Technical Assessment between Worldwide Interoperability for Microwave Access (WiMAX) and Wireless Fidelity (Wi-Fi)

Iroegbu Chibuisi, Omusun Yerima

***Abstract*— This paper is on the Technical Assessment between Worldwide Interoperability for Microwave Access (WiMAX) and Wireless Fidelity (Wi-Fi). WiFi and WiMAX are closely evaluated and compared. The technical performance evaluation of the two technologies are done based on the information obtained from research works, reports, journals, with more emphases on range and coverage, Scalability, frequency band, Channel Bandwidth, Bandwidth Efficiency, Radio Technique, Security, Mobility, Quality of Service (QoS) etc. From the result obtained from this study, it is concluded that WIMAX technology, although new points out to be better in terms of mobility, bandwidth efficiency, scalability, security, channel bandwidth, and Maximum Coverage.**

***Index Terms*— WiMAX, Wi-Fi, Security, Technical, Bandwidth.**

I. INTRODUCTION

With the help of many expert communication engineers, IEEE has developed various wireless standards in a hierarchical trend [1]. Some of the deployed wireless standards are 802.11 (Wi-Fi), and 802.16 (WiMAX) promoted by WiMAX forum. Worldwide Interoperability for Microwave Access (WiMAX) is a telecommunications technology based on the IEEE 802.16 standard, aimed at providing wireless data over lengthy distances in a diversity of ways from point-to-point links to full mobile cellular type access. Wireless Fidelity (Wi-Fi) on the other hand, is a popular technology based on IEEE 802.11 standard, which allows any electronic device to exchange and transfer data wirelessly over the network giving rise to high speed internet connections [2]. Improved semiconductor and electronics manufacturing technology, and the growth of the internet and mobile telecommunications have also help in fueling the growth in telecommunications. Many service providers had adopted the WiMAX technology as a quick and cheap option to provide connectivity between access points or base stations and their backbone network [3]. With the increasing market demand for WiMAX, it is now regularly compared with Wi-Fi. While both technologies have some indistinguishable technical characteristics, however they are approaching the wireless space from completely different perspectives [4]. The purpose of this paper is to provide a technical comparison of Wi-Fi and WiMAX technologies in order to know which of the technology will be better to build a wireless access infrastructure.

Section II of this research examines the individual technologies. Section III surveyed the methodology, Section IV presents the result analysis, while section V summarizes and concludes the work.

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II. TECHNOLOGICAL OVERVIEW

A. *Wi-Fi*

Wi-Fi stands for "wireless fidelity". It is a popular technology which allows any electronic device to exchange and transfer data wirelessly over the network giving rise to high speed internet connections [5]. Any device which is Wi-Fi enabled can connect to a network resource like the internet through a wireless network access point. Web pages that use SSL are secure but unencrypted internet access can easily be detected by intruders.

B. *WiMAX*

WiMAX is a fourth generation (4G) telecommunication protocols that provides permanent and mobile internet [6]. It is intended to bring high speed data communication, and it also has the capability to sustain dedicated links and VoIP services at a reliable and high quality speed. It provides broadband connectivity anywhere, anytime for any device and on any network. It has the ability to allow a subscriber to connect to a wireless Internet service provider even when they roam outside their offices or homes. One of the main applications of the WiMAX is that it can be used in disaster recovery scenes where the wired networks have broken down [7].

III. METHODOLOGY

Figure1 and 2 shows the network architectures of Wi-Fi and WiMAX.

The technical assessment of the two technologies are done based on the information gained from research works, reports, journals, with more emphases on range and coverage, Scalability, frequency band, Channel Bandwidth, Bandwidth Efficiency, Radio Technique, Security, Mobility, Quality of Service (QoS) etc

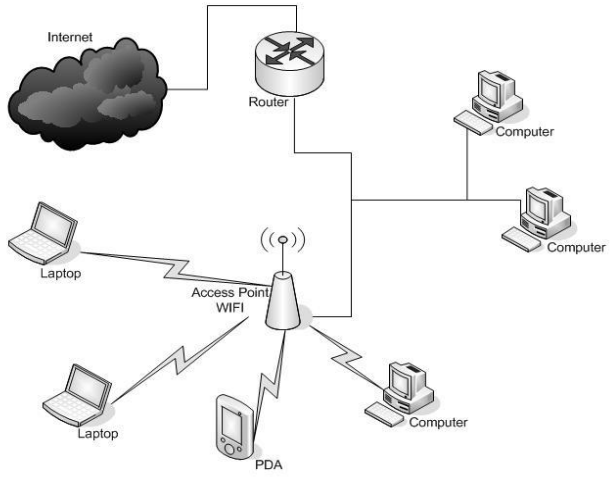

Figure 1: Wi-Fi Network

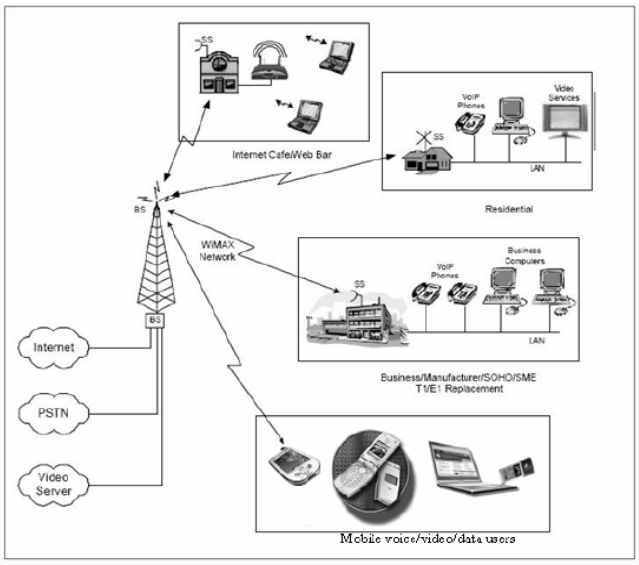

Figure 2: WiMAX Network

A. *Security:*

Security is a major issue in communication because it protects signals from eavesdropping [9]. Security has been one of the major lacking in Wi-Fi, encryption is optional here [10]. WiMAX is designed for public network so security is very much crucial. All the data that is transmitted in WiMAX network is virtually encrypted.

B. *Efficiency:*

In Wi-Fi, the maximum channel bandwidth ranges from 20 MHz to 25 MHz, while the bit rates is 54 Mbps and latency range of 50 ms. In WiMAX, the channel bandwidth ranges from 1.25 MHz to 20 MHz, while the latency ranges from 25 to 40ms [8].

C. *Maximum Coverage Range:*

WiMAX ranges from 8 km Non Line of Sight (NLOS) to 50 km Line of Sight (LOS). Its main goal is to provide long range transmission. Wi-Fi is mainly designed for indoor use. It has an optimize range of around 100 meters.

D. *Mobility*

Mobility is the speed of the mobile access point at which the technology can remain connected to the global world without losing packets or service interruption. The network must maintain connection at vehicular speeds

E. *Radio transmission Modulation techniques*

Wi-Fi uses Direct-Sequence spread spectrum (DSSS) technique, while WIMAX uses Orthogonal Frequency Division Multiplexing (OFDM).

F. *Quality of Service (QoS)*

In Wi-Fi, guaranteed QoS is not provided. In WIMAX, QoS is based on a request/grant protocol. It supports multiple QoS which is built in MAC.

G. *Dependability*

Dependability is defined as how much a wireless technology is reliable to the end user. It evaluate with few significant metrics like average number of packet loss, average number of disconnects of calls, and whether the wireless technology is hampered by environmental issues such as line of sight, weather, etc. If a connection is not dependable, in that case packets may loss and that affect the network for that reason the speed of the network will decrease. Both Wi-Fi and WIMAX are both dependable.

H. *Mobility Management*

Mobility management is supported by WiMAX. This standard supports mobile capability with the support of hand-offs capability, mainly for users when they moved between cells. Currently mobility management is not supported by Wi-Fi.

IV. RESULTS ANALYSIS

Stated in table 1 below are the summarized key results arising from the technical assessment between WiMAX and Wi-Fi.

Table 1: Key technical assessment results between WiMAX and Wi-Fi

COMPARATIVE TOOLS	Wi-Fi	WiMAX
Channel Bandwidth	On the range from 20-25 MHz	Adjustable range from 1.25 to 20 MHz
Security	Security is optional here. Better encryption technique like WPA and WEP available now.	3 DES (128 bit)
Radio Technique	OFDM 64 channels and Direct Sequence Spread Spectrum	OFDM 256 Channels
Primary Application	Wireless LAN	Wireless MAN mainly designed for broadband wireless
Range and Coverage	Mainly designed for indoor Optimized for 100 meters No mesh topology is supported	Designed for outdoor NLOS performance Optimized for 50 km Mesh topology

		is supported
Frequency Band	Unlicensed Band 2.4 GHz to 5 GHz	Licensed and Unlicensed Band 2 GHz to 11 GHz
Scalability	MAC designed to support tens of user	MAC designed to support thousands of users
Mobility	In Development phase now	Mobile WiMAX build in to 802.16e
QoS	Contention Based MAC (CSMA/CA) QoS is proposed in IEEE 802.11e	Grant Request MAC Mainly designed to support voice and video
Bandwidth Efficiency	0.44 to 2.7 bps/Hz	<=5 bps/Hz
Half/Full Duplex	Half	Full
Modulation	QPSK	BPSK, QPSK, 16-, 64-, 256-QAM
FEC	Convolutional Code	Convolutional Code Reed-Solomon
Mesh	Vendor Proprietary	Yes
Access Protocol	CSMA/CA	Request/Grant

V. SUMMARY AND CONCLUSION

This paper has presented a precise description of two of the most prominent developing wireless access networks. Detailed technical comparative analysis between the 802.11 (Wi-Fi) and 802.16 (WIMAX) wireless networks that provide alternative solution to the problem of information access in remote inaccessible areas where wired networks are not cost effective has been x-rayed. From the result in table 1, it is evident that there are many reasons why WIMAX tends to be a better technology to build wireless access infrastructure. These factors have been justified in terms of mobility, bandwidth efficiency, scalability, security, channel bandwidth, and Maximum Coverage.

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