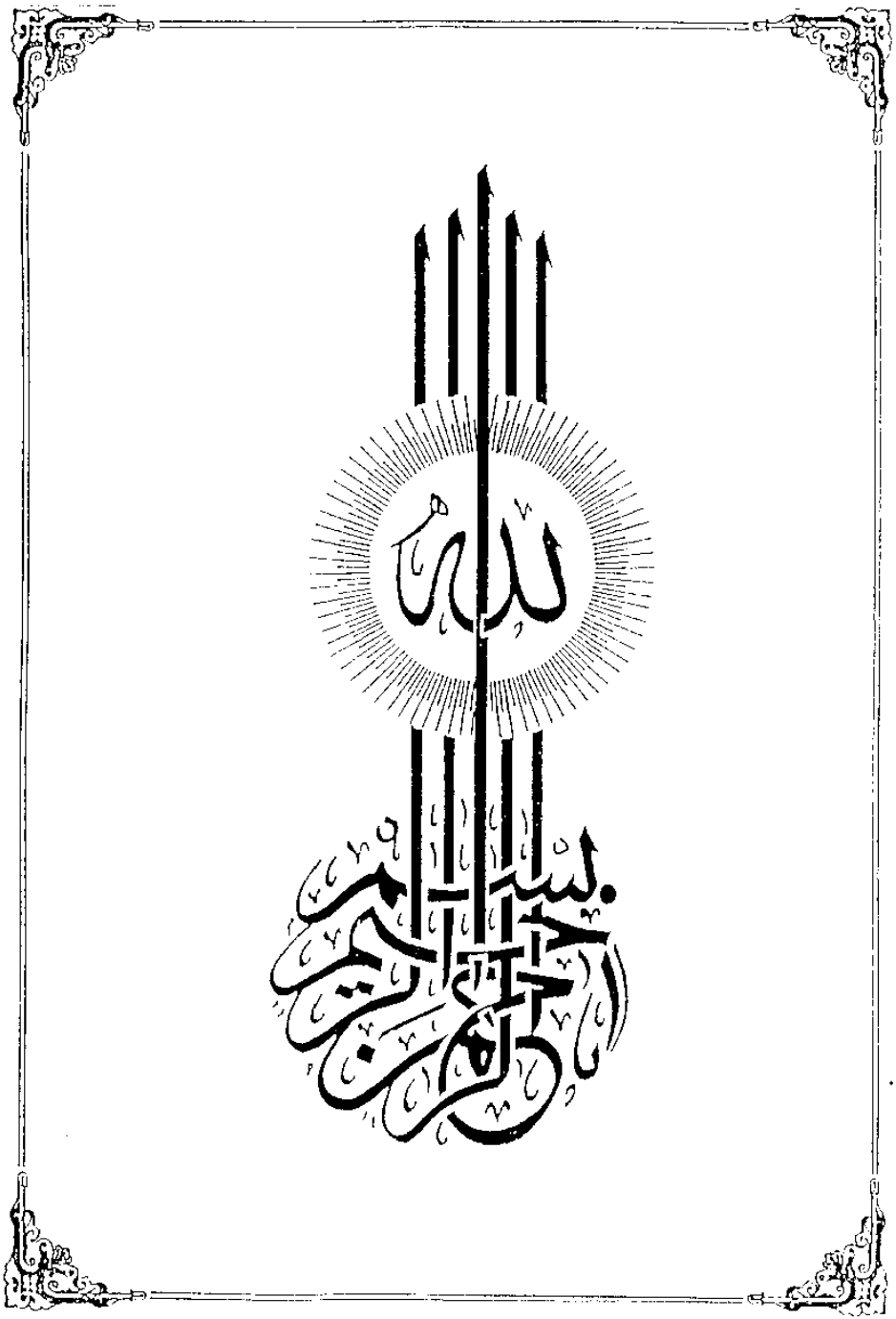

To all members of my family,

the contribution of each in this work

is undeniable

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CONTENTS

ABSTRACT

This thesis presents a brief study on the basic principles and methods of measuring and evaluating data network performance, according to :

a. Up-time and down-time durations of the network .

b. Message response time .

where the network performance improves as up-time (a) increases with respect to the overall working period of the network, and also as message response time (b) decreases. The study also presents a survey of the technical tools available for measuring networks performance, both hardware and software-wise .

The thesis also presents a new approach for measuring and evaluating networks performance . That is,

a. to determine the actual network capabilities and capacity .

b. to investigate, in practice, the effect of adding new terminal stations, to the existing network, on overall network performance .

This approach is based on simulating terminal stations, that are to be added in the network, using microcomputer-based devices which apply standard statistical message distributions of existing terminals . This aims to simplify

network design modifications so as to achieve better performance, prior to installing new terminal stations .

The thesis includes a design of a new multi-microprocessor based device which handles the simulation and performance measurement tasks, as previously described, and it also monitors network activities and records them for further investigations and simulation procedures .
This device is to be connected in the network as a terminal station to carry on its assigned tasks . It has the ability to simulate several terminal stations, simultaneously, and this is dependant on its memory size, processors speed, and the number of available built-in network interfaces .

Introduction

INTRODUCTION

Networking principles and techniques, spurred by rapid technological advances, have evolved at such a fast pace that we can, without exaggeration, speak of a networking revolution rather than a networking evolution.
In a short period of time, networking has covered the spectrum from very-low-speed switched network and point-to-point applications to megabit plus, distributed, and value-added communications networks.

Network applications have grown exponentially with the technological revolution.
In our society, data networks are expanding rapidly to conquer several areas of activity for the sake of a better performance and improved services. Banking, petrochemical operations, customs, security, and airliner operations are examples of applications which rely on data networks.

Planning and design are important preliminary aspects in the developement of all projects whether the project is a computer system with a data communication network or else. Apart from management problems, there are a number of technical factors that need to be considered and evaluated for each aspect of the data communication system-factors associated with the computer, the programs, the lines, the terminals, and other equipment required by

the system. And there are general considerations that apply to the design of the entire system and that must be kept in mind constantly while the system is planned in detail. These overall cosiderations are:

1. System performance requirements.
2. User interface.
3. Expansibility.
4. Modularity versus specific application design.
5. Cost.

In the early days of computer-based communications systems, there were many system failures. In this instance, the term "System failure" is used to mean that the system either did not work or did not achieve its design goals. Generally, the failures occured because (1) the hardware and software involved were not really suited to communication-based system, and (2) there was little or no experience available to highlight potential problem areas. We now have a lot of experience behind us, and there are analytical tools available that can help us to predict the performance of a network.

With large systems, the design process and the analysis of system performance can be very complex and costly, involving perhaps the use of simulation packages and other computer-based aids. For smaller systems (this

covers the majority of on-line systems and data communication networks in the world), there are a number of simple techniques that can be applied to perform a reasonableness test on a design. A reasonableness test indicates whether the system is likely to work and, if not, where the bottlenecks and problem areas are likely to be. This gives the designer the opportunity to test different system and network alternatives and come up with a workable design. A workable system not only satisfies the functional requirements defined in the application specifications, but it carries the required load with an adequate response time, provides an efficient interface with the people who will be using the system, is easily expandable, and its cost is not unreasonable.

This thesis presents a new tool for measuring the performance of data communication networks, which we called "Network Performance Measuring Device" (NPMD).
The NPMD is a microprocessor-based-device that is to be connected to different computing facilities, that control the various parts of the network, in order to monitor network activity, to measure transaction and message response time, and to test network performance under artificial user-defined loads as means for determining the actual capacity of the network, and for predicting network behaviour due to future expansions and growth.

Chapter ONE

Performance Criteria & Related Devices

1.1 Performance Criteria

1.2 Throughput, response time & utilization

1.3 Performance in terms of Availability