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ENHANCING OPTICAL BURST SWITCHING NETWORKS THROUGHPUT AT LOW & HIGH TRAFFIC LOADS

By

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DECLARATION

I certify that all the material in this thesis that is not my own work has been identified and that no material is included for which a degree has previously been conferred on me.

The contents of this thesis reflect my own personal views and are not necessarily endorsed by the University.

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بسم الله الرحمن الرحيم

"... قَالَ رَبِّ أَوْزِعْنِيَ أَنَ اَشْكُرَ نِعْمَتَكَ التِي أَنْعَمْتَ عَلَيَّ وَعَلَى وَالِدَيَّ وَأَنَ اَعْمَلَ صَالِحًا تَرْضَاهُ...." (الأحقاف:15)

In the name of Allah, the Beneficent, the Merciful

"…he says: My Lord! Grant me that I may give thanks for Thy favor which Thou hast bestowed on me and on my parents, and that I may do good which pleases Thee…" (The sandhills: 15)

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ABSTRACT

A burst overlapping in core router is one of the biggest problems that face OBS network. The Fiber Delay Line (FDL_{max}) has been used to avoid burst overlapping in the egress router of OBS network considering a Tell and Go (TAG) protocol at low and high traffic loads, in an intermediate node having three incoming links and one outgoing link in an egress node of optical domain. We found the conditions for the burst controls, either passing of all bursts or blocking of some bursts in the egress nodes of optical domain.

It is shown that in low traffic loads, burst blocking can be made zero but in higher traffic loads there is burst blocking, which can be reduced using different sets of FDLs for which minimum usage of wavelengths can be achieved. This thesis has described a proposed burst scheduling algorithm to avoid burst overlapping in the egress router of Optical Burst Switching (OBS) network, and hence to improve the quality of service (QoS) in developing several optical networks to fulfill the increasing demand of Internet facilities.

We used time-based assembly algorithm in an assembly node to build the burst at low and high traffic loads. The performance of an OBS network is investigated the performance measure in terms of Throughput (Th) is evaluated.

The impact of the Burst Size (B) and Inter-Arrival Time (t) on the throughput, and a relation for the Th and FDL_{max} depending on B, t, Minimum Time Gap (d) and Burst Loss Rate (BLR) was studied.

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LIST OF SYMBOLS

B	Burst Size
B_{min}	Minimum Burst Length Requirement
C	Capacity
D	Buffer Granularity
F	Delay Factor
G	Gain Factor
L_{i-1}	Service Time of Class
N	Delay Values
N_L	Number of Burst Lost at the Output Path O
N_R	Number of Nodes
N_T	Total Number of Input Bursts
P	Packet Size
Pd	Path Difference
P_r	Distribution of Burst Size
R	Round Ttrip Time
$R_{i,j}$	Offset Time Difference
T	Effective absolute temperature of the receiver
T’	Higher Values of Assemble Times
T_{Hi}	Burst Assembling in the Higher Range of Traffic Load
T_{Li}	Burst Assembling in the Lower Range of Traffic Load
3n	Number of Bursts in the Output Channel
be	Input Electrical
d	Time Gap
n	Total Number of Bursts in Each Input Channels
n_p	Number of Packets Contained in Burst
t	time
$t_{i,j}$	Offset Time Difference
t_p	Pre-Transmission Delay
t_w	Wavelength Holding Time
α	Time Units
ι	Burst length
λ	Wavelength
λ_p	Average Packet Arrival Rate to The Assembly Queue
ρ	Traffic Load
ρ_H	Higher Traffic Load
ρ_L	Lower Traffic Load

LIST OF ABBREVIATIONS

ABT	ATM Block Transfer
ABT-IT	ATM Block Transfer with Immediate Transmission
ACK	Acknowledgement
BH	Burst Header
BLR	Burst Loss Rate
BORA	Burst Overlap Reduction Algorithm
BORA-DS	BORA with Destination Based Search
BORA-VF	BORA-VF with Void Filling
BORA-FS	BORA with Fixed order Searching
BORA-TE	BORA Traffic Engineering
BORA-TE-VF	BORA-TE with Void Filling
BORA-FS-VF	BORA-FS with Void Filling
DiffServ	Differentiated Services
DR	Deflection Routing
DWDM	Dense Wavelength Division Multiplexing
FDL	Fiber Delay Line
IntServ	Integrated Services
IP	Internet Protocol
JET	Just Enough Time
JIT	Just In Time
LAUC	Latest Available Unscheduled Channel
LAUC-VF	Latest Available Unscheduled Channel with Void Filling
LAUT	Latest Available Unscheduled Time
NACK	Negative Acknowledgement
OADM	Optical Add/Drop Multiplexer
OBS	Optical Burst Switching
OCS	Optical Circuit Switching
O/E/O	Optical-Electrical-Optical
OPS	Optical Packet Switching
OXC	Optical Cross Connect
QoS	Quality of Service
RAM	Random Access Memory
RED	Random Early Detection
SCU	Switch Control Unit
TAG	Tell And Go
TAW	Tell And Wait
TWC	Tunable Wavelength Converter
WDM	Wavelength Division Multiplexing

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