International Journal of Technology Research and Management
ISSN (Online): 2348-9006
Vol 4 Issue 2 February 2017

A Comparative Analysis of WiMAX & WiFi

Asst. Prof. Deepak Bicholia [1] and Research Scholar. Stuti Upadhyaya [2]
Dept. of Electronics & Communication Engineering,
Institute of Engineering & Science, IPS Academy, Indore (M.P.) India [1, 2]
deepak.bicholia@gmail.com[1], stuti.0602@gmail.com[2]

Abstract: *IEEE 802.16(d) i.e fixed WiMAX and IEEE 802.11 i.e Wi-Fi (wireless fidelity) have emerged as promising broadband access solutions for the latest generation of wireless MANs and LANs respectively. With the success of wireless technologies in consumer electronics, standard wireless technologies are deployed. Applications involving voice, video and data are supported both by wifi and wimax. Nonetheless these applications have different QoS requirements that need to be met. The main aim of this paper is to simulate an environment of Wi-Fi and Wimax network and investigate the comparative performance of individual environment with respect to QoS parameters like end-to-end delay, throughput and packet delivery ratio for 101, 151 and 201 number of nodes.*

Keywords: *IEEE 802.16, WiMAX, IEEE 802.11, Wi-Fi, WLAN, WMAN, end-to-end delay, throughput, packet delivery ratio.*

1. INTRODUCTION

Wireless network has made a network extremely portable due to digital modulation, adaptive modulation, and information compression. Wireless means transmitting signals using radio waves as the intermediate instead of wires.[2] Wireless technologies can be classified in different ways depending on their range. Each wireless technology is designed to serve a specific usage segment. The requirements for each usage segment are based on a variety of variables, including Bandwidth needs, Distance needs and Power.

Wireless Wide Area Network (WWAN): This network enables you to access the Internet at very fast data speed compared with the data rates of mobile telecommunications technology. Cellular and mobile networks based on CDMA and GSM are good examples of WWAN

Wireless Personal Area Network (WPAN): These networks are very similar to WWAN except their range is very limited.

Wireless Local Area Network (WLAN): This local area network uses high-frequency radio waves rather than wires to communicate between nodes. These networks provide a very fast data speed compared with the data rates of mobile telecommunications technology, and their range is very limited. Wi-Fi is the most widespread and popular example of WLAN technology.

Wireless Metropolitan Area Network (WMAN): This network enables you to access the Internet and multimedia streaming services via a wireless region area network (WRAN). These networks provide a very fast data speed compared with the data rates of mobile telecommunication technology as well as other wireless network, and their range is also extensive.

Wi-Fi (Wireless Fidelity): Wi-Fi is based on the IEEE 802.11 family of standards and is primarily a local area networking (LAN) technology designed to provide in-building broadband coverage.

WiMAX (Worldwide Interoperability for Microwave Access): WiMAX is an emerging technology for broadband wireless access. It offers both Fixed and mobile broadband wireless Internet access. It promises very high data rates, high

reliability, good efficiency and low cost. It enjoys strong industry support and standardization. Because of its low cost, It can be used to provide broadband Internet access to suburban and rural areas and thus bridge the digital divide.

2. WIMAX TECHNOLOGY

WiMAX stands for Worldwide Interoperability for Microwave Access. WiMAX technology is a telecommunications technology that offers transmission of wireless data via a number of transmission methods; such as portable or fully mobile internet access via point to multipoint links. The WiMAX technology offers around 72 Mega Bits per second speed without any need for the cable infrastructure. WiMAX technology is based on Standard that is IEEE 802.16, it usually also called as Broadband Wireless Access. WiMAX Forum created the name for WiMAX technology that was formed in Mid June 2001 to encourage compliance and interoperability of the WiMAX IEEE 802.16 standard. WiMAX technology is actually based on the standards that making the possibility to delivery last mile broadband access as a substitute to conventional cable and DSL lines.[4]

3. FEATURES OF WIMAX

WiMAX is a revolutionary wireless technology that has a rich set of technological improvements compare to the other broadband access technology. The set of features of WiMAX are listed below:
OFDM based physical layer: WiMAX is based on orthogonal frequency division multiplexing that offers multipath resistance and allow NLOS communication.

a. High data rate*:* WiMAX can support very high peak data rate which is as high as 74 mbps.

b. Quality of service: WiMAX MAC layer is responsible for QoS. WiMAX MAC layer support real time, non real time and best effort data traffic and its high data rate, sub channelization, and flexible scheduling improve the QoS.

c. Flexible architecture: WiMAX architecture is very flexible. It can support point to point and point to multipoint connection according to its requirements. It also supports IP-based architecture that is easily converge with other networks and takes advantage of application development from the existing IP based application.

4. BENEFITS OF WIMAX

1. WiMAX Coverage: The single station of WiMAX can operate and provide coverage for hundred of users at a time and manage sending and receiving of data at very high speed with full of network security.

2. WiMAX High Speed: The High speed of connectivity over long distance and high speed voice makes it more demanded in hardly populated areas plus compacted areas.

3. Multi-functionality within WiMAX Technology*:* WiMAX Technology perform a variety of task at a time such as offering high speed internet, providing telephone service, transformation of data, video streaming, voice application etc

4. Potential and development*:* WiMAX Technology is a great invention for new Era because WiMAX has enough potential for developing and opportunity to offer various types of services for new generation. Now you can connect internet anywhere and browse any site and make possible online conference with mobile internet, multimedia application never let you bored, IPTV stay you up to date etc.

5. Stay in touch with end user*:* WiMAX network always keep stay in touch with your friends and all others using same WiMAX network because it provide absolute communication service to the end users to make possible rich communications.

6. WiMAX Infrastructure*:* WiMAX infrastructure is very easy and flexible therefore it provides maximum reliability of network and consent to actual access to end users.

7. WiMAX, cheap network***:*** WiMAX is a well known wireless network now days because it provide a low

cost network substitute to internet services offered via ADSL, modem or local area network.

8. WiMAX Rich Features*:* WiMAX Technology is offering rich features which make it useful. WiMAX offers separate voice and data channel for fun, the semantic connection make your network more secure than before, fast connectively, license spectrum, liberty of movement etc.

5. LIMITATIONS OF WIMAX

1. **Low bit rate over Long distance**: WiMAX technology offering long distance data range which is 70 kilometre or 30 miles and high bit rate which is 70Mbit/s. It is good but both features doesn't work together when we will increase distance range the bit rate will decreased and if we want to increase bit rate then we should reduce the distance range.

2. **Speed of connectivity**: The WiMAX other drawback is that any user closer to the tower can get high speed which is up to 30Mbit/s but if a user exists at the cell edge from the tower can obtain only 14Mbit/s speed.

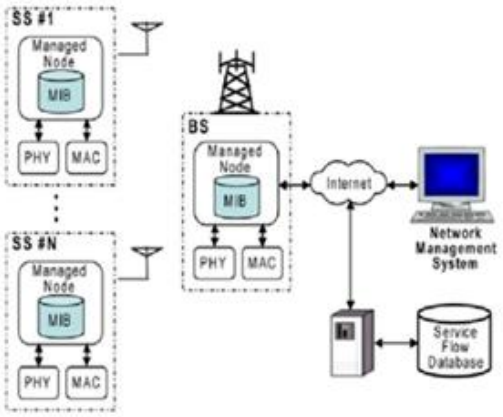
3. **Sharing of bandwidth**: In all wireless technology the bandwidth is shared between users in a specified radio sector. Therefore functionality could go down if more than one user exists in a single sector. Mostly user have a range of 2- to 8 or 12 Mbit/s services so for better result additional radio cards.

6. WI-FI TECHNOLOGY

Wireless Fidelity (Wi-Fi) is a wireless technology which provides internet connectivity or connectivity among the users. In 1997 IEEE provide a set of standard and specification for Wi-Fi which is under the title 802.11 that explains the structure of the comparatively short range radio signal for Wi-Fi service. After that several specifications came and most commonly used specifications today are 802.11b, 802.11g and 802.11a. Out of these three, 802.11a can provide higher speeds within the various radio frequencies. IEEE is now working for a new standard 802.11n which is more reliable, secure and faster than the other standard.

7. FEATURES OF WI-FI

1. **Ease of Use in WiFi Technology**: WiFi is a new characteristic in networking and has fetched a new feature in the field of networking. The data broadcasting is finished by means of radio waves. Through WiFi Technology a user can easily get access to internet for objective to sharing all around the world. Now establishing a computer network in any type of business is not difficult such as companies, coffee shops, Libraries, campus, Hotels, colleges, universities, , private institutes etc. WiFi Technology enabled you to get more profit from your business and facilitate you to connect your client anywhere.



2. **No need for cabling in WiFi Technology**: WiFi is creating new strength to connect anything or any task without giving up task. There are lots of utilities initiated by WiFi. Music streamers are a great utility by WiFi Technology that put your music to speakers without any cable. WiFi Technology also enables you to play radio online and enjoy music via remote computer. Downloading of songs, sharing of files, above the ground speed makes WiFi Technology matchless mobility. WiFi has no cable so you can easily move your pc from one location to another

because it is very helpful, easy and convenient

3. **WiFi Features of Scalable System and Robust Performance**: The scalable system of WiFi Technology shows performance in a while rather than days and makes exact result. Flexible authentication methods facilitate the transportation and procedure of keying substance. You never need any experience to install devices because WiFi Technology itself smart enough to provide security to your personal computer but also offer an easy way of network installation.

8. BENEFITS OF WI-FI

1. **Cabling Free**: WiFi wireless LAN technologies is that it is completely wire-free. Now, if you want to sit in one of your comfort zones in your house, such as a couch or in your yard, you can carry your laptop with you and still be able to access the internet. These days, if you buy a new laptop, a built-in WiFi card will allow you automatic allowance of use. (Brain)

2. **Range**: Instead of having to be constricted to your home wired/wireless Local Area Network (LAN), you can now enjoy the advantages of the Internet in public places such as lobbies, cafes, universities, hotels, airports, and many other common areas. WiFi also supports roaming: you can walk around a building from one access point to another.

3. **Interference**: WiFi is the ability for 802.11b and 802.11g to frequency hop. This process allows the 802.11b and 802.11g cards to transmit themselves on any of three bands, or splitting the radio bandwidth into channels and hop between them. (Brain) This enables the WiFi cards to talk at the same time without interference.

9. LIMITATIONS OF WI-FI

1. **Range**: The limitation of Wi-fi network is that it provides a connection in limited area. Its radio connectively can't reach beyond 20 to 25 meters. When your location is away from 25 meters you can't get access to internet or local wireless network. The Wi-fi antenna broadcast signals around specific areas everywhere but as you goes far your connection will lose strength.

2. **Security**: There are some security issues which may cause of wi-fi limitation because the setting of its network is really very easy but to maintain security need lots of efforts, because there is no encryption methods organize on access point of its network. Sometime Wi-fi network become more vulnerable when hacker attacks on its network and steal your important data and reduce the performance of your network traffic.

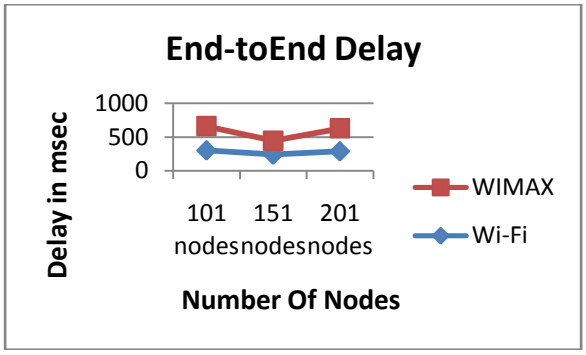
Feature	**WiMAX (802.16a)**	**Wi-Fi (802.11b)**
Primary Application	Broadband Wireless Access	Wireless LAN
Frequency Band	Licensed/Unlicensed 2 G to 11 GHz	2.4 GHz ISM
Channel Bandwidth	Adjustable 1.25 M to 20 MHz	25 MHz
Half/Full Duplex	Full	Half
Radio Technology	OFDM (256-channels)	Direct Sequence Spread Spectrum

Bandwidth Efficiency	<=5 bps/Hz	<=0.44 bps/Hz
Modulation	BPSK, QPSK, 16-, 64-, 256-QAM	QPSK
FEC	Convolutional Code Reed- Solomon	None
Encryption	Mandatory- 3DES Optional- AES	Optional- RC4 (AES in 802.11i)
Mobility	Mobile WiMAX (802.16e)	In development
Mesh	Yes	Vendor Proprietary
Access Protocol	Request/Grant	CSMA/CA

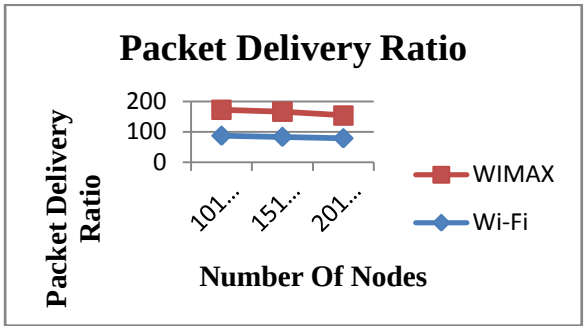
10. SIMULATION MODEL

I implemented my work i.e. Creation of WiMAX and Wi-Fi Scenario in NS-2 , and analyzed them with the use of Various performance matrices like Packet Delivery Ratio, End to End delay and Overall Throughput. with varying node densities 101 nodes, 151 nodes and 201nodes.

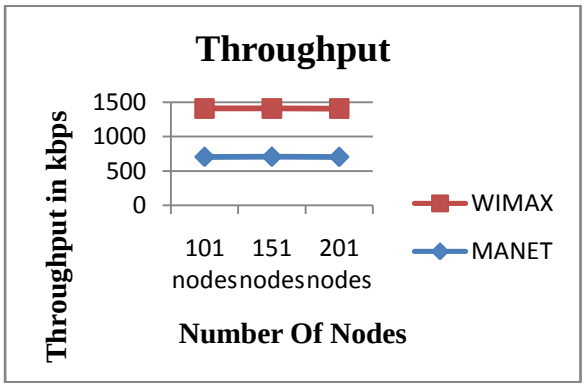
End-to-end Delay:



Packet Delivery Ratio:



Throughput:



11. CONCLUSION

In this paper we analyzed WiMAX has very powerful security architecture. It uses Advance Encryption Standard (AES) for its encryption mechanism which is fast and efficient

computational capability for both hardware and software operation. It is also designed to handle properly the authentication and access control mechanism. IEEE 802.11 standard which is spontaneously name as wireless fidelity (Wi-Fi) is another choice of broadband wireless technology. Due to its scalability, usefulness and inexpensiveness, from the last few years Wi-Fi has grown rapidly from home to office, from coffee shop to airport, by comparing the WiMAX and Wi-Fi and, we observe that WiMAX offers better services than the Wi-Fi. Its network can be a effective choice to fill up the gap between the Wi-Fi hotspots. It also resolves some of the technical difficulties of Wi-Fi.

REFERENCES

[1] Seokhoon Kim, Intae Ryoo and Hangki Joh "Design and Implementation of tiny-WiMAX Connection Manager (t-WCM) for Specific Purposed Devices" Dept. of Computer Engg, Kyunghee University, Korea, Transactions on Consumer Electronics, Vol. 55, No. 4 Page no. 1825-1831[IEEE 2009]

[2] Jim Martin, Bo Li, Will Pressly, James Westall "WiMAX Performance at 4.9 GHz" School of Computing Clemson University Clemson, Vehicular Technology Conference, 2009 SC 29634, USA, 2009 Page no. 1-7[IEEEAC]"

[3] I-Kang Fu, Yih-Shen Chen, and Paul Cheng, MediaTek "Multicarrier Technology for 4G WiMAX System" Intel Technology Journal, vol. 08, Page no. 50-58, 2004[IEEE].

[4] Joon Ho Park, Mingji Ban and Sung Ho Cho "A Design of a Mobile WiMAX System for Military Applications and Its Performance in Fading Channels" Division of Electrical & Computer Engineering Hanyang University, Seoul, 133-791 Korea, 2008 International Conference on Advanced Technologies for Communications, Page no. 185-188,2008 [IEEE].

[5] Wen-Hsing Kuo, Wanjiun Liao "Adaptive Resource Allocation for Layer-Encoded IPTV Multicasting in IEEE 802.16 WiMAX Wireless Networks" IEEE, and Tehuang Liu IEEE Transcations on multimedia, VOL. 13, NO. 1,[2011]

[6] Masood Habib, Masood Ahmad "A Review of Some Security Aspects of WiMAX & Converged Network" Department of Computer Science & IT Shaheed Zulfikar Ali Bhutto Institute of Science and Technology Islamabad, Pakistan Department of Computer Science National University of Computer & Emerging Sciences Peshawar, Pakistan, Second International Conference on Communication Software and Networks Page no.372-376[2010].

[7] Andriy Luntovskyy, Dietbert Gutter, Alexander Schill "Models and Methods For WLAN/WiMAX-Network Design" in 16th Inernational Crimean Conference Microwave & Telecommunication Technology Sevastopol, Crimea, Ukraine. Page no. [391-393], [2006]

[8] Kejie Lu and Yi Qian "A Secure and Service-Oriented Network Control Framework for WiMAX Networks" in National Sun Yat-Sen University Page no. [124-130] [2007]