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A New Scheduling Algorithm for Real-Time Communication in LTE Networks

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ABSTRACT: In recent times, the demand for high data rates is ever increasing in any wireless network environment. Long Term Evolution-Advanced (LTE-A) is the latest 4G technology which is developed based on 3GPP specifications. Our main objective in this proposed research wok is to analyze the various packet scheduling algorithms for downlink real time data and present their scheduling metrics. A principle component in the LTE activity handling is the bundle scheduler which is responsible for allotting radio assets to User Equipment (UE) base on planning plans required in the LTE base station. The fundamental part of this work is to offer another booking calculation for Long Term Evolution (LTE) framework. The arranged scheduler fulfills the nature of administration (QoS) prerequisites of the continuous activity. Recreation comes about demonstrates that the proposed scheduler can modernize the execution on the utilized measurements among administrations. The execution assessment is looked at regarding responsible for allotting radio assets to User Equipment (UE) base (PLR), basic throughput and cell spectral proficiency.

KEYWORDS: LTE; QoS; scheduling algorithms; Allocation radio resources; Real-time traffic.

I. INTRODUCTION

The requirements for 4G systems as specified by 3rd Generation Partnership Project (3GPP), a part of International Mobile Telecommunications-Advanced (IMT-A), is 1 Gbps downlink peak data rate and 500 Mbps uplink peak data rate1. Orthogonal Frequency Division Multiple Access (OFDMA), Carrier Aggregation (CA), Multi Input and Multi Output (MIMO), Coordinated Multi-Point transmission (CoMP) techniques, Relaying and Heterogeneous Networks (HetNets) deployments are some of the key technologies standardized for fulfilling IMT-A targets1. In recent years, there has been an increasing demand for multimedia services over the mobile devices. To address this, the wireless telecommunication industry defined a new air interface for mobile communication that offers a framework for high mobility broadband services and enhances in the overall system capacity. LTE system exposes a very stimulating multiuser communication problem: Many User Equipments (UEs) in the same cell require high on-demand data rates in a limited bandwidth with low latency. Multiple access techniques permit UEs to allocate the available bandwidth by the assignment of each UE some fraction of the limited radio resources. One of these multiple access techniques is Orthogonal Frequency Division Multiple Access (OFDMA) which is adopted by 3GPP release 8 thanks to its suppleness for accommodating many UEs with broadly varying applications data rates and QoS exigency. Although the LTE specs represent both Frequency Division Duplexing (FDD) and Time Division Duplexing (TDD) to separate uplink and downlink transmission,market preferences impose that several deployed systems will be FDD. There are three main challenges in wireless communication that need to be met so as to enable access to information and data sharing anywhere and anytime, by anyone and anything. These are:

1. Massive growth in the number of connected devices.
2. Mammoth growth in traffic volume.

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3. An ever increasing range of wide applications with varying requirements and characteristics.

Motivation

1. There is a major motivation beyond the scheduling and resource allocation of limited resources to improve system performance by enhancing the spectral efficiency of the wireless interface and improving the system capacity.
2. To demonstrate the requirement for algorithms of scheduling and radio resource allocation in LTE Networks.
3. Scheduling is a key Radio Resource Management (RRM) mechanism for achieving QoS requirements and enhancing system performance of LTE networks
4. In order to be able to meet the QoS demands for real time communication various packet scheduling algorithms have been used to allocate limited frequency and time sources for all data transfer devices
5. including mobile and wireless networks

Objective and goal

1. Goal- Increase throughput and reduce PLR(Packet Loss Ratio)
2. Objectives - Implement the effective Scheduling Algorithm For LTE Network.
3. In recent times, the demand for high data rates is ever increasing in any wireless network environment. Long Term Evolution-Advanced (LTE-A) is the latest 4G technology which is developed based on 3GPP specifications. Our main objective in this proposed research wok is to analyze the various packet scheduling algorithms for downlink real time data and present their scheduling metrics.

II. LITERATURE SURVEY

1. COMPARATIVE ANALYSIS OF DOWNLINK PACKET SCHEDULING ALGORITHMS IN 3GPP LTE NETWORKS, Farhana Afroz1, Roshanak Heidery, Maruf Shehab, Kumbesan Sandrasegaran and Sharmin Sultana Shompa

Long Term Evolution (LTE) mobile network aim to bolster fast system benefits even in highmobility situations. To accomplish this objective, LTE receives some propelled highlights in Radio Resource Management (RRM) techniques. Among them, LTE parcel booking assumes a principal part in expanding framework execution. In this paper, a similar examination on the exhibitions of Proportional Fair (PF), Exponential/Proportional Fair (EXP/PF), Exponential (EXP) Rule, Maximum-Largest Weighted Delay First (M-LWDF), Logarithmic (LOG) Rule and Frame Level Scheduler (FLS) LTE downlink parcel planning calculations is accounted for. Execution is assessed in single cell with obstruction condition while expanding client number and client speed.

2. Bandwidth Allocation Scheduling Algorithms for IEEE 802.16 WiMax Protocol to Improve QoS: A Survey, Avinash Kaur

In recent times, wireless network is widely got to innovation to associate remote client terminal with its essential system. QoS is the indispensable parameter that can be dealt with admirably when information is exchanged between terminal clients and system heads. In WiMax, QoS is resolved precisely at MAC layer however data transfer capacity portion booking calculation which characterizes QoS is not unmistakably characterized in IEEE 802.16 system design. This paper assesses and think about different existing calculations and illuminate distinctive issues in outlining of these calculations, besides another data transfer capacity distribution planning calculation is proposed for IEEE 802.16 WiMax convention keeping in mind the end goal to enhance Quality of Service (QoS).

3. A Survey on Analysis and Design of Scheduling Algorithm for LTE-Advanced Heterogeneous Networks, Ammar Hafeez, Mohammad Masoom Zafar, Sir Ahmad Mudassir

Long Term Evolution Advanced (LTE-Advanced) is the one of the fastest growing technologies. As it is new formof Long Term Evolution (LTE) networks. It gives its endorsers enhanced administration abilities and enhanced system execution and this is helped through the savvy sending of new methods and advancements. In 3G LTE the transmission

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of information is conveyed as parcels and through the savvy choice of the clients. Long haul Evolution (LTE) bolster traffics like video conferencing, voice over IP (VoIP), video gushing, document exchange and furthermore the web perusing. Shrewd parcel planning calculations are in charge of picking fine time and recurrence determination and they assume the principle part in LTE systems. Some essentially known components of LTE-Advanced are upgrade in heterogeneous systems, transporter accumulation, multipoint transmission and gathering, utilization of transfer hubs in the remote system and propelled various data sources and different yield use. LTE-Advanced is for improvement of the radio get to some portion of cell systems. In this paper, we think about some bundle planning calculations for LTE downlink instrument.

4. **Radio Resource Scheduling in 3GPP LTE: A Review, Davinder Singh, Preeti Singh**

Long Term Evolution (LTE),proposed by 3rdGeneration Partnership Project (3GPP) as a 3.9G technology,speaks to an exceptionally encouraging response to the continually rising data transmission request of portable applications. To bolster immeasurable scope of sight and sound and web administrations at high information rates that too with expanded ghostly productivity; LTE fuses different Radio Resource Management (RRM) systems. The way to accomplish ideal execution of base station is progressively planning constrained assets like power and data transmission to offer the best administration for terminals with the most minimal cost. In this specific situation, radio Resource designation systems assume a key part in disseminating radio assets among various stations by thinking about the channel conditions and QoS necessities. The present paper gives audit of radio asset designation methodologies show in the writing.

5. **WE-MQS: A new LTE Downlink Scheduling Scheme for Voice Services based on User Perception, Hang Nguyen**

The Long Term Evolution (LTE) is a high data rates and fully All-IP network. Scheduling and resource allocation are very important tasks in LTE network. So that, the improvement of the constant administrations transmission is exceptionally basic. Be that as it may, there are many difficulties while conveying the live sight and sound administrations, for example, VoIP, Video, and so on. This paper proposes another booking plan which in view of the Wideband (WB) E-model, Channel-and QoS-Aware (known as WE-MQS scheduler) for voice movement in LTE downlink bearing. The voice movement stream is exceptionally touchy to network weaknesses, for example, delay, bundle misfortune, jitter, and so forth. The proposed planning plan depends on the expansion of the WB E-show and the thought of Maximum Queue Size (MQS) as an element for the metric. Since this planning plan considers Mean Opinion Score (MOS) values, consequently, it gets higher client recognition.

6. **A Review of Downlink Packet Scheduling Algorithms for Real Time Traffic in LTE-Advanced Networks,S. Radhakrishnan1, S. Neduncheliyan and K. K. Thyagharajan**

The requirements for 4G systems as specified by 3rd Generation Partnership Project (3GPP), a part of International Mobile Telecommunications-Advanced (IMT-A), is 1 Gbps downlink peak data rate and 500 Mbps uplink peak data rate1. Orthogonal Frequency Division Multiple Access (OFDMA), Carrier Aggregation (CA), Multi Input and Multi Output (MIMO), Coordinated Multi-Point transmission (CoMP) techniques, Relaying and Heterogeneous Networks (HetNets) deployments are some of the key technologies standardized for fulfilling IMT-A targets

7. **Radio Resource Scheduling in 3GPP LTE: A Review Davinder Singh1, Preeti Singh**

Long Term Evolution (LTE) ,proposed by 3rdGeneration Partnership Project (3GPP) as a 3.9G technology,represents a very promising answer to the ever rising bandwidthdemand of mobile applications. To support vast range ofmultimedia and internet services at high data rates that too withincreased spectral efficiency; LTE incorporates various RadioResource Management (RRM) procedures. The key to achieveoptimal performance of base station is dynamically schedulinglimited resources like power and bandwidth to offer the bestservice for terminals with the lowest cost. In this context, radioResource allocation strategies play a key role in distributingradio resources among different stations by taking intoconsideration the channel conditions as well as QoSrequirements. The present paper provides review of radioresource allocation strategies present in the literature.

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8. **A Survey on Analysis and Design of Scheduling Algorithm for LTE-Advanced Heterogeneous Networks, Ammar Hafeez**

Long Term Evolution Advanced (LTE-Advanced) is the one of the fastest growing technologies. As it is new formof Long Term Evolution (LTE) networks. It provides its subscribers with improved service capabilities and improved networkperformance and this is carried through the intelligent deployment of new techniques and technologies. In 3G LTE thetransmission of data is carried in the form of packets and through the smart selection of the users. Long Term Evolution (LTE)support traffics like video conferencing, voice over IP (VoIP), video streaming, file transfer and also the web browsing. Smartpacket scheduling algorithms are responsible for choosing fine time and frequency resolution and they play the main role inLTE networks. Some significantly known features of LTE-Advanced are enhancement in heterogeneous networks, carrieraggregation, multipoint transmission and reception, use of relay nodes in the wireless network and advanced multiple inputsand multiple output usage. LTE-Advanced is for enhancement of the radio access part of cellular networks. In this paper, wecompare some packet scheduling algorithms for LTE downlink mechanism.

9. **WE-MQS: A new LTE Downlink Scheduling Scheme for Voice Services based on User PerceptionDuy-Huy Nguyen**

The Long Term Evolution (LTE) is a high data rates and fully All-IP network. Scheduling and resource allocation are very important tasks in LTE network. So that, the optimization of the real-time services transmission is very essential. However, there are many challenges when deploying the live multimedia services such as VoIP, Video, etc. This paper proposes a new scheduling scheme which based on the Wideband (WB) E-model, Channel- and QoS-Aware (known as WE-MQS scheduler) for voice traffic in LTE downlink direction. The voice traffic flow is very sensitive to network impairments such as delay, packet loss, jitter, etc. The proposed scheduling scheme is based on the extension of the WB E-model and the consideration of Maximum Queue Size (MQS) as a factor for the metric. Since this scheduling scheme considers Mean Opinion Score (MOS) values, thus, it gets higher user perception. The simulation results show that the proposed scheme has the performance which not only satisfies QoS requirements of voice services but also outperforms well-known schedulers such as Frame Level Scheduler (FLS), Modified Largest Weighted Delay First (M-LWDF) and Exponential/Proportional Fair (EXP/PF) schedulers in terms of delay for all the number of user (NU) and Packet Loss Rate (PLR) when the NU is more than 47. For the cell throughput, Fairness Index (FI), and Spectral Efficiency, the proposed scheduler is always in the middle of the remaining schedulers.

10. **PERFORMANCE COMPARISON OF PACKET SCHEDULING ALGORITHMS FOR VIDEO TRAFFIC IN LTE CELLULAR NETWORK BiswapratapsinghSahoo**

In this paper we have studied downlink packet scheduling algorithms proposed for LTE cellular networks.The study emphasize on three most promising scheduling algorithms such as: FLS, EXP rule and LOG rule.The performance of these three algorithms is conducted over video traffic in a vehicular environment usingLTE-Sim simulator. The simulation was setup with varying number of users from 10 - 60 in fixed boundedregions of 1 km radius. The main goal this study is to provide results that will help in the design process ofpacket scheduler for LTE cellular networks, aiming to get better overall performance users. Simulationresults show that, the FLS scheme outperforms in terms of average system throughput, average packetdelay, PLR; and with a satisfactory level of fairness index.

III. SOFTWARE REQUIREMENT SPECIFICATION

User Classes and Characteristics

To design products that satisfy their target users, a deeper understanding is needed of their user characteristics and product properties in development related to unexpected problems that the user's faces every now and then while developing a project. The study will lead to an interaction model that provides an overview of the interaction between user characters and the classes. It discovers both positive and negative patterns in text documents as higher level features and deploys them over low-level features (terms).

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In proposed work is designed to implement above software requirement. To implement this design following software requirements are used. Operating system: Windows XP/7.

1. Coding Language : JAVA/J2EE
2. Tool : Eclipse Luna

IV. IMPLEMENTATION STATUS

This paper gives a new scheduling algorithm for downlink direction in LTE system. The simulation results were implemented using the open source LTE system simulator called long term evolution-SIM (LTE-SIM). The whole process can be divided into a sequence of the scheduler which calculates a metric for each stream that can be allocated. We assume that the metric attributed to stream i on j-th sub-channel is noted by wi,j. In particular, at each TTI, the estimate Riis given by:

$$\bar{R}_i(k) = 0.8\bar{R}_i(k-1) + 0.2\bar{r}_i(k) \qquad (1)$$

Where ri(k) is the rate allocated to i-th flow during the k-th TTI and Ri(k − 1) is the average transmission data rate estimating at the (k-1)-th TTI.

A. Proportional Fair (PF) Scheduler

The PF scheduling algorithm provides a good trade-off between system throughput and fairness by selecting the user. PF is a very suitable scheduling option for non-real time traffic.

B. Modified Largest Weighted Delay First (M-LWDF) Scheduler

M-LWDF is an algorithm selected to support mixed real time data users in CDMA-HDR systems

C. VT-M-LWDF Scheduler

The main goal of the virtual token scheme (VT-M-LWDF) given in is to ameliorate the QoS performance metrics for real time communication, like video and VoIP, and to conserve minimum throughput for non-real times communication. Then, we use the M-LWDF scheduler with DHOL,ibeing changed by Qi. The following equation give the metric used to represent the VT-M-LWDF scheduler:

$$w_{i,j} = \alpha_i Q_i \frac{r_{i,j}}{\bar{R}_i} \qquad (5)$$

D. Queue-HOL-MLWDF Scheduler

The main goal of the virtual token scheme (Queue-HOLMLWDF) presented in is to enhance the QoS performance metrics. This scheduler adopts the consideration of the queue size and the packets delay parameters in the VT-M-LWDF and M-LWDF rules respectively, in order to measure the performance of the new scheduler when serving real times communication compared to the others schedulers.

E. Proposed Scheduler

The following Figure 1 depicts the overall Radio Resource Management (RRM) process that interacts with the downlink packet scheduler. The whole process can be divided into a sequence of operations that are repeated, in general, every Transmission Time Interval (TTI).

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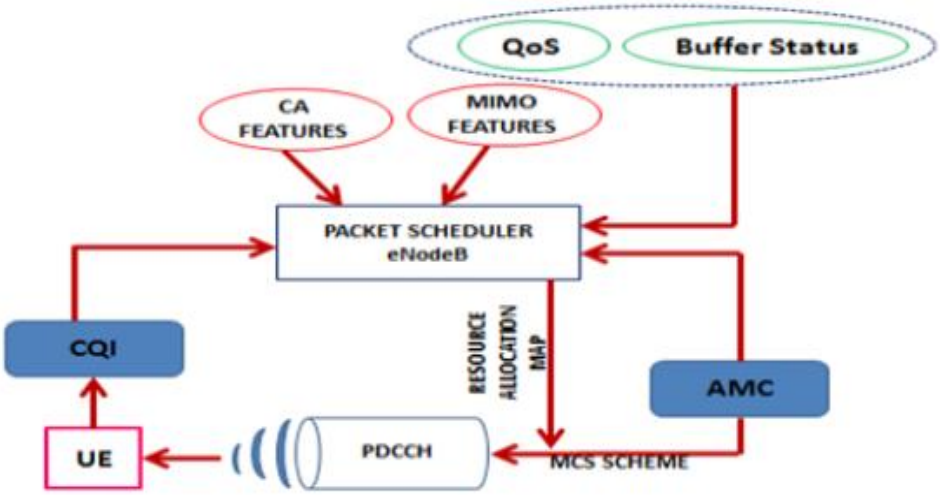

Figure 3.Basic model of a packet scheduler3.

Considering the characteristics of real-time traffic, especially in regard to the delay requirements, a scheduling process should consider various factors. First, we must assure that packets are received within a time limit, preventing them from being discarded by the expiration of this deadline. Thus, the scheduler assigns a deadline for each ow that has a packet queued at the eNodeB. The deadlines are computed taking into account the following parameters: the maximum delay for the class of ow τi, the waiting time of the ow in the queue DHOL,i and the queue size Qi. The proposed scheduler adopts the consideration of theirparameters in order to evaluate the performance of the proposed scheduler when serving RT traffic compared to the others schedulers.

Advantages

1. The presented review will help the researchers and academicians to develop more efficient scheduling schemes for real time applications for smart phone users with better quality of experience and efficient radio resource management.

V. COMPARISON BETWEEN EXISTING SYSTEM AND PROPOSED SYSTEM

Item	Existing System	Proposed System
Algorithms	1. Proportional Fair (PF) Scheduler 2. ModifiedLargest Weighted Delay First (M-LWDF) Scheduler. 3. Queue-HOL-MLWDF Scheduler	1. Frame Generation 2. For video compression 3. Video transmission from sender to receiver 4. Video compression to receiver end
Accuracy	Low	High
Complexity	Low	High
Explanation	In the existing system Many works focused on Performance study of AllocationResource in downlink LTE. MauricioIturralde proposes a novel downlink scheduling algorithmfor multimedia flows in LTE networks using virtual tokenmechanism in. On the other side, Moustafa M. Nasrallain presents a downlink scheduling	In the proposed system The PF scheduling algorithm provides a good tradeoffbetween system throughput and fairness by selecting the user. PF is a very suitable scheduling option for non-real time traffic.

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	approach for balancingQoS.	M-LWDF is an algorithm selected to support mixed realtime data users in CDMA-HDR systems The main goal of the virtual token scheme (VT-M-LWDF)given in is to ameliorate the QoS performance metrics forreal time communication, like video and VoIP, and to conserve Minimum throughput for non-real times communication. The main goal of the virtual token scheme (Queue-HOLMLWDF) Presentedin is to enhance the QoS performancemetrics. This scheduler adopts the consideration of the queue size and the packets delay parameters in the VT-M-LWDFand M-LWDF rules respectively, in order to measure theperformance of the new scheduler when serving real timescommunication compared to the others schedulers.

VI. ALGORITHM FOR RELEVANT FEATURE DISCOVERY

Efficient Algorithms play important role in the relevant feature discovery from text document using text mining. The following steps explain the relevance feature of text documents:

1. Start.
2. Request
3. View the traffic
4. Stop

VII. SYSTEM ARCHITECTURE

A frame is 10 ms in length and each frame, in time domain, is divided into 10 subframes. Theduration of a subframe is 1 ms in length and each subframe is also divided into 2 slots where each slot is 0.5 ms in length. In frequency domain, each slot is divided into a number of resource blocks. Each slot contains 6 or 7 OFDM symbols in normal cyclic prefixes and extended cyclic prefixes, respectively. The frequency domain structure of a time slot is divided into bandes of 180 kHz that contain 12 consecutive subcarriers.

The basic unit of exchanging user information in downlink of LTE system is known as resource block (RB). Therefore, a RB is the radio resource that is available for a user in the 3GPP LTE system and is defined by both frequency and time domains. The number of RBs in a slot depends on the system bandwidth [6]. In FDD duplexing mode, a frame of 10ms is separatedinto 20 slots of 0.5ms each. Each two slots constitute a 1ms sub-frame. Each sub-frame represents a Transmission Time Interval (TTI) which is the minimum transmission unit.

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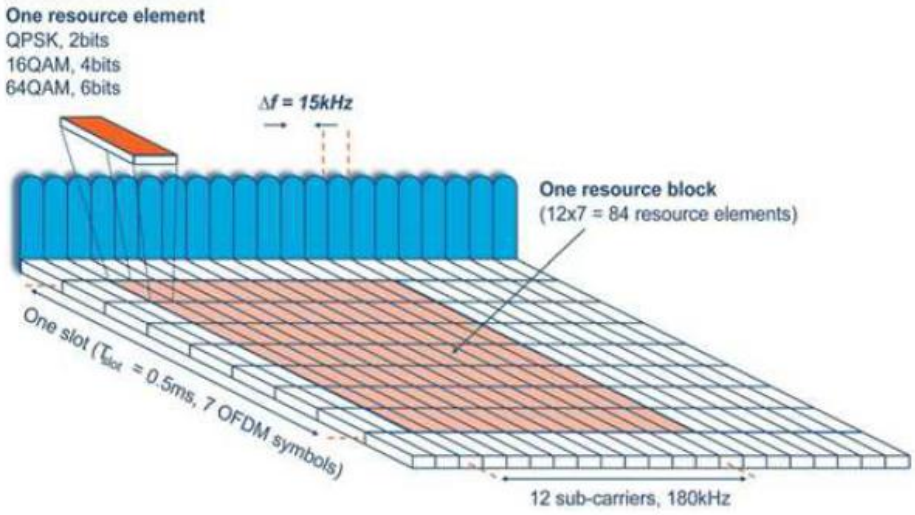

Fig. 1: LTE frame structure.

The architecture of a downlink data scheduler with multiple shared channels for multiple UEs is shown in Fig. 2. An eNodeB serves M UEs in a cell at a given time. Every TTI, the UE computes the Channel Quality Indicator (CQI) in compliance with the SINR and enquire the eNodeB of the state channel.

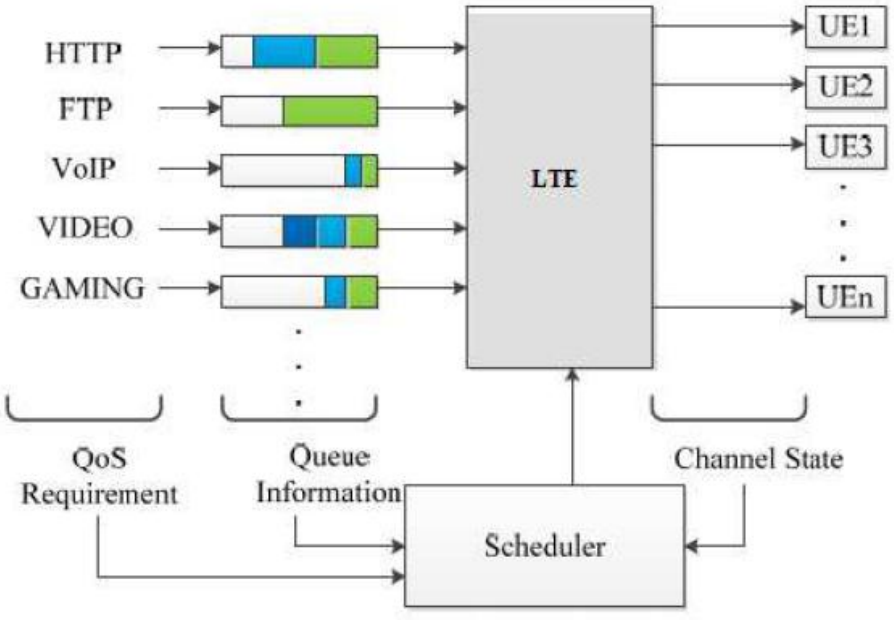

Fig. 2: Packet Scheduling Model.

For each UE a buffer is attributed in the eNodeB. The packets that arrive at these buffers are given a time stamp and are queued for transmission. For each packet in the queue, the HOL is estimated. If the HOL packet delay exceeds a specified threshold for the flow, then this packet is discarded. The packet scheduler decides which users will be served according to a

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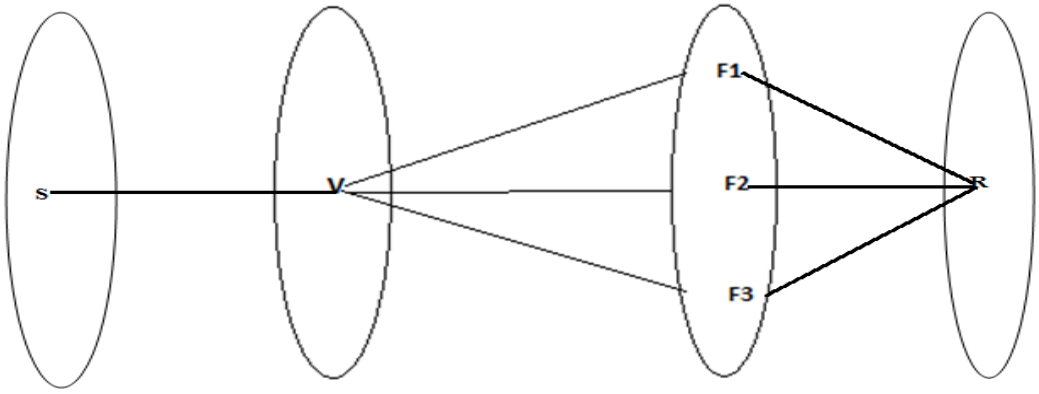
Scheduling algorithm. In order to get a suitable scheduling algorithm, we have to weigh and balance channel state, QoS requirement, and queue status. The users are prioritized by packet scheduler on the basis of a scheduling algorithm being used. These algorithms while
making scheduling decisions, take into account the instantaneous or average channel conditions, Head of Line (HOL) packet delays, status of receiving buffer or type of service
being used.

VIII. MATHEMATICAL MODULE



Where,
S=Source node
R=Receiver node
V=Video
F=Frame
Set Theory:
Where,
S={X, Y, e,ϕ}
S=System
X=Input
Y=output
E=end of the system
X={v}

Divide Frame

Firstly, we present a mathematical framework to analyse the frame-level energy quality tradeoff for delay-constrained multihomed video communication over multiple communication paths. Secondly, we develop scheduling algorithms for prioritized frame scheduling[10] and unequal loss protection to achieve target video quality with minimum device energy consumption.
Y=Reconstructing video(actual video)

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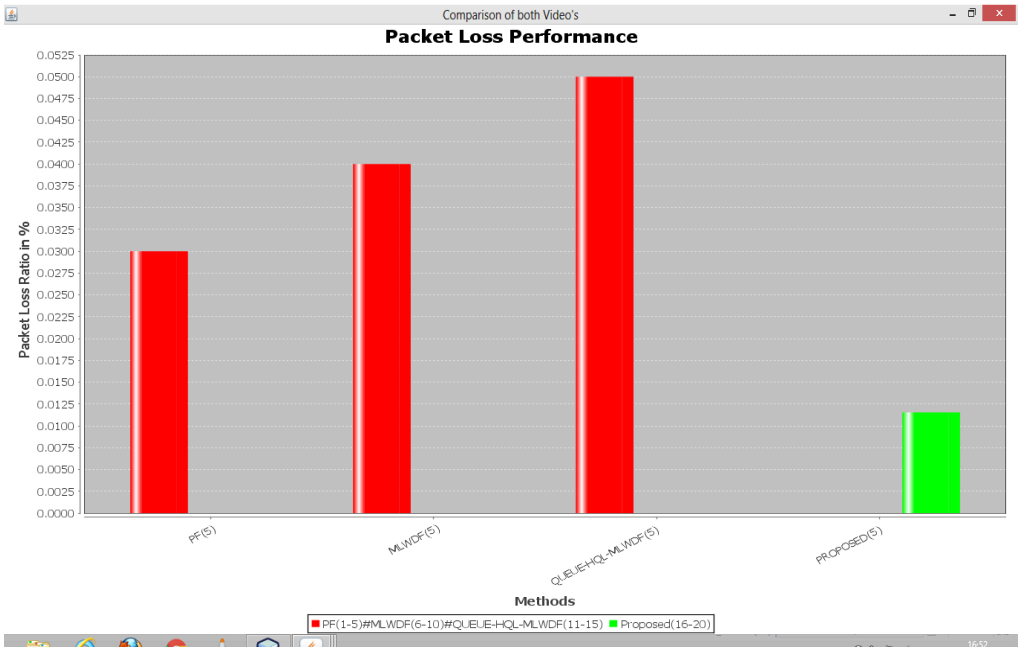
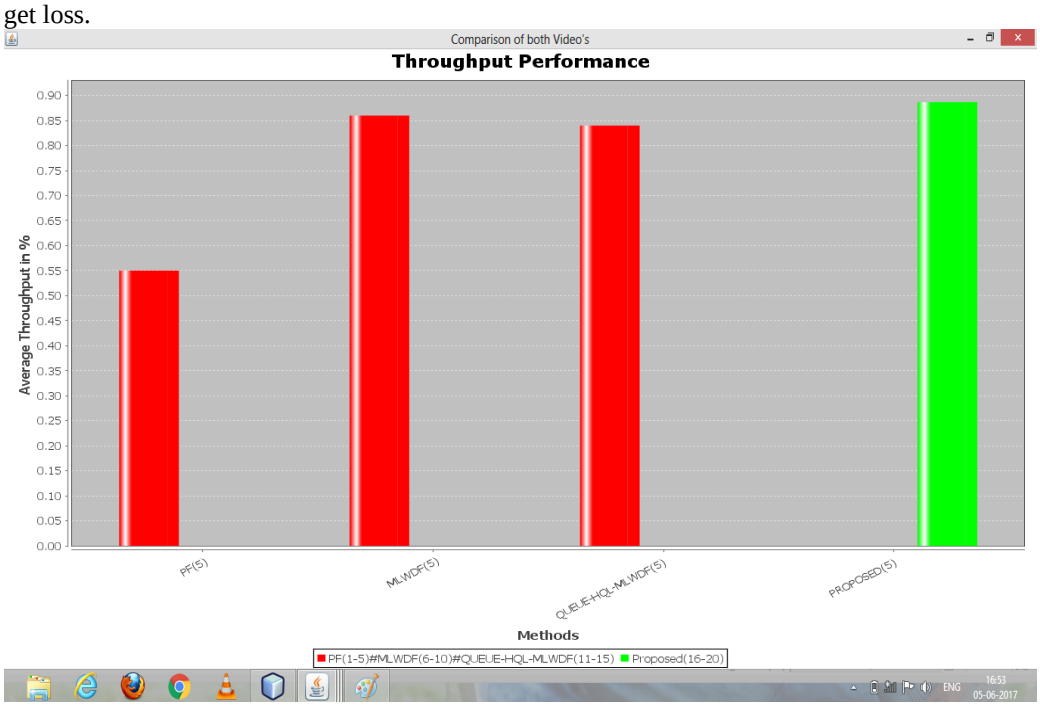
IX. GRAPH AND RESULT



The above graph shows, if any sender send the data to the number of receiver at that time to get the data packet loss is minimum as compare to previous algorithms. The PF, M-LWDF and Queue-HOL-MLWDF algorithms shows the some data packet get loss.



The presented graph shows the better Throughput as compare to previous algorithms throughput

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X.CONCLUSION

In this paper a new scheduling algorithm has been implemented along with some well-known algorithms to evaluate the performance of multimedia services. We defined two performance metrics such as throughput and PLR. Moreover, the proposed scheduler aimed, in particular, at improving the performance metrics for video services and maintaining, in general, a satisfactory level of the performance metrics for the other services in the network simultaneously. Upcoming work will be addressed to the use of otherindicators of QoS in the measures scheduler and a comparisonwith other schedulers such as Exponential Rule, LogarithmicRule and Exponential Proportional Fair.Our most significant observation from this review is that any packet scheduling algorithm for downlink real time data should be QoS aware so that it is readily deployable in the present day multimedia networks. It can also be noted that these scheduling schemes should take into account the latest technologies such as Carrier Aggregation and Multi Input and Multi Output (MIMO) which are specified by the 3GPP, so that the data rate can be increased for real time applications.

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