



**WIMAX ARCHITECTURE FOR IRAQ ENVIRONMENT:
MOSUL CASE STUDY**

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**MASTER OF COMPUTER SCIENCE
(INTERNETWORKING TECHNOLOGY)**

2014



Faculty of Information and Communication Technology

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CASE STUDY**

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Master of Computer Science (Internetworking Technology)

2014

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**A thesis submitted
in fulfillment of requirements for the degree of Master of Computer Science
(Internetworking Technology)**

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2014

DECLARATION

I declare that this thesis entitled “WiMAX Architecture for Iraq Environment: Mosul Case Study” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :

Name : Ayman N. Majed

Date :

APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of the degree Master of Computer Science (Internetworking Technology).

Signature :

Supervisor Name :

Date :

DEDICATION

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ
(قل اعملوا فسيرى الله عملكم ورسوله والمؤمنون)
صدق الله العظيم

My God the night is not pleased only by thanking you and the day is not a pleasure only by your forgiveness... Moments are pleased only by remembering you... Afterlife are pleased only by your forgiveness... Paradise are pleased only by seeing you

God Almighty

To whom hit the message and The Secretariat... And advised the nation... To the Prophet of mercy and the light of the Worlds

Our prophet Muhammad, peace be upon him

To whom Allah gives him prestige and dignity... To those who taught me tender without waiting... to those who carry his name proudly... I ask God to give you at your age to see, the fruit is ripe for the picking after a long wait and will remain your star guided his day and tomorrow and forever.

My dear father Dr. Naser Majeed AL-Sumaidaie

To my angel in life... To the meaning of love and the meaning of compassion and dedication... Smile to life and the mystery of existence... To those who were her praying is the secret of my success and her affection is the heart balm to the most lover one.

My beloved mother Engineered Sbahia Mohammed AL-Zobaidy

To who make me older and I rely upon ... Burning candle to illuminate the darkness of my life... To whom her existence is my gained strength and her love has no limits... To know from them the meaning of life.

My precious wife

To my precious sister and all my brothers... Omar Naser AL-Sumaidaie, Nashwan Naser AL-Sumaidaie, and Mohammed Naser AL-sumaidaie my road mates and this life without you is not something I am with you and without you I like anything... At the end of my career, I want to thank you for your positions to the noble looked to my success stares hope.

Ayman N. Majeed

إهداء

بسم الله الرحمن الرحيم
(قل اعملوا فسيرى الله عملكم ورسوله والمؤمنون)
صدق الله العظيم

إلهي لا يطيب الليل إلا بشكرك ولا يطيب النهار إلا بطاعتك ... ولا تطيب اللحظات إلا بذكرك ... ولا تطيب
الآخرة إلا بعفوك ... ولا تطيب الجنة إلا برؤيتك
الله جل جلاله

إلى من بلغ الرسالة وأدى الأمانة ... ونصح الأمة ... إلى نبي الرحمة ونور العالمين ...
سيدنا محمد صلى الله عليه وسلم

إلى من كلله الله بالهبة والوقار ... إلى من علمني العطاء بدون انتظار ... إلى من أحمل أسمه بكل افتخار ...
أرجو من الله أن يمد في عمرك لترى ثماراً قد حان قطافها بعد طول انتظار وستبقى كلماتك نجوم أهدي بها
اليوم وفي الغد وإلى الأبد.
والدي العزيز الدكتور نصر مجيد الصميدعي

إلى ملاكي في الحياة ... إلى معنى الحب وإلى معنى الحنان والتفاني ... إلى بسملة الحياة وسر الوجود إلى
من كان دعائها سر نجاحي وحنانها بلسم جراحي إلى أعلى الحباب.
أمي الحبيبة المهندسة سباهيه محمد الزبيدي

إلى من بها أكبر وعليه أعتمد ... إلى شمعة متقدة تنير ظلمة حياتي ... إلى من بوجودها أكتسب قوة ومحبة
لا حدود لها ... إلى من عرفت معها معنى الحياة.
زوجتي الغالية

إلى اختي العزيزة وكل من إختي عمر نصر الصميدعي ونشوان نصر الصميدعي ومحمد نصر
الصميدعي رفاق دربي وهذه الحياة بدونكم لا شيء معكم أكون أنا وبدونكم أكون مثل أي شيء ... في نهاية
مشواري أريد أن أشكركم على مواقفكم النبيلة إلى من تطلعوا لنجاحي بنظرات الأمل.

أيمن نصر مجيد

ABSTRACT

WiMAX is a broadband technology that provides an access to the internet using a wireless microwave approach which known also as Worldwide Interoperability for Microwave Access. WiMAX is a trade name that represents IEEE 802.16 standard technology which is implemented in the metropolitan area networks (MAN) level. This research is conducted because no WiMAX architecture technology have been implemented in Iraq. In this case, we need to propose a suitable WiMAX architecture that provides the most benefit out from this technology to be suitable by determining the best approach solution that will be the best choice from the all kinds that are related to this particular topic to be used in Iraq. Our methodology classified the into four phases, the Investigation phase, collecting data and analysis phase, proposing phase, evaluations and discussion phase. The Investigation phase will investigate current research in the WiMAX. Background study, problems, importance, issues in the current research in order to address gaps in WiMAX domain. In collecting data and analysis phase, we are permitted to collect and analyze the data from different sources for the sake of getting better and efficient results in our research. In proposing phase a suitable WiMAX architecture will be proposed. In order to finalize our work, the evaluations and discussion phase will take place.

ABSTRAK

WiMAX adalah teknologi jalur lebar yang menyediakan kemudahan capaian internet menggunakan pendekatangelombang mikro tanpa wayar yang dikenali sebagai “Worldwide Interoperability for Microwave Access”. WiMAX adalah nama yang diwakilkan oleh piawai teknologi IEEE 802.16 yang digunakan pada kawasan paras Area Rangkaian Metropolitan (ARM). Kajian ini dilakukan kerana tiada senibina WiMAX yang digunakan di Iraq. Pada kajian ini, kami mencadangkan senibina WiMAX yang sesuai dengan menentukan pendekatan penyelesaian yang terbaik yang memberikan pilihan dari semua perkara yang berkaitan dengan topik ini untuk digunakan di Iraq. Metodologi terbahagi kepada empat fasa iaitu fasa penyiasatan, pengumpulan data dan analisis, cadangan dan penilaian. Fasa penyiasatan akan menyiasat kajian terkini berkaitan WiMAX, latar belakang, masalah, kepentingan dan isu terkini di dalam mendapatkan jurang dalam domain WiMAX. Dalam pengumpulan data dan analisis, data dipungut dan dianalisis dari pelbagai sumber untuk mendapatkan keputusan yang baik dan efisien dalam kajian ini. Dalam fasa cadangan, senibina WiMAX telah dicadangkan. Akhir sekali, senibina yang dicadangkan dilakukan penilaian dan perbincangan.

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LIST OF ABBREVIATIONS

3G: Third generation network.

3GPP: 3rd Generation Partnership Project.

4G: Fourth generation network.

AAA: Authentication, Authorization and Accounting.

ASN: Access Service Network.

ASP: Access Service Provider.

BS: Base Station.

CPE: Customer Premise Equipment.

CSN: Connectivity Service Network.

DL: Downlink.

EPC: Evolved Packet Core.

E-UTRAN: Evolved UMTS Terrestrial Radio Access Network.

FDMA: Frequency-division multiple access.

FTTH: Fiber-To-The-Home.

GGSN: Gateway General Support Node.

IEEE: Institute of Electrical and Electronics Engineering.

IP: Internet Protocol.

ISDN: Integrated Services Digital Network.

ISP: Internet service provider.

ISPs: Internet Service Providers.

ITU: International Telecommunication Union.

LAN: Local Area Network.

LBRRRA: Location Based Radio Resource Allocation.

LOS: Line-of-Sight.

LTE: Long Term Evolution.

MAC: Media Access Control.

MAN: Metropolitan area network.

MIMO: Multiple Input Multiple Output.

MS: Mobile Station.

NAP: Network Access Provider.

NLOS: None Line-of-Sight.

NRM: Network Reference Model.

NSP: Network Service Provider.

OFDM: Orthogonal Frequency Division Multiplexing.

OFDMA: Orthogonal Frequency Division Multiple Access.

OSI: Open Systems Interconnection.

P-GW: Packet Data Network Gateway.

PHY: Physical.

PLMN: Public Land Mobile Network.

PSTN: Public Switched Telecommunications Network.

QoS: Quality of Service.

RAN: Radio Access Network.

RNC: Radio Network Controller.

RP: Reference Point.

S-GW: Serving Gateway.

SS: Subscriber Station.

TCP: Transmission Control protocol.

TDM: Time Division Multiplexing.

TDMA: Time Division Multiple Access.

UDP: User Datagram Protocol.

UL: Uplink.

UMTS: Universal Mobile Telecommunications System.

Wi-Fi: Wireless Fidelity.

WiMAX: Worldwide Interoperability for Microwave Access.

WLAN: Wireless Local Area Network.

CHAPTER 1

INTRODUCTION

1.0 Background

This chapter aims to clearly describe this research aspects in terms of its problem statement, the objectives that should be achieved, questions that should be identified, scoping for narrowing down the research and finally the significance of the research. In addition, these aspects are explained respectively.

1.1 Introduction

The need for more bandwidth and speed (Data rate) is desirable nowadays which it creates the need for a newer technologies to be implemented and used in real life. The need for high rate of data comes from the use of high bit rate applications, video streaming, TV broadcasting, and so on (Dmitry et al. 2010).

WiMAX is a broadband technology that provides an access to the internet using a wireless microwave approach which known also as Worldwide Interoperability for Microwave Access (Anon 2009). WiMAX is a trade name that represents IEEE 802.16 standard technology which is implemented in the metropolitan area networks (MAN) level. It can provide different kinds of access method such as internet access points and point-to-point access. The difference between Wi-Fi technologies that represent IEEE 802.11 and

WiMAX is that WiMAX can support up to 75Mbps transmission speed and a wider distance wirelessly up to 50Km unlike Wi-Fi that designed for indoor and support up to 100m which is not enough for a wide distance according to (McNaught & Mink 2011) and (de Carvalho et al. 2008). IEEE 802.16 is designed for outdoor wireless as a standard for the Data link layer 2 and Physical layer 1 of the OSI reference model according to (Rengaraju et al. 2011).

WiMAX has been used in many countries (Saghaeian, A. 2008). However, WiMAX technology has not been implemented or used in Iraq, because Iraq country influenced to three wars in a row, the first was started at 1980 and least to 1988. The second started by the imposition of economic sanctions on the country by America from 1991 until 2003 when their soldiers occupy the country and the last one is just starting now (2014). In addition, there is no any infrastructure that will help this country grow up as the developed countries. So that is the reason why I propose WiMAX to be implemented in this country.

Although WiMAX is a technology that widely used by Europe, Latin America, Africa, and so on, but the deployment or implementation of this technology in the Middle East is less than %5 which is very low (Saghaeian, A. 2008). Unfortunately this technology (WiMAX) is not yet been explored and used in Iraq environment.

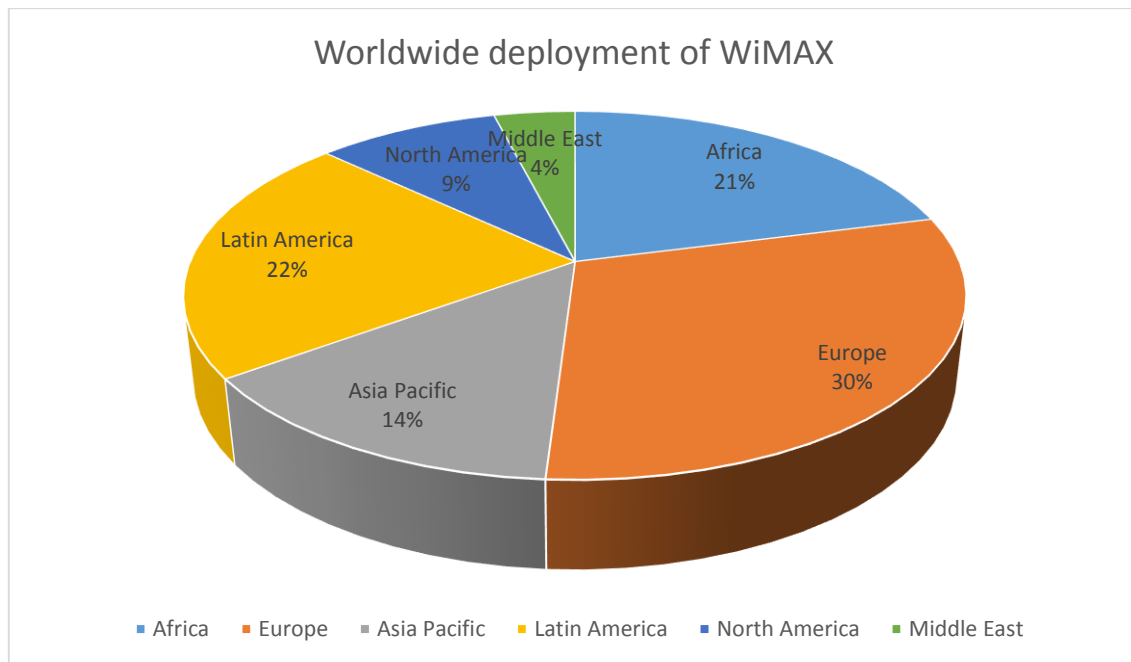


Figure 1.1: Worldwide growth of WiMAX by region (Saghaeian, A. 2008).

From figure 1.1 we can notice the percentage of deploying this technology in the worldwide. The most deployments are within Europe, which has 30% and the lowest is Middle East which has only 4% which is very low comparing with other regions.

1.2 Research Problem

This research is conducted because no WiMAX architecture technology have been implemented in Iraq. In this case, we need to propose a suitable WiMAX architecture that provide the most benefit out from this technology so it can suit to Iraq geographical and environmental area. In order to deploy and implement WiMAX technology, we need to determine the recent trend that influenced by this standard to gain the ability to conduct this study in a better way. In addition, deploying this standard in the Iraqi country will need to investigate the aspects of challenges that could be faced in that particular environment. By surveying the requirements of implementing this technology will provide all the