UNIVERSITI PUTRA MALAYSIA

PRIORITY HYBRID AND EEF UPLINK SCHEDULING ALGORITHM FOR IEEE 802.16E

ANEEL OAD

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MASTER OF SCIENCE
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PRIORITY HYBRID AND EEF UPLINK SCHEDULING ALGORITHM FOR IEEE 802.16E

By

ANEEL OAD

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirement for the Degree of Master of Science

January 2013

DEDICATION

I wish to dedicate this work to my parents and teachers.

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

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ANEEL OAD

January 2013

Chairman: **Associate Professor Shamala Subramaniam, PhD**

Faculty: **Computer Science and Information Technology**

Worldwide interoperability for Microwave Access (WiMAX) is based on the IEEE 802.16 standard. The IEEE 802.16-2004 standard (i.e. Fixed WiMAX) provides specification for the Medium Access Control (MAC) and Physical (PHY) layers for WiMAX. A critical part of the MAC layer specification is scheduling, which resolves contention for bandwidth and determines the transmission order of users. In this research the focus is on the WiMAX uplink traffic scheduling in the Point to Multipoint (PMP) mode. In this research, two algorithms tailored at enhancing the performance of hybrid algorithms in the WiMAX domains have been designed and developed. The spectrum of constraints which have been extracted from the researched hybrid algorithm includes the static nature by which priorities are assigned and maintained during the entire duration of a transmission time. The second constraint is embedded within the EDF scheduling algorithm and the perseverance of pursuing deadline associated weightages. In this research, the

introduction of a versatile and flexible computing threshold has been developed. The second contribution of this research is the reengineering of the EDF scheduling algorithms. The dominance of the pre-stipulated deadline is indeed acknowledged in the proposed and developed enhanced EEF algorithm. The simulation results indicate that legacy algorithms are not suitable for the multi-class traffic systems of WiMAX. This is because these algorithms do not explicitly incorporate the WiMAX QoS parameters into their mechanisms. Extensive discrete – event simulation experiments have been done for the purpose of performance analysis. The performance metrics used are average throughput, average delay, missed deadline ratio and average queue size utilization ratio. The acquired results have proven that the proposed algorithms have successfully enhanced the legacy hybrid and the deadline based algorithm.

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

HIBRID KEUTAMAAN DAN ALGORITMA PENJADUALAN BAGI SAMBUNGAN NAIK EEF UNTUK IEEE 802.16E

Oleh

ANEEL OAD

Januari 2013

Pengerusi: **Associate Professor Shamala Subramaniam, PhD**

Fakulti: **Sains Komputer Dan Teknologi Maklumat**

Worldwide interoperability for Microwave Access (WiMAX) adalah berdasarkan piawaian IEEE 802.16. Piawaian IEEE 802.16-2004 (i.e. WiMAX tetap) menyediakan spesifikasi untuk *Medium Access Control* (MAC) dan *Physical* (PHY) untuk WiMAX. Bahagian kritikal spesifikasi lapisan MAC melibatkan penjadualan, yang menyelesaikan pengguna jalur lebar serta turutan transmisi setiap pengguna. Dalam kajian ini, tumpuan diberikan kepada penjadualan trafik WiMAX dalam mod *Point to Multipoint* (PMP). Dalam penyelidikan ini, dua algoritma khusus untuk meningkatkan prestasi algoritma hibrid dalam domain WiMAX telah direka dan dibangunkan. Spektrum kekangan yang telah diekstrak daripada algoritma hibrid termasuk sifat statik dalam pengaggihan keutamaan yang diberikan dan dikekalkan sepanjang tempoh keseluruhan masa penghantaran. Kekangan kedua melibatkan penjadualan algoritma EDF dan ketelitian mengikuti pemberat tarikh akhir yang berkenaan. Dalam kajian ini, pengenalan kepada pengkomputeran serba boleh dan

pengkomputeran yang fleksibel telah dibangunkan. Sumbangan kedua kajian ini adalah pengubahsuaian algoritma penjadualan algoritma EDF. Penguasaan *deadline* yang ditetapkan memang diakui mempunyai peningkatan di dalam algoritma EEF yang telah dicadangkan dan dibangunkan dalam penyelidikan ini. Keputusan yang didapati daripada simulasi yang dijalankan menunjukkan bahawa algoritma legasi tidak sesuai untuk sistem trafik pelbagai kelas WiMAX. Ini adalah kerana algoritma ini tidak jelas menggabungkan parameter QoS WiMAX ke mekanisme mereka sendiri. Peristiwa simulasi yang meluas dan berasingan telah dilakukan untuk tujuan analisa terhadap prestasi. Metrik prestasi yang digunakan adalah *throughput*, purata kelewatan, nisbah bilangan paket yang terlepas tarikh akhir dan purata nisbah panggunaan baris gilir. Keputusan yang diperolehi telah membuktikan bahawa algoritma-algoritma yang dicadangkan berjaya mempertingkatkan algoritma legasi dan algoritma berdasarkan *deadline*.

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I certify that an examination committee has met on 18th of January 2013 to conduct the final examination of Aneel Oad on his Master of Science thesis entitled "PRIORITY HYBRID AND EEF UPLINK SCHEDULING ALGORITHM FOR IEEE 802.16e" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the student be awarded the Master of Science.

Members of the Examination Committee were as follows:

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the supervisory committee were as follows:

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Date:

DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not currently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

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ANEEL OAD

Date:

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