ADAPTIVE LOW POWER ERROR CONTROL FOR WIRELESS LINKS

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DECEMBER 2003

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THIS THESIS IS SUBMITTED IN FULFILLMENT OF
THE REQUIREMENTS FOR
MASTER DEGREE OF COMPUTER SCIENCE (COMPUTER NETWORKS)

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KUALA LUMPUR

DECEMBER 2003

Dedicated to:

my parent: Mek, Ayah & Abah (father-in-law)
....my beloved wife: Azura
....and my son & daughters : Naim, Adnin & Nur Jannah

ABSTRACT

In mobile and wireless communications system, error control is crucial for evaluating the performance of wireless links. In certain condition where a fast and reliable feedback channel is not available, Forward Error Control (FEC) is one of the most powerful solutions for error control. The retransmission techniques, Automatic Repeat reQuest (ARQ), to recover from channel errors become a feasible solution, which in some instances can be expected to be more efficient than FEC.

In particular, the error control strategies (FEC, ARQ) used for wireless link data transport has a direct impact on energy consumption. However, this project studies the problem of error control from a perspective of adaptation and selecting an error control scheme to achieve a desired level of radio channel performance. Adaptation is crucial strategy to maintain channel quality for any data transmission in wireless network.

Briefly, in this project, we propose new adaptive error control algorithm and compare their performance to non-adaptive error control algorithms for both data transmission and speech transmission source. These three algorithms were tested for different mobility speed and the adaptive algorithm will react to the changes of channel quality by tuning error control scheme to be used. Through simulation results and experimentation, we show that the performance of proposed adaptive algorithm outperforms the two non-adaptive error control algorithms for the same parameters setting are used.

ABSTRAK

Dalam sistem komunikasi wayarles dan bergerak, kawalan ralat adalah amat penting bagi mengukur prestasi pautan wayarles. Dalam sesetengah keadaan di mana saluran maklumbalas yang cepat dan bolehdipercayai tidak wujud, maka FEC adalah merupakan penyelesaian yang paling baik bagi mengawal ralat daripada berlaku. Teknik penghantaran semula, ARQ yang berfungsi memulihkan ralat ketika dalam saluran menjadi penyelesaian tersaur di mana di dalam sesetengah keadaan ianya adalah lebih cekap daripada FEC.

Secara khususnya, strategi-strategi kawalan ralat (protokol FEC, ARQ, hibrid) yang digunakan untuk mengangkut data di lapisan pautan wayarles mempunyai kesan langsung ke atas penggunaan tenaga. Bagaimanapun projek ini mengkaji masalah kawalan ralat daripada perspektif adaptasi dan pemilihan skim kawalan ralat bagi mencapai paras prestasi saluran radio yang dikehendaki. Adaptasi adalah merupakan strategi penting bagi mengekalkan kualiti saluran bagi sebarang transmisi data di dalam rangkaian wayarles.

Secara ringkasnya, di dalam projek ini, kami mencadangkan algoritma kawalan ralat mudah-suai yang baru dan membandingkan prestasinya dengan algoritma kawalan ralat bukan mudah-suai bagi kedua-dua sumber transmisi data dan suara. Ketiga-tiga algoritma diuji dengan kelajuan pergerakan yang berbeza dan algoritma mudah-suai didapati akan bertindak balas terhadap perubahan kualiti saluran melalui pengalihan skim kawalan ralat yang akan digunakan di dalam transmisi seterusnya. Melalui keputusan simulasi dan eksprimen, kami membuktikan bahawa prestasi algoritma mudah-suai mengatasi kedua-dua algoritma kawalan ralat bukan mudah-suai bagi setiap parameter yang sama digunakan.

ACKNOWLEDGEMENT

Assalamu'alaikum wrt. wbt.

First of all, I would like to express my utmost thanks and gratitude to Almighty ALLAH for giving me life without which this thesis will never be carried out. *Selawat* and *salam* to His righteous messenger, Prophet Muhammad S.A.W.

Here, I would like to acknowledge my

classmate, Sim Kwan Yong, who spent much time on the phone helping me setup a PARSEC language to my workstation; Sis Nazlina for giving me a lot of useful motivation while I'm doing this project; Mr. Paul Lettieri, who helped me providing the paper's related to my study; Dr. Mohamed, for introducing me to a parallel processing environment; and my friend, Dr. Yunus, who restored my faith in writing this dissertation.

Lastly, many thanks to everyone else who helped me during run this project. *Wassalam.*

DECLARATION

I certify that this thesis submitted for the degree of Masters is the result of my own research, except where otherwise acknowledged, and that this thesis (or any part of the same) has not been submitted for higher degree to any other university or institution.

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(ABDULLAH B. MUHAMMED)

Date : December 4, 2003

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LIST OF ABBREVIATIONS

ACK	Acknowledgement
ARQ	Automatic Repeat reQuest
ATM	Asynchronous Transfer Mode
BER	Bit Error Rate
CRC	Cyclic Redundancy Code
CACK	Cumulative Acknowledgement
CMOS	Complementary Metal-Oxide Semiconductor
DSP	Digital Signal Processor
DTMC	Discrete Time Markov Chain
FCS	Frame Check Sequence
FEC	Forward Error Correction
MAC	Medium Access Control
NACK	Negative Acknowledgement
PARSEC	PARallel Simulation Environment for Complex system
PDA	Personal Digital Assistant
QoS	Quality of Service
RTT	Round Trip Time
SACK	Selective Acknowledgement
SNR	Signal to Noise Radio
TCP	Transmission Control Protocol
UCLA	University of California, Los Angeles
VLSI	Very Large Scale Integration