

STUDY OF ENHANCED DCF (EDCF) IN MULTIMEDIA APPLICATION

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**A dissertation submitted in partial fulfilment
of the requirements for the award of the degree
of Master of Engineering
(Electrical-Electronics & Telecommunication)**

**Faculty of Electrical Engineering
Universiti Teknologi Malaysia**

MARCH, 2005

Specially dedicated to my family, mum and dad for their support and eternal love. To all my friends especially Alin, Jig, Tikah, Sue, Sya, Asiah, Chen, Nansah, Fauzan and Azhar, thanks a lot for your helping.

ACKNOWLEDGEMENTS

Praise to Allah, the Most Gracious and Most Merciful, Who has created the mankind with knowledge, wisdom and power. First of all, the author would like to express his deepest gratitude to Associate. Professor Dr. Sulaiman Bin Mohd Nor for his continuous support, supervision and encouragement during the course of this project. The author would not have completed this project successfully without his assistance. The author is thankful to all friends for their advice and helpful cooperation during the period of this research. Appreciation is also acknowledged to those who have contributed directly or indirectly in the completion of this project. The author would also like to extend his appreciation to his family members, for their support, patience and endless love.

ABSTRACT

IEEE 802.11e Medium Access Control (MAC) is an emerging supplement to the IEEE 802.11 Wireless Local Area Network (WLAN) standard to support Quality-of-Service (QOS). The 802.11e MAC is based on both centrally-controlled and contention-based channel accesses. This project is aimed towards evaluating the contention-based channel access mechanism, called Enhanced Distributed Coordination Function (EDCF), in comparison with the 802.11 legacy MAC, Distributed Coordination Function. Then, by using EDCF model, the acceptable number of streams for traffic type individually and combination of all traffics are determined based on ITU-T requirements. Three different types of traffic are considered namely, voice, video and data. The evaluation was done using ns-2 simulator (version 2.26) running on Linux Fedora Core 2. The metrics used in the evaluation are throughput (Byte), delay (sec) and packet loss (%). Depending on graphs of these three metrics, the performance of EDCF and DCF are evaluated, and also the numbers of stream that fulfil the ITU-T requirements are determined. Through this simulation study, a summary can be made of that EDCF can provide differentiated channel access for different traffic types. Simulation results show that EDCF performs better performance than legacy DCF. Depending on ITU-T requirements especially for delay and packet loss, the acceptable number of streams both for traffic type individually and combination of all traffics type can be determined under EDCF model.

ABSTRAK

IEEE 802.11e Medium Access Control (MAC) adalah satu tambahan yang dibangunkan terhadap piawai *IEEE 802.11e* rangkaian kawasan tempatan tanpa wayar (*WLAN*) untuk menyokong kualiti servis. *802.11e MAC* adalah berdasarkan kepada kawalan secara berpusat dan juga capaian medium secara bertanding. Projek ini adalah untuk menilai perbezaan antara mekanisma capaian medium secara bertanding iaitu *Enhanced Distributed Coordination Function (EDCF)*, dengan *802.11 MAC* yang asal, *Distributed Coordination Function (DCF)*. Kemudian, dengan menggunakan model *EDCF*, bilangan aliran yang boleh diterima untuk jenis-jenis trafik secara individu dan juga kombinasi semua jenis trafik ditentukan berdasarkan keperluan *International Telecommunication Union- Telecommunication (ITU-T)*. Tiga jenis trafik yang digunakan iaitu suara, video dan data. Penilaian ini dilaksanakan dengan menggunakan penyelaku ns-2 (versi 2.26) yang beroperasi dalam *Linux Fedora Core 2*. Metrik-metrik yang digunakan dalam penafsiran ini adalah jumlah hasil proses (bait), masa lengah (saat) and jumlah kehilangan paket (%). Berdasarkan pada graf ketiga-tiga metrik ini, prestasi *EDCF* and *DCF* ditafsirkan, dan juga bilangan aliran yang memenuhi keperluan *ITU-T* ditentukan. Menerusi kajian simulasi ini, dapat disimpulkan bahawa *EDCF* boleh menyediakan capaian medium yang berbeza untuk setiap jenis trafik. Hasil simulasi menunjukkan prestasi *EDCF* adalah lebih baik berbanding dengan *DCF*. Berdasarkan keperluan *ITU-T* terutama untuk masa lengah dan jumlah kehilangan paket, bilangan aliran yang boleh diterima untuk jenis-jenis trafik secara individu dan juga kombinasi semua jenis trafik boleh ditentukan bagi model *EDCF*.

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LIST OF ABBREVIATIONS

ACK	Acknowledgment
AIFS	Arbitration Interframe Spaces
CW	Contention Window
DCF	Distributed Coordination Function
DIFS	DCF Interframe Spaces
EDCF	Enhanced DCF
ITU-T	International Telecommunication Union – Telecommunication
IEEE	Institute of Electrical and Electronics Engineers
LAN	Local Area Network
MAC	Medium Access Control
PHY	Physical Layer
WLAN	Wireless Local Area Network

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CHAPTER I

INTRODUCTION

1.1 Introduction

Mobile communication devices like Laptops and PDAs become more and more popular. For easy communication between these devices as well as the connection to the Internet, Wireless LAN (IEEE 802.11) is used in a lot of scenarios today. Especially the number of WLANs in public facilities like railway stations, official buildings and airports increases rapidly, not taking into account all the small private "home" WLANs.

The increase in popularity of Wireless LANs led to more close considerations with respect to multimedia traffic over WLANs in the past. The most sensitive case of multimedia traffic is Internet telephony (Voice-over-IP). In particular the delay is most critical in Voice-over-IP (VoIP) applications.

1.2 Problem Statements

The two access methods used in 802.11 wireless LAN are Distributed Coordination Function (DCF) and Point Coordination Function (PCF). The 802.11 legacy DCF access mechanism does not support the concept of differentiating frames with different priorities. Basically, the DCF is supposed to provide a channel access with equal probabilities to all stations contending for the channel access in a distributed manner. However, equal access probabilities are not desirable among stations with different priority frames. The emerging Enhanced DCF (EDCF) is designed to provide differentiated, distributed channel accesses for frames with different priorities. EDCF is supposed to provide better performance enhancement for real time traffic as compared to DCF. Two questions which need to be answered are

- 1) How good is Enhanced DCF (EDCF) compared to DCF?
- 2) With EDCF, what are the maximum streams for individual traffic type and combination of various traffic types that can fulfill ITU-T requirements?

1.3 Project Objective

The objective of this project is to study the performance of Enhanced Distributed Coordination Function (EDCF) versus legacy Distributed Coordination Function (DCF) access mechanisms in IEEE 802.11 Wireless LANs. Another objective is to determine the maximum streams for individual traffic type and combination of various traffic types that can fulfill ITU-T requirements by using EDCF.

1.4 Scope of Project

In this project, the task focus on DCF access mechanism that is the basic of 802.11 MAC access protocol. The evaluation has been done on IEEE 802.11 mode for DCF and EDCF to study the performances of both modes. By using EDCF, the evaluation also has been done on each traffic type individually with different number of streams and under combination of various traffics type with different number of streams.

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```

        $node_id = $x[4];
        $pkt_size = $x[36];
        $flow_id = $x[38];
        $pkt_id = $x[40];
    }

#column 1 is time
if ($time-$clock <= $granularity)
{
#checking if the event corresponds to a reception
if ($event eq 'r')
{
#checking if the destination corresponds to 1st argument
if ($node_id eq $tonode)
{
#checking if the packet type is TCP/CBR
if ($flow_id eq '11')
{
        $sum=$sum+$pkt_size;
    }
}
}
}
else
{
        $throughput=$sum/$granularity;
        print STDOUT "$time $throughput\n";
        $clock=$clock+$granularity;
        $sum=0;
    }
}

        $throughput=$sum/$granularity;
        print STDOUT "$time $throughput\n";
        $clock=$clock+$granularity;
        $sum=0;

        close DATA;
exit(0);

```