A Novel HWRR-SJF Scheduling Algorithm for Optimal Performance Improvement in LTE System

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Abstract: In currently, the revolution in a high-speed broadband network is the requirement and also endless demand for high data rate and mobility. To achieve above requirement, the 3rd Generation Partnership Project (3GPP) has been established the Long Time Evolution (LTE). LTE has established an improved LTE radio interface named LTE-Advanced (LTE-A) and it is a promising technology for providing broadband, mobile Internet access. But, better Quality of Service (QoS) to provide for customers is the main issue in LTE-A. To reduce the above issue, the packets should be utilized by using one of the most significant function of packet scheduling to upgrading system performance via determines the throughput performance. In existing scheme, the user with poor Channel Quality Indicator (CQI) has smaller throughput issue is not focused. In this paper, a Hybrid Weighted Round Robin with Shortest Job First (HWRR-SJF) Scheduling technique is proposed to enhance efficient throughput and fairness in LTE system for stationary and mobile users. In this proposed scheduling, to schedule users according to a different criterion like fairness and CQI. HWRR-SJF Scheduling has been proposed for scheduling of the users and it produces increased throughput for various SNR values simulated alongside Pedestrian and Vehicular moving models. The proposed method also uses a 4G-LTE filter or Digital Dividend (DD) in order to align the incoming signal. The digital dividend is used to remove white spaces, which refer to frequencies assigned to a broadcasting service but not used locally. The proposed model is very effective for users in terms of the performance metrics like packet loss, throughput, packet delay, spectral efficiency, fairness and it has been verified through MATLAB simulations.

Keywords: 3GPP, LTE, quality of service, channel quality indicator, weighted round robin, shortest job first, digital dividend.

I. INTRODUCTION

The increasing demand for network facilities, such as web browsing, VoIP, video telephony, and video streaming, with constraints on delays and bandwidth requirements, and it causes new issues in the design ofthe cellular networks based future generations. For the radio access and the core networks, 3GPP introduced the LTE specifications [1] and it aiming at determined performance objectives and defining new packet-optimized and all-IP architectures. As said by [2], more than 20 LTE cellular operators there in worldwide, and by 2013more than 32 million LTE subscribers are foreseen.

In LTE network access, set aggressive performance conditions thatrely on physical layer technology like Orthogonal Frequency Division Multiple Access (OFDMA), which is supported to a wide range of Internet services and multimedia even in high mobility scenarios. So, it has been designed to provide low latency, high data rates and an improved spectral efficiency by respect to previous 3G networks. The Radio Resource Management (RRM) section utilizes a combination of advanced Medium Access Control (MAC) and Physical functions, such as resource sharing, Hybrid Automatic Retransmission Request (HARQ)CQI reporting and link acclimatization via Adaptive Modulation and Coding (AMC) are used to achieve those goals. In this perspective, the design of efficient resource allocation schemes becomes critical. Actually, the effectual use of radio resources is necessary to achieve the system performance targets and to satisfy user needs along with specific QoS requirements [3]. For this reason, both industrial communities and research are presenting a significant effort on the study of LTE systems, in order to improve and analyse their performance proposing new and innovative solutions. The Standard LTE is continued development toward establishing an improved LTE radio interface described as LTE- A.

The reason of supporting additional (as far as 100 MHz) transmission bandwidth, the 3GPP has proposed Carrier Aggregation (CA) technology and it has been embedded inside the latest LTE-A[4]. Here, the exclusive objective is to recognize a minimum data rate of 1 Gbit/sin the4G (4th Generation) mobile schemes.

In 3GPP LTE-A, it can be recollected that various promising technologies are loaded. These contain Coordinated Multi-Point (CoMP), improved Inter-Cell Interference Coordination (eICIC), CA and advanced Multiple-Input Multiple-Output (MIMO) transmissions, and these are has efficient capable of delivering an effective transmission and increasing spectral efficiency [5].Due to CAs capability of providing high throughput for LTE-A networks, this is characterized to be the best vital technology. To enhance the data rate and the mixture of two or more Component Carriers (CCs)used to achieve CA.

In CA technology of application, any user can be programmed in possible way either continuous or non-continuous CCs mode [6]. It is automatically perform the resource scheduling algorithm the moment that evolved

NodeB(eNB) chooses specific CCs for the users. In addition, a scheduling system is evaluated in parameters of the highest benefitin the system can acquire from an exact resource together with the equitable distribution of the process assets among the customers. The benefit is computed by the procedure throughput and spectral management efficiency. Alternatively, fairness is computed by the rate of data and the delay constraints of the various users.

A resource allocation mechanism is one of the major challenges for LTE-A systems. And this mechanism is responsible for describing how resources are dispersed along with the various users. Greater bandwidth conservation and better fairness are defined as a good allocation of resources results of the system. In resource scheduling, considered factors such as the QoS for each application, data rate and the quality of the radio link. And the packet loss ratio considered within reasonable limits. These losses are commonly responding with the aid of dropping packets that violate the delay bound to the applications.

In this paper, a HWRR-SJF scheduling is proposed for resource allocation in LTE-A to achieve high data rate and minimum delay. The proposed method also uses a 4G-LTE filter or Digital Dividend (DD) in order to align the incoming signal. The digital dividend is used to remove white spaces, which refer to frequencies assigned to a broadcasting service but not used locally. The proposed model is very effective for stationary users in terms of the performance metrics like packet loss, throughput, packet delay, spectral efficiency and fairness. In this regard, this paper is designed thus: the part 2 discusses related works on Scheduling methods in LTE. In part 3, describes the proposed methodology. Part 4 reports simulation outcome of proposed system. Phase 5 concludes the work.

II. RELATED WORK

In this section, few works on LTE scheduling schemes has been mentioned. These scheduling schemes are supported to increasing performance based on objectives like throughput and fairness. In [7] proposed two Proportionally Fair (PF) schedulers that assign Resource Blocks (RBs) employing a localized theme and an interleaved allocation. In [8] presented a Heuristic Localized Gradient scheme (HLGA) that allots contiguous RBsto every UE. It is projected with H-ARQ awareness wherever it reserves a set of RBsto be utilized by the H-ARQ method for previous unsuccessful transmissions. To incorporate allocation pruning, in [18] was extended in [9] wherever the quantity of RBsis adjusted supported the state info of the buffer size at the UE's end function. It showed an improvement within the utilization of accessible resources due to adding the buffer awareness of the scheduler. Three schedulers are presented in [10] with PF-based utility functions: First Maximum Expansion (FME), Recursive Maximum Expansion (RME) and Minimum Area Difference (MAD). The performance of those presented schedulers was evaluated and compared to a reference RR scheduler and the results of spectral fairness and efficiency are not efficient.

In [11] presented two variants of the RME scheduler for SC-FDMA as an extension of in [9].SC-FDMA has been selected as the uplink access scheme in the UTRA Long Term Evolution (LTE) because of its low peak-to-average power ratio properties. In [12] a binary search tree-based PF scheduler proposed for LTE transmission. In this schedule scheme, the accessible RBs are divided into fixed-sized Resource Chunks (RCs), and then these RCs are allocates among the accessible UEs. This scheduler performance showed throughput and noise rise improvement compared to the RR scheduler. In [13] introduced an adaptive transmission bandwidth-based scheduler, wherever it dynamically changes the resources appointed per UE in each scheduling period.

In [14] proposed a SINR-based PF metric in Frequency Division mingled with a throughput-based PF metric in Time Division as an extension of the work presented in [13]. In [15] designed sensible Multi-User resource allocation schemes for the LTE transmission during which the term resource refers to RBs, power levels, modulation, selection of transmit antennas and coding schemes. In [16-17], a Kwan Maximum Throughput (KMT) scheduler is presented that tries to maximise the throughput.

An analysis environment for perceptive the combination performance of the various schedulers is obtainable in [18]. Though, the analysis failed to address the QoS characteristics of the schedulers and failed to discuss their connection-level performance. In [19] investigated the throughput conditions for two of the foremost widespread scheduling strategies, RR and PF, to show a better comparison for downlink transmission.

In [20] compared three transmission schedulers like RME method, FME and therefore the Riding Peaks scheme. In this work, such a performance comparison is nevertheless to be created for other important LTE scheduler's uplink. Given the rising range of commitments to each LTE and LTE-A [21], it becomes expensive to more investigation of the necessary schedulers conferred in recent analysis and planned for LTE [7-20] becomes invaluable recognition to rising range of commitments to LTE and LTE Advanced.

In [22] proposed wo Service Specific Queue Sorting Algorithms (SSSA) for Real Time (RT) and Non Real Time (NRT) streaming video traffic, severally. This SSSA is enforced in a QoS aware dynamic Packet Scheduling Architecture (PSA) for LTE-A networks and aims at raising the support of QoS guarantee and maintaining the throughput and user fairness at a decent stage. Multiuser diversity is exploited each within the Time Domain (TD) and Frequency Domain (FD) to attain effective resource utilization. The simulation results show that SSSA has reduces average delay. QoSof various traffic varieties and overall system performance is less.

In [23] an Accommodative Time Domain scheduling Algorithm (ATDSA) proposed for LTE-A down link (DL) transmission. It uses the Hebbian learning method to assign radio resource adaptively to differing types of traffic. It is enhanced QoS provision for various traffic varieties whereas maintaining a sensible trade-off between user fairness and system throughput. But the delay is high.

In [24] proposed an algorithm referred to as Energy-saving based Inter-group Proportional Fair (EIPF) for the LTE downlink multicast services. During this a correct transmission power is calculated initial in line with the on the data rate then IPF rule is followed to apportion the resources among completely different multicast teams. One typical scheduling algorithm for multicast services is Inter-group Proportional Fairness (IPF) however its disadvantage is that during this information is transmitted at a hard and fast rate means that for every Resource Block the scheduler picks one cluster to be regular on that in line with the principle of IPF.

In [25] presented a Packet Prediction Mechanism (PPM) scheduling algorithm and compared it with the other algorithms. Two typical strategies PF and maximum throughput and alternative two real time applications MLWDF and EXP/PF were used for the comparison with the presented algorithm. It performed higher than the standard mechanism but the delay performance has high value.

In [26] introduced greedy–knapsack algorithm to assess user candidates that are looking forward to scheduling and choose an optimum set of the users to maximise system performance, while not exceeding available bandwidth capacity. This algorithm is outlined as an optimum solution to the resource allocation issue, formulated based on the fractional knapsack problem. A class-based ranking function used for obtain throughput and QoS provisioning .It has less QoS performance.

In [27] focused on the resource designing of LTE-Ain downlink. As well as Carrier Aggregation (CA) technology focused. On every occasion CA is being place to use, it is terribly very important to enrich the LTE-A system with a robust and appropriate resource scheduling arrangement. Joint User scheduling (JUS)and Separate Random User scheduling (SRUS)schemes are presented. The SRUS is easier, however less economical, whereas the latter performs optimally at the expense of higher computation complexity. JUS enhancing the system equity and refraining from high complexness of the system, it's suggested that the JUS relies on Earliest deadline first (EDF), to supply QoS guarantees and even-handed distribution of radio resources.

III. PROPOSED METHODOLOGY

In this section, LTE-Advanced scheduling has been discussed. It achieves better resource allocation and quality channel for stationary as well as mobile users.

System model

In this work, an OFDMA system considered with minimum allocation unit as 1 Physical Resource Block (PRB) containing 12 sub-carriers in each TTI. The downlink channel is a fading channel within each scheduling drop. The received symbol$R_{k,m}(t)$ at the mobile user k on sub channel m is the product of actual data and sum of white Gaussian noise and then channel gain is given below,

$$R_{k,m}(t) = CG_{k,m}(t)DS_{k,m} + CZ_{k,m}(t) \qquad (1)$$

Where $CG_{k,m}(t)$ →the complex channel gain of sub channel m for user k, $DS_{k,m}$ →data symbol from eNB to user $k$at sub channel m, $CZ_{k,m}(t)$ →complex White Gaussian Noise [28].

Power allocation for all sub channels calculated as

$$P_m(t) = P/T_m \qquad (2)$$

Where P →total transmit power, $P_m(t)$ →the power allocated at sub channel m, T_m →total number of sub channels.Initialization of every scheduling drop function, the channel state information $CG_{k,m}(t)$is known by the eNodeB. The Channel Capacity (CC) of user k on sub channel m canbe calculated by

$$CC_{k,m}(t) = Blog_2\left(1 + \frac{\left|CG_{k,m}(t)\right|^2}{\sigma^2\Gamma}\right)P_m(t) \qquad (3)$$

Where B → bandwidth of each PRB, σ^2 →the noise power density and$\Gamma \rightarrow -ln\frac{(5BER)}{1.5}$ is the SNR gapdetermined by bit error rate BER.

The main objective of LTE-Advanced scheduling is to supply high quality channel and better resource allocation for mobile phones through exploiting the wireless channel variation. With CA, users will access bandwidth with abundant larger transmission bandwidth up to 100 megahertz with five carrier component in LTE-A release 10, compared with the LTE unleash eight commonplace.

Supported the worth of CQI of each association between the mobile device and therefore the eNodeB, the signal of the channel are often modulated. Also, CQI selects the acceptable antenna module, and measures the moment quality of the channel within the frequency domain. An appropriate block size used to decide, antenna assignment and modulation, the MAC layer of the LTE-Advanced is accountable. Supported the mode of TDD, the scheduling decision is formed when that it is then transferred to PHY layer.

In scheduling, channel quality is incredibly crucial and enode B gets this once it receives feedback of the indicator of channel quality from the user. Scheduler assigns a resource for the users supported the channel quality; QoS desires and fairness. Also, supported the planning results, enodeB can send date and scheduling signal. Then, the users of planning settle for the information within the rbs allocation results, MCS and antenna choose choices within the downlink scheduling signal.

In every transmission time Interval (TTI), Users equipment (UE) measures the Channel Quality Indicator (CQI) supported the SINR and indicates the enodeB regarding the case of the immediate downlink channel. For each user, a buffer is allotted within the enodeB. The packets that get to those buffers are given a timestamp then queued for transmission purpose. For each packet within the queue, Head of Line Delay (HOL) is calculated. If the packet delay in HOL exceeds the limit for flow means, the packet is deleted.

The packet scheduler finds out the particular user means it will allocate resource based on scheduling. The selection of those users is based on priority and it is calculated based on arrival time and queue weight.

Weighted Round Robin scheduling

The WRR is easy round Robin based scheduling rule utilized in packet-switched networks with static weight appointed to connections' queues. In RR, the PRB allotted to every UE in a part is equal. One when another UE with CQI data is inducted within the system. However, CQI isn't a metric that's taken under consideration to possess them inducted for PRB allocation. So, all the users are equally opportune for planning. But, it achieves high latency and low fairness and rate. In WRR, it cycles through queues transmission quantity of packets from every queue as per its weight and CQI so guaranteeing every association a fraction of output link information measure. It conjointly ensures that lower priority queues ne'er starved for very long time for buffer house and output link information measure. it has process complexness of O (1) that build it possible to high speed interfaces in each core and at the sting of network.

WRR scheduling is predicated on distribution fraction weight $\mathrm{Fw_i}$every service queue such total of weight of all service queues is adequate one.

$$\sum_{\mathrm{i=1}}^{\mathrm{N}} \mathrm{Fw_i} = 1 \qquad (4)$$

Since weight is fraction and range of number packets determined to be served from every queue, the fraction weight is increased by correct constant number interface. The product is rounded off to nearest larger integer to obtain integer weight Wei. This integer weight price of every queue specifies number of packets to be maintained from that queue. The whole total of those counter values is stated as round robin length. The number weight of ith queue is

$$\mathrm{w_i} = \lceil \mathrm{Fw_i} * \mathrm{C_i} \rceil \qquad (5)$$

Existing N active connections sum is described as round robin length RR_l and is given by

$$\mathrm{RR_l} = \sum_{\mathrm{i=1}}^{\mathrm{N}} \mathrm{w_i} = \mathrm{C_i} \qquad (6)$$

Considered r is the rate of outgoing link, and the rate offered to i^{th}connection is

$$\mathrm{r_i} = \frac{\mathrm{w_i}}{\mathrm{RR_l}} \mathrm{r} \qquad (7)$$

The effect of increasing number of connections on the data rate is measured. As number of connection N increases, the equality of equ. (4) describes that individual weight of connection $i$decreases and it reducesw_i. As sum of all weight remains constant, C_i remains unchangedand hence as per equ.(7) rate of that connection decreases.

In this analysis, the latency θ_{i} of any connection i defined in [29] and is adopted. In standard scheduling algorithm, the parameters like allocated rates, transmission rate of output link and number of connections may influence latency. Here, worse-case latency determined for connection i for conventional WRR scheduler. There is N connection queues being backlogged assumed and scheduler is presently serving w_i^{th}packet from i^{th} connection. While cycle length is W, around could be $W - w_i$ packets to be provided from other N-1 queues before $(w_i + 1)^{th}$ packet fromconnection queue i is served. So, worst-case latency for i^{th} connection isgiven as

$$\theta_{\mathrm{i,WRR}} = (\mathrm{W} - \mathrm{w_i}) \; = \mathrm{W}(1 - \phi_{\mathrm{i}}) \frac{\mathrm{L_i}}{\mathrm{r}} \qquad (8)$$

WhereL_i → is the maximum length of packet and it belongs to i^{th} connection. If worst-case latency increases meansFw_idecreases with increase in number of connections. Therefore, it has inefficient latency tuning characteristics. Total latency computed by a packet, queuing latency is added to equ (8).

The proportional fairness $\eta_{PF} = 1$since a connection$i(j)$ can establish the other connection $j(i)$ at $w_i(w_j)$ packets. Worst case Fair Index (WFI) is used to measure worst-case fairness referred in [30] to characterize fair queuing servers. A server is said to guarantee a WFI ofWc_i for connection i, if delay of a packet arriving at t is means it is bounded

$$\mathrm{d_i} < \mathrm{a_i} + \frac{\mathrm{Q_i(t)}}{\mathrm{r_i}} + \mathrm{Wc_i} \qquad (9)$$

Where$Q_i(t)$ → queue size of connection i at the packet arrival time ,Wc_i → worst casefair index for connection i. Considered connection $i$for a new packet arrives at time t when the serverhas just crossed i, and presume the backlog of connection i at time ti.e$Q_i(t)$ multipleof w_i. Next, this packet departs after a maximum of time of$\left[\frac{Q_i(t)}{r_i} + (C_i + w_i + 1)\frac{L_i}{r}\right]$. Thus WFI of WRR scheduler is given by

$$\mathrm{Wc}_{i,WRR} = \mathrm{d_i} - \mathrm{a_i} - \frac{\mathrm{Q_i(t)}}{\mathrm{r_i}} \qquad (10)$$
$$= (\mathrm{C_i} - \mathrm{w_i} + 1)\frac{\mathrm{L_i}}{\mathrm{r}}$$

As the number of connections increases, on scheduler degrades WFI.

Shortest Job First Scheduling Algorithm

SJF is a scheduling technique with the intention of selects the job with the smallest execution time. SJF is used in packet-switched networks. The jobs are queued with the smallest transmission time placed first and the job with the longest transmission time placed last and given the lowest priority. In this work, this algorithm is allocated packet to the process with least transmission time i.e. Burst Time (BT).The SJF algorithm is given below

Algorithm 1: Shortest Job First Scheduling

```
 for i = 0 to i < main queue-size
if task i+1 BT< task iBT then
add task i+1 in front of taski  in the queue
```

```
end if
if main queue-size = 0 then
task ilast in the mainqueue
end if
end for
```

Best CQI Technique

Best CQI scheduling may be an additional increased technique for increasing system capability of 4G LTE system. Signal to Noise magnitude relation (SNR) takes under consideration CQI data from UEs. On the bottom of CQI, PRB is appointed to UE. eNB should have CQI for liquid ecstasy SINR implementation. Smart data rate guarantees higher CQI that successively gets priority for a collection of UEs. GBR is ensured with high QoS during this form of planning [31]. In this scheduling, the UEs that are removed from eNB and can't be bonded QoS don't seem to be inducted to scheduling.

Hybrid WRR with SJF

In this proposed algorithm, Weighted Round Robin with shortest Job first scheduling is proposed and it follows:

i. Allocate PRB allocated to each UE in WRR fashion, according to given queue weight.

ii. After completion of step 1 process are arranged in ascending order or the remaining burst time in the ready queue. New priorities are assigned according to the remaining burst time of processes; the process with shortest remaining burst time is assigned with highest priority. The processes are executed according to the new priorities based on the remaining bursts time. The pseudo code of the proposed algorithm 2 is shown below

Algorithm 2: proposed *Hybrid WRR with SJF*

```
1. Initially, all the processes present in ready queue are process in a WRR fashion.
Count → counter set // counter defined queue weight value
2. Do {
if (Time Quantum (TQ) >= Min Burst Time (BT)) then // TQ = Time Quantum = Square root of (mean*Highest Burst)
BT → TQ
Counter ++}
While (Ready queue! =NULL)
3. Assign TQ to (1 to n ) process
For (1 to n) {
        $P_n = BT_n - TQ_n$
$TQ_n \rightarrow P_n$ }
4. Calculate the remaining burst time of the processes
if (new process is arrived and BT! = 0)
Go to Step 1
Else
Go to Step 2
Else
Go To Step 5
End if
End if
 End For
End Do While
5. Calculate ATT, AWT and CS //ATT = Average Turnaround Time, AWT = Average Waiting Time, CS = No. of Context Switches
6. End
```

In this proposed system, to align the incoming signal the digital dividend is used and it removes white spaces. The whitespace is the result of releasing of frequency band, resulting from the analog-to-digital TV switchover, referred as Digital Dividend (DD) in literature. The Digital TV (DTV) band is example of incompetent spectrum use since, depending on the geographical location, certain channels only occupied.

IV. RESULTS AND DISCUSSION

In this the section, proposed method is evaluated using MATLAB. The proposed HWRR-SJF scheduling algorithm in LTE-A is compared with existing Round Robin (RR) in LTE-A and LTE [18].The input data signal processed in LTE-A shown in fig 1. And step by step by process of input data signal processing are shown from fig2 to fig 4. And the scheduling processing time is shown in table 1.

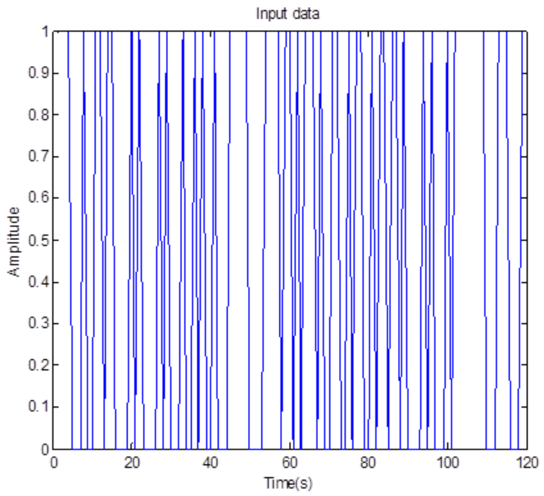

Fig 1: input data signal

Fig 1 shows MATLAB simulation of input data. It defines how the input data signal is processed with regarding time vs. Amplitude.

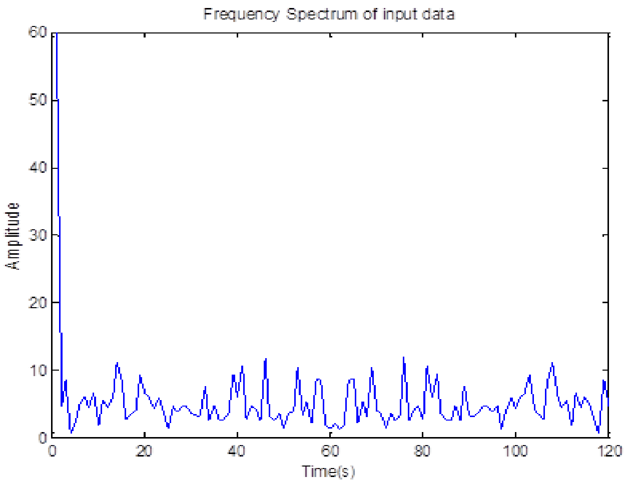

Fig 2: frequency spectrum of input data

Fig 2 shows the simulation of frequency spectrum of input data. It shows the frequency allocation with based on time and amplitude.

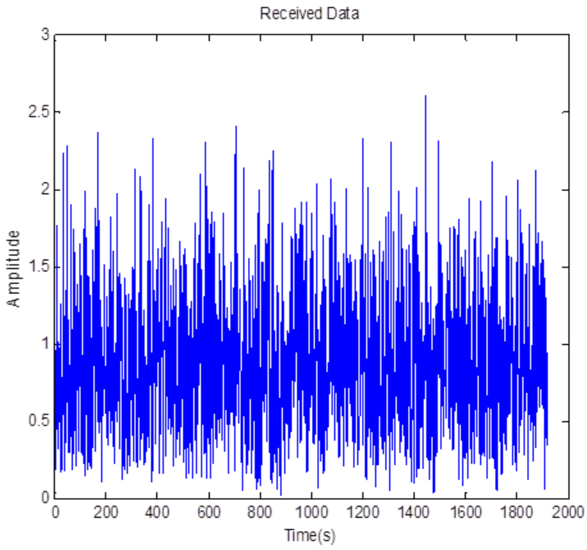

Fig 3: received data

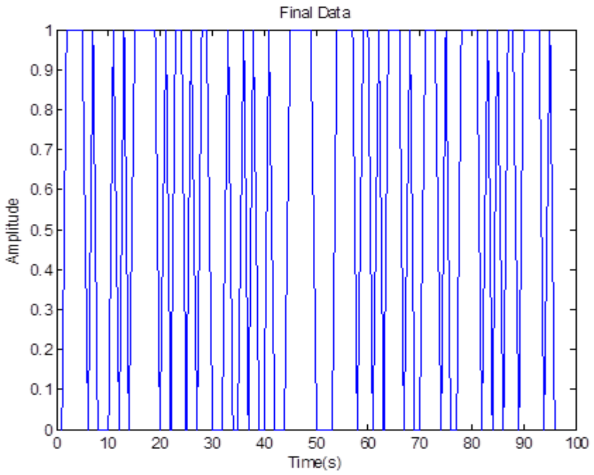

Fig 4: final data

Fig 3 shows the simulation of received input data. After the frequency allocation or spectrum allocation completed, signal process out data is received for further processing and it is denoted as received date. Fig 4 shows the simulation of final input data. After reduction of error data is defined as the final data and it further processed for scheduling.

Table 1: proposed scheduling time

Process	Burst time	Waiting time	Turnaround time
P2	2	7.000000e+00	9.000000e+00
P3	4	9.000000e+00	1.300000e+01
P4	5	1.300000e+01	1.800000e+01
P5	3	1.800000e+01	2.100000e+01
P6	1	2.100000e+01	2.200000e+01
average waiting time		13.600000	
average turnaround time		16.600000	

Performance evaluation

The comparison has been divided on thebasis of some performance parameters of each algorithm such as the packet loss, throughput, packet delay, spectral efficiency, and fairness.

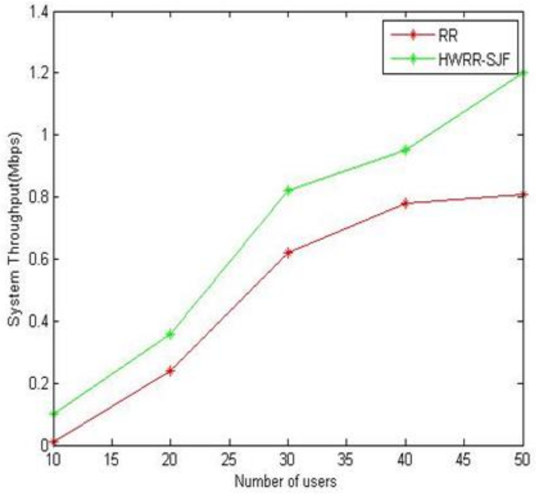

Fig 5: System Throughput vs. Number of Users

Fig 5 shows the system throughput with increasing number of users. It is observed that the throughput reduced when increasing number of users and it is demonstrated within the fig 6that the HWRR-SJF is having the best throughput performance compared than RR. In HWRR-SJF, while in high level it assessed the amount of data that transmitted in a single time frame and it supports to degrade the PLR and the effect hence is resulted in system throughput gain.

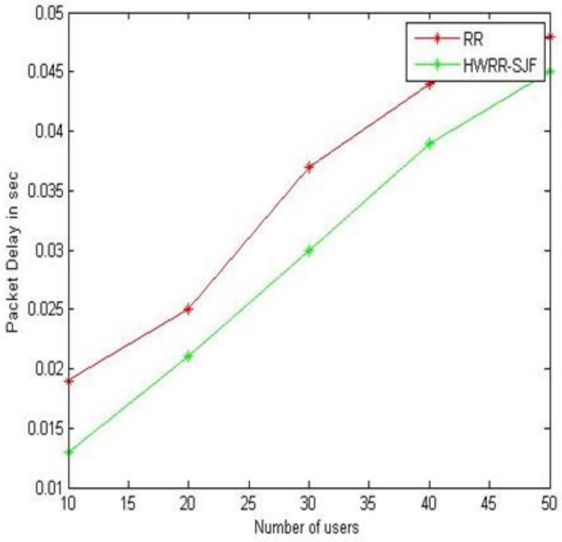

Fig 6: Delay vs. Number of Users

Fig 6 shows the packet delay performance of proposed and existing scheme. It shows that, the HWRR-SJF scheme is having better performance than RR scheme. In both schemes, if number of user's increases means the delay also increase. Hence it can be conclude from the result that, HWRR-SJF supports best in terms of packet delay over LTE-A networks performance.

Fig 7 shows the Packet Loss Ratio (PLR) performance for proposed and existing schemes. The fig shows the impacts of PLR variation, while the number of users is increasing. The RR has the highest PLR with higher number of users. The proposed HWRR-SJF scheme has less PLR compared than RR.

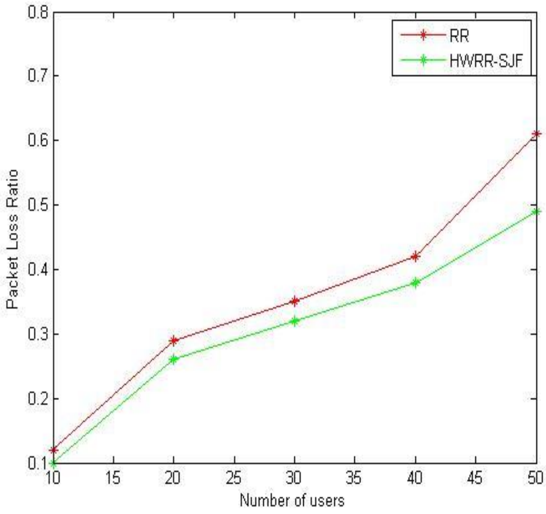

Fig 7: Packet Loss Ratio vs. Number of Users

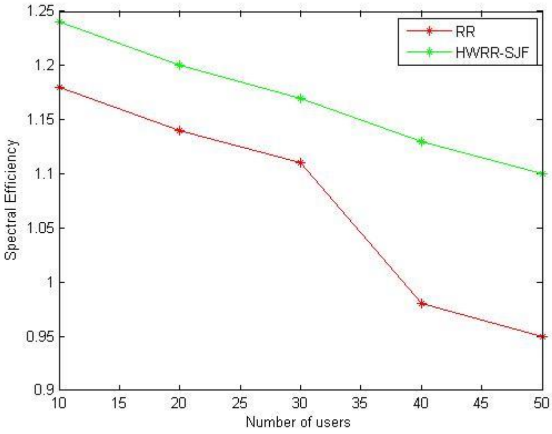

Fig 8: Spectral efficiency vs. Number of Users

Fig 8 shows Spectral efficiency to be accomplished the successful usage of radio resources. Fig 8 shows the performance in terms of spectral efficiency for both proposed and existing schemes. The HWRR-SJF approach achieves the highest Spectral efficiency with varying number of users. When compared with RR scheme, the proposed scheme achieves better spectral efficiency.

Fig 9 shows the fairness performance of proposed and existing packet scheduling algorithm. Due to the higher network load with increasing number of UEs, the fairness decreases. As the HWRR-SJF algorithm provides a good transaction between fairness and system throughput when compared to RR.

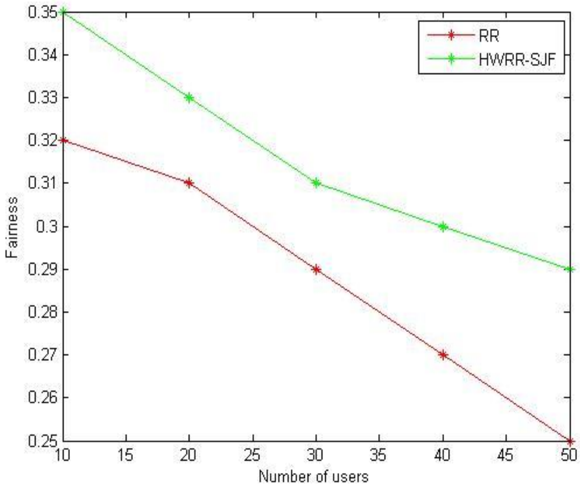

Fig 9: Fairness vs. Number of Users

V. CONCLUSION

In this paper, a Hybrid Weighted Round Robin with Shortest Job First packet scheduling algorithm is proposed to allocate resource for the downlink system with deadline properties on LTE-Advanced networks. This proposed system was analysed with performance matrices like packet loss, fairness, packet delay, system throughput and spectral efficiency over stationary and mobile users in LTE-A system. The proposed HWRR-SJF was compared against the existing scheduling algorithms. Through these measures values, the proposed allocation scheme that has improved performance with respect to throughput and spectral efficiency and has less packet loss rate and delay, achieved by using the deadline properties. Regarding the HWRR-SJF throughput, the gains made by the proposed scheduler and it don’t have any side effects on the fairness. The proposed scheme achieved high performance in its execution, as a result making it feasible for CA implementation in LTE-A networks. In future, the proposed idea can be extended to analyse how broadcasting can be made over long distances for Wimax handoff with WLAN. And also focused how to applied security mechanism in the handoff between Wimax and WLAN.

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