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REVIEW ARTICLE

A REVIEW ON EFFICIENT RESOURCE BLOCK ALLOCATION IN LTE SYSTEM

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Abstract— This paper presents a review on long term evolution which is fourth generation mobile network LTE network is very simple, flat architecture, having higher bit rate, lower delay, cost efficient and scalability. Brief introduction about LTE-A is also given. Resources are allocated to the user according to their priority for this various scheduling techniques are used. The throughput of user equipment various according to the different algorithm used.

Key Terms: - LTE; Resource blocks; scheduling; 3GPP; OFDM

I. INTRODUCTION

LTE means Long Term Evolution .It is started in 2004 with 3GPP means third Generation Partnership Project as a project release 8 was published in March 2009. It is stable for the commercial development and further continued in release 10. In December 1994, the Third Generation Partnership Project (3GPP) was established. Its collaborative agreement is to bring all the number of Telecommunications standard bodies known as "Organizational Partners together. This organization is based on a layered hierarchy with a "Technical specifications" It is designed to meet the increasing user demand for mobile broadband services as it provides very high speed data and voice support. LTE aims to provide a high data rate, lower latency and packet optimized radio access technology and flexible bandwidth deployments. It has higher data rates, 300Mbps peak downlink and 75 Mbps peak uplink and Bandwidth ranges from 1.4MHz up to 20 MHz, it bring up to 50 times better performance and having speed 10 times faster than 3G. LTE-Advanced is the new version of LTE and is compatible with LTE as it includes all technologies of LTE and some new features like wider bandwidth, advanced MIMO technique, coordinated multipoint transmission and reception (CoMP), relaying to increase its capacity[5]. Time Division Duplex (TDD) and Frequency Division Duplex (FDD) mode are used by LTE. In FDD uplink and downlink transmission each uses different frequency and in TDD both uplink and downlink are having the different time and uses the same carrier. There are various parameters like frequency range, channel coding, duplexing, mobility, channel bandwidth, transmission bandwidth and latency.

Scheduling plays a great role in the resource allocation. The resources are allocated to the user according to their need and priority. LTE is easy to use which is having higher privacy and security. It improved the speed and data rate. OFDM means Orthogonal Frequency Division Multiplexing that is used by LTE for downlink transmission where OFDM divide the bandwidth into multiple narrower sub-carries and data is transmitted on these carries in parallel streams.In OFDM the subcarrier is modulated with different modulation method like QPSK, QAM, 64QAM and The use of higher order modulation such like 16QAM and 64QAM provides the higher bandwidth utilization, higher data rate, within a particular bandwidth an OFDM symbol is obtained by adding different modulated subcarrier signals In downlink of an OFDMA the resources are divided in the

frequency and time domains. In the frequency domain the resources are divided into *N* traffic channels which are a cluster of OFDM subcarriers. Whereas in the time domain the time resources are divided into slots which is called as frames and super frames. OFDM is also used in other of systems like WLAN, WiMAX to broadcast technologies.

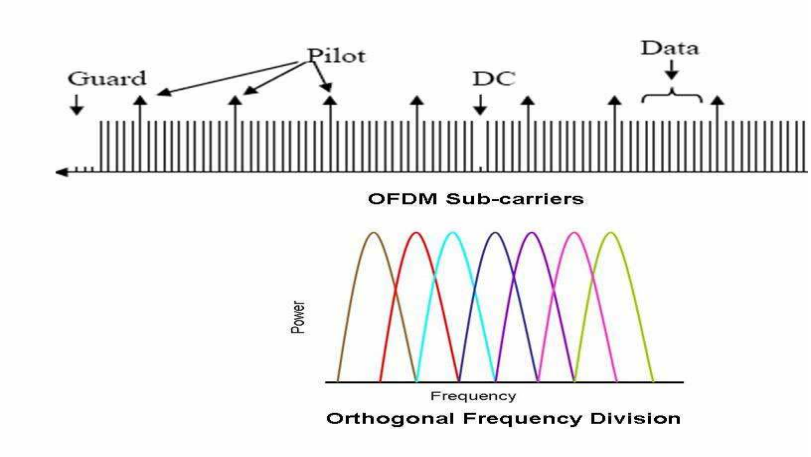

Figure 1: OFDM

II. RELATED WORK

In this section, we are presenting some of the research work of the prominent authors in this field.

In year 2011 Aderemi A. Atayero et al. [6] LTE is a better choice for next generation wireless mobile networks due to its simple architecture. An overview of LTE and its architecture and the functions of both the core and access networks of LTE, The Functional details and layout of the associated protocols are explained and The five categories of LTE interfaces namely: Air interface, E-UTRAN interfaces, Core network interfaces, Mobility and interworking interfaces, and service interfaces are explained.

In year 2011 Sinh Chuong Nguyen et al. [5] The advanced version of LTE known as LTE- Advanced. It is a 4G technology. It contains all the features of LTE and some new features like support wider bandwidth, advanced MIMO technique, coordinated multipoint transmission and reception (CoMP), relaying. The LTE terminals can work in LTE-A network and vice-versa. A simulation tool is essential for research relating to Radio Resource Management mechanisms such as packet scheduling. The description of a simulation tool such as its functions, features can effectively represent packet scheduling.

In year 2011 Na Gaun et al. [4]. During the downlink transmission in LTE system scheduling block (SB) is the minimum allocation unit for user. All SB are allocated to one user. In conventional resource allocation algorithm every user can use different modulation and coding scheme. The number of SBs are required by each user are estimated by calculating the average channel gain and then SBs are assign to user according to the user priority which bring improvement in quality of service and high throughput.

In year 2011 Mohsen M. Tantawy et al. [7] LTE is well placed to meet the increasing needs of next-generation mobile networks by offering high performance, mobile broadband services, along with a combination of high bit-rates and system throughput in both the uplink and downlink along with low latency. A novel Quality of Service (QoS)-guaranteed cross-layer scheduling algorithm for LTE system is proposed which allocates resources to the users as resource blocks and modulation and coding scheme has provided to users having Different traffic loads. Where QoS mechanisms follow a network that is based on GBR and non-GBR bearers

In year 2012 Honghai Zhang et al. [2] Scheduling plays a very important role in LTE downlink systems with Multiple Input and Multiple Output (MIMO) antennas. new construct called transmission mode, which tells a particular choice of MIMO operational mode, precoding matrix, transmission rank and the modulation and coding schemes (MCSs) of up to two codewords (one codeword is transport block of information bits) and then develop a unified low- greedy algorithm and the two variants of the algorithm: 1) for the backlogged traffic model and 2) for the finite queue traffic model. Concluded that gives a solution guaranteed to be within 1/2 of the respective Optima.

In year 2012 Mohammad T. Kawser et al. [3] in this paper Long Term Evolution (LTE) MAC layer scheduler can allocates the available resources to different UEs according to their priority. The various scheduling method can change the throughput of individual users and the throughput of the cell. The throughput of two scheduling

methods, Round Robin and Proportional Fair are investigated. The scheduler in the MAC layer of the eNodeB can make a suitable distribution of the Resources with certain objectives like,

- Required QoS for applications
- Optimized spectral efficiency ensuring high cell throughput under existing channel conditions.
- Fairness among UEs and applications
- Limiting the impact of interference through special handling of cell edge users.
- Load balancing among cells.

In year 2013 M. H. Habaebi et al. [1] presents that in LTE system traffic scheduling plays an important role by providing resources to users in the well- organized manner. LTE is having very high speed data rate with the help of which user can access the internet through their mobiles. There are three types of scheduling algorithms such as: Round Robin, best Channel Quality Indicator (CQI) and Proportional Fair (PF) schedulers. The performance of these scheduling algorithms on the downlink was calculated in terms of throughput and Block error rate using a MATLAB. The best CQI algorithm shows better performance in terms of throughput than the other algorithm.

III. RESOURCE ALLOCATION SCHEDULING ALGORITHM

In OFDM system the radio resource scheduling has been studied. Scheduling is the process of allocating resources to the user to get better throughput and to increase system efficiency. CQI is 5 bit information. A higher CQI value indicates that the channel has a better channel quality and lower value indicate low better channel quality. 5-bit CQI value ranges from 0-30, a higher CQI gives transport-block size, a modulation scheme, and the number of channelization codes .There are various types of scheduling algorithm.

- Round robin (RR)
- Max C/I
- Proportional fair (PF).

Round Robin (RR) Scheduling Algorithms – In RR the resources are allocated to each user without using channel condition.[1] Each user can use the resources in proper time interval. First user can use the resource for the given time interval after the completion of time then these resources is assigned to another user. The new user has placed at the end of waiting queue. The implementation of RR is easy and it result in poor throughput. This results in good fairness and it is the simplest algorithm

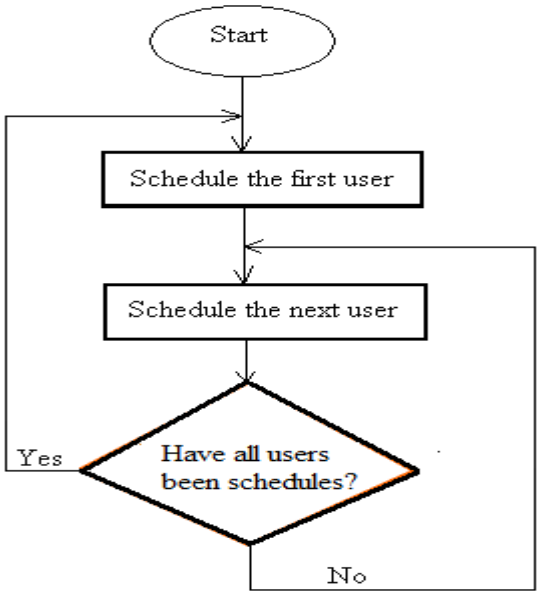

Figure 2: flow chat for RR

Proportional Fair (PF) Scheduling Algorithm - The most commonly used scheduling algorithm is PF. PF results in high cell throughput and fairness. In PF channel condition is calculated and then resources are

allocated to user which is having the highest priority and further the allocation is done to next priority user. This allocation is continuing until all the resources are allocate to the user.

The priority of kth user for jth resource block in time 'n' is calculated as follows

$P_{k,j}(n) = RDR_{k,j}(n) / R_k(n)$

$RDR_{k,j}(n)$ - The requested data rate for the k-th user over the j-th RB in time n

$$P_i(t) = r_I(t)/R_i(t) \quad \text{..... (1)}$$

$$P_i(t) = r_i(t)/R_i(t) \_i(t) \quad \text{..... (2)}$$

Where $P_i(t)$ = the priority for user i at slot t,

$r_i(t)$ = represents the request data rate

$R_i(t)$ = the average data rate of user i at time slot

t. _i (t) = indicates the channel with a different data rate

Maximum C/I Scheduling Algorithm- The highest value of CQI means that the channel quality is good. It provides excellent throughput but not fair. In this resources are assigned to the user according to the link quality. During scheduling the terminals which are located far away from the base station are not scheduled and nearby terminals are scheduled by sending CQI to the base station.

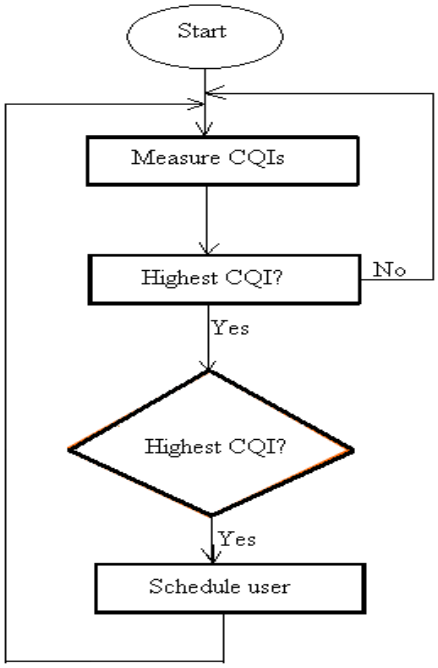

Figure 3: Flow chart for MAX C/I

IV. COMPARISON

Scheduling plays a very important role. In this section comparison of three resource allocation scheduling algorithm i.e. RR, PF and Max C/I is performed. Where the green line shows the throughput range of Best CQI. The red line shows the Proportional Fair and the blue line show the throughput of the Round Robin. Here the green line shows the highest throughput and at the top, then comes the proportional fair in term of throughput and at the last red line be there.

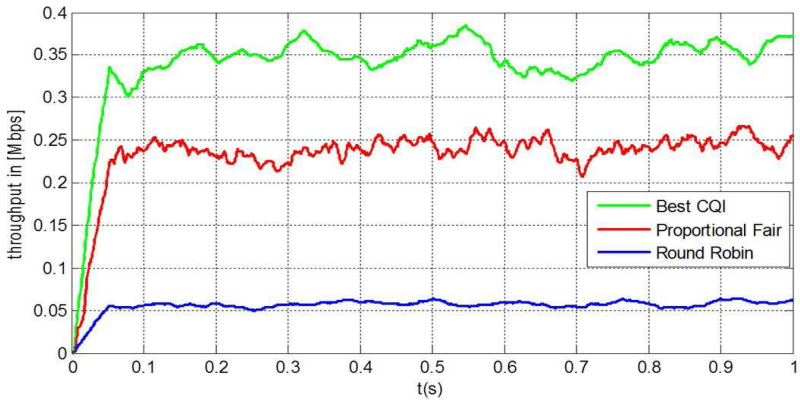

Figure 4: Comparison Graph

V. CONCLUSION

It is shown in this paper LTE can provide a further development of functionality, increased speeds and performance should be improved. The details of resource allocation scheduling methods .This paper presents the comparison of RR, PF, and Best CQI and find that Best CQI is better performed than other algorithms in term of throughput. Round Robin algorithm is the worst performance shown in the comparison graph .There is various advantages and disadvantages of other algorithm.

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