Ain Shams University
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Modeling and Performance Analysis of Access Media Protocols in Local Area Networks

By

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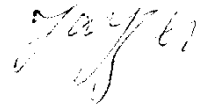
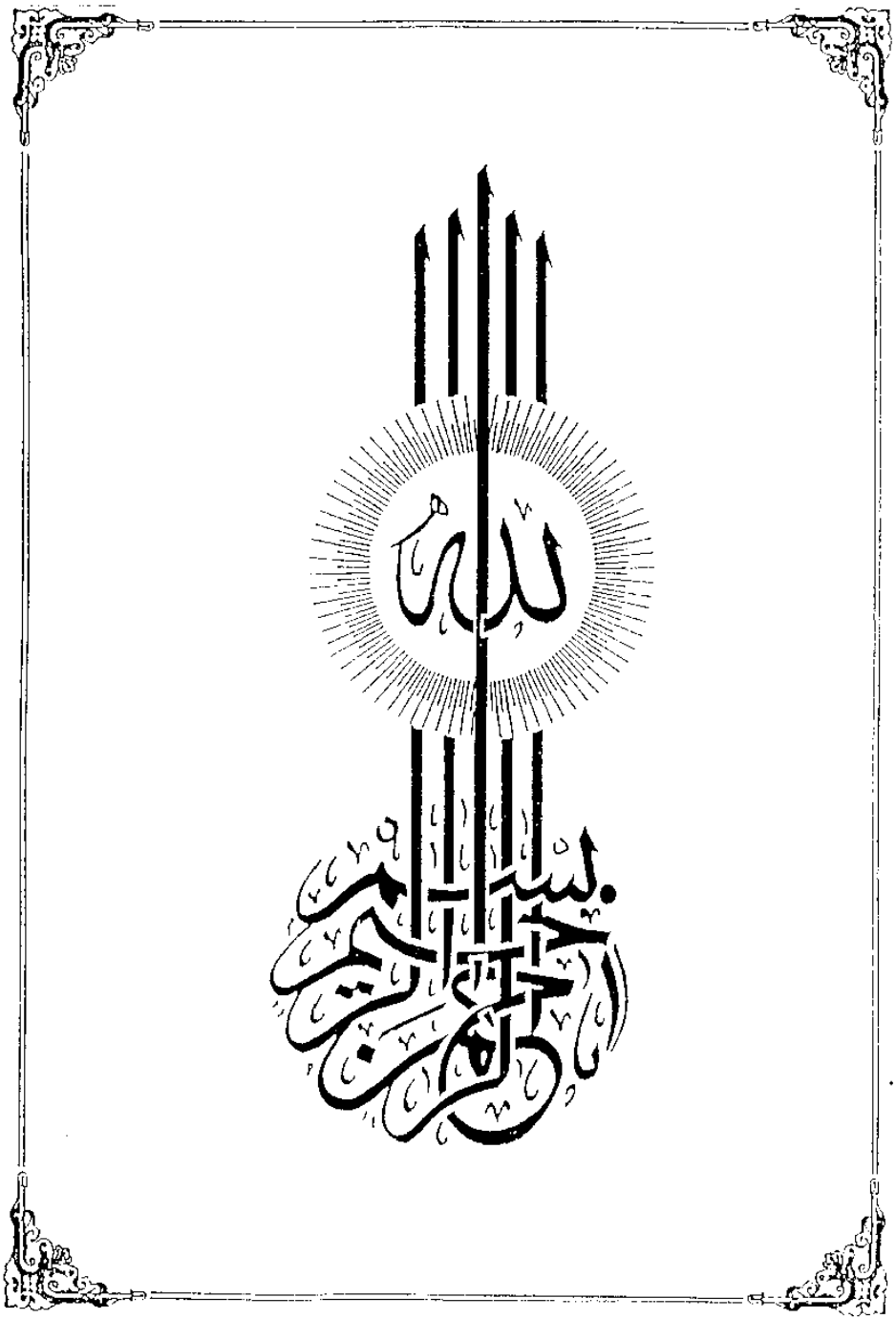
Prof. Dr. Fayza Abd El Migid	



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Modeling and Performance Analysis of Access Media Protocols in Local Area Networks

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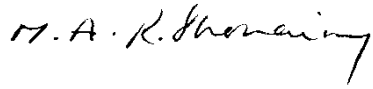
Prof. Dr. M. A. R. Gohmany	

Statement

This dissertation is submitted to Ain Shams University for the degree of Masters of Science of Computer Engineering.

The work included in this thesis was carried out by the author in the department of Electronics and Computer Engineering, Faculty of Engineering, Ain Shams University.

From	To
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No part of this thesis has been submitted for a degree of a qualification at any university or institute.

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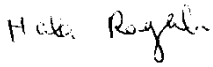
Signature 

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Abstract

The present work considers the performance evaluation of Local Area Networks, LAN, which has proved to be a powerful technique in interconnecting computers in a limited area. An overview of LANs protocols has been given to illustrate their performance and to present a base for comparison.

This thesis presents a new protocol for LANs. This protocol is a priority based scheme. A full description of the network (hardware and software) is also presented. Both mathematical modelling and simulation techniques has been considered to evaluate the performance of the protocol model.

First, a mathematical models were deduced for describing both the new protocol and the CSMA/CD. These models were derived for general statistical properties of input packet and service time. The results obtained from both models were compared with those obtained from the simulation model.

Second, a simulation has been developed, implemented and carefully validated to simulate both the new protocol and the CSMA/CD protocol. It is an event driven organization to decrease the computational cost. It is implemented in a general purpose language (PASCAL) to allow design flexibility. It has a modular structure which permits ease in both correction, modification and future expansion. Nevertheless, different LAN specifications are easily accepted as input data to produce a valuable base of comparison. Results obtained for both protocols were compared with each other. They were also compared with the results obtained from the mathematical model to validate the rest of the simulation results.

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1.1 Introduction

The demand of computer networks is continually growing all over the world. They are the most sufficient reliable mean available to interconnect computers regardless of separating distances.

Although Long-haul networks are very impressive, Local Area Networks LANs found its place as a communicating facility. LANs are a resource sharing data communication network that is limited in a geographic area, providing high bandwidth communication over inexpensive transmission media and are usually privately owned. Thus LANs are unique because they simplify social processes and they are implemented to make more cost effective use of people rather than machines.

LANs differ from Long-haul networks in their bandwidth, network topology and protocols. LANs transmission bandwidth is inexpensive and complicated routing and control algorithms are not needed. Nevertheless, a LAN can be used as a separate resource connected to a Long haul network.

LANs are able to communicate different types of resources as minicomputers, terminals, copiers and large and small computers. This makes them applicable for offices, universities, factories, laboratories... etc.

As a result of LANs applications and advantages, efforts have been contributed to increase their power and efficiency. These contributions lead to introduce a various number of protocols to control the resource to access the channels connecting them. These contributions differed in the topologies they use, transmission media and the protocol itself. Some of the most important protocols using a bus topology was the Carrier Sense Multiple Access CSMA which was refined by the Carrier Sense Multiple Access with Collision Detection CSMA/CD. This protocol has been already implemented and still tests are held to produce the bus performance. Another protocol using ring topology was the slotted ring and token ring. The slotted ring use time slots to transmit messages between the hosts connected to it while the token ring uses a token to hold the message from one host to the other. Although these protocols are used now with good performance, still they are trying to get the best they can from them.

1.2 Thesis Overview

The work on this thesis represents one of the many efforts to present a new protocol. The protocol was designed and partially implemented by the computer lab at the Atomic Energy Authority. The LAN interconnects a number of hosts connected to a common serial data bus through microprocessor based nodes. These nodes control data transfer over the single data channel. The node is divided into two sections namely a common section that interfaces with the serial data channel and a private section that interfaces with the host computer. The latter part would naturally tend to have some variations in the hardware details to match the requirements of individual host computers.

Our work is concerned with the common section that interfaces with the serial data channel. The protocol is based on a priority scheme. Each node has a predefined priority for transmission depending on its importance. A simulator was built to measure the performance of this protocol. Also a comparison was held to compare the results obtained with those like the CSMA/CD . The CSMA/CD was taken as a base comparison because it is familiar and in wide spread use in the world of LANs. It also uses a bus topology.

This thesis starts with chapter 2 which gives a brief description of LANs. It presents the classifications of LANs with respect to those various topologies and transmission media used. It also presents the important performance measures and the methods of evaluation of any network.

Chapter 3 deals with the different access media control (protocols) that a LAN can use. We present the action of these different protocols when introducing different work loads.

With chapter 4 we start the work on the core of the thesis. It presents the protocol in detail. It also gives a full description of the node (hardware and software). It gives the basic operation of the protocol and shows how the node acts in both transmitting and receiving modes.

In chapter 5 a mathematical model is implemented for the NPP protocol. Besides, we presented the mathematical model of the CSMA/CD for comparing the results.