

# DE LA SALLE UNIVERSITY

*A Dynamic, Grouped-Based  
Load Balancing Algorithm  
With Resource Matching*

**SE0000**

A Thesis

Presented To The  
Faculty of the Graduate Program  
of the College of Computer Studies  
De La Salle University

In Partial Fulfillment  
of the Requirements for the Degree of  
Master of Science in Computer Science

by

*Jefferson L. Tan*

*Prof. Philip Chan*  
Adviser

January 2, 1995

**AKLATANG EMILIO AGUINALDO**



# DE LA SALLE UNIVERSITY

## ABSTRACT

A distributed operating system loses its essence if it cannot manage its resources efficiently. But this is not simply a full load for its processors but an intelligent and fair one. The system must assign a task to a processor considering the processor's availability as well as its ability to satisfy the resource and computation requirements of that task. Many load distribution schemes allocate tasks based on the load of processors, but most of them deal only with an environment of processors with identical resource sets and tasks that have identical resource requirements. In this type of environment, all processors have the same ability to execute any task.

This research aims to design a dynamic, group-based load balancing algorithm for a distributed system with consideration for the diverse resource requirements of tasks and the various resource surplus of processors. This strategy represents the system as a collection of processor groups of common or similar resource sets. It also considers that a processor's resource surplus changes as these resources get allocated and released. A set of primitives will be defined to support this layer, and a load balancing algorithm will be written based on this abstract layer.



# DE LA SALLE UNIVERSITY

## TABLE OF CONTENTS

### Abstract

1.0	Introduction .....	1-1
2.0	Related Works .....	2-1
2.1	Load Sharing Schemes .....	2-1
2.2	Load Balancing Schemes .....	2-2
2.3	Detailed Discussion: Load Balancing Algorithms .....	2-3
2.3.1	Balancing Load Under Large and Fast Load Changes in Distributed Computing Systems .....	2-3
2.3.2	A Periodic Symmetrically Initiated Load Balancing Algorithm for Distributed Systems ..	2-5
2.3.3	Piranha Scheduling .....	2-8
2.3.4	Distributed Scheduling of Tasks with Deadlines and Resource Requirements .....	2-10
2.4	Detailed Discussion: Load Balancing Algorithms Using Grouping Features .....	2-18
2.4.1	Scalable, Adaptive Load Sharing for Distributed Systems .....	2-18
2.5	Distributed Clustering or Grouping Strategies .....	2-20
2.5.1	Distributed Process Groups in the V Kernel .....	2-20
2.5.2	A Distributed Clustering Algorithm for Large Computer Networks .....	2-21
2.5.3	Membership Algorithms for Multicast Communication Groups .....	2-23
3.0	Theoretical Framework .....	3-1
3.1	Distributed Operating Systems .....	3-1
3.2	Resource Management .....	3-3
3.3	Load Distribution .....	3-4
3.4	Computer Networks .....	3-7
4.0	Project Description .....	4-1
4.1	Statement of the Problem .....	4-1
4.2	Objectives of the Study .....	4-1
4.2.1	General Objectives .....	4-1
4.2.2	Specific Objectives .....	4-1



# DE LA SALLE UNIVERSITY

4.3	Significance of the Study	4-2
4.4	Scope and Limitations	4-3
4.5	Methodology	4-5
5.0	The Group Adaptive Load Balancing Algorithm	5-1
5.1	The System Model	5-1
5.1.1	System Parameters, Structures and Functions	5-5
5.1.2	Communication	5-9
5.1.3	Processor Groups	5-10
5.2	The Policies of the GA Load Balancing Algorithm	5-14
5.2.1	Load Balancing Policies	5-14
5.2.2	System Architecture	5-18
5.2.3	The Algorithms	5-22
5.3	Design Issues	5-32
5.3.1	Issues on Policies and Components	5-32
5.3.2	Exceptions	5-33
6.0	Analysis	6-1
6.1	Semi-Quantitative Analysis of the GA System	6-1
6.2	The GA System and the Bidding Algorithm [RAMA89]: A Brief Comparison	6-5
7.0	Conclusions and Recommendations	7-1
Bibliography		

