Volume 3, Issue 10, October 2013 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

An Efficient Resource Block Allocation in LTE System

Rupinder Kaur*,
*Student of M.Tech
Department of Computer Engineering,
Yadavindra College of Engineering
Punjabi University, Talwandi Sabo, Punjab, India

Manoj Kumar**
**Assistant Professor
Department of Computer Engineering
Yadavindra College of Engineering
Punjabi University, Talwandi Sabo, Punjab, India

Abstract: - LTE is known as long term evolution. It provides higher data rate, higher speed data, improved power efficiency, low latency and wider bandwidth. In OFDM system every user can use different modulation and coding scheme (MCS) on allocated subcarriers to get good throughput. LTE system in which the resources should be allocated in the unit of Scheduling Block and all Scheduling blocks assigned to one user that use the same MCQ. In LTE system the various resource allocation algorithm applications are not performed well because MCS are selected according to the worst Scheduling Block. The proposed algorithm firstly judge the Scheduling Block required by each user and after that assign Scheduling Block to each user according to their priority then allow fair distribution of available resources among the users. Simulation results show that the implementation of the newly developed algorithms shows the improvement in the overall system throughput and the user rate. At the end Result will be compared with the existing algorithm results and shows that proposed algorithm provides better results in the form of higher throughput, and user rate and works well.

Keywords: LTE, scheduling, resource block; OFDM, MCQ.

1. INTRODUCTION

In 2004 long term evolution (LTE) was started as a project with third Generation Partnership Project In March 2009 it published release 8 and continues in release 10. LTE is the next generation wireless communication. In December 1994, the 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" LTE support high date rates for the services like voice over IP (VOIP), streaming multimedia, videoconferencing or even a high-speed cellular modem. 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. All LTE devices supports Multiple Input Multiple Output transmissions (MIMO), the several data streams are transmitted by the base station over the same carrier simultaneously. Its network architecture designed with the aim to support packet-switched traffic with seamless mobility and better quality of service. Due to increase in the usage of mobile data and appearance of new applications such as MMOG (Multimedia Online Gaming), mobile TV, Web 2.0, Greater download and upload speeds to increases the amount and types of data made available through mobile devices. Streaming contents have encouraged the 3rd Generation Partnership Project to work on the Long-Term Evolution (LTE) towards fourth-generation mobile. The two modes i.e. Time Division Duplex (TDD) and Frequency Division Duplex (FDD) mode are used by LTE. LTE represents LTE and SAE. LTE is easy to use which is having higher privacy and security. It improved the speed and data rate. LTE-A is the improved version of LTE. It includes the feature of LTE and some more features to improve its version like wider bandwidth; advanced MIMO technique, coordinated multipoint transmission and reception (CoMP), relaying to increase its capacity [5]. Orthogonal Frequency Division Multiplexing (OFDM) which divides the available bandwidth into narrow band and data transmission on these subcarriers are in parallel which results in better spectral efficiency.

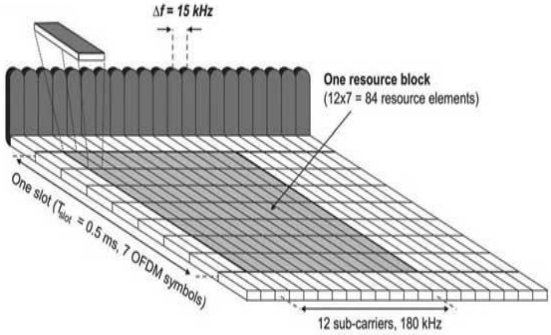

Figure1: LTE downlink physical resource based on OFDM

OFDM is also used in other of systems like WLAN, WiMAX to broadcast technologies. There are different modulation scheme like QPSK, QAM, 64QAM. The modulated subcarrier signals are added to obtain the OFDM symbol. OFDM symbols are group into resource blocks. The total size of resource blocks are 180 kHz in the frequency domain and 0.5ms in the time domain. The resource blocks are allocated to the users in the time. Frequency grid. If large number of the resource blocks a user get higher the modulation used in the resource elements and the higher the bit-rate. The advantages of OFDM like robustness to multipath fading and interference. OFDM is used in both formats like FDD and TDD formats. The Multi-User version of OFDM is called Orthogonal Frequency Division Multiple Access (OFDMA). OFDM symbol is taking place by a cyclic prefix (CP).

Scheduling plays a very important role. Resources are allocated to the users according to their need and the priority and to increase the system performance and the throughput of the system. The user which is having best channel conditions for a given time-frequency resource block should be allocated for transmission. There are various types of the scheduling algorithms are there like Round Robin, Proportional Fair, Best CQI. It is not easy to use the various scheduling algorithms. Some users are having worst channel quality compared to other users and they never be scheduled for transmission. Quality of Services is also being affected by this.

- Round Robin (RR) - RR is the most commonly used scheduling algorithm as it is very simple to implement and easy to use. The scheduler assigns resources at regular intervals to the users without taking channel conditions into account. This is a simple procedure which gives the best fairness and results in the poor throughput.

- Best CQI - Best CQI results in the better throughput and it totally ignore the fairness. To perform scheduling, terminals send Channel Quality Indicator (CQI) to the base station (BS). Better channel condition means highest CQI value. Resources are allocated to the users with the best channel quality.

- Proportional Fair (PF) - It provides the highest cell throughput as well as the fairness. With better channel quality the PF can allocate more resources to the users.[3]

II BENEFITS OF LTE

- Global ecosystem with inherent mobility is provided.
- Easy to use and use with greater security and privacy.
- Improved speed and latency.
- Delivered improved real-time video and multimedia for a better overall experience.
- High-performance mobile computing.
- Real-time applications are supported due to its low latency.
- Platform is created upon which to build and arrange the products and services of today and those of tomorrow.
- Cost is less and improved spectral efficiency.

The **Goal** of the resource block allocation is that resource are allocated to the users in such a way that firstly the priority of the user is identified , then it provide a fair distribution of the resources to the users which results in:
Increase in system throughput.
User Rate is also improved.

III EXISTING RESOURCE BLOCK ALLOCATION ALGORITHM

The existing resource block allocation algorithm comprises of two steps: 1) Number of SBs required by each user is estimated based on the ratio of minimum rate required to average channel gain. 2) Allocate the SBs to the users according to their priority.

1) Estimation of the number of SBs required by every user.
    - Calculate average channel gain for every user - Instead of channel state on every SB the average channel gain is considered. One MCS is organized for all allocated SBs for every user. Feedback method which is based on CQI threshold for k users are used with the help of this feedback overhead is reduced. CQI value is feedback by every user which is larger than the threshold in every scheduling time interval.CQI values are 0 whose CQI values are not feedback by the user. The users which are far away from the centre can have low threshold while the users which are near are having the highest threshold. This means that the different users are having different threshold. [4]. The average channel gain is:-

      $$\bar{g}_k = \frac{1}{\alpha k} \sum_{n=1}^{\alpha k} g_{k,n} \quad , \qquad g_{k,n} \geq \lambda_k \quad \text{and} \quad \alpha_k \leq N$$

      Where $\bar{g}_k$ and α_k denotes average channel gain and number of SBs with CQI value feedback.

    - The number of SBs required by each user are estimated – The number of SBs required by each user are calculated the ratio of users minimum rate required to the users average channel gain

Let N_k is the number of resources allocated to the users. N_k The following conditions are satisfied

$$N_1 : N_2 : \ldots\ldots\ldots : N_k = \emptyset_1 : \emptyset_2 : \ldots\ldots\ldots : \emptyset_k$$

2) Allocate the SBs to the users according to their priority.

- User's priority is calculated and sorts them in the decreasing order.

$$\text{If } \bar{g}_k > \bar{g}_i \text{ then } p_k > p_i$$

$$\text{If } \bar{g}_k = \bar{g}_i \text{ and } R_k < R_i \text{ then } p_k > p_i$$

$$p_1 > p_2 > \ldots\ldots\ldots\ldots > p_k$$

- Allocate SBs to every user- users are assigned the SBs according to their rate requirement. One user is assigned the SBs if its requirement is not satisfied then more SBs are allocated to the same user. If all the requirement of the SBs are fulfilled then assign the remaining SBs to the highest priority user.

IV PROPOSED RESOURCE BLOCK ALLOCATION

The algorithm designed in this section for better resource allocation. In this section we will go through the steps of the proposed algorithm. The propose algorithm works as following (Methodology):-

In our proposed resource allocation algorithm the class name User is taken.

Step 1: Enter the number of users and SBs and are taken as input.
Step 2: Enter rate require, modulation and coding technique for each user.
Step 3: Make CQI matrix in which number of users and SBs are assigned.
Step 4: Calculate average channel gain and minimum required SBs to the users.
Step 5: Priority is calculated for each user.
Step 6: SBs are assign to the users in the decreasing order.
Step 7: Calculate all user satisfied and total remains SBs.
Step8: Remaining SBs are allocated to the user.
Step 9: Calculate throughput for each user.
Step 10: Calculate the filled required rate.

Figure 2 shows the flow chart of the proposed algorithm and its tells how the algorithm works and in brief the various steps of the proposed algorithm of resource block allocation in LTE system.

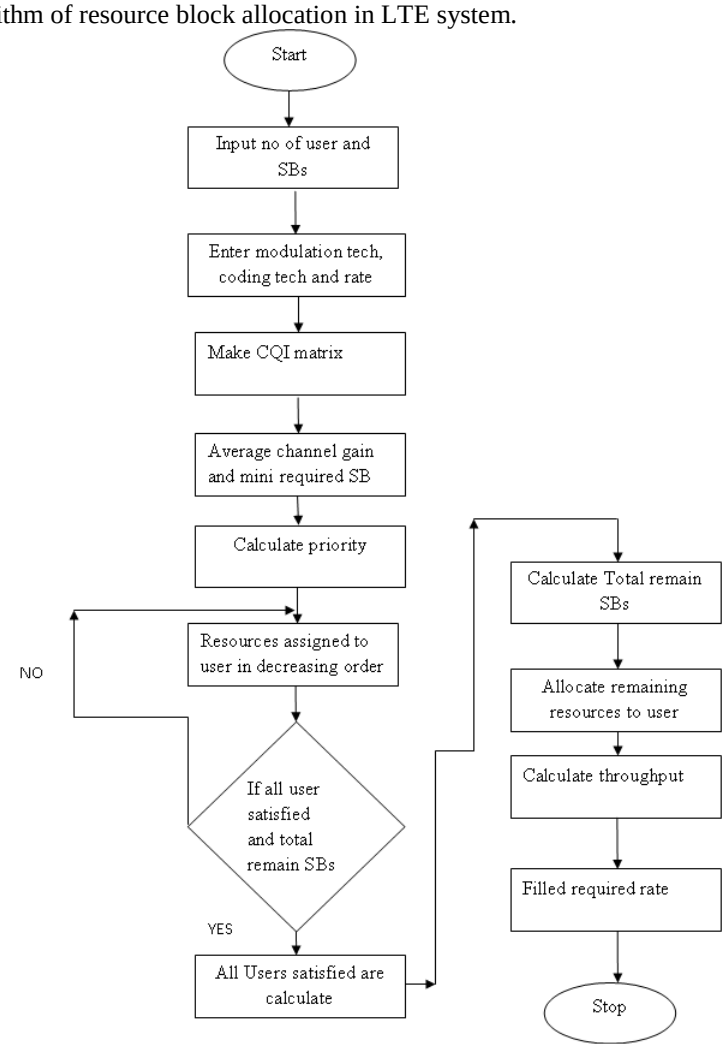

Figure 2: Flowchart of proposed algorithm

V EXPERIMENTAL RESULTS

To demonstrate the results of proposed algorithm, the algorithm was developed in c++. The results are based on various parameters shown in Table 1. The performance of two algorithms i.e. existing resource block allocation and the proposed algorithm is seen and at the end comparison is done between these two algorithms.

Table 1: System configuration

Total number of subcarriers	192
Number of SBs	16
Sub frame length T	1 ms
Maximum Doppler	30 Hz
Channel model	6- ray Rayleigh channel
Delay spread	5 us
Minimum rate requirements	0.768, 1.024, 1.536 Mbits/sec
Modulation and coding	QSPK: 1/3, 1/2 , 2/3, 3/4, 4/5 16 QAM: 1/2 , 2/3, 3/4, 4/5 64 QAM: 2/3, 3/4, 4/5 256 QAM: 2/3, 3/4, 4/5

For both algorithms we calculate the user rate and the throughput for each user. We take the 3 cases of user's i.e. for user 2, user 4 and user 6 and the throughput is calculated for all these users and at the end comparison will be done. In resource block allocation the resources are allocated to the users in such a way so that there should be increase in the system throughput and the users rate.

Firstly we take case 1: for 2 users

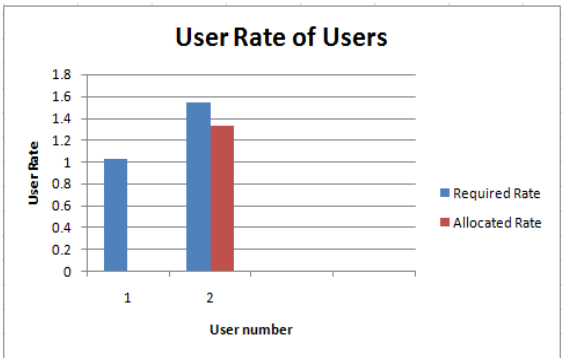

Figure 3: Existing algorithm for 2 users

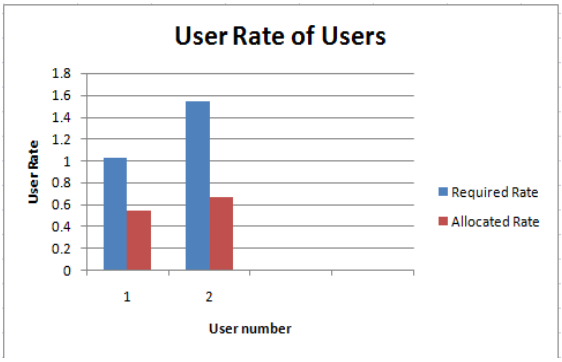

Figure 4: Proposed algorithm for 2 users

In figure 3 and 4 we see the user rate graph for both the algorithm. Here the user rate of proposed algorithm is better where both the users have some values i.e 0.5376 Mbps and 0.66528 Mbps. In the existing algorithm the user 1 is having no value. The throughput of existing algorithm is 1 and 2 is for proposed algorithm.

We take the case 2: for 4 users

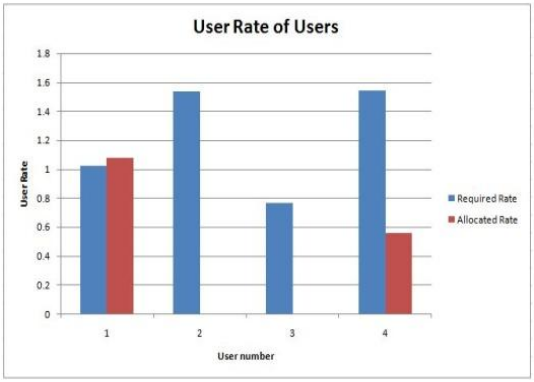

Figure 5: Existing algorithm for 4 users

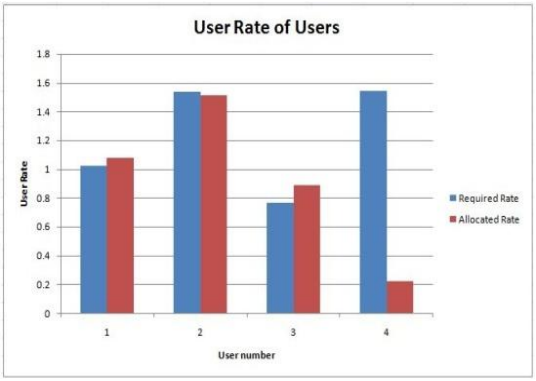

Figure 6: Proposed algorithm for 4 users

In figure 5 only 2 users having their user rate i.e 1.0752 Mbps,0,0,0.5544 Mbps and the proposed algorithm having the values for user rate is: 1.0752 Mbps, 0.22176 Mbps, 0.88704 Mbps, 1.512 Mbps. The throughput for existing algorithm is 9 and for proposed algorithm is 9.75.

Now case 3: for 6 users

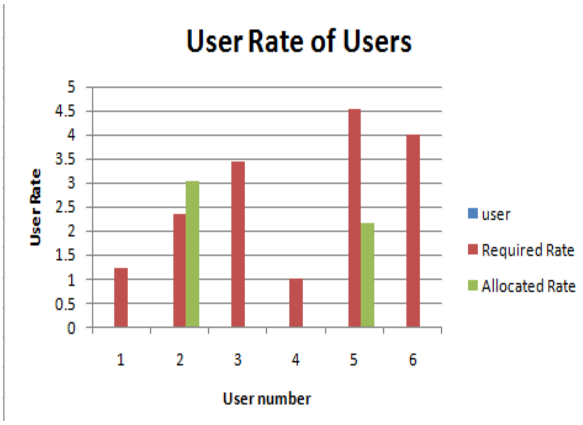

Figure 7: Existing algorithm for 6 users

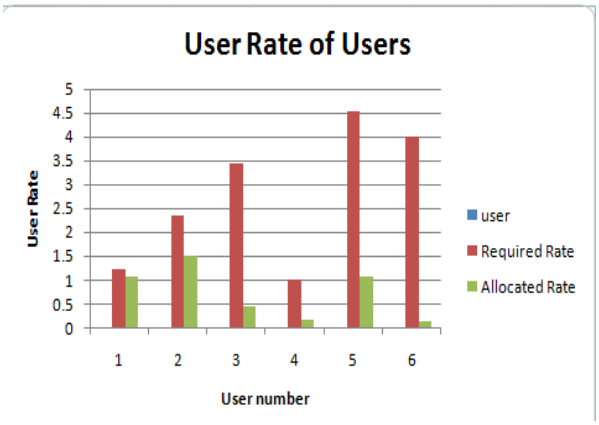

Figure 8: Proposed algorithm for 6 users

The throughput for the existing algorithm is 8 and for the proposed algorithm are 12. The user rate is calculated for both the algorithms and their users.

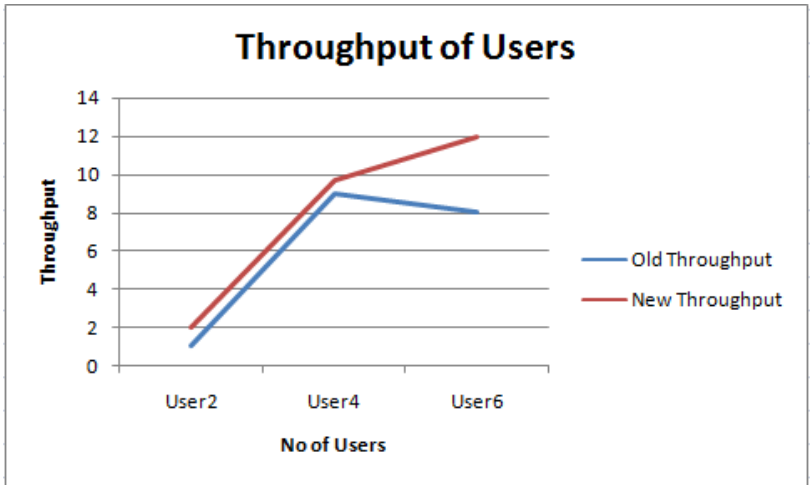

Figure 9: Throughput graph

Figure 9 shows the throughput graph for all the users i.e for 2 users, 4users, 6 users and for both the algorithms. The blue line shows the old throughput values of the existing algorithm and red line shows the new throughput values of the proposed algorithm. At the end comparision will be shown between the existing algorithm and the proposed algorithm. We find that proposed algorithm is better having higher value of throughput and user rate.

VI CONCLUSION

In this paper we analyzed the performance of algorithms. In this better algorithm has been proposed to improve the resource allocation among the various users. Proposed algorithm is the modification of the existing algorithm. Throughput and user rate is also calculated at the end. At the end comparison between the existing algorithm and the proposed algorithm are done. Here in our proposed algorithm the throughput of the proposed algorithm is much better than the existing algorithm. And the user rate of the proposed algorithm is good where each user is performing some task. At the end comparison between the two algorithm shows that the proposed algorithm works well and is much better than the existing algorithm and produces much better results.

REFERENCES

[1] M. H. Habaebi, J. Chebil, A.G. Al-Sakkaf and T. H. Dahawi, "Comparison between Scheduling techniques in long term evolution", IIUM Engineering Journal, Vol. 14, No. 1, 2013 Department of Electrical and Computer Engineering Malaysia. pp 66-75.

[2] Honghai Zhang, Narayan Prasad and Sampath Rangarajan "MIMO Downlink Scheduling in LTE systems" in 2012, IEEE.

[3] Mohammad T. Kawser, Hasib M. A. B. Farid, Abduhu R. Hasin, Adil M. J. Sadik, and Ibrahim K. Razu, "Performance Comparison between Round Robin and Proportional Fair Scheduling Methods for LTE", International Journal of Information and Electronics Engineering, Vol. 2, No. 5, September 2012.

[4] Na Gaun, Lin Tian and Gang Sun "Qos Guaranteed Resource block allocation algorithm for LTE System" in 2011, IEEE

[5] Sinh Chuong Nguyen, Kumbesan Sandrasegaran and Faisal Mohd. Jamal Madani, "Modeling and Simulation of Packet Scheduling in the Downlink LTE- Advanced" in 2011, IEEE.

[6] Aderemi A. Atayero, Matthew K. Luka, Martha K. Orya, Juliet O. Iruemi, "3GPP Long Term Evolution: Architecture, Protocols and Interfaces", International Journal of Information and Communication Technology Research, Volume 1 No. 7, November 2011, Department of Electrical & Information Engineering Covenant University, Nigeria

[7] Mohsen M. Tantawy, Adly S. Tag Eldien, and Rokaia Mounir Zaki 1, "A Novel Cross-Layer Scheduling Algorithm for Long Term-Evolution (LTE) Wireless System", Canadian Journal on Multimedia and Wireless Networks, Vol. 2, No. 4, December 2011.

[8] Raymond Kwan and Cyril Leung, "A Survey of Scheduling and Interference Mitigation in LTE", Journal of Electrical and Computer Engineering Volume 2010, Department of Electrical and Computer Engineering, University of British Columbia, 2332 Main Mall, Vancouver.

[9] I-Hong Hou and Chung Shue Chen, "Self-Organized Resource Allocation in LTE Systems with Weighted Proportional Fairness", Computer Engineering and System Group & Department of ECE, USA.

