QUALITY OF SERVICE PARAMETER CENTRIC RESOURCE ALLOCATION FOR LTE-ADVANCED

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Abstract
Efficient radio resource allocation algorithm is proposed in this paper. Proportional fair algorithm gives favorable performance compared to two classical algorithms max-C/I and RR. But PF algorithm does not consider QoS parameters while allocating resources to the users. Moreover with less transmission power utilization Fairness disappears in PF algorithm. A PF<sub>QoS-Centric</sub> is proposed in this paper. PF<sub>QoS-Centric</sub> gives better performance. In this proposed algorithm Data rate fairness and Allocation Fairness increase with increase in time jitter threshold values or increase in number of active users increases. Thus Data rate fairness and Allocation fairness is becoming more as compared to that of proportional algorithm. Here Throughput is also maintained during increase in fairness. QoS parameters like Data rate Fairness, Allocation Fairness Delay is most important for next generation of mobile communication. Propose Algorithm (PF<sub>QoS-Centric</sub>) gives guarantee to satisfy the QoS parameters.

Keywords: Quality of Service (QoS), Packet scheduling, Proportional fair (PF), Radio resource allocation (RRA), Data rate Fairness, Allocation Fairness, Long term evolution-advanced (LTE-A).

1. INTRODUCTION
The integration of wireless and internet communications and rapid development of next generation of mobile communications is expected to support the outburst of high-speed packet based application. These applications have large variety of QoS requirements. Radio resource Allocation faces challenges when come across such large variety of QoS requirements. This is because of Limited radio resources, rapidly changing wireless channel condition and ever increasing number of mobile users [1].

In this paper the QoS parameter is taken into consideration for the purpose of PF scheduling. This includes the required scheduling activity for a user to fulfill the QoS requirements. In this paper the scheduling for non-QoS users is also taken into consideration. Instead of selecting users based on the ratio of future data-rate to past achieved data-rate, here it is taken as the ratio of the minimum required data-rate to instantaneous throughput for that scheduling interval. For feasible load case it is satisfying the minimum required data-rate to the users demanding QoS services then providing access to users requiring non-QoS services, and for congested case it’s maintaining the fairness to all users demanding QoS service with same relative degradation for all active users [2].

In this paper, it tries to maintain the QoS in terms of maximum tolerable latency. In this case the HoL delay is taken into consideration to take care of latency. And also buffer value is taken in to consideration, so that there should not be any loss of data for a user due to buffer overflow [3].

Fig -1(a): scheduling behaviors for two users with different average channel quality for max C/I. [5]

Allocating resources to the users with instantaneously best radio link conditions is known as MAX-C/I scheduling. The data-rate fairness disappears. Allocation of the resources among the existing active users in a manner, such that all the users will get access to equal amount of resources over certain duration of time The requirement of the user is not taken into consideration.
2. PACKET SCHEDULING

In fig 2 a block diagram of packet scheduling is shown.

2.1 Scheduler

Here in the first stage the scheduler selects the schedulable users. The rest user will be inactive. This function is known as Schedulability check.

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Max_{LP} = \max \left( 1 - \frac{E(n)}{PR(n)} \right) 
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(1)

The users with jitter value more than threshold value are in class-2. Priority equation is

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Max_{HP} = \max (Max_{LP}) + \max \left( 1 - \frac{E(n)}{PR(n)} \right) 
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(2)

Here, Max_{HP} is the priority metric of higher priority users (the users of class-2), Max_{LP} is the priority metric of lower priority users (the users in class-1). E(n) is the expected bit rate of user 'n' and PR(n) is the achieved past average bit rate over a certain time period.

2.2 QoS Time Domain Scheduler

The time domain scheduler provides needed QoS, with regards of time jitter for packet delivery to the user. The users are splits into two classes according to delay is experienced by user. The users with time jitter value below the threshold time are grouped to into class-1 and a prioritization is calculated according to formula given below.

But among three Max-C/I and RR does not give optimum performances for throughput as well as QoS parameters. Moreover PF also gives poor performance compared to RR algorithms for Allocation Fairness.

In this paper problem formulation is to increase allocation fairness as well as data rate fairness and maintain other parameters. As the Fairness is one of the most important parameter among QOS parameters. Here we also study performance as the number of user increases.

The rest of paper is formed as follows. Section –II represents an idea about packet scheduler, section –III represents simulation algorithm and environment, section –IV represents simulation result and analysis, and section-V represents final conclusion.
3. SIMULATION ALGORITHM & ENVIRONMENT

Simulation algorithm and simulation environment are as follows.

**PFQoS-Centric Algorithm**

1. Initialization: \( N = \text{Number of users} \)
2. If UE delay< Delay threshold
   - Calculate Priority according to equation (1)
   Else
   - Calculate Priority according to equation (2)
3. Sort all the users according to their priority value in decreasing order.
4. Select first \( N_{\text{mux}} \) users according to the priority value who can be provided some data rate at particular time instance.
5. Select resource block of Maximum gain for particular user thus user throughput can be maximized and set allocation flag of that particular PRB to 1.
6. Repeat for \( N_{\text{mux}} \) users.
7. If some resource blocks are not allocated and sorted users do not have good channel condition then consider rest of the users for resource allocation.

The Simulation parameters are set according to the values specified by 3GPP-LTE [6]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier Frequency</td>
<td>2GHz</td>
</tr>
<tr>
<td>Delay Spread</td>
<td>0.001ms</td>
</tr>
<tr>
<td>LA per frame</td>
<td>1</td>
</tr>
<tr>
<td>Sub-frame duration</td>
<td>1ms</td>
</tr>
<tr>
<td>OFDM symbols per sub-frame</td>
<td>14</td>
</tr>
<tr>
<td>BW</td>
<td>5MHz</td>
</tr>
<tr>
<td>FFT size</td>
<td>512</td>
</tr>
<tr>
<td>MIMO</td>
<td>1X1</td>
</tr>
<tr>
<td>Target FER</td>
<td>0.1</td>
</tr>
<tr>
<td>Sub-frame duration</td>
<td>1ms</td>
</tr>
<tr>
<td>Inter Site Distance</td>
<td>1732mtrs</td>
</tr>
<tr>
<td>Number of active users</td>
<td>30 &amp; 40</td>
</tr>
<tr>
<td>Mobility of the users</td>
<td>30kmph</td>
</tr>
<tr>
<td>Per user file size</td>
<td>2Mb</td>
</tr>
<tr>
<td>( N_{\text{mux}} )</td>
<td>10</td>
</tr>
<tr>
<td>Delay Threshold</td>
<td>5ms</td>
</tr>
</tbody>
</table>

4. SIMULATION RESULT AND ANALYSIS

In this paper, Outputs are compared for Classical PF and Proposed PFQoS-Centric Outputs also compared for Number of active users like 30 & 40. The other parameters consider for proposed algorithm are 5ms Delay, 1 X 1 MIMO, 1732mtrs Inter site distance, 2Mb Per user file size, 5MHz Band Width, 2 GHz Carrier Frequency, 14 OFDM symbols per sub-frame, 512 FFT size, 0.1, 1ms Sub frame duration, Target FER, 0.001ms Delay Spread, 30kmph Mobility of users, 10 \( N_{\text{mux}} \). Data Rate Fairness for Proposed algorithm is shown in fig-3. This new algorithm is still able to provide reciprocal data-rate fairness, among users, of about more than 80% with increase in time. This little fall in fairness is because of consideration of time jitter while scheduling. Though there is a drop in data rate fairness in case of new proposed scheme, this drop is not significant.

Allocation Fairness is shown in fig.4. The figure says that, in case of proportional fair, with increase in number of active users in the system the allocation fairness decreases. But in case of proposed scheme with increase in number of users in system the fairness in allocation is increasing. It is also clear from the figure that with increase in number of users in the system the allocation fairness is becoming more as compared that of proportional fair algorithm.
5. CONCLUSIONS

Here we proposed such an algorithm which provides data rate allocation is more with increase in time. Proposed algorithm also gives better performance compared to proportional fair algorithm as increase in the number of users. Now a day QoS parameters are extremely important for next generation mobile communication. In this paper, QoS parameters are guaranteeing by the proposed algorithm (PFQoS-Centric)

REFERENCES


BIOGRAPHIES

Nilam Dhameliya has completed her graduate in Electronics and Communication engineering from L D College of Engineering, Ahmedabad. At present, she is pursuing her M.Tech in area of Digital Communications from College of Science and Technology, Bhopal. Her research area includes OFDM and LTE.

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