PERFORMANCE EVALUATION OF PHORIZON AND PJET_VEOT RESERVATION SCHEMES FOR OPTICAL BURST SWITCHING

By

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Partial Fulfilment of the Requirements for the Degree of Masters of Science

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To my grandma, my parents and my siblings.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in partial fulfilment of the requirement for the degree of Master of Science

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Chairman: Professor Borhanuddin Mohd. Ali, PhD

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There have been rapid changes in the networking field in the past decade or so, mainly due to an exponential growth in the number of users and traffic volumes, and emergence of new applications. This has caused a higher demand for bandwidth, with better quality of service and reduced blocking probability. Meeting this demand efficiently would be possible in high-speed optical networks with a proper switching paradigm employing dynamic reservation schemes.

Optical burst switching (OBS) is a new switching concept, based on ideas developed for electronic burst switching almost two decades ago. Now the idea has evolved to become a paradigm, which combines the best of both switching techniques i.e. circuit switching and packet switching, thus overcoming the inherent setbacks in the respective switching techniques. OBS applies an out of band signaling technique, which enables the bandwidth reservations to be made in advance.

In this thesis, two modified reservation schemes are proposed based on the prioritized just enough time (pJET) and Horizon reservation schemes, which are referred to as the prioritized just enough time with variable extra offset time (pJET_VEOT) and the prioritized Horizon (pHorizon), respectively.

These reservation schemes are designed to reduce the blocking probabilities of both classes of traffic, i.e. real-time (RT) and non real-time traffic (NRT), while provisioning sufficient Quality of Service (QoS) for ensured and timely delivery of higher priority traffic. Performance evaluation is conducted in order to analyze the reduction in blocking probability, the effect on system delay and to display the service differentiation achieved. This is done by comparing the proposed schemes to its predecessor schemes respectively. The predecessor schemes used in the simulation are pJET, Just Enough Time (JET) and Horizon.

The proposed schemes, pHorizon and pJET_VEOT show a significant reduction in blocking probabilities and along with sufficient provisioning of QoS for both classes of traffic tested, i.e. the RT and NRT when compared to Horizon, JET and pJET respectively.

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

PENILAIAN PERLAKSANAAN SKIMA PENEMPAHAN PHORIZON DAN PJET_VEOT BAGI PENSUISAN LEDAKAN OPTIK

Oleh

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April 2006

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Perubahan yang pantas dalam bidang rangkaian sejak sedekad yang lalu disebabkan oleh peningkatan yang pesat dalam pengguna internet, peningkatan saiz trafik dan kemunculan aplikasi-aplikasi baru. Ini secara tidak langsung telah menyebabkan tuntutan yang tinggi ke atas jalur lebar-lingkaran, kualiti perkhidmatan yang lebih baik, dan juga telah mengurangkan kebarangkalian penghalangan. Tuntutan ini mungkin boleh dihadapi dengan efisen dengan penggunaan rangakain optik pantas serta paradigma pensuisan baik yang mengaplikasikan skima penempahan yang dinamik.

Pensuisan ledakan optik (OBS) merupakan suatu konsep pensuisan baru, yang telah dibangunkan daripada idea-idea pensuisan ledakan elektronik lebih kurang dua dekad lalu. Kini, idea ini telah berkembang menjadi sebuah paradigma yang terdiri daripada gabungan kelebihan-kelebihan daripada dua teknik pensuisan yang terkenal iaitu pensuisan litar dan pensuisan paket, sekaligus ia mengatasi kekurangan yang dihadapi oleh kedua-dua teknik pensuisan tersebut. Ia mengaplikasikan teknik pengisyaratan di luar lingkaran, yang membolehkan penempahan jalur lebar-lingkaran di buat lebih dahulu

Dalam tesis ini, dua skima penempahan yang diubahsuai daripada *prioritized just enough time (pJET)* dan *Horizon, iaitu prioritized just enough time with variable extra offset time (pJET_VEOT)* dan *prioritized Horizon (pHorizon)* telah dicadangkan.

Skima-skima penempahan in telah direkabentuk supaya ia dapat mengurangkan kebarangalian penghalangan bagi kedua-dua jenis trafik, iaitu trafik masa-nyata dan trafik masa-tak-nyata, serentak memberi kualiti perkhidmatan yang secukupnya bagi memastikan penghantaran trafik keutamaan tinggi. Penilaian pelaksanaan telah dijalankan bagi mendapatkan perbandingan bagi tujuan

menganalisa kekurangan dalam kebarangkalian penghalangan, kesan kelambatan sistem and juga memaparkan kewujudan pembezaan perkhidmatan. Ini dijalanakan dengan membuat perbandingan diantara skema-skema penempahan yang telah dicadangkan dengan skema-skema tetua tertentu. Diantaranya adalah, pJET, *just enough time* (JET) dan *Horizon*.

Skima-skima yang dicadangkan, pJET_VEOT dan pHorizon menunjukan pengurangan yang ketara dalam penghalangan dan pemberian kualiti perkhidmatan yang secukupnya bagi kedua-dua kelas trafik iaitu trafik masa-nyata dan trafik masa-tak-nyata jika dibandingkan dengan Horizon, JET dan pJET.

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I certify that an Examination Committee has met on 21st April 2006 to conduct the final examination of Deepalaxmi Silvarajah on her Master of Science thesis entitled "Performance Evaluation of pHorizon and pJET_VEOT Reservation Schemes for Optical Burst Switching" 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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TABLE OF CONTENTS

	Page
DEDICATION	2
ABSTRACT	3
ABSTRAK	5
ACKNOWLEDGEMENTS	7
APPROVAL	9
DECLARATION	11
LIST OF TABLES	14
LIST OF FIGURES	15
LIST OF ABBREVIATIONS	17

CHAPTER

INTRODUCTION		19
Optical Networks and Optical Burst Switching		19
Reservation Schemes		22
Objective		23
Problem Statement		24
Thesis Outline		25
REVIEW OF OPTICAL BURST SWITCHING AND QUALITY OF SERVICE		***27***
Introduction		27
WDM Network and All Optical Network		28
Optical Circuit Switching		28
Wavelength Routing Network		29
Optical Packet Switching		31
Optical Burst Switching	31	
Characteristics of Optical Burst Switching		34
Out-of-Band Signaling and One-Way Reservation Scheme		35
Granularity		37
Burst Length and Assembly		37
Buffering		39
Providing Quality of Service		40
Quality of Service in Optical Networks		42
Quality of Service in OBS Network		43
Conclusion		44
3 **REVIEW OF RESERVATION SCHEMES**		45
3.1 Introduction		45
3.2 Reservation Schemes		46
3.2.1 Reserve a Fixed Duration (RFD)		46
3.2.2 Reserve a Limited Duration (RLD)		47

3.2.3 In-Band Terminator (IBT) 47
3.2.4 Tell and Wait (TAW) 48
3.2.5 Tell and Go (TAG) 50
3.2.6 Just in Time (JIT) 52
3.2.7 Labeled OBS (LOBS) 54
3.2.8 Just Enough Time (JET) 55
3.2.9 Prioritized JET (pJET) 58
3.2.10 Preemptive pJET (PPJET) 61
3.2.11 Horizon 62
3.3 Motivation Behind the Proposals 64
3.4 Conclusion 68

4 **METHODOLOGY** 71
4.1 Introduction 71
4.2 Proposed pHorizon 71
4.2.1 System Description and Assumptions 73
4.2.2 pHorizon System Algorithm 75
4.3 Proposed pJET_VEOT 79
4.3.1 System Description and Assumptions 82
4.3.2 pJET_VEOT System Algorithm 83
4.4 Parameters Considered for Performance Evaluation 86
4.4.1 Blocking Model 86
4.4.2 Delay Consideration 87
4.5 Important Design Parameter 89
4.6 Analysis tools 91
4.7 Conclusion 91

5 **RESULTS AND DISCUSSION** 92
5.1 Introduction 92
5.2 pHorizon Reservation Scheme 93
5.2.1 Blocking Probability Evaluation 93
5.2.2 Burst Transmission Analysis 96
5.2.3 Delay Analysis 101
5.3 Comparative Evaluation of pHorizon 103
5.3.1 Burst Blocking Analysis 103
5.3.2 System Delay Discussion 108
5.4 pJET_VEOT Reservation Scheme 110
5.4.1 Blocking Probability Evaluation 110
5.4.2 Burst Transmission Analysis 113
5.4.3 Delay Analysis 117
5.5 Comparative Evaluation of pJET_VEOT 118
5.5.1 Burst Blocking Analysis 119
5.5.2 System Delay Discussion 124
5.6 Discussion and Conclusion 126

6 **CONCLUSION** 129

REFERENCES 135
APPENDICES 139
BIODATA OF THE AUTHOR 152