An Extensive Survey on Wi-Max Communication Technologies and its Advancement

Suman Kushwaha and Prof Sini Shibu
Department of Computer Science Engineering
NRI Institute of Information Science and Technology, Bhopal

Abstract: Worldwide Interoperability for Microwave Access (WiMAX), or the IEEE 802.16d/e standard, is engineering for expansive band remote access (BWA) with significantly advertise potential. This paper surveys the BER execution investigates of a virtual MIMO half-duplex hand-off framework on a WiMAX OFDMA system. For such a condition where multi-reception apparatus hand-off is not an alternative, utilizing numerous single-receiving wire transfers in the framework might be an elective to still profit the differing qualities pick up. The effect of expanding the amount of transfer hubs to the framework execution is additionally researched. As of late, examinations are centered to diminish the receiving wire association by the outlining new reception apparatus structures.

*Index Terms-*WiMAX, Relay, MIMO, IEEE 802.16, WLAN.

I.   INTRODUCTION

Portable Wi-Max is a broadband remote result that gets to versatile and altered broadband systems through broadband radio access engineering for wide zone system. Versatile Wi-Max gives a lot of adaptability, versatility with high information rates and nature of administrations. The execution of portable Wi-Max utilizing convolutional codes for different tweak plans, coding rates and distinctive sizes of convolutional encoders approaches as far as possible. No undertaking on the planet is carried out better without a legitimate correspondence. Around different modes of correspondence, Wireless Communication frameworks do serve the best for this current quick moving world. Wi-Fi, WLAN, Radar, Mobile correspondence, Wi-Max are the sure common fields of remote correspondence. Provisions of Ultra wide band (3.1 to 10.6 GHz) engineering on remote correspondence have been given careful consideration since Federal correspondences requisition (FCC) discharged an otherworldly veil permitting the operations of the UWB frameworks [1]. Contrasted and other customary radio innovations, UWB have the preferences of expanding cost and expanding proficiency. UWB has the normal for ease, cumbersome information transmission rate and low power utilization that make it magnetic in neighborhood, position & area following framework, radio frameworks and numerous different administrations. Broadband remote access (BWA) has pulled in much consideration as of late. As a BWA result, Worldwide Interoperability for Microwave Access (WiMAX) is acknowledged via transporters of worldwide for broadband remote administration. It is evaluated that general broadband business sector could be 20billions in 2010 with the portable WiMAX piece anticipated that will be something like 7billions. WiMAX standard might be classified as Fixed WiMAX (IEEE 802.16d variant [2]) and Mobile WiMAX (IEEE 802.16e adaptation [3]). It could be utilized within hotspot, urban and country range as an elective determination for broadband access. Its center procedures, for example, OFDMA and MIMO, will be utilized within cutting edge remote/portable correspondence framework. Portable WiMAX [4], taking into account the IEEE 802.16 air interface

specifications [5], embraces MIMO as a critical component in limit in- pleat. 3gpp has likewise specified MIMO in Release 7 (HSPA) [6] and Release 8 (LTE, see www.3gpp.org/article/discharge 8). Nonetheless, executions of 3gpp MIMO specifications are allegedly late when contrasted and Mobile WiMAX. HSPA+ improved 3g systems are still not accessible. Long haul Evolution (LTE) is still in the offing. Indeed, the first business HSPA systems are relied upon to be begun up in late 2009. The first LTE-empowered supplies are required to be presented in the businesses at some point in 2010. Remarkably, the IEEE 802.11 working gathering is likewise defining a change standard for WLANs where MIMO is utilized to build throughput [7]. In spite of the fact that the standard is not finish, a few organizations have officially created are IEEE 802.11n executions. These advancements unmistakably indicate a future remote net- working environment where MIMO assumes a key part in the exertion to build limit and oversee sign obstruction brought on by, for instance, multipath blurring. It is generally expected that this environment will involve significantly more client portability, which will just feature sign obstruction phenomena. In spite of the expanded investment, notwithstanding, there are just a couple of experimental assessments of MIMO execution picks up in the open writing and none where Mobile WiMAX is employed.
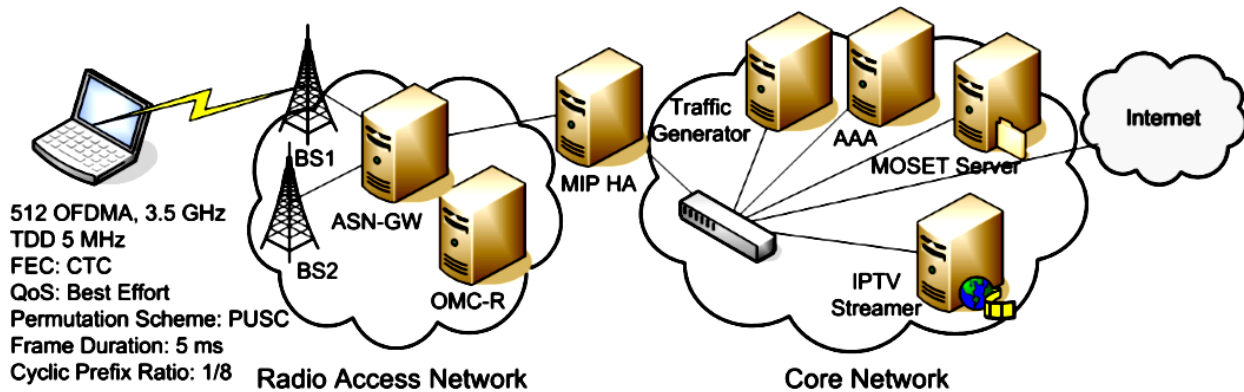
Fig. 1 Schematic of the Mobile WiMAX test bed

In this study, we assess 2x2 MIMO utilizing Space-Time Block Coding (STBC), additionally called Space-Time Coding (STC), in work on utilizing our Mobile WiMAX proving ground. STC does not bring any increases regarding most extreme flow limit however enhances information transmission unwavering quality and therefore Bit Error Rate (BER) contrasted with single receiving wire mode. STC uses transmission differing qualities, that is, the same information are sent through diverse transmitting radio wires utilizing orthogonal coding, permitting singular blurring channels for every information stream.

II. SYSTEM MODEL

WiMAX is known as the cutting edge broadband remote engineering which offers fast, secure, sophisticate and last mile broadband administrations alongside a phone back pull and Wi-Fi hotspots. The advancement of Wimax started a couple of years prior when researchers and designers felt the need of having a remote Internet access and other broadband administrations which works well all around particularly the rustic territories or in those zones where it is tricky to create wired base and financially not achievable.

IEEE 802.16, otherwise called IEEE Wireless-MAN, investigated both authorized and unlicensed band of 2-66 GHz which is standard of altered remote broadband and included portable broadband requisition. WiMAX discussion, a private association was framed in June 2001 to arrange the segments and create the supplies those will be good and bury operable. After a few years, in 2007, Mobile WiMAX supplies created with the standard IEEE 802.16e got the certificate and they affirmed to discharge the item in 2008, giving versatility and migrant access. The IEEE 802.16e air interface dependent upon Orthogonal Frequency Division Multiple Access (OFDMA) which primary point is to give better execution in non-observable pathway situations. IEEE 802.16e acquainted versatile channel transmission capacity up with 20 MHz, Multiple Input Multiple Output (MIMO) and AMC empowered 802.16e engineering to help top Downlink (DL) information rates up to 63 Mbps in a 20 MHz channel through

Scalable OFDMA (S-OFDMA) framework [8]. IEEE 802.1e has solid security building design as it uses Extensible Authentication Protocol (EAP) for shared confirmation, an arrangement of solid encryption calculations, CMAC or HMAC based message assurance and decreased key lifetime [9].

WiMAX Architecture

WiMAX building design involves a few segments yet the essential two parts are BS and SS. Different segments are MS, ASN, CSN and CSN-GW and so forth. The WiMAX Forum's Network Working Group (NWG) has created a system reference model as stated by the IEEE 802.16e-2005 air interface to verify the goals of WiMAX are attained. To backing settled, itinerant and portable WiMAX system, the system reference model might be coherently separated into three parts.
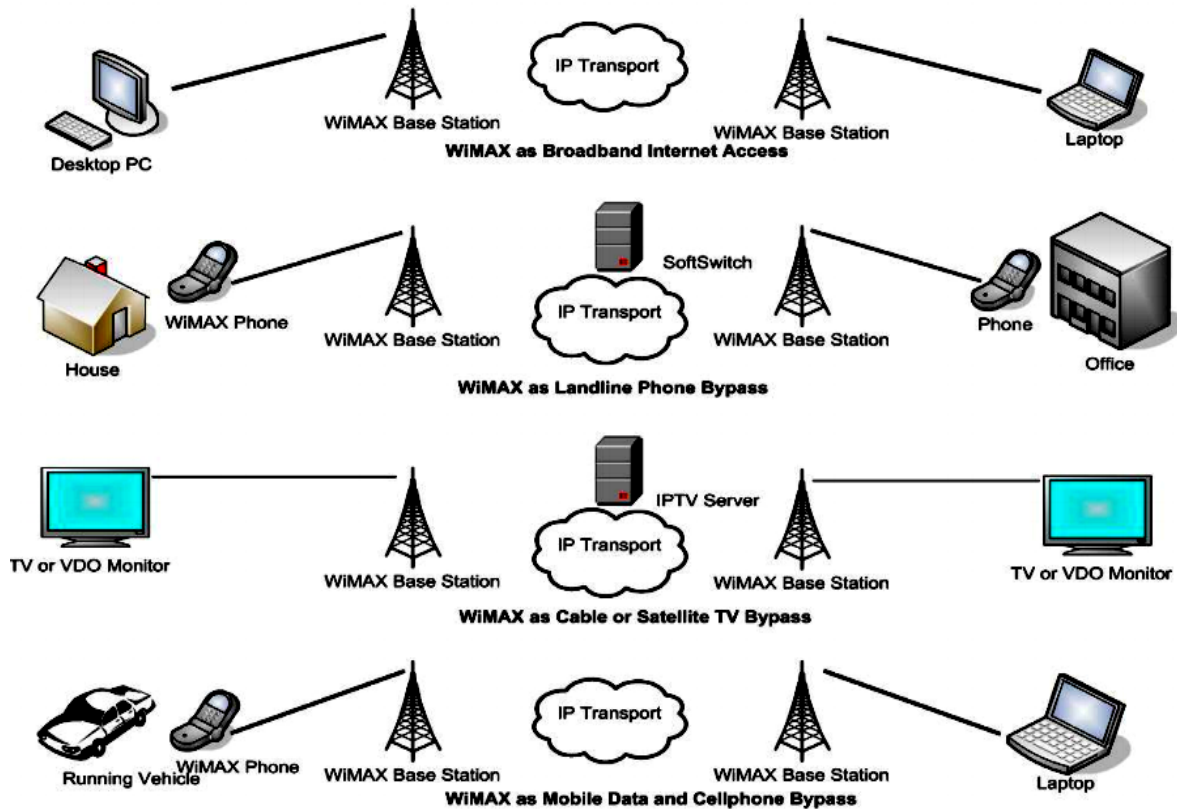
Figure 2 Fixed and Mobile WiMAX in different applications

Mobile Station (MS)

It is for the end client to get to the versatile system. It is a movable station ready to move to wide zones and perform information and voice correspondence. It has the whole vital client supplies, for example, a reception apparatus, speaker, transmitter, collector and programming required to perform the remote correspondence. GSM, FDMA, TDMA, CDMA and W-CDMA gadgets and so on are the illustrations of Mobile station.

Access Service Network (ASN)

It is claimed by NAP, framed with one or a few base stations and ASN doors (ASN-GW) which makes radio access system. It gives all the right to gain entrance administrations with full portability and proficient versatility. Its ASN-GW controls the right to gain entrance in the system and arranges between information and systems administration components.

Connectivity Service Network (CSN)

Gives IP connectivity to the Internet or other open or corporate systems. It additionally applies for every client strategy administration, address administration, area administration between ASN, guarantees Qos, meandering and security.
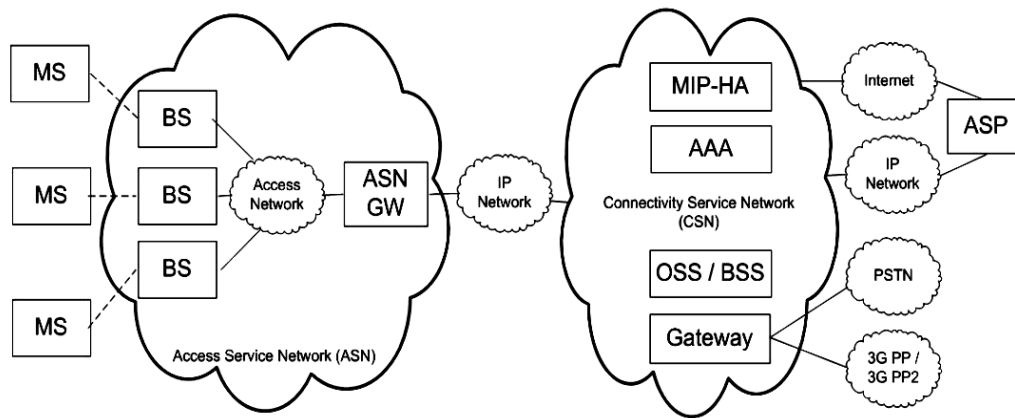
Figure 3 WiMAX Network Architecture based on IP

The channel models might be grouped into two primary classes: measurable and observational models. Exact models are dependent upon estimations performed in genuine situations, while the factual models evaluate the channel's aspects through numerical relations. Two exact models are for the most part utilized for depicting a WiMAX framework: the SUI (Stanford University Interim) station model, which is utilized for reproducing an IEEE 802.16-2004 framework (a settled WiMAX framework) [10] and the ITU-R (International Telecommunication Union- Radio correspondence) station model. This kind of model is utilized for the reproduction of an IEEE 80216e-2005 framework (a portable WiMAX framework). The ITU wideband channel is portrayed dependent upon a tapped deferral line model, with a greatest number of 6 taps.

III. LITERATURE REVIEW

Yusuf Acar, Todor Cooklev, Hakan Doˇgan, Hakan Yıldız [11] Radio wire association restrains the multiplexing increase attained by viable MIMO-OFDM frameworks and debases the execution significantly. As of late, examinations are centered to lessen the receiving wire association by the planning new reception apparatus structures. Distinctively, in this paper, we propose the summed up prefix methodology to tackle issue for associated MIMO-OFDM framework. It is demonstrated that the proposed summed up prefix for 4x4 MIMO-OFDM shows an addition of about 8 db over the routine 4x4 MIMO-OFDM framework at BER = 10^{-4} .

Anggia Anggraini, Jfugen Peissig, Thomas Kaiser [12], This paper introduces the BER execution breaks down of a virtual MIMO half-duplex hand-off framework on a WiMAX OFDMA system with Alamouti coding. For such a condition where multi-reception apparatus hand-off is not an alternative, utilizing various single-radio wire transfers in the framework might be an elective to still profit the differing qualities pick up. The effect of expanding the amount of hand-off hubs to the framework execution is likewise explored. Besides, the execution correlation of Increase and-Forward (AF) and Decipher and-Forward (DF) handing-off procedures connected on the framework is additionally exhibited.

Zafar Iqbal, Saeid Nooshabadi [13], in this paper, we show an investigation of the distinctive channel coding and interleaving

plans utilized within MIMO-OFDM frameworks. A correlation of these plans is exhibited dependent upon the bit blunder rate (BER) execution and fittings usage issues. A dissection is carried out on the impacts of four separate sorts of channel coding and interleaving plans being utilized. The IEEE 802.16 or WiMAX is utilized as a source of perspective for recreation, usage, and dissection. It is demonstrated that from around the coding and interleaving plans mulled over, the cross-reception apparatus coding and for every receiving wire interleaving frameworks perform better under a SNR conditions for all tweak plans. Utilizing the proposed plans, the information rates for IEEE 802.16 are multiplied for 2x2 MIMO frameworks without utilizing the transmit differences.

Aamir Habib, Christian Mehlf˙uhrer, and Markus Rupp [14], Radio wire subset choice systems are practical to lessen the fittings multifaceted nature of Various Information Numerous Yield (MIMO) frameworks. Various systems have been concocted to determination this issue. A large portion of these determination plans were connected to specific framework models and for recurrence flat frameworks. In broadband frameworks like WiMAX (IEEE 802.16-2004), the general channel under attention is commonly recurrence particular, and flat just over the subcarrier transfer speeds. In this work, accept radio wire subset determination plans are connected to a WiMAX consistent MIMO-OFDM transmission framework. Reproduction brings about terms of normal throughput and BER on a versatile balance and coding connection are indicated. Startlingly we find that the ideal determination for most extreme throughput, does not give the best brings about terms of BER execution. We hence reason that base BER is not the right decision for reception apparatus choice. We additionally find through our recreations that the straightforward, low intricate standard based determination calculation, gives great effects, near ideal choice in recurrence specific channels.

[15] Qing Wang1, Da Fan, Yonghua Lin, Jianwen Chen, Zhenbo Zhu [15], Overall Interoperability for Microwave Access (WiMAX), or the IEEE 802.16d/e standard, is engineering for wide band remote access (BWA) with significantly advertise potential. In this paper, we propose a base station (BS) physical layer (PHY) transceiver answer for WiMAX orthogonal- recurrence division-multiplexing access (OFDMA) mode. Our point is to give a solitary chip answer

for baseband transforming of WiMAX PHY. The information throughput ought to accomplish 20mbps both for uplink and downlink. The result is actualized on Cell Broadband Motor, which is a multi center processor together created by IBM, SONY and Toshiba for elite registering (HPC). Calculations for image timing balance, bearer recurrence counterbalance, channel estimation and Space-Recurrence Square Code (SFBC) are installed in this transceiver. Recreation and genuine test on Cell demonstrate that the proposed results can

full the bit-failure rate (BER) necessities under most situations.

Table 1 Summary of Literature Review

Year	Author	Title	Approach	Results
2013	Yusuf Acar, Todor Cooklev, Hakan Doˇgan, Hakan Yıldız	Performance Improvement for Correlated 4x4 MIMO-OFDM Systems by Generalized Prefix Approach	Generalized prefix approach	Reduce the antenna correlation
2012	Anggia Anggraini, Jfugen Peissig, Thomas Kaiser, Virtual MIMO in WiMAX Relay System	Virtual MIMO in WiMAX Relay System	WiMAX OFDMA network with Alamouti coding	Benefit the diversity gain
2011	Zafar Iqbal, Saeid Nooshabadi,	Effects of Channel Coding and Interleaving in MIMO-OFDM Systems	MIMO-OFDM systems	Cross-antenna coding and per-antenna interleaving systems perform better
2009	Aamir Habib, Christian Mehlf˙uhrer, and Markus Rupp,	Performance Comparison of Antenna Selection Algorithms in WiMAX with Link Adaptation	Receive antenna subset selection schemes	Reduce the hardware complexity of Multiple-Input Multiple- Output (MIMO) systems
2008	Qing Wang1, Da Fan, YongHua Lin, Jianwen Chen, Zhenbo Zhu,	Design Of Bs Transceiver For IEEE802.16E OFDMA Mode	Base station (BS) physical layer (PHY) transceiver	Proposed solutions can full the bit-error-rate (BER) requirements under most situations

IV.   CONCLUSION

In this paper, we considered the BER exhibitions of different single-radio wire transfers in the WiMAX MIMO framework through different writing systems. It has been indicated that misusing single-radio wire transfers to make an alleged virtual MIMO framework expands the assorted qualities pick up, which in exchange, enhances the BER execution of the WiMAX MIMO transfer system. As such, a single- receiving wire transfer could be thought as an alternative to improve the execution of a WiMAX MIMO framework particularly when the immediate connection is debased, i.e., because of keyhole impact or extreme blurring impact. This explanation is demonstrated legitimate for both handing-off systems. As the amount of hand-off hubs expands, the execution likewise enhances despite the fact that not directly. We have additionally inspected that at higher number of transfer hubs K, the AF procedure yields preferred execution over the method which demonstrates that the previous technique has better safety against serious connection qualities contrasted with the last.

V.REFERENCES

[1] Hao. Z., Hong,J.: "Ultra wide band filter technologies", IEEE Microwave, May 2010.

[2] IEEE STD 802.16-2004. Part 16: Air Interface for Fixed Broadband Wireless Access Systems, ," Oct. 2004.

[3] IEEE Std 802.16e-2005. Part 16: Air Interface for Fixed, Mobile Broadband Wireless Access Systems Amend- ment2: Physical, Medium Access Control Layers for Combined Fixed, and Mobile Operation in Li- censed Bands., ," Feb. 2006.

[4] J. Pinola and K. Pentikousis. Mobile WiMAX. The Internet Protocol Journal, vol 11, no. 2, pages 6–14, June 2008.

[5] IEEE 802.16 WG. IEEE Standard for Local and Metropolitan Area Networks - Part 16: Air Interface for Broadband Wireless Access Systems. IEEE 802.16-2009, May 2009.

[6] H. Holma, A. Toskala, K. Ranta-aho, and J. Pirskanen. High-Speed Packet Access Evolution in 3GPP Release 7. IEEE Comm. Magazine, 45:29–35, December 2007.

[7] IEEE 802.11 WG. Draft Standard for Local and Metropolitan Area Networks. Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications.

Amendment 5: Enhancements for Higher Throughput. IEEE Draft, June 2009.

[8] WiMAX Forum, "Mobile WiMAX – Part 1: A Technical Overview and Performance Evaluation", August 2006

[9] Johnston D., Walker J., "Overview of IEEE 802.16 Security", IEEE Computer Society, 2004.

[10] V. Erceg, Iospan Wireless Inc., K.V. S. Hari, Stanford University "Channel models for Fixed Wireless Application," IEEE 802.16.3c - 01/29r4, 16 July, 2001.

[11] Yusuf Acar, Todor Cooklev, Hakan Doˇgan, Hakan Yıldız, "Performance Improvement for Correlated 4x4 MIMO-OFDM Systems by Generalized Prefix Approach" 2013 IEEE.

[12] Anggia Anggraini, Jfugen Peissig, Thomas Kaiser, "Virtual MIMO in WiMAX Relay System" 2012 IEEE

[13] Zafar Iqbal, Saeid Nooshabadi, "Effects of Channel Coding and Interleaving in MIMO-OFDM Systems" 2011 IEEE.

[14] Aamir Habib, Christian Mehlf`uhrer, and Markus Rupp, "Performance Comparison of Antenna Selection Algorithms in WiMAX with Link Adaptation" PROCEEDINGS OF THE 4th INTERNATIONAL CONFERENCE ON CROWNCOM 2009.

[15] Qing Wang, Da Fan, YongHua Lin, Jianwen Chen, Zhenbo Zhu, "Design of BS Transceiver For Ieee802.16e Ofdma Mode" IEEE ICASSP 2008.