IJCSE International Journal of Computer Sciences and Engineering Open Access
Survey Paper Vol.-7, Issue-2, Feb 2019 E-ISSN: 2347-2693

A Bloc of CODED-OFDM and WiMAX overshadowing OFDM: A Survey

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DOI: https://doi.org/10.26438/ijcse/v7i2.515518 | Available online at: www.ijcseonline.org

Accepted: 19/Feb/2019, Published: 28/Feb/2019

***Abstract*—** The latest favorable technology which delivers to the customer end data facilities at a high speed is the Worldwide Interoperability for Microwaves Access (WiMAX). By observing the foundation of the WiMAX physical layer an understanding has been superlatively attained regarding the system of WiMAX. The foundation of the WiMAX physical layer is discussed in this paper. The studies and research of the students and scholars are based on the meadow of WiMAX can use this model as a helpful reserve. By using some kind of channel coding the performance can be augmented. Coded-OFDM (COFDM) is scheme this form of implementation is termed as. The reimbursements of using COFDM in a WiMAX system have also conversed in this paper.

***Keywords*—** WiMAX (Worldwide Interoperability for Microwaves Access), Coded-OFDM (COFDM), Orthogonal Frequency Division Multiplexing (OFDM).

I. INTRODUCTION

The arena of telecommunication has an inflating demand of a greater set of amenities such as instant messaging, video conferencing, or any other kind of communication service. New technologies are developed to meet the requirements of high data rates with the hundreds of individuals trying to get access at a similar tower. WiMAX (Worldwide Interoperability for Microwave Access) is a propitious elucidation or a technology that offers digital Broadband Wireless Access (BWA) with increased rapidity and distance that makes it fall under the Fourth Generation (4G) of technology [1].

Development of the WiMAX was done by IEEE (Institute of Electrical and Electronics Engineers), a society that works for the educational and technical innovation in various disciplines. IEEE 802.16 was the commercial standardization of the WiMAX family for which a group called WiMAX Forum was created in June 2001. A wireless substitute to cables, DSL, and fiber providing much higher bandwidth over the analogous coverage areas. Another headway in the family of wireless communication is the spearhead version of WiMAX, prevalently known as WiMAX 2+ that can work in combination with LTE (Long Term Evolution) [2]. It is also sometimes termed as MAN (Metropolitan Area Network) interconnecting the operators in a geographical region offering resourceful interconnection to a Wide Area Network (WAN) [3].

Two categories of WiMAX have been proffered to address the plea of different types of access. IEEE802.16-2004 is the first version of WiMAX also termed as Fixed WiMAX for fixed applications from its base stations. It is based upon the two standards namely ETSI HiperMAN (High-Performance Radio Metropolitan Area Network) in addition to IEEE 802.16 consenting global deployment. It involves the usage of 256 carriers Orthogonal Frequency Division Multiplexing (OFDM) and the profiles aimed at compliance testing. This version has its support outspreading to both line-of-sight and non-line-of-sight provinces providing a bit rate ranging from 32 Mbps to 134 Mbps. IEEE 802.16e is the second version or the amendment that supports mobile applications [4, 5]. This standard supported a lower bit rate of 15 Mbps while providing access in the non-line-of-sight domain. It facilitated full nomadic and mobile users together with roaming and handoff [6]. The basic standards as per IEEE802.16 for WiMAX are given in the fig.1 [7].

Section II of the paper describes the implementation of OFDM and while section III describes specifics about the advantages

of COFDM used in WiMAX offers over the use of OFDM. Section IV describes the Conclusion and Future Scope.

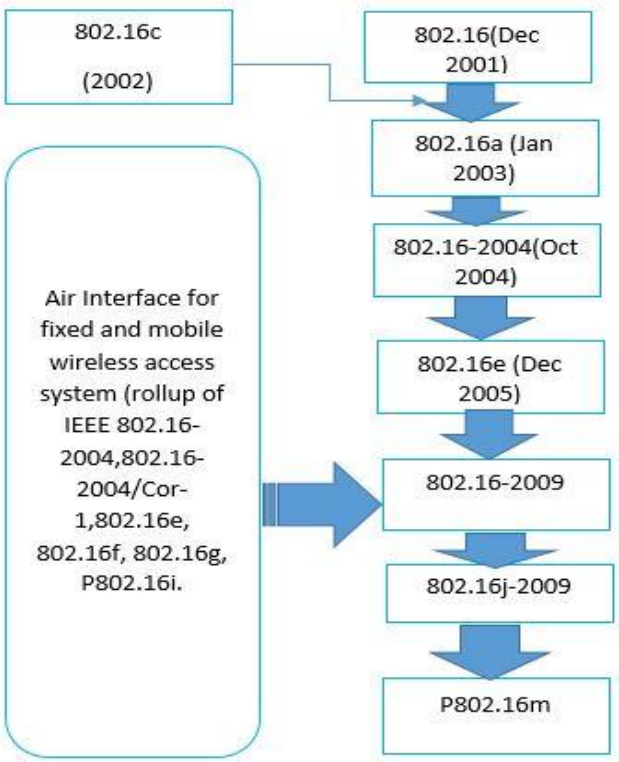

Figure 1: The basic standards as per IEEE802.16

II. IMPLEMENTATION OF OFDM

The WiMAX physical layer has its foundation based upon Orthogonal Frequency Division Multiplexing (OFDM). It basically gratifies audio at a very great speed and video applications. Mobility was the significant feature of IEEE802.16e-2005 as Scalable OFDM (SOFDM) was introduced in it. Today is the world of technologies and in terms of communication, every technology demands mobility as its main feature otherwise its absence could lead to a major deterrent in the deployment of that scheme or technology [8].SOFDM refers to the scheme based upon the air interfacing outlined for portable or mobile Wi-MAX systems by a society labeled as IEEE. It supports bandwidths of the channel which range from 1.25 MHz to 20 MHz. Scalability is added in terms of bandwidth, which helps regulations based upon multiple frequencies to be imitated by the mobile WiMAX. Wider channels are imperiled to larger FFT size, while lower bandwidth channels are subjected to a smaller FFT size. SOFDMA makes the spacing in the sub-carriers constant, due to which complexity of system due to smaller channels gets reduced and the efficiency of wider channels gets augmented [9].

A .The Basic OFDM model:

The basic OFDM has been shown in the fig.2 [1].

a) *Source Generator:* The information bits will be engendered for further transmission.

b) Randomization: Randomization is the initial track progressed in the physical level of the WiMAX system after the collection of data from the upper layers. This block compels on the bit by bit basis.

c) *Modulation:* The digital Broadband Wireless Access (BWA) supports a variety of modulation structures. Leading edge systems enclose an isolated hardware block for modulation scheme. Various modulation schemes used are BPSK, QPSK8-QAM, 16-QAM, and 16-PSK.

d) *FEC*: Numerous types of coding schemes have been used so that the robustness gets escalated against the interventions usually termed as the wreckages in the channel.

e) *Interleaving*: Working on the position of bits is the main work of this stage. There are two types such as Time Interleaving and Frequency Interleaving used in this stage. The input is read in ordered in the row and after writing they are transmitted ordered in the column in interleaving block.

f) *S/P and P/S Converters*: Alteration of serial data into parallel data and vice-versa is the main work of this block.

g) *IFFT and FFT*: An Inverse Fast Fourier Transform (IFFT) fundamentally accomplishes the renovation of samples in frequency illustration into samples in time illustration and Fast Fourier Transform (FFT) converts samples in time illustration into samples in frequency illustration. IFFT block satisfies the orthogonality condition.

h) *Addition of Cyclic Prefix (CP):* This block is castoff to combat the multipath channel impairments such as ISI and ICI. The length of this preceding part must be lengthier than the maximum delay spread of the subjective surrounding [1, 10].

B. *Forward Error Correction (FEC):*

Being baptized also as a form of "Channel Coding" to augment the communicated data's reliability the know-how of FEC makes the enactment of the all-inclusive communication structure enhanced. Significant superior enactment as well as enhancement in proficiency, reliability, capacity, and reduction in message postponement, maintenance of bandwidth, faster gesticulating, and traffic congestion prevention are the pros achieved with this scheme [11]. Numerous categories are enumerated below:

a) *Convolution Code (CC):* Convolution Code (CC) is the necessary coding scheme active in Mobile WiMAX. dependence of the computations of this coding configuration is not only on the set of prevailing data keyed in but also on the data was inputted previously. For the purpose of convolution encoding a Trellis depiction is employed and for decoding purpose Viterbi algorithm is used.

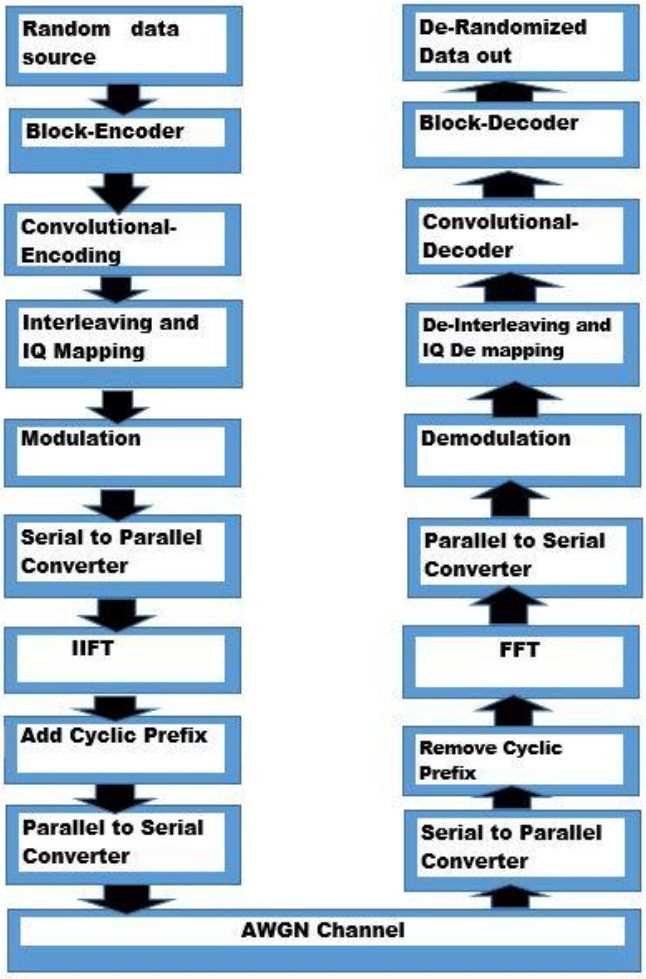

Figure 2: Block diagram of the OFDM model.

b) *Low-Density Parity Check (LDPC) codes*: The category of linear block codes is to which these codes fall beneath. This code is named after its characteristic of having only a few ones in comparison to the number of zeros in their parity-check matrix. Achieving maximum theoretical capacity and the complex algorithms by means of improvement in the performance in terms of rate of transmission for the decoding phenomenon. The LDPC significantly recovers the system performance by with both spatial and selective-fading diversity in wireless channels [10].

c) *Reed Solomon (RS) code*: With a wider range of applications in digital communications these are a type of codes employed for the correction of inaccuracy ascending through the channel. Reed Solomon codes are a subclass of BCH codes and are linear block codes. An amalgamation of these codes and Orthogonal Frequency Division Multiplexing (OFDM), in which segment of these code functions as a front-end of the high-speed modulation scheme employed. Low Peak to Average Power Ratio (PAPR) is the reimbursements leading to the profit of this scheme because of the finest performance presentation of this complete code [12, 13].

d) *Space-Time Block Code (STBC) code*: This technique is used in wireless communications by providing a number of antennas a data stream copy and works with a variety of data received reliability of transferred data gets mend. Alamouti first familiarized STBC in terms of simple scheme MRC diversity identical performance achievement. Because of its cost-effectiveness, it becomes a most wished structure. Spatial diversity (transmission and reception multiple ports) as well as time diversity techniques (conjugate signals replica transmission in terms of time series) are related by the STBC techniques [14].

III IMPLEMENTATION OF CODED-OFDM ELUCIDATING PROBLEMS AFFECTING OFDM

Being employed for digital subscriber lines, acoustic propagation, digital video, and, and as well as for wide area network principles OFDM is dynamically employed. However, due to frequency-selective fading and time-selective fading the propagation impairments Bit Error rate (BER) spreads definitely. Conjoining some sort of channel coding with OFDM boosts the performance. Coded-OFDM (COFDM) is what this kind of OFDM has been dubbed as. European Telecommunication Standard Institute (ETSI) standards have given utmost importance to this new conjoint scheme [15]. The following major problems by which OFDM has been affected by are being elucidated by channel coding:

a) *Lack of Frequency Diversity*: The non-existence of frequency diversity has been a major shortcoming. Fast fades are astounded by means of some application of coding.

b) *High Peak to Average Power Ratio (PAPR):* This constraint at high values being the foremost downside in the performance. Inadequacy in the peak power reduces the apportioned average power, thus the range of transmission gets restricted. Furthermore, for surging the power consumption dramatically a power inputted back-off is crucial to producing it and thus allowing in the linear region the transmit amplifiers to work. All the remunerations are overshadowed due to the inadequacies ascending due to plentiful low-cost operations [13].

c) *Frequency-Dependency on Uncoded OFDM:* Forward error coding acts as an upshot to grip the effects rising due to frequency enslavement. Fetching a performance that is much better due to the precise tailoring of the channels that are frequency dependent due to the combination of coding and decoding in an upright manner [16].

d) *Fading environment*: Conjoining interleaving with some kind of coding enriches eminence of transmission that conveys sequential fading defiance through a memoryless channel. The diversity intensifications and transmission persistence with BER and high gain abridged.

e) *Power Limitation*: Error of weak sub-carrier cause error that is being reread by the is reread by the strong sub-carriers information when channel coding is used. Thereby, diminishing the total error rate. Weakest sub-carriers power restricts the efficiency of the system if channel coding is not employed.

f) *Jamming margin:* By using an error control technique that is appropriate in the spread spectrum communication system there is exaltation in the Jamming margin [17, 18].

IV.CONCLUSION AND FUTURE SCOPE

In this paper, it is noted that extraordinary spectral efficiency and transmission at a reliable rate can be observed by using a more suitable choice labeled as COFDM. With respect to BER, bandwidth proficiency, and propagation impairments OFDM has been outshined by COFDM. The study also demonstrates that the throughput of the system can be enhanced by using FEC coding schemes that achieve transmission at a high data rate. Negligible delay and complexity are thereby introduced due to excellent capabilities if this coding scheme**.** So using COFDM in the WiMAX system can remove the hurdles that this technology is facing in society today.
Future works can be describing the combined work of a unique or different coding scheme with the WiMAX system and defining how meritoriously it would work as per user present-day necessities.

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