An Analysis For The Performance of 4g Mobile Wireless Systems Through The Literature Survey

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Abstract: - The communication industry is one of the fastest growing industries. The cellular systems started in the 80's with 1G have now reached to 4G. The growing demand of high data rates are increasing exponentially with time. The typical goals of a communication engineer are high speed communication for which the data rate should be high, better quality of signal for which we have to minimize the bit error rate as low as possible, less power consumption ability. The 4G system ensures us data rate of 1Gbps which cannot be achieved by SISO systems and hence we go for MIMO system. The various benefits of MIMO are discussed in this research study.

Keywords – 4G wireless systems, Wi-MAX, LTE, OFDM, MIMO, multiple antennas.

I. INTRODUCTION

In Europe the Global system for mobile communication started and became very popular for almost 20 years. Then the 3G (third generation) cellular system came into existence and it allows high speed data transmission as well as internet access. It also supported voice activated calls. Then the 4G system has become a hot topic. It ensures us data rate more than 100Mbps i.e. almost no waste of time and multi mega bit internet access. But the real challenge involved in 4G is how to design such a network. The conventional SISO (single input and single output) systems can never reach the barrier of 100Mbps.

Fourth Generation Networks

4G is short for Fourth (4th) Generation Technology. 4G Technology is basically the extension in the 3G technology with more bandwidth and services offers in the 3G. But at this time nobody exactly knows the true 4G definition. Some people say that 4G technology is the future technologies that are mostly in their maturity period. The expectation for the 4G technology is basically the high quality audio/video streaming over end to end Internet Protocol. If the Internet Protocol (IP) multimedia sub-system movement achieves whatit going to do, nothing of this possibly will matter.

Wi-MAX or mobile structural design will become progressively more translucent, and therefore the acceptance of several architectures by a particular network operator ever more common. The main features of 4G services of interest to users are application adaptability and high dynamism userstraffic, radio environment, air interfaces, and quality ofservice.

MIMO

The typical aspirations of a system designer are high data rate, low bit error rate, low power consumption, low cost and easy implement ability. The MIMO system ensures us very high data rates even more than 1Gbps while minimizing the bit error rate. By Shanon's theorem the rate of transmission is always less than or equal to the capacity. Practically it is less than the capacity. The capacity depends on the bandwidth of the channel and SNR of the channel. Both the bandwidth and signal to noise ratio are characteristics of the channel. The SNR can be improved either by reducing noise power or by increasing signal power. Reduction in noise power is not possible while increase in signal power requires more power for transmission which should be avoided for a good design. The improvement of bandwidth is not possible. However there are techniques like9OFDM (orthogonal frequency division multiplexing) which assure us efficient use of the channel i.e. spectral efficiency. But however the use of multiple antennas at the transmitter and at the receiver that is use of MIMO meets the ongoing requirements in 4G. The bit error rate in MIMO is very less as compared to conventional SISO systems.

MIMO-OFDM

OFDM stands for orthogonal frequency division multiplexing. It is a method that uses the spectrum in the most efficient way.

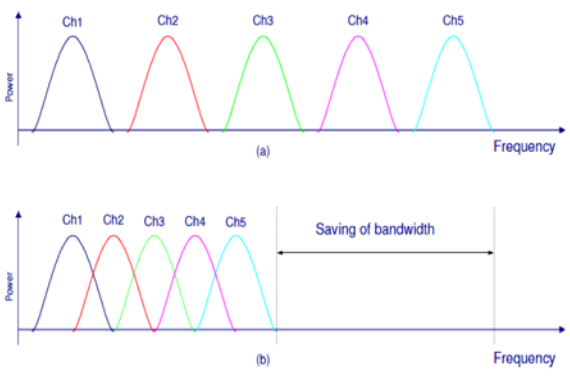

Fig. 1.1 Bandwidth saving in OFDM

Typically the channel is irregular and frequency selective fading is prominent, OFDM divides the frequency selective channel into anumber of sub-channels which are orthogonal to each other but having frequency-flat response so that frequency selective fading can be avoided. The OFDM implemented in MIMO is known as MIMO-OFDM. It ensures us great data rate as well as minimized bit error rate along with efficient use of the channel bandwidth. The implementing block diagram for MIMO-OFDM is shown below.

II. MIMO SYSTEMS ADVANTAGES

Spatial multiplexing gain

MIMO system provides a linear increase in data rate via spatial multiplexing. This means to send multiple independent data streams from the receiver within the bandwidth provided. If there is rich scattering then the receiver can easily separate the data streams. Each and every data stream realizes the same channel as they would in a SISO system and hence they effectively enhance the capacity of the channel by a multiplicative factor of number of data streams. Hence the spatial multiplexing gain improves the capacity of the system considerably.

Spatial diversity gain

In a wireless system due to multipath interference the signal level at the receiver never remains constant; it fluctuates or fades. If transmit multiple copies of the same signal then the probability that the signal goes into deep fade is decreased. It may happen that a copy of the signal goes into deep fade while others may be accurate may not go into fading at all. The number of copies is named as diversity order. To keep on increasing the independent copies of the same signal then the error keeps on decreasing. A MIMO system with MT transmit antennas at the transmitter and MR number of receiving antennas at the receiver offer a diversity order of MT MR.

III. LITERATURE SURVEY

O. Popescu and D. C. Popescu, [1] This paper studies physical layer performance of LTE and WiMAX schemes used in fourth generation (4G) wireless communication systems when multiple antennas are employed in the receiver to provide diversity. Bit Error Rate (BER) plots obtained from simulations are presented to evaluate system performance with and without diversity and to do a side-by-side comparison of the two main 4G wireless technologies.

Sr. No.	Title	Authors	Year	Methodology
1	On the performance of 4G mobile wireless systems with multiple antennas	O. Popescu and D. C. Popescu	2014	Physical layer performance of LTE and WiMAX schemes used in fourth generation (4G) wireless communication systems when multiple antennas are employed in the receiver to provide diversity.
2	Implementation of MIMO-OFDM using adaptive multiuser detection in wireless communication	N. Parveen and D. S. Venkateswarlu	2012	AMUD MIMO-OFDM performs better when compared to SISO-OFDM and MIMO-OFDM in terms of Bit Error Rate (BER) and Signal to Noise Ratio (SNR).
3	Performance analysis of PAPR reduction in STBC MIMO-OFDM system	P. Sunil Kumar, M. G. Sumithra and E. Praveen Kumar	2013	Provides a performance Comparison for reduction of PAPR in STBC MIMO-OFDM Systems using Clipping and Filtering (CF), Selective Mapping (SLM), Partial Transmit Sequence (PTS) and Tone Reservation (TR) scheme.
4	MB-OFDM UWB system with multiple antennas for high capacity transmission in wireless personal area network	Myung-Sun Baek, So-Young Yeo, Mi-Jeong Kim, Young-Hwan You and Hyoung-Kyu Song	2005	Apply the MIMO layered space-time architecture to MB-OFDM UWB system supporting streaming multimedia content and full motion video in WPAN for low cost and high performance.

N. Parveen and D. S. Venkateswarlu, [2] High data-rate wireless access is demanded by many applications. In a bid to cope with challenges of increasing demand for higher data rate, better quality of service and higher network capacity, there is a migration from Single Input Single Output (SISO) antenna technology to a more promising Multiple Input Multiple Output (MIMO) antenna technology. OFDM combined with MIMO increases the diversity gain and enhances system performance. Adaptive Receivers are employed in MIMO-OFDM systems

(AMUD MIMO-OFDM) to achieve a better performance. In this paper, simulation results are obtained for SISO-OFDM, MIMO-OFDM and AMUD MIMO-OFDM for 2×2 and 4×4 antennas and the capacity results are obtained for different antenna configurations and for SISO-OFDM, MIMO-OFDM and AMUD MIMO-OFDM. The simulation results show that AMUD MIMO-OFDM performs better when compared to SISO-OFDM and MIMO-OFDM in terms of Bit Error Rate (BER) and Signal to Noise Ratio (SNR).

P. Sunil Kumar, M. G. Sumithra and E. Praveen Kumar,[3] Orthogonal frequency division multiplexing (OFDM) may be united with antenna arrays at the transmitter and receiver side to improve the diversity gain and to improve the system competence on time-variant along with the frequency-selective channels, which results in a multiple-input multiple-output (MIMO) composition. The space-time block coding (STBC) incorporated for OFDM systems with multiple transmit antennas is actually a type where coding is implemented in the time domain, that is, OFDM symbols. Therefore it is a relatively new signal processing technique for systems with multiple transmit antennas and multiple receives antennas, to increase capacity in wireless communications without sacrificing bandwidth. However, like OFDM, one main disadvantage of MIMO-OFDM is the high Peak to Average Power Ratio (PAPR) of the transmitter's output signal on different antennas. This research provides a performance Comparison for reduction of PAPR in STBC MIMO-OFDM Systems using Clipping and Filtering (CF), Selective Mapping (SLM), Partial Transmit Sequence (PTS) and Tone Reservation (TR) scheme.

Myung-Sun Baek, So-Young Yeo, Mi-Jeong Kim, Young-Hwan You and Hyoung-Kyu Song, [4] Authors apply the MIMO layered space-time architecture to MB-OFDM UWB system supporting streaming multimedia content and full motion video in WPAN for low cost and high performance. And also address a channel estimation based on the time-domain windowing and its imperfectness in MB-OFDM with MIMO antenna systems.

IV. PROBLEM IDENTIFICATION

In the previous research work a side-by-side comparison of 4G LTE and WiMAX systems with multiple antennas and receive diversity. In future work plan to study also the use of transmit diversity techniques for improving the performance of 4G wireless systems. While receiver diversity is mostly considered for mobile units, transmit diversity can be more suitable for base stations where open-loop techniques may be used in conjunction with Space-Time Block Codes (STBC), or closed-loop methods using channel feedback information may be implemented.

V. CONCLUSION

Following the explosive growth of the Internet during the last two decades, the current unprecedented expansion of wireless technology promises an even greater effect on how people communicate, interact and enjoy their entertainment. The growing advances in research and development of wireless communication technologies and the increasing capabilities of electronic devices are driving an evolution towards ubiquitous services to mobile users. Wireless networks become increasingly interoperable with each other and with the high-speed wired networks. This reflects a paradigm shift towards new generations of mobile networks where seamless mobility across heterogeneous networks becomes fundamental. This generation is referred to as fourth generation (4G).

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