IOSR Journal of Computer Engineering (IOSR-JCE)
e-ISSN: 2278-0661,p-ISSN: 2278-8727, Volume 17, Issue 6, Ver. III (Nov – Dec. 2015), PP 65-70
www.iosrjournals.org

An Approach to Improve the Quality of Service in OFDMA Relay Networks via Re-transmission

Avanti Anarth [1], Ms.Rashmi Jain [2]
[1]*Scholar Student, Dept of CSE, Rajiv Gandhi College of Engineering and Research, Nagpur, India.*
[2]*Assistant Professor, Dept of CSE, Rajiv Gandhi College of Engineering and Research, Nagpur, India.*

Abstract: *With the next-generation cellular networks making a transition toward smaller cells, two-hop orthogonal frequency-division multiple access (OFDMA) relay networks have become a dominant, mandatory component in the 4G standards (WiMAX802.16j, 3GPP LTE-Adv.). Here we are using the multicasting strategy Given the growing importance of multimedia broadcast and multicast services (MBMS) in 4G networks, the latter forms the focus of this project. The main aim of this project is to improve the performance of the OFDMA based relay networks. The OFDMA transmission Scheme is a widely accepted scheme for improving the quality and speed of communication over the 4G cellular network. There are two different models designed for OFDMA relay networks .Distributed (DP) and Contiguous (CP) permutations. We are checking the performance of two algorithms The linear programming algorithm and the greedy algorithm by using two models of OFDMA for multicast scheduling and after performance evaluation we select the best model and the algorithm for transmission. We further improve the throughput via retransmission of lost packets during data transfer over the specified network. We can detect the packet loss by packet synchronization technique and a request will be sent by the destination for re-sending the lost packets which is called as Re-Transmission.[1]*

Keywords: *Orthogonal frequency-division multiple access (OFDMA), Packet loss detection, Retransmission, Wireless multicast.*

I. Introduction

With the next-generation wireless networks moving toward smaller (micro, Pico) cells for providing higher data rates, there is a revived interest in multihop wireless networks from the perspective of integrating them with cellular networks. With a decrease in cell size, relay stations (RS) are now needed to provide extended coverage in the network for the proper transmission. [1]

The main aim of this paper is to improve the performance of transmission used in network architecture. Our proposed work is to improve the performance of OFDMA based relay network packet loss using retransmission technique.[8] The OFDMA transmission scheme is a widely accepted scheme for improving the quality and speed of communication over 4G cellular network. There are two different models designed for OFDMA relay networks. Distributed Permutation (DP) and Contiguous (CP) Permutations.

We are checking the performance of two algorithmic approaches The linear programming approach and the greedy approach by using two models of OFDMA i.e. DP and CP for multicast scheduling and after performance evaluation of these two algorithm we select the best model and the algorithm approach for transmission. We further improve the performance that is improve the throughput via retransmission of the lost packets during data transfer over the specified network. [2]

Hence the Objectives are:

1. Implement linear programming and greedy algorithm for multicast scheduling over two models then Performance evaluation and selection of best model and algorithm.
2. Transmission of packets from one network (Sender) to another (Receiver).
3. Identify the packet loss
4. Ask for retransmission to Sender.
5. Confirm data retransmitted successfully if not again resend.

II. Related Work

2.1 Multiple Access Techniques for Cellular Wireless Networks

A number of new technologies are being integrated by the telecommunications industry as it prepares for the next generation mobile services. One of the key changes incorporated in the multiple channel access techniques is the choice of Orthogonal Frequency Division Multiple Access (OFDMA) for the air interface. Here presents a survey of various multiple channel access schemes for 4G networks and explains the importance of these schemes for the improvement of spectral efficiencies.

There are different multiple access schemes such as Time Division Multiple Access (TDMA),Frequency Division Multiple Access (FDMA), Code Division Multiple Access (CDMA) & Orthogonal Frequency Division Multiple Access (OFDMA)

According to the 4G working groups, the infrastructure and the terminals of 4G will have almost all the standards from 2G to 4G implemented. Although legacy systems are in place to adopt existing users, the infrastructure for 4G will be only packet-based (all-IP). Some proposals suggest having an open internet platform. With the wireless standards evolution, the access techniques used also increased in efficiency, capacity and scalability. The first generation wireless standards used plain Time division Multiple Access (TDMA) and Frequency Division Multiple Access (FDMA). In the wireless channels, TDMA is less efficient in handling the high data rate channels because it requires large guard periods to alleviate the multipath impact. Again, FDMA consumes more bandwidth for guards for avoiding inter carrier interference. So two branches came in second generation systems, one branch of standard used the combination of FDMA and TDMA and the other introduced a new access scheme called Code Division Multiple Access (CDMA). Usage of CDMA increased the system capacity. Data rate is also increased as CDMA is efficient to handle the multipath channel. This enabled the third generation systems to use CDMA as the access scheme. The only issue with CDMA is that it suffers from poor spectrum flexibility and scalability. Recently, new access schemes like Orthogonal Frequency Division Multiple Access (OFDMA)[10]

For the next generation Cellular Network, OFDMA is being considered as best Multiple Access Technique. OFDMA is a modulation method that divides the channel into multiple narrow orthogonal bands that are spaced. The advantages of these access schemes are that they offer the same efficiencies as older technologies like CDMA, scalability and higher data rates but they require less complexity for equalization at the receiver. This is an added advantage especially in the MIMO environments as the spatial multiplexing transmission of MIMO systems requires high complexity equalization at the receiver. With these advantages in these multiplexing systems, improved modulation techniques are also used.[10]

2.2 Comparison of different Network Generations of Cellular Network

Generation	**1G**	**2/2.5G**	**3G**	**4G**
Data Rate	2 kbps	14.4-64 kbps	2 Mbps	200 Mbps to 1 Gbps
Technology	Analogue cellular technology	Digital cellular technology	Digital broadband packet data CDMA,UMTS	Digital broadband packet data Wimax,LTE,Wifi
Speed	14.4 kbps	56 kbps to 115 kbps	5.8 Mbps to 14.4 Mbps	100 Mbps to 1 Gbps
Multiplexing	FDMA	TDMA	CDMA	OFDMA
Core Network	PSTN	PSTN	CDMA	OFDMA

2.3 Multicast Scheduling

In the system with OFDMA modulation, i.e. LTE, the scheduling has two dimensions, time domain and frequency domain. While in time domain, the scheduler decide for which users should receive the data content, the frequency scheduling algorithm allocate the frequency resources to each user. Due to multipath fading, the mobile wireless channel is frequency selective .Based on user's transmission channel frequency response, some part of spectrum greatly is degraded by channel. If the scheduler allocates the user's frequency resources on those areas, users suffer from low signal-to-noise ratio (SINR). Moreover frequency resources are also limited, so again the term of fairness can be used during frequency resource scheduling. There have been lots of studies on frequency resource allocation algorithms for LTE. The Frequency scheduling allocates the frequency resources to a user regardless of its position on the spectrum.[3]

2.4 The Main Permutation Models in OFDMA

We consider two models for how subcarriers are grouped to form a sub channel in OFDMA: Distributed Permutation (DP) and Contiguous Permutations(CP)

1. Distributed Permutation:

It is also called as Diversity Permutation. Here the subcarriers are Distributed pseudo-randomly. This permutation model includes FUSC (Full Uses of Sub channel) and PUSC (Partial Uses of Sub channel), OPUSC (Optional PUSC), OFUSC (Optional FUSC) and TUSC (Tile Usage of Subchannal).

The main advantage of Distributed Permutation is frequency diversity and intercell interference averaging. The Diversity Permutation minimize the probability of using the same subcarrier in adjacent sector or cells. On the other hand, Channel estimation is not easy as the subcarriers are distributed over the available bandwidth.[4]

2. Contiguous Permutation:

It is also called as Adjacent Permutation. These are consider as group of Adjacent Sub carriers. This permutation model includes the AMC (Adaptive Modulation and Coding) mode. This type of permutation leaves the door open for the choice of best conditions part of the band width. channel estimation is easier as the sub carriers are adjacent.[4]

Now, we are using the following Scheduling Techniques which are applied on this two models these are:

1. Linear Programming Technique:

Linear programming (LP; also called linear optimization) is a method to achieve the best outcome (such as maximum profit or lowest cost) in a mathematical model whose requirements are represented by linear relationships. Linear programming is a special case of mathematical programming (mathematical optimization).

Linear programming is a considerable field of optimization for several reasons. Many practical problems in operations research can be expressed as linear programming problems. Certain special cases of linear programming, such as network flow problems and multicommodity flow problems are considered important enough to have generated much research on specialized algorithms for their solution. A number of algorithms for other types of optimization problems work by solving LP problems as sub-problems. [1]

Advantages of Linear Programming Technique:

1. Linear programming is heavily used in microeconomics and company management, such as planning, production, transportation, technology and other issues
2. Although the modern management issues are ever-changing, most companies would like to maximize profits or minimize costs with limited resources.
   Therefore, many issues can be characterized as linear programming problems

2. Greedy Technique

A greedy algorithm is an algorithm that follows the problem solving heuristic of making the locally optimal choice at each stage with the hope of finding a global optimum. In many problems, a greedy strategy does not in general produce an optimal solution, but nonetheless a greedy heuristic may yield locally optimal solutions that approximate a global optimal solution in a reasonable time.

For example, a greedy strategy for the traveling salesman problem (which is of a high computational complexity) is the following heuristic: "At each stage visit an unvisited city nearest to the current city". This heuristic need not find a best solution, but terminates in a reasonable number of steps; finding an optimal solution typically requires unreasonably many steps. In mathematical optimization, greedy algorithms solve combinatorial problems having the properties of matroids.[1]

Disadvantages in Greedy Technique

For many other problems, greedy algorithms fail to produce the optimal solution, and may even produce the unique worst possible solution. One example is the travelling salesman problem mentioned above: for each number of cities, there is an assignment of distances between the cities for which the nearest neighbor heuristic produces the unique worst possible tour.

2.5 Techniques to Improve Performance

We are using the multicasting strategy with Wi-Max(Wi-Fi) technology in 4G standards. It uses OFDMA transmission scheme. This transmission scheme is divided into two models:

1. Distributed permutation (DP)
2. Contiguous permutation.(CP)

Out of these two techniques we are using the linear programming based distributed permutation strategy for multicast scheduling which has better performance over the other techniques.[1]

Then we will check the packet loss condition of OFDMA based relay network and improve it i.e. improve the throughput via retransmission of the lost packets in network.[2]

The proposed approach is to detect lost packets by packet synchronization technique For eg. Packet Received acknowledgement technique will identify the packet loss situation. .A request will be sent by the destination for sending the lost packets (Re-Transmission)[8]

2.5.1 Retransmission Technique

Retransmission, essentially identical with Automatic repeat request (ARQ), is the resending of packets which have been either damaged or lost. Retransmission is one of the basic mechanisms used

by protocols operating over a packet switched computer network to provide reliable communication (such as that provided by a reliable byte stream, for example TCP).

Such networks are usually 'unreliable', meaning they offer no guarantees that they will not delay, damage, or lose packets, or deliver them out of order. Protocols which provide reliable communication over such networks use a combination of acknowledgments (i.e. an explicit receipt from the destination of the data), retransmission of missing or damaged packets (usually initiated by a time-out), and checksums to provide that reliability.[5]

There are several forms of acknowledgement which can be used alone or together in networking protocols:

1. Positive Acknowledgement (PACK): The receiver explicitly notifies the sender which packets, messages, or segments were received correctly. Positive Acknowledgement therefore also implicitly informs the sender which packets were not received and provides detail on packets which need to be retransmitted. Positive Acknowledgment with Re-Transmission (PAR), is a method used by TCP (RFC 793) to verify receipt of transmitted data. PAR operates by re-transmitting data at an established period of time until the receiving host acknowledges reception of the data.

2. Negative Acknowledgment (NACK): The receiver explicitly notifies the sender which packets, messages, or segments were received incorrectly and thus may need to be retransmitted (RFC 4077).

3. Selective Acknowledgment (SACK): The receiver explicitly lists which packets, messages, or segments in a stream are acknowledged (either negatively or positively). Positive selective acknowledgment is an option in TCP (RFC 2018) that is useful in Satellite Internet access (RFC 2488).

4. Cumulative Acknowledgment (CACK): The receiver acknowledges that it correctly received a packet, message, or segment in a stream which implicitly informs the sender that the previous packets were received correctly. TCP uses cumulative acknowledgment with its TCP sliding window.

Retransmission is a very simple concept. Whenever one party sends something to the other party, it retains a copy of the data it sent until the recipient has acknowledged that it received it. In a variety of circumstances the sender automatically retransmits the data using the retained copy. Reasons for resending include:

- If no such acknowledgment is forthcoming within a reasonable time, the time-out
- The sender discovers, often through some out of band means, that the transmission was unsuccessful
- If the receiver knows that expected data has not arrived, and so notifies the sender
- If the receiver knows that the data has arrived, but in a damaged condition, and indicates that to the sender. [6]

2.6 Model Description

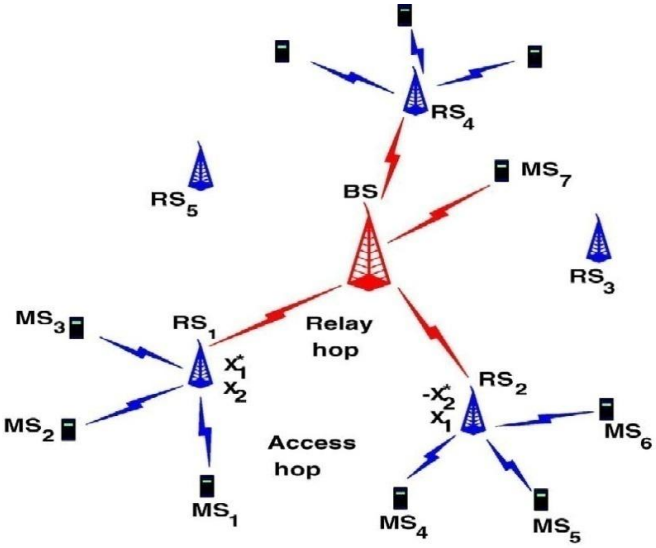
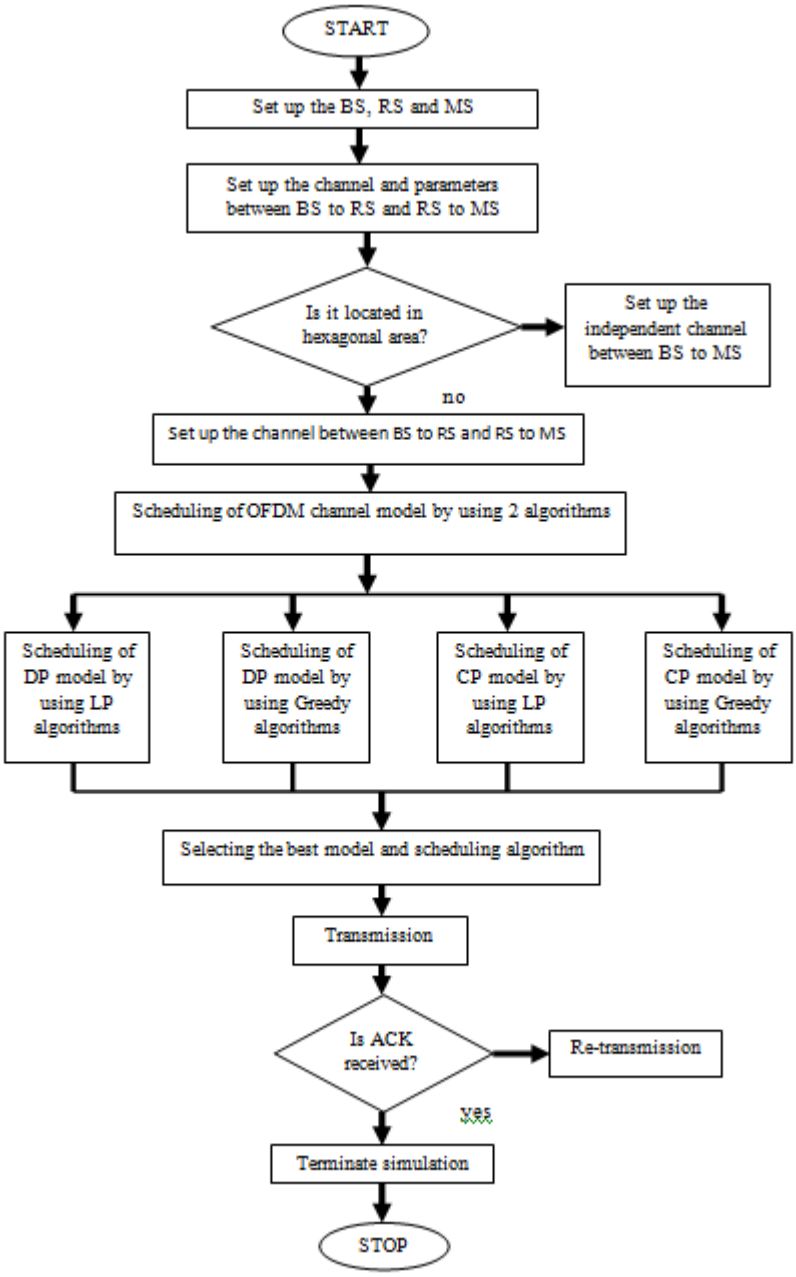


Fig 1.:Network Model.[1]

We consider a downlink OFDMA-based, relay-enabled, two-hop wireless network as shown in Fig.1 A set of MS are uniformly located within the macro cell. A small set of RS are added to the midway belt of the network MS farther from the base station (BS) connect with the RS that is closest to them The one-hop links between BS and RS are referred to as relay links, between RS and MS as access links, and between BS and MS as direct links. [1] The OFDMA transmission Scheme is a widely accepted scheme for transmission and further improving the quality and speed of communication in cellular network.

III. Flowchart



IV. Conclusion

For the next generation communication network for making the transmission to other network OFDMA is the transmission scheme which is widely accepted scheme in the wireless network. There are two models of OFDMA Distributed Permutation and Contagious Permutation and to implement these models two approaches are popularly used that are linear programming approach and greedy approach. Then we are checking the performance of two approaches by using two models of OFDMA for multicast scheduling and after performance evaluation of these two approaches we will select the best model and algorithm approach for transmission Then we will check the packet loss condition of OFDMA based relay network and improve it i.e. improve the throughput via retransmission of lost packet in the network. The proposed approach is to detect lost packet by packet synchronization technique For eg: The packet received acknowledgement technique will identify the packet loss situation and the request will be sent by the destination for sending of lost packets(Re-transmission)

Acknowledgements

We have this opportunity to express our deep sense of gratitude and whole hearted thanks to my Guide Ms.Rashmi Jain, Computer Science and Engineering Dept. for this invaluable guidance, inspiration and encouragement. it is because of her that I could synchronies my efforts in this Project. I greatly indebted to her for piloting me whenever I faced difficulties in my Project work.

This acknowledgment would be incomplete without rendering impartial gratitude to all those who directly or indirectly helped me in my Project work.

Thank you.

References

[1] Karthikeyan Sundaresan, Senior Member, IEEE, and Sampath Rangarajan, Senior Member, IEEE, " Cooperation Versus Multiplexing: Multicast Scheduling Algorithms for OFDMA Relay Networks" 978-1-4799-4482-8/14/$31.00 ©2014 IEEE

[2] M. Herdin, "A chunk based OFDM amplify-and-forward relaying scheme for 4G mobile radio systems," in Proc. IEEE ICC, Jun. 2006, vol. 10, pp. 4507–4512.

[3] Hossein Barzegar,"Multicast scheduling for streaming video in single frequency networks"Master's Degree Project,Royal Institute of Technology,Stockholm,Sweden May 2011

[4] Prof.Loutfi Nuaymi,"WiMAX:Technology for Broadband Wireless Access"John Wiley & Sons, 23-Mar-2007-Technology & Engineering

[5] Yufeng Zhao,"Reducing power consumption by utilizing retransmission in short range wireless networks"local comp networks proceedings IEEE 10.1109/LCN.2002.1181826.

[6] Steven W. Peters and Robert W. Heath," The Future of WiMAX: Multihop Relaying with IEEE 802.16j" 0163-6804/09/$25.00 © 2009 IEEE.

[7] Z. Zhang,Y.He, andK. P. Chong, "Opportunistic downlink scheduling for multiuser OFDM systems," in Proc. IEEE WCNC, Mar. 2005, vol.2, pp. 1206–1212.

[8] H. Viswanathan and S. Mukherjee, "Performance of cellular networks with relays and centralized scheduling," IEEE Trans. Wireless Commun., vol. 4, no. 5, pp. 2318–2328, Sep. 2005.

[9] K. Sundaresan and S. Rangarajan, "Efficient algorithms for leveraging spatial reuse in OFDMA relay networks," in Proc. IEEE INFOCOM,Apr. 2009, pp. 1539–1547.

[10] Dr Rupesh Singh, "Multiple Access Techniques For 4G Mobile Wireless Networks" International Journal of Engineering Research and Development, Volume 5, Issue 11 (February 2013)