

**COMBINATORIAL OPTIMIZATION OF TOPOLOGICAL  
DESIGN IN COMPUTER COMMUNICATION NETWORK**

**By**

**SALISU GARBA MOHAMMED**

**Thesis submitted to the School of Graduate Studies,  
Universiti Putra Malaysia, in Fulfilment  
of the requirements for the Degree of  
Master of Science**

**October, 2004**

## **DEDICATION**

This thesis is dedicated to my parents in Nigeria, Alhaji Garba Mohd and Hajiya Saratu Zakari, and my brother Lawal Garba Mohd whose selfless sacrifices and dedications have made it possible for me to reach this stage of my studies.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in  
Fulfilment of the requirements for the degree of Master of Science

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**Chairman: Mohd Rizam Bin Abu Bakar, Ph. D.**

**Faculty: Science**

We are living in a new era of information revolution, in which our economy, society, culture and political life are increasingly shaped by computers and communications. The field of telecommunications and networking has, in particular, witnessed more significant developments than many other fields of human knowledge.

The communication systems and digital technologies have resulted in the buildup of massive information banks by government, industries and individuals, which are required for efficient, available, reliable and integrity of international and commercial information.

The study in this thesis focuses on the problem of locating concentrators in a computer communication network whereby a concentrator will be located in an area that can provide an efficient service at a minimum cost. A mathematical model using facility location problem is developed. The objective is to minimize the cost of setting up and operating the communications network subject to capacity constraints. A lagrangian relaxation approach using subgradient optimization techniques is used to develop a heuristic solution procedure.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia  
sebagai memenuhi keperluan untuk ijazah Master Sains

**PENGOPTIMUMAN KOMBINATORIK BAGI RANCAGAN TOPOLOGI  
REKABENTUK DALAM JARINGAN KOMUNIKASI KOMPUTER:  
REHABATEK MASALAH MENYELURUH**

Oleh

**SALISU GARBA MOHAMMED**

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Komputer memainkan peranan yang penting dalam mencorak kehidupan di era baru dalam revolusi informasi dimana pembangunan ekonomi, sosial, kebudayaan dan politik pesat berkembang. Bidang jaringan telekomunikasi telah menyaksikan pembangunan yang sangat pesat selari dengan- bidang ilmu yang.

Sistem komunikasi dan teknologi digital telah membuahkan suatu pembangunan mantap dalam pusat informasi melalui kerajaan, industri dan individu. Pembangunan ini memerlukan kecekapan, kebolehdapatan/kesenangan, kebolehpercayaan dan integriti di peringkat antarabangsa dan juga informasi komersial.

Pengajian tesis ini memfokus kepada permasalahan untuk menempatkan 'concentrator' di dalam sesebuah jaringan komunikasi komputer. 'concentrator' ini akan ditempatkan di kawasan dimana ia boleh menghasilkan suatu kemudahan kecekapan pada kos yang minimum model matematik menggunakan kemedahan lokasi dibina.

Objektif ialah untuk meminimumkan kos pengaturan dan operasi jaringan komunikasi tartakluk upada kapasiti khayun. Di sini, pendekatan teknik 'pengenduran lagrange menggunakan subhecerunan' digunakan untuk membentik prosedur 'selesaian heuristik'.

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I certify that an Examination Committee met on 25<sup>th</sup> October 2004 to conduct the final examination of Salisu Garba Mohammed on his Master of Science thesis entitled “Combinatorial Optimization of Topological Design in Computer Communication Network” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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## **DECLARATION**

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it have not been previously or concurrently submitted for any other degree at Universiti Putra Malaysia or other institutions.

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**SALISU GARBA MOHD**

Date:

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