

**QUALITY OF SERVICE (QOS) PERFORMANCE IN WIRELESS
NETWORK –WIFI, WIMAX AND LTE**

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**QUALITY OF SERVICE (QOS) PERFORMANCE IN
WIRELESS NETWORK –WIFI, WIMAX AND LTE**

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DEDICATION

Dedicated to my parents who have supported me in reaching this stage and respected lecturer Dr. Juwita binti Mohd Sultan who always guide me in this project.

ABSTRACT

WiFi (Wireless Fidelity) is one of the technologies that has been improved in the past decade and it is still one of the major wireless technologies used day to day by people. Next, WiMAX (Worldwide Interoperability for Microwave Access) is a technology standard for long range wireless networking, for both mobile and fixed connections. LTE (Long Term Evolution) is one of the latest technologies which is known as currently one of the fastest ways of mobile data transfer communication. But, between WiFi, WiMAX and LTE have several limitations due to their technologies. In order to have a continuity connection, these networks need to be aligned together known as hybrid WiFi+WiMAX and WiFi+LTE. Before that, each QoS level in these networks needs to be analyzed first due to the different level of QoS in each network. The QoS for WiFi are rtPS and BE while in WiMAX, the QoS classes are UGS, rtPS, ertPS, nrtPS and BE. For the LTE, the QoS classes are GBR and Non-GBR. So, this project will focus on the QoS performance such as throughput, delay and data drops. In addition, the effect of the number of users in the network and the distances between the access point and the users will also be evaluated.

ABSTRAK

WiFi adalah salah satu teknologi yang telah bertambah baik dalam dekad yang lalu dan ia masih merupakan salah satu teknologi tanpa wayar utama yang digunakan setiap hari oleh ramai orang. Seterusnya, WiMAX adalah satu teknologi standard rangkaian tanpa wayar jarak jauh, untuk kedua-dua sambungan mudah alih dan sambungan tetap. LTE adalah salah satu teknologi terkini yang dikenali sebagai salah satu cara komunikasi pemindahan data mudah alih yang terpantas. Tetapi, di antara WiFi, WiMAX dan LTE terdapat beberapa kekurangan disebabkan oleh teknologi mereka. Untuk mendapatkan sambungan yang berterusan, rangkaian ini perlu diselaraskan dan dikenali sebagai hibrid WiFi + WiMAX dan WiFi + LTE. Sebelum itu, setiap tahap kualiti perkhidmatan (QoS) dalam rangkaian ini perlu dianalisis terlebih dahulu kerana tahap kualiti perkhidmatan dalam setiap rangkaian berbeza. Kualiti perkhidmatan untuk WiFi adalah rtPS dan BE manakala untuk WiMAX, kelas kualiti perkhidmatan adalah UGS, rtPS, ertPS, nrtPS dan BE. Bagi LTE, kelas kualiti perkhidmatan adalah GBR dan Non-GBR. Oleh itu, projek ini akan memberi tumpuan kepada prestasi QoS seperti penghantaran, kelewatan dan penurunan data. Di samping itu, kesan bilangan pengguna dalam rangkaian dan jarak antara titik akses dan pengguna juga akan dinilai.

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TABLE OF CONTENTS

Declaration	
Approval	
Dedication	
Abstract	i
Abstrak	ii
Acknowledgements	iii
Table of Contents	iv
List of Figures	ix
List of Tables	xiv
List of Symbols and Abbreviations	xv
CHAPTER 1 INTRODUCTION	1
1.1 Problem Statement	3
1.2 Objectives	4
1.3 Project Scope	4

1.4	Research Motivation	5
1.5	Structure of The Report	5
CHAPTER 2 LITERATURE REVIEW		7
2.1	Evolution of Mobile Technology	7
2.1.1	1 st Generation	8
2.1.2	2 nd Generation	9
2.1.3	3 rd Generation	10
2.1.4	4 th Generation	10
2.2	Overview of WiFi, WiMAX and LTE	11
2.2.1	IEEE 802.11 standard	12
2.2.2	IEEE 802.16 standard	13
2.2.3	LTE Evolution	14
2.3	Quality of Service (QoS)	15
CHAPTER 3 METHODOLOGY		19
3.1	Overview	19
3.2	Simulation Tool	19
3.3	The project flow	20
3.3.1	Create Network Model	20
3.3.2	Choose Statistic	21
3.3.3	Run Simulation	21

3.3.4	View and Analyze Results	21
CHAPTER 4 RESULTS AND DISCUSSION		22
4.1	Overview	22
4.2	WiFi Network	22
4.2.1	Simulation for 2 user	23
4.2.1.1	Scenario 1 – All BE	24
4.2.1.2	Scenario 2 – All rtPS	26
4.2.1.3	Scenario 3 – 1 BE 1 rtPS	27
4.2.1.4	Scenario 4 – All BE	29
4.2.1.5	Scenario 5 – All rtPS	30
4.2.1.6	Scenario 6 – 1 BE 1 rtPS	32
4.2.1.7	Summarize table for 2 user	34
4.2.2	Simulation for 10 users	35
4.2.2.1	Scenario 1 – All BE	36
4.2.2.2	Scenario 3 - 3 rtps 7 BE	38
4.2.2.3	Scenario 4 - 5 rtps 5 BE	40
4.2.2.4	Scenario 5 - 7 rtps 3 BE	42
4.2.2.5	Scenario 6 - All rtps	44
4.2.3	Simulation for 10 users for larger distance	46
4.2.3.1	Scenario 1 - All BE	47

4.2.3.2	Scenario 3 - 3 rtps, 7 BE	49
4.2.3.3	Scenario 4 - 5 rtps, 5 BE	51
4.2.3.4	Scenario 5 - 7 rtps, 3 BE	53
4.2.3.5	Scenario 6 - All rtps	55
4.2.3.6	Summarize table for 10 user	57
4.2.4	Simulation for 20 users for smaller distance	58
4.2.4.1	Scenario 1 - All BE	59
4.2.4.2	Scenario 2 - 4 rtps , 16 BE	61
4.2.4.3	Scenario 3 - 10 rtps, 10 BE	63
4.2.4.4	Scenario 4 - 14 rtps 6 BE	65
4.2.4.5	Scenario 5 - All rtps	67
4.2.5	Simulation for 20 users for larger distance	69
4.2.5.1	Scenario 1 - All BE	70
4.2.5.2	Scenario 2 - 4 rtps, 16 BE	72
4.2.5.3	Scenario 3 - 10 rtps, 10 BE	74
4.2.5.4	Scenario 4 - 14 rtps 6 BE	76
4.2.5.5	Scenario 5 - All rtps	78
4.2.5.6	Comparison between 20 user with distance 15m and 30m	80
4.3	WiMAX Network	81
4.3.1	Scenario 1 - 10 (2 BE http, 8 rtps video)	82

4.3.2 Scenario 2 - 20 (1 BE http, 19 rtps video)	85
4.3.3 Scenario 3 - 20 (19 Be http, 1 rtps video)	87
4.3.4 Scenario 4 - When changed BE > video, rtps> web browsing	89
4.4 Qos Mapping Table	92
CHAPTER 5 CONCLUSION AND FUTURE WORKS	93
5.1 Conclusion	93
5.2 Future works	94
REFERENCES	96

LIST OF FIGURES

Figure 2.1 : AMPS network architecture	8
Figure 2.2 : 2G architecture network	9
Figure 3.1 : Flow of the project	20
Figure 4.1 : Simulation layout for 2 users for distance 15m	23
Figure 4.2 : Simulation layout for 2 users for distance 30m	23
Figure 4.3 : WiFi throughput for http application	24
Figure 4.4 : Average delay for http application	25
Figure 4.5 : Average data drops for both user	25
Figure 4.6 : Throughput for video application	26
Figure 4.7 : WiFi delay for user 1 and user 2	26
Figure 4.8 : Data drops in video application	27
Figure 4.9 : Throughput for http and video application	27
Figure 4.10 : Delay for http and video application	28
Figure 4.11 : Data drops for http and video application	28
Figure 4.12 : Throughput for http application	29
Figure 4.13 : Average delay for http application	29

Figure 4.14 : Data dropped for http application	30
Figure 4.15 : Throughput for video application	30
Figure 4.16 : Delay for video application	31
Figure 4.17 : Data dropped for video application	31
Figure 4.18 : Throughput for http and video application	32
Figure 4.19 : Average delay for http and video application	32
Figure 4.20 : Data dropped for http application and video application	33
Figure 4.21 : Simulation layout for 10 users for distance 15m	35
Figure 4.22 : Average throughput for http application	36
Figure 4.23 : Average delay for http application	36
Figure 4.24 : Average data drops for http application	37
Figure 4.25 : Average throughput for 3 rtPS application and 7 BE application	38
Figure 4.26 : Average delay for 3 rtPS application and 7 BE application	38
Figure 4.27 : Average data drops for 3 rtPS application and 7 BE application	39
Figure 4.28 : Average throughput for 5 rtPS application and 5 BE application	40
Figure 4.29 : Average delay for 5 rtPS application and 5 BE application	40
Figure 4.30 : Average data drops for 5 rtPS application and 5 BE application	41
Figure 4.31 : Average throughput for 7 rtPS application and 3 BE application	42
Figure 4.32 : Average delay for 7 rtPS application and 3 BE application	42
Figure 4.33 : Average data drops for 7 rtPS application and 3 BE application	43
Figure 4.34 : Average throughput for all rtPS application	44
Figure 4.35 : Average delay for all rtPS application	44
Figure 4.36 : Average throughput for all rtPS application	45

Figure 4.37 : Simulation layout for 10 users for distance 30m	46
Figure 4.38 : Average throughput for all BE application	47
Figure 4.39 : Average delay for all BE application	47
Figure 4.40 : Average data drops for all BE application	48
Figure 4.41 : Average throughput for 3 rtPS application and 7 BE application	49
Figure 4.42 : Average delay for 3 rtPS application and 7 BE application	49
Figure 4.43 : Average data drops for 3 rtPS application and 7 BE application	50
Figure 4.44 : Average throughput for 5 rtPS application and 5 BE application	51
Figure 4.45 : Average delay for 5 rtPS application and 5 BE application	51
Figure 4.46 : Average data drops for 5 rtPS application and 5 BE application	52
Figure 4.47 : Average throughput for 7 rtPS application and 3 BE application	53
Figure 4.48 : Average delay for 7 rtPS application and 3 BE application	53
Figure 4.49 : Average data drops for 7 rtPS application and 3 BE application	54
Figure 4.50 : Average throughput for all rtPS application	55
Figure 4.51 : Average delay for all rtPS application	55
Figure 4.52 : Average data drops for all rtPS application	56
Figure 4.53 : Simulation layout for 20 users for distance 15m	58
Figure 4.54 : Average throughput for all BE application	59
Figure 4.55 : Average delay for all BE application	59
Figure 4.56 : Average data drops for all BE application	60
Figure 4.57 : Average throughput for 4 rtPS application and 16 BE application	61
Figure 4.58 : Average delay for 4 rtPS application and 16 BE application	61
Figure 4.59 : Average data drops for 4 rtPS application and 16 BE application	62

Figure 4.60 : Average throughput for 10 rtPS application and 10 BE application	63
Figure 4.61 : Average delay for 10 rtPS application and 10 BE application	63
Figure 4.62 : Average data drops for 10 rtPS application and 10 BE application	64
Figure 4.63 : Average throughput for 14 rtPS application and 6 BE application	65
Figure 4.64 : Average delay for 14 rtPS application and 6 BE application	65
Figure 4.65 : Average data drops for 14 rtPS application and 6 BE application	66
Figure 4.66 : Average throughput for all rtPS application	67
Figure 4.67 : Average delay for all rtPS application	67
Figure 4.68 : Average data drops for all rtPS application	68
Figure 4.69 : Simulation layout for 20 users for distance 30m	69
Figure 4.70 : Average throughput for all BE application	70
Figure 4.71 : Average delay for all BE application	70
Figure 4.72 : Average data drops for all BE application	71
Figure 4.73 : Average throughput for 4 rtPS application and 16 BE application	72
Figure 4.74 : Average delay for 4 rtPS application and 16 BE application	72
Figure 4.75 : Average data drops for 4 rtPS application and 16 BE application	73
Figure 4.76 : Average throughput for 10 rtPS application and 10 BE application	74
Figure 4.77 : Average delay for 10 rtPS application and 10 BE application	74
Figure 4.78 : Average data drops for 10 rtPS application and 10 BE application	75
Figure 4.79 : Average throughput for 14 rtPS application and 6 BE application	76
Figure 4.80 : Average delay for 14 rtPS application and 6 BE application	76
Figure 4.81 : Average data drops for 14 rtPS application and 6 BE application	77
Figure 4.82 : Average throughput for all rtPS application	78

Figure 4.83 : Average delay for all rtPS application	78
Figure 4.84 : Average data drops for all rtPS application	79
Figure 4.85 : Simulation layout for WiMAX network	81
Figure 4.86 : Average throughput for rtPS and BE	82
Figure 4.87 : Average data drops for rtPS and BE	83
Figure 4.88 : Average delay for rtPS and BE	84
Figure 4.89 : Average throughput for rtPS and BE	85
Figure 4.90 : Average delay for rtPS and BE	86
Figure 4.91 : Average throughput for rtPS and BE	87
Figure 4.92 : Average delay for rtPS and BE	88
Figure 4.93 : Average throughput for rtPS and BE	89
Figure 4.94 : Average delay for BE users	90
Figure 4.95 : Average delay for rtPS users	91

LIST OF TABLES

Table 2.1 : 802.11 phy standards	13
Table 2.2 : WiFi Quality of Service	17
Table 2.3 : WiMAX Quality of Service	17
Table 2.4 : LTE Quality of Service	18
Table 4.1 : Summarize table for 2 user	34
Table 4.2 : Summarize table for 10 user	57
Table 4.3 : Summarize table for 20 user with distance 15m	80
Table 4.4 : Summarize table for 20 users with distance 30m	80
Table 4.5 : QoS Mapping Table between WiFi+WiMAX	92

LIST OF SYMBOLS AND ABBREVIATIONS

WLAN	:	Wireless Local Area Network
WiFi	:	Wireless Fidelity
WiMAX	:	World Interoperability for Microwave Access
LTE	:	Long Term Evolution
IEEE	:	Institute of Electrical and Electronics Engineers
3GPP	:	3rd Generation Partnership Project
ETSI	:	European Telecommunications Standart Institute
GSM	:	Global system for Mobile Communications
OFDMA	:	Orthogonal Frequency- Division Multiple Access
SC-FDMA	:	Single-Carrier Frequency-Division Multiple Access
QoS	:	Quality of Service
AMPS	:	Advanced Mobile Phone System
FDMA	:	Frequency Division Multiple Access
MTS	:	Mobile Telephone System
AMTS	:	Advanced Mobile Telephone System
IMTS	:	Improved Mobile Telephone Service
PTT	:	Push to Talk

SMS	:	Short Message Service
ITU-R	:	International Telecommunications Union-Radio
IMT-Advanced	:	International Mobile Telecommunications Advanced
MMS	:	Multimedia Messaging Service
DVB	:	Digital Video Broadcasting
IP	:	Internet Protocol
NGN	:	Next Generation Network
UGS	:	Unsolicited Grant Service
rtPS	:	Real-time Polling Service
ertPS	:	Extended Real-time Polling Service
nrtPS	:	Non-real-time Polling Service
BE	:	Best Effort
GBR	:	Guaranteed Bit Rate
NoN- GBR	:	Non- Guaranteed Bit Rate
DES	:	Discrete Event Simulations

CHAPTER 1

INTRODUCTION

Wireless mobile Internet is migrating toward an integrated system of Internet and telecommunications technologies in order to fulfill the future telecommunications requirement: ubiquitous communication, where mobile users move freely almost anywhere and communicate with anyone, anytime with any device using the best service available [1]. This demands a rapid progress in telecommunications and the Internet technologies.

IEEE 802.11 wireless LAN (WLAN) is one of the most deployed wireless technologies all over the world and is likely to play a major role in next-generation wireless communication networks [2]. WiFi stands for wireless fidelity, it defined as the wireless local area network (WLAN) products that are based on the IEEE 802.11 standards. IEEE 802.11 has 2 basic modes of operation which are the ad hoc mode

and infrastructure mode. In ad hoc mode, the mobile transmits the data peer-to-peer while in infrastructure mode, the mobile communicates other networks through the access point, which we call it Internet or LAN [3]. It also provides the highest transmission rate among standard wireless networking technologies. Today's WiFi devices, based on IEEE 802.11a and 802.11g, provide transmission rates up to 54 Mbps and the new standard of providing the highest transmission rate among standard wireless networking technologies [4].

The Worldwide Interoperability for Microwave Access (WiMAX) Forum was originally established in 2001 as an industrial organization, whose goals are to certify and promote the compatibility and interoperability of broadband wireless products based on the IEEE 802.16 standards [5]. The WiMAX Forum describes WiMAX as “a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL”. Since the WiMAX technology is to be deployed as broadband wireless metropolitan area networks, IEEE 802.16 standard family is also called WirelessMAN [6].

LTE stands for long term evolution, was developed by the 3rd Generation Partnership Project (3GPP) with the association of the European Telecommunications Standard Institute (ETSI) [7]. It is currently known as a leading fourth generation standard for wireless mobile communication technology. The data transfer in LTE that evolves from the Global System for Mobile Communications (GSM) and Enhanced Data rates for GSM Evolution [3]. In order to conserve the power, LTE used the Orthogonal Frequency- Division Multiple Access (OFDM) for the downlink and single-carrier frequency-division multiple access (SC-FDMA) for uplink. LTE also provide higher data rate and lower latency for the user.