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Implementation scheduling in LTE based 4G Networks

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ABSTRACT

In this work I provide the intent of long term evolution advanced technology is set forth high level of speed in data application its requirements and contend with different technique . Different Technique like relaying carrier aggregation .for multiple input and same for multiple output and heterogeneous network provide higher throughputs , low latency and let LTE become a best standard for wireless broadband .Due to almost exponetional increases in demand for high rate of data it is expected that network will consist the occupied by more data resource it is required for better performance of LTE system suitability exhibition schedule is adopting to 4G system to achieve Orthogonal Frequency Division Multiple Access (OFDMA) potentiality in time domain system (TDS) and Frequency Domain scheduling systems (FDS) this paper scoring at totalize the implementation of suitability fair algorithm by create future assessment of Channel Quality Indicator to exhibit high data rate in all proposed algorithm on the downlink is measured in terms of throughput and block error rate using a math lab based system level simulator.

Keywords: *LTE, LTE-A, eMBMS, TDS, OFDMA.*

1. INTRODUCTION

In the past few years, we have seen a global flurry of the Internet in the rapid roll-out of multimedia the commercial products such as Live, YouTube, and Skype have occupied a large portion of Internet bandwidth. One reason behind the continual growth of multimedia services is due to the increasingly deployed and offered broadband networks. Besides the traditional wired end users, Internet service providers (ISPs) are expected to provide multimedia services, especially video streaming, to wireless end users as well in that it allows ISPs to strengthen their competitiveness by offering these new services. However, the existing solutions to multimedia in wired networks cannot directly apply to wireless networks with lower bandwidth, higher latency, and higher burst error rate. Furthermore, these services could suffer from user's mobility and the heterogeneity caused by different wireless technologies (e.g. CDMA2000, WCDMA, TD-SCDMA, Wi-Fi, Long-Term Evolution (LTE), and LTE-A). This paper surveys the long term evolution advance in mobile multimedia, focusing on the stander defines broadcasting to, capability in the form of enhanced multimedia broadcast and multicast service (eMBMS) The rate of which there has growing acceptance waiting the industry of oTT no longer being of threat but complementary has come as a surprise too many iptv has been existing for while it has recently attracted content and service providers part of this is probably due exponential growth in technology. The number of mobile subscribers is increasing and it is predicted that by the year 2020, mobile devices will be widely popular across the world thus the need arises for enhanced data rates to accommodate these users and to serve the ever evolving high speed mobile services. International Mobile excommunication-Advanced (IMT-Advanced) is an evolving standard by the ITU (International Telecommunications Union) that aims to provide the above mentioned aspects. It also promises seamless mobility making the network ubiquitous and many more features such as high quality mobile services, worldwide roaming, low cost services and applications across fixed as well as wireless networks and compatibility across radio access systems. Long Term Evolution (LTE) is the latest version of cellular technology - commonly referred to as 'fourth generation technology' or 4G. On behalf of com, PA studied the impact of LTE on future consumer and business services in the UK. Particular focus areas for research were 'Blue Light' emergency and mobile broadcast services. Our findings are based on interviews with industry stakeholders, extensive secondary research and our own industry insight. This paper previous the study of long term evolution and IPTV services which able to have value of new future work.

2. BACKGROUND AND RELATED WORK

The first generation (1G) of cellular networks came into existence in the early 1980s [Table 1]. TACS (Total Access Communication System) and AMPS (Advanced Mobile Phone System) were the two commonly used standards that provided analog transmission of voice in Europe and North America

Respectively. By the next decade the analog transmission was replaced by digital transmission using D-AMPS (Digital- Advanced Mobile Phone System) for a better, much clearer voice transmission. D-AMPS was eventually replaced by the newer 2G (Second Generation) technologies like GSM (Global

System for Mobile Communication) and CDMA (Code Division Multiple Access). The 2.5 generation of technologies were a step further and supported data transmission along with voice. The 3G (Third Generation) of technologies absorbed the need for high data rates required for data transmission and

Voice. The 3G technologies were standardized as IMT-2000 [ITU-R M.687] and the work on the 4G (Fourth Generation) technologies and its standardization is under progress by the name IMT-Advanced.

Table 1:Generations of Cellular Technologies

Generation	Year	Network	Technology	Data
1G	Early 1980s	Circuit switched	TACS,AMPS	Analog Voice
2G	Early 1990s	D-AMPS, GSM,CDMA	D-AMPS, GSM,CDMA	Digital Voice
2.5G	1996	Cicuit switched or Packet switched	GPRS, EDGE, EVDO, EVDV	Digital Voice + Data
3G	2000	Non IP, Packet switched / Circuit switched	WCDMA, CDMA2000	Digital Voice + High speed Data + video
4G	2012	IP based, Packet switched core network.	Not finalized.	Digital Voice, High speed Data , Multimedia, Security

LTE technology promises a richer, more reliable data experience:

LTE has been developed based on the experiences with 3G services and includes a number of significant technological improvements that help to enhance end user experience significantly. These include lower latency, higher throughput rates and improved reliability when compared with previous generations of mobile technology. These three key elements come together to provide an improved customer experience.

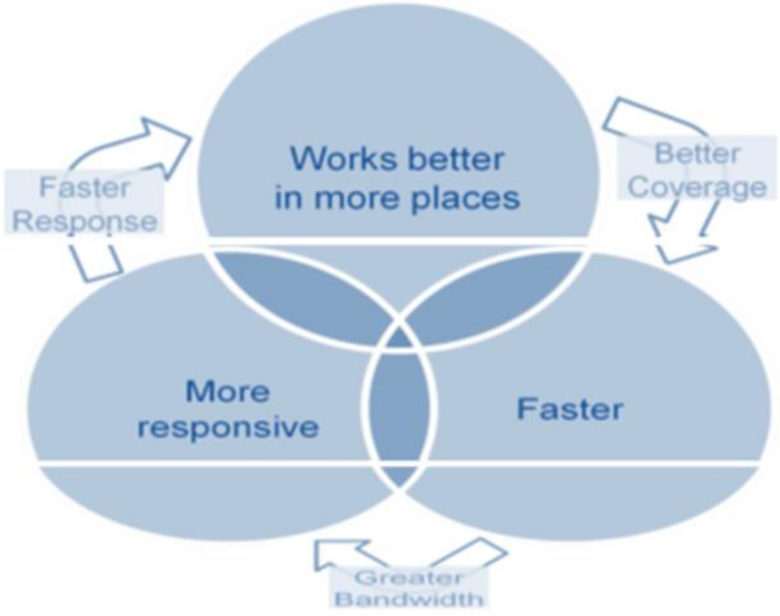


Figure 1 - LTE user experience enhancements

LTE delivers responsive applications through lower latency

Latency is the time measure for a given request or action to be completed across the network. Fixed broadband network latency is measured when completing a server request. While the overall user experience includes the latency of the end-to-end delivery system, including external servers we expect that LTE networks will be able to deliver similar latency to current broadband networks for comparable request.

As a result, users will experience more responsive applications where latency is reduced, in particular when the data updates only require only small amounts of data to be transmitted. Examples of where users may notice this delay are loading of a web page or updating status on a social networking site or enterprise CRM system. Applications like gaming or share trading that have so far been largely limited to fixed broadband may now also become more prominent for mobile.

Whilst 3G required setting up such a connection, LTE networks are designed to offer always-on services where the end device is consistently connected to the network. This removes the need for the device to make requests to the network and the network to recognize and authenticate the device.

LTE networks are simpler and work with fewer components compared to 3G. This removes interactivity and also results in lower latencies. The following diagram shows this simplified network architecture.

2-LTE simplifies network architecture

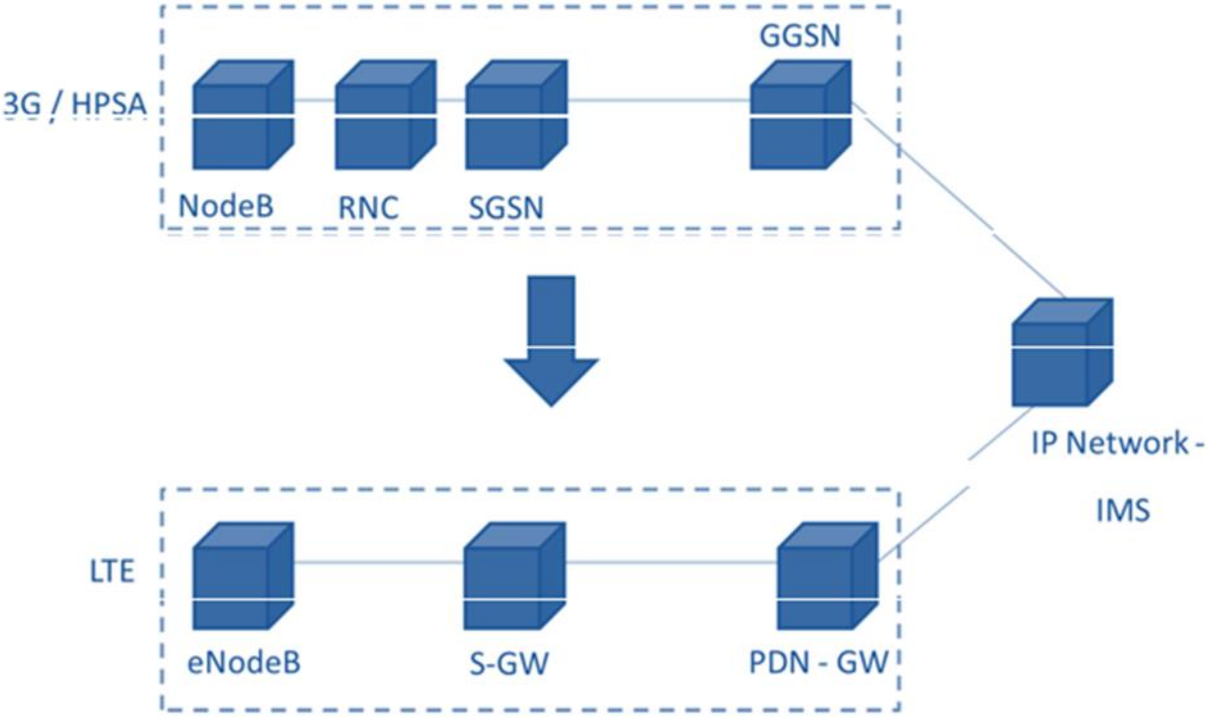


Fig (2) LTE simplifies network architecture

A. PROPORTIONAL FAIR ALGORITHM

Proportional Fair algorithm Proportional was originally used for Time Domain Systems and latter LTE system adopted the PF algorithm for implementation of OFDMA in Frequency Domain Systems and Time Domain systems [12]. PF algorithm is used in time frequency shared multi-user systems. A good trade-off between overall throughput of system and data rate fairness is achieved through a combined TDS and FDS systems by exploiting multi-user diversity [13]. Allocation Fairness (FA) is a commonly used parameter in PF scheduler. FA refers to the allocated amount of resources within a given time window. PF algorithm uses the following equation for FA

[13]:

Where $0<\wedge_x$ (1x>0) = 1 means that all users are allocated the same share. Refers to the number of considered users.is the user index and it has values from 12 and 14 refers to the number of allocation units resources assigned to user in a time interval PF scheduler maintains a good trade-off between two com- petting parameters: Data-rate fairness among all users and overall system throughput. PF allocates resource blocks (RBs) to the user that has maximum CQI in the rest slot period of each subprime; while in the following second slot period the RB is allocated to each user in turn by the PF scheduler. Such interchange provides a compromise between the throughput and fairness that can be achieved. The orchard of PF algorithm is illustrated in Fig. 1. At the start of scheduling, the CQI values from different UEs are compared by BS. Then the BS selects the UE with maximum CQI value. If more than one user has highest CQI value, then the scheduler selects a random one. In the second slot the UEs are selected cyclically in turn. The same scheduling process is repeated in the third slot period [14].

3. PROPOSED METHOD

In this research work, users with high mobility are consider- erred. Channel quality indicator (CQI) is transmitted by UE to eNodeB, to convey the information about channel condition. CQI index ranges from 0 to 15, where 0 indicates that the channel is in poor condition while 15 indicates healthy channel conditions. With high mobility of user, CQI values change rapidly, in other words, there exists high variations in CQI values. Thus by calculating the variance of CQI index of each individual user, eNodeB will be capable of estimating the speed of user. If the user is moving at high speed, the variance of CQI will be high otherwise it will be low (in case of low speed) or zero (in case of no mobility).

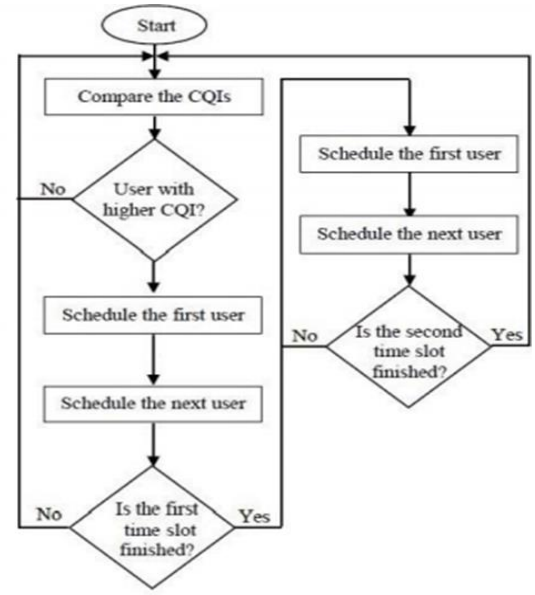
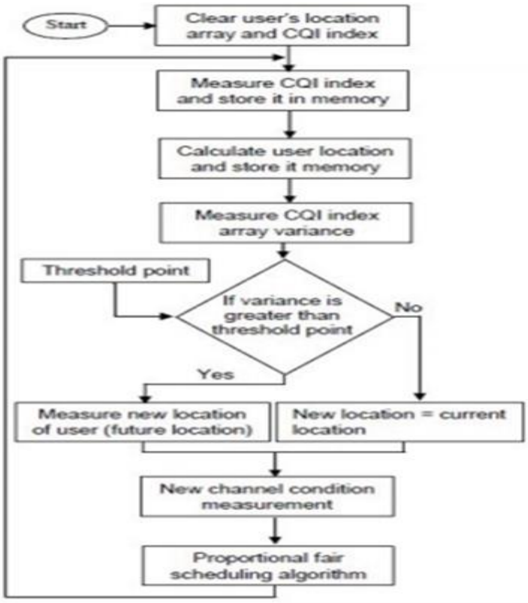


Fig. 1: Chat Flow

A threshold value for variance is defined to indicate whether the user is moving with high speed or low speed. The speed of user considered in this research for setting the value of threshold was 100 km/hr. and threshold value obtained at this speed was 4. Then the variance of CQI values is calculated for each user. Due to random motion of users, a unique value of CQI variance exists for each user. The threshold value is set equal to the minimum obtained value of CQI variance. In case, the variance of CQI index is less than the threshold value, no future distance estimation will be done because the user is assumed to be moving at low speed or is in a stationary condition. In case, the variance of CQI index is higher than the threshold value, future distance will be estimated according to user’s current position. If variance is less than threshold value, this mean either the user is moving at low speed or user is stationery. In this case, no future distance will be calculated and current location of the user will be the new location of that user and scheduling will be performed using PF algorithm. While in case, the variance is greater than threshold, this means the user is moving at a fast speed, therefore the future location will be calculated and new location of the user will be that calculated location. Equation to calculate the future location is: previous location respectively. After calculation of new location of each UE individual user, path loss will be measured by considering the new location of. On the basis of path loss, corresponding CQI value will be calculated. This will be the future CQI of the UE for a future location. Channel allocation will be done according to that future CQI



value. Fig. 2 illustrates the chart of the proposed work. At the beginning, user location and CQI array will be emptied. Then CQI and location of each client will be measured and stored in memory. From the stored array of CQI values, variance will be calculated. A threshold value is measured for CQI variance. In next step, variance will be compared with threshold value, if variance is greater than threshold then future estimation of users location will be done and for this future location, future CQI will be calculated and suitable modulation scheme for that calculated CQI will be selected by PF algorithm. If variance is equal to or less than threshold value then future location of user will not be estimated and channel will be assigned on the basis of current location. This whole process will be repeated continuously

C. Simulation Scenario

No.	Parameters	Values
1	Frequency	2 GHz
2	Bandwidth	5 MHz
3	nTx	2
4	nRx	2
5	Inter eNodeB distance	500m
6	Minimum coupling loss	70 dB
7	Macroscopic path loss model	TS25814
8	Shadow fading	Claussen
9	Number of eNodeB	3
10	Number of users	5
11	eNodeB tx power	20 watts
12	TTI	100
13	Latency time scale	25 TTIs
14	eNodeB tx power	20 dBm
15	Receiver noise figure	9 dB
16	Thermal noise density	-174 dBm/Hz
17	UEs speed	250km/hr
18	Channel model type	Veh A
19	Antenna gain pattern	TS 36.942
20	Mean antenna gain	15
21	Scheduler	Proportional fa
22	Power allocation	Homogeneous
23	Feedback channel delay	3 TTIs
24	SINR averaging algorithm	MIESM
25	RB bandwidth	180 kHz
26	TTI length	1 m-Sec
27	Cyclic prefix	Normal
28	Maximum number of code words pe	2

Fig. 2: Flow chart of proposed algorithm

Cell transmission network of MIMO was used for evil- action of proposed scheme for PF algorithm. PF algorithm is implemented in MATLAB-based system level simulator [15] and proposed method for user mobility was evaluated for this PF scheduler. TABLE I lists the parameters that were used in the simulation. This work evaluates the two aspects of performance: accuse- racy and the bit rate. Calculation of throughput indicates the bit rate, and the accuracy is investigated in terms of Block Error Rate (BLER)

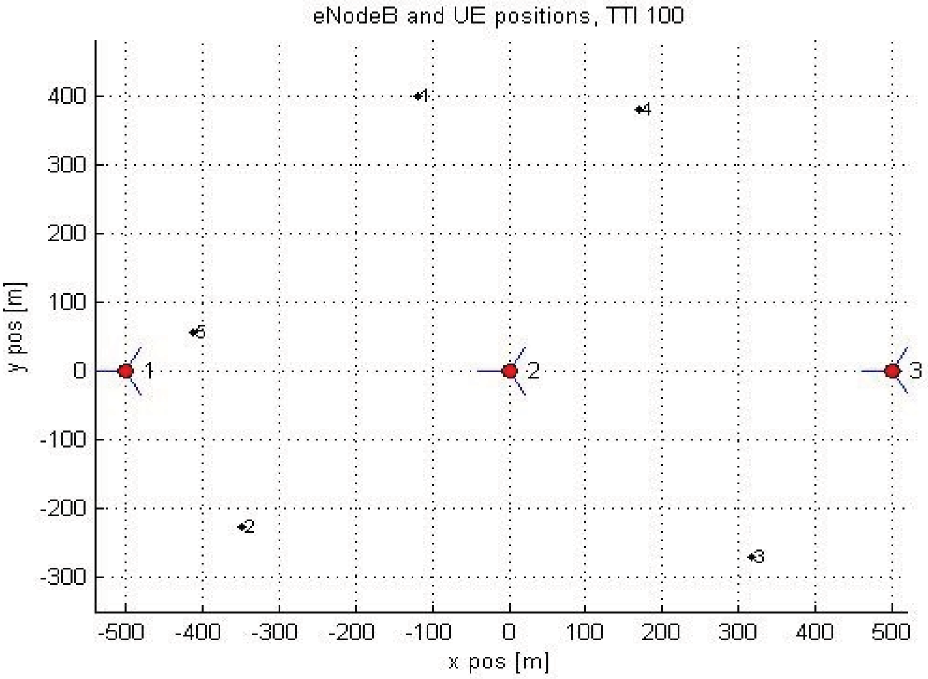


Fig. 3: (X, Y) Positions of 5 UEs near eNodeB (meters)

D. PERFORMANCE EVALUATION AND ANALYSIS

In order to evaluate the throughput and BLER values of the use resend eNodeB , this simulate own arson the basis of following considerations. 5 user equipment's were considered in the simulation and these UEs were distributed randomly in the network as shown in Fig. 3. LTE network uses 15 CQI levels. Simulations of proposed method and proportional fair algorithm are performed. The plots of throughput and BLER over time for proportional fair algorithm and proposed method are presented in Fig. 4 to Fig. 8.

Table II: UES Average Throughput and BLER for Proposed Algorithm

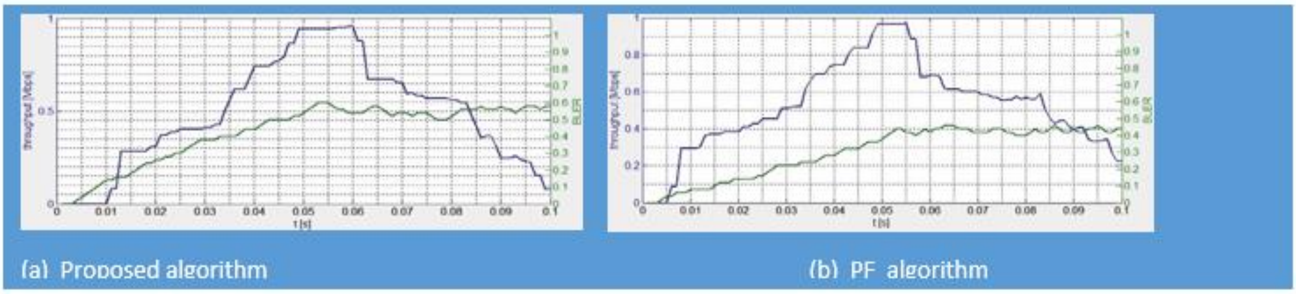
UE	Average throughput	Average BLER
1	0.53905	0.302
2	0.5054	0.3996
3	1.09932	0.4100
4	0.55955	0.3548
5	0.7649	0.3498

Table III: UES average throughput and BLER for P.F algorithm

UE	Average throughput	Average BLER
1	0.4871	0.4221
2	0.5809	0.4357
3	0.6021	0.4265
4	0.3322	0.4170
5	0.5801	0.3678

For the selected stream of line and UE, the user throughput in Mb/s is illustrated by blue line and the green line depicts the BLER asmeasured by the ACK/NACK ratioand the BLER value applied by the link quality model The system was adjusted to produce 01but the variations in channel state and uplink delay can influence the actual results [15].CQI level is a function of state of the channel and location of the UE, and it is not affected by the selection of scheduling algorithm. Fig. 4 to Fig. 8 illustrate the throughput and BLER of 5 users for the PF algorithm and the proposed algorithm. Graphs present instantaneous values of throughput and BLER. Average values of throughput and BLER of each user is shown in TABLE II and TABLE III. It is clear from results that the performance of proportional fair algorithm is better than the proposed algorithm for UE2, while proposed method performs well for UE1, UE3, UE4 and UE5 as compared to proportional fair algorithm, in terms of throughput. The proposed method provides less throughput for UE2 because the value of CQI variance for UE2 is very high than rest of the UEs, which shows that channel condition of UE2 is highly unstable. Plots from Fig. 4 to Fig. 8 present that peak value of throughput is higher for UE3, UE4 and UE5 in case of proposed algorithm and for UE2, PF algorithm gives higher peak value of throughput, and peak value for UE1 is almost same for both algorithms. Proposed method produces less BLER than PF scheduler for all users, as shown in TABLE II and TABLE III.

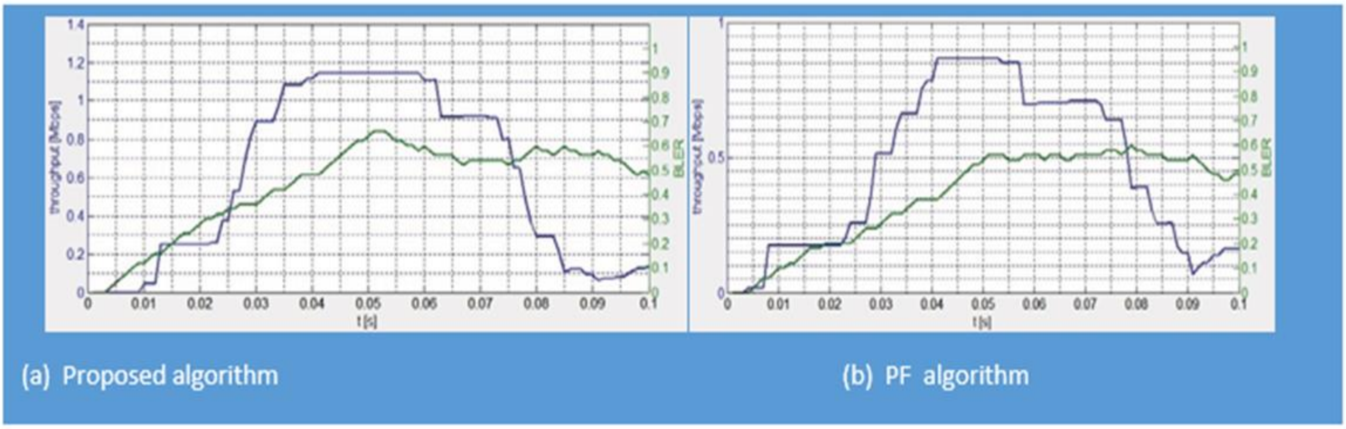
The simulator used in this research work was conjured to calculate single achievable BLER of UE, throughput of UE and cell BLER and cell throughput as well. We preferred to achieve the BLER and throughput values calculated averaged over all UEs in the network, disregarding respective locations of UEs, in order to evaluate the global network performance. Fig. 9 plots the average throughput for all the UEs in the net- work within a duration of 0.1 second. The guru presents the throughput for both the



(a) Proposed algorithm

(b) PF algorithm

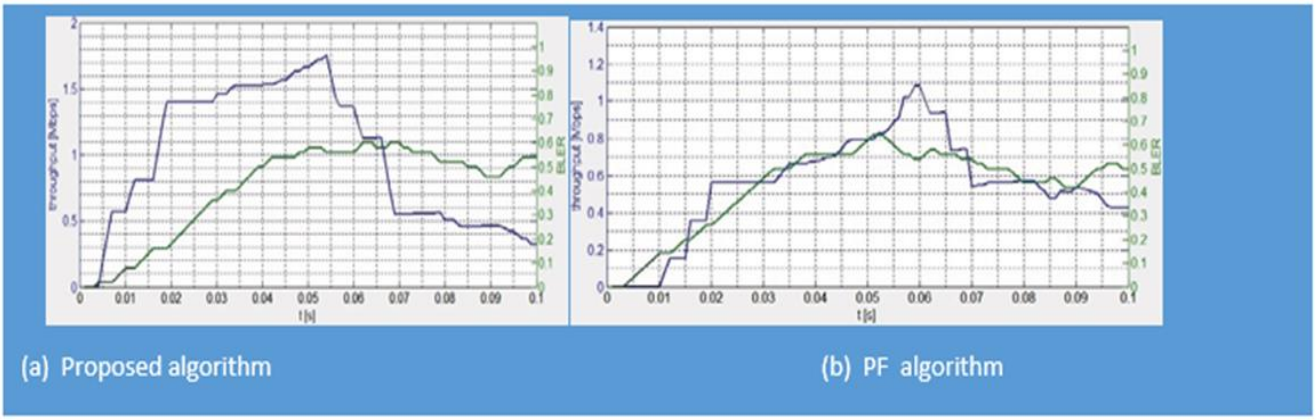
Fig. 4: UE1 throughput and BLER curve



(a) Proposed algorithm

(b) PF algorithm

Fig. 5: UE2 throughput and BLER curve



(a) Proposed algorithm

(b) PF algorithm

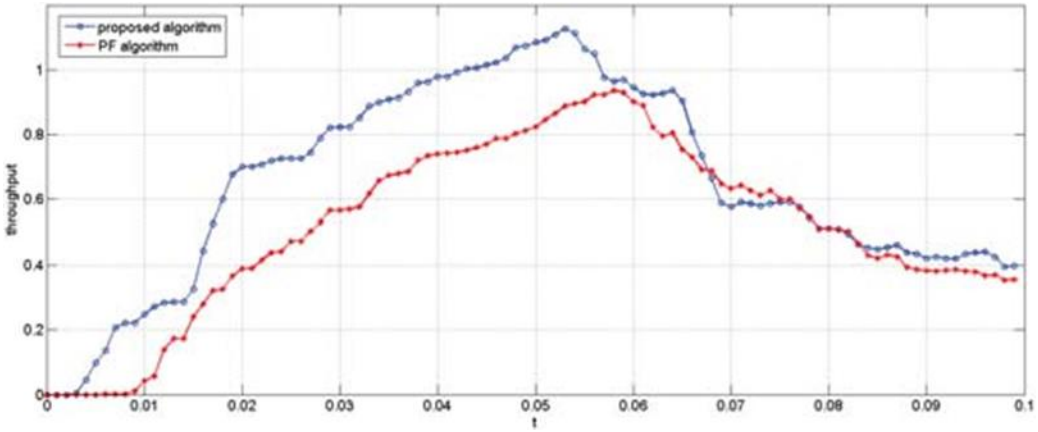


Fig. 9: Average UE throughput for 5 users , PF algorithm and Proposed algorithm

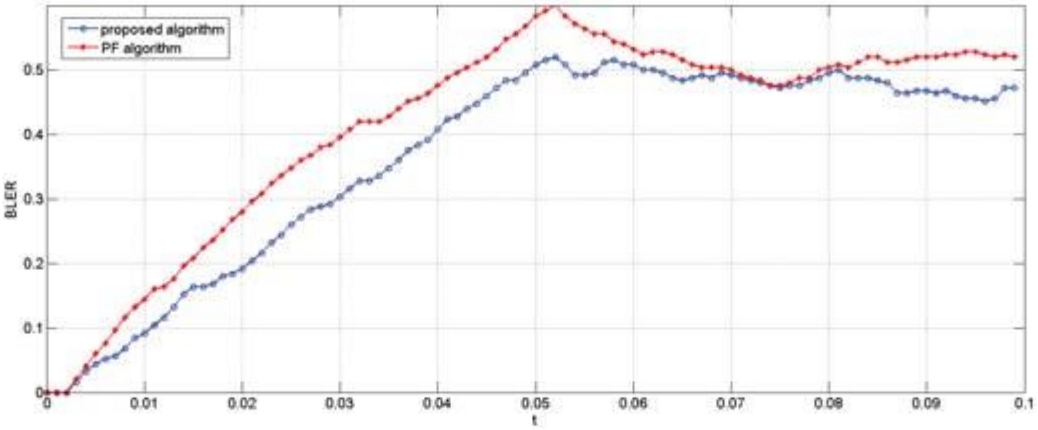


Fig. 10: Average UE BLER for 5 users , PF algorithm and proposed algorithm

Fig. 10 plots the average BLER for all the UEs in the netwok within a duration of 0.1 second. The gure presents the BLER for both the proposed algorithm and PF algorithm. Plots of average throughput and BLER for all users show that proposed method provides higher throughput and low BLER than PF algorithm.

4. CONCLUSION

The proposed algorithm has been evaluated in terms of BLER and throughput. It outperforms Proportional Fair al- algorithm for all UEs except UE2, for which Proportional Fair algorithm performs better. But the overall system throughput is improved in case of our proposed algorithm and it also provides lower system BLER as compared to the PF algorithm. Therefore, the enhancement in PF scheduler i-e the use of proposed method, will improve its performance when the users in the network are moving at fast speed

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