RESEARCH ARTICLE OPEN ACCESS

A Novel Approach for Minimizing the Delay and Load in Wireless Network (WIMAX)

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Abstract

The demand for high speed broadband wireless systems is increasing rapidly. In this context, the IEEE 802.16 standard defines the wireless broadband access technology called WiMAX, which introduces several interesting advantages including variable and high data rate, last mile wireless access, point to multipoint communication, large frequency range and QoS for various types of applications. Efficient scheduling design is left for designers and developers and thus providing QoS for IEEE 802.16 BWA system is a challenge for system developers. The scheduling architecture must ensure good bandwidth utilization, maintain the fairness between users and respond to the constraints of some applications (i.e. video, voice). In the literature, a good number of articles are available to analyze the performance of the standard; however few studies describing the scheduling algorithm are to be appreciated. To analyze these studies, a classification based on the scheduling mechanism or method used in the different propositions is presented in this paper. Some studies are based on traditional algorithms and other studies use new methods and mechanisms that are proposed for the new standard in order to provide QoS. Transmission performances were extracted from different scenarios considering: throughput, jitter, average end-to-end delays, number of active sessions, handover delays. In this scenario, it is very important to provide outstanding service to end-user by ensuring that diversifying requirements of different applications are satisfied in the best way possible. Due to this Quality of Service (QoS) has become very important issue in present era to differentiate oneself from other competing technology. In this, we develop a new algorithm (QOS Recovered) that is helpful in minimizing the delay and load. We compared the new algo with old one (WFQ algo).For minimizing the Daley and load; we fixed the queue size and also fixed the number of packets. In this way, subscriber station does not need to calculate the size of queue at base station every time. If the queue size is full, then the coming packet will be discarded. In this way, we can minimize the delay and load

I. INTRODUCTION

Broadband Wireless Access (BWA) has become the easiest way for wireless communication and a solution to rapid requirement of internet connection for data, voice and video service. BWA is a fast and easy alternative of cable networks and Digital Subscriber Line (DSL) technologies. The IEEE working group has designed a new standard based on BWA systems for last mile wireless access named IEEE 802.16 Wireless MAN [1].The IEEE 802.16 architecture is designed to achieve goals like easy deployment, high speed data rate, large spanning area, and large frequency spectrum. The IEEE 802.16 standard provides QoS to all different kinds of application including real time traffic in the form of flow type association with each application.

The above stated advantages of IEEE 802.16 Wireless MAN prepare a platform for this standard to compete with other wireless communication technologies like IEEE 802.11 and its variants. Subsequently the requirement from IEEE 802.16 is to provide QoS for all possible applications in both (uplink and downlink) directions. The IEEE 802.16 is likely to emerge as a dominant technology for cost-competitive ubiquitous broadband wireless access, supporting fixed, nomadic, portable and fully mobile operations offering integrated voice, video and data services.

The basic IEEE 802.16 architecture consists of one Base Station (BS) and one (or more) Subscriber Stations (SSs). Both BS and SS are stationary while clients connected to SS can be mobile. BS acts as a central entity to transfer all the data from SSs in PMP architecture. Any two (or more) SSs are not allowed to communicate directly. Transmissions take place through two independent channels−Downlink Channel (from BS to SS) and Uplink Channel (from SS to BS). Uplink channel is shared between all the SSs while downlink channel is used only by BS. The standard defines both Time Division Duplexing (TDD) and Frequency Division Duplexing (FDD) for channel allocation. Both channels are time slotted and composed of frames. The TDD frame composed of downlink and uplink sub frames. The duration of each of these frames can be controlled by BS whenever needed. Downlink channel is broadcast channel. BS broadcast data to all SS on downlink channel. SSs accept only those packets which are destined to it. More details on this architecture can be found in IEEE 802.16 draft.

II. PROBLEM STATEMENT

IEEE 802.16e based WiMAX networks promise the best available quality of service for mobile data service users., WiMAX networks incorporate several quality of service (QoS) mechanisms at the Media Access Control (MAC) level for guaranteed services for data, voice and video. The problem of assuring QoS is basically that of how to allocate available resources among users in order to meet the QoS criteria such as delay, delay jitter and throughput requirements. IEEE standard does not include a type's flows.standard scheduling mechanism. We propose a scheduling architecture with an aim at providing the delay and bandwidth, throughtput guarantees of the various QoS sensitive flows. We will evaluate the performance of our algorithm by running extensive simulations. Based on the results of the simulations we will study the effectiveness of our algorithm in catering to the QoS needs of different.

2.1 Introduction to Scheduling Architecture in WiMax

IEEE 802.16 can support multiple applications (data, voice and video) with different QoS requirements. The M AC layer protocol defines four QoS services.

- Real -Time Polling Service (rtPS): It is designed for services which generate variable size data packets**.** but delay requirements should be met e.g. MPEG video
- Non-Real-Time Polling Service: It is designed for services which require good average data rate performance but can tolerate delay.e.g ftp.
- Best Effort (BE) service: It is designed for services which don't require any specific QoS guarantee e.g.HTTP
- Unsolicited Grant Service (UGS): It is designed for services which require onstant Bit Rate (CBR)

2.2 Scheduling Strategies

As Scheduling for rtPS, nrtPS and BE services is not defined in IEEE 802.16 standard, there are various approaches described to address this issue. Some of them consider modifying scheduling algorithms defined for other types of networks i.e. wired networks. But this approach does not give accurate results for wireless networks because wireless channel is going to fade over time and so channel quality does not remain same. So, scheduling algorithm should consider this factor in scheduling. Besides this, different algorithms works on a specific approach e.g some algorithm are just priority based which schedules all connection by just one centralized scheduling.

2.3 Scheduling Algorithms

- FIFO Queuing
- Priority Queuing
- Fair Queuing
- Weight Fair Queuing
- Weight Round Robin

III. PROPOSED METHODOLOGY

The OPNET Modeler Wireless Suite provides high fidelity modeling, simulation, and analysis of a broad range of wireless networks. Technology developers leverage advanced simulation capabilities and rich protocol model suites to design and optimize proprietary wireless protocols, such as access control and scheduling algorithms.

Simulations incorporate motion in mobile networks, including ground, airborne, and satellite systems. Modeler Wireless Suite supports any network with mobile devices, including cellular (GSM, CDMA ,UMTS, IEEE 802.16 WiMax etc.), Wireless network planners, architects, and operations professionals can analyze end-to-end behavior, tune network performance, and evaluate growth scenarios for revenue-generating network services. OPNET is a high level event based network level simulation tool.

3.1 Introduction of OPNET

- Simulation operates at "packet-level"
- OPNET contains a huge library of accurate models of commercially available fixed network hardware and protocols
- Nowadays, the possibilities for wireless network simulations are also very wide.
- Accurate radio transmission pipeline stage for the modeling of the physical layer (radio interface) .
- The simulator has a lot of potentiality, but there exists typically a lack of the recent wireless systems .
- Much of the work considering new technologies must be done by oneself.
- OPNET can be used as a research tool or as a network design/analysis tool (end user)

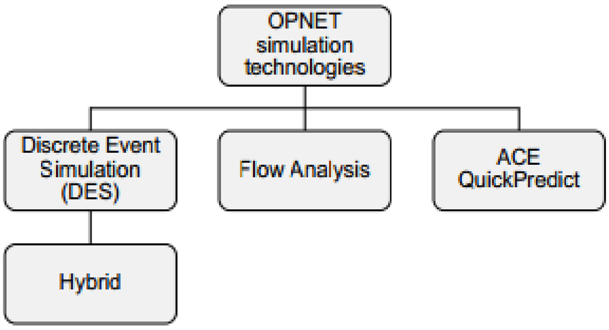
3.2 The structure of OPNET

- OPNET consists of high level user interface, which is constructed from C and C++ source code blocks with a huge library of OPNET specific Functions.
- Hierarchical structure, modeling is divided to three main domains.
- Network domain
- Networks + sub-networks, network topologies, geographical coordinates, mobility
- Node domain
- Single network nodes (e.g., routers, workstations, mobile devices…)
- Process domain
- Single modules and source code inside network nodes (e.g., data traffic source model)

- With OPNET it is also possible to run external.

3.3 Simulation Technologies

- OPNET supports 4 simulation technologies:
- Discrete Event Simulation (DES)
- Flow Analysis
- ACE QuickPredict



OPNET Technologies

3.4 Key Features

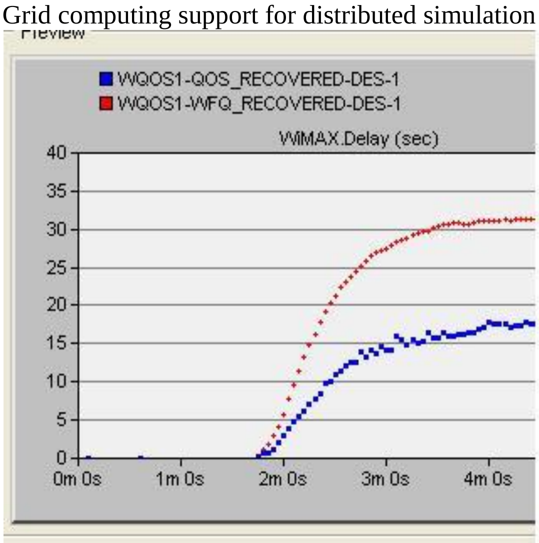
- Fastest simulation engine among leading industry solutions
- Hundreds of wired/wireless protocol and vendor device models with source code
- Object-oriented modeling
- Hierarchical modeling environment
- Scalable wireless simulations incorporating terrain, mobility, and multiple pathloss models
- Customizable wireless modeling
- Discrete Event, Hybrid, and optional Analytical simulation
- 32-bit and 64-bit fully parallel simulation kernel
- Grid computing support for distributed simulation
- Optional to interface simulations with live systems
- Realistic Applicationmodeling and analysis
- Open interface for integrating external object files, libraries, and other simulators
- Integrated, GUI-based debugging and analysis

IV. IMPLEMENTATION

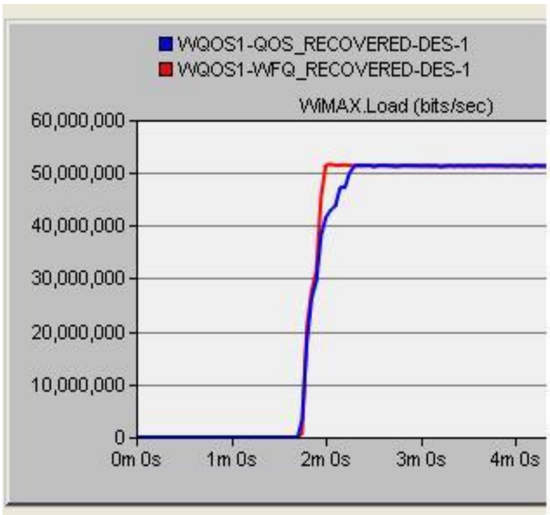
In QOS Scheduling Algorithm for WiMax, Our Main motive is to minimizing the delay and load. For minimizing the dealy and load many scheduling algorithm is used like fifo, wfq, priority, fair queuing. These algorithms is used to schedule the packets that depends upon the different scheduling mechanism schemes like first in first out, on priority basis, on weight of the packet. These algorithm does not provide the solution for minimizing the delay and load.So, we gernate a new Scheduling algo i.e QOS Recoverd. We compared the new Scheduling algorithm (QOS Recovered) with old Scheduling (WFQ).In QOS Recovered algorithm, for minimizing the delay we keep constant the queue size and fixed the number of packets.Here we presented the algorithm.

4.1 QOS Recovered Parameters

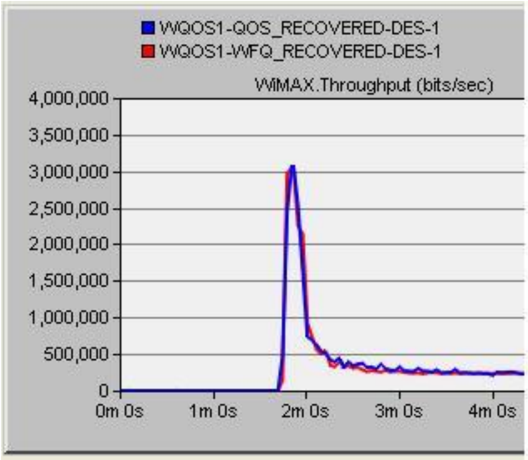
Here We considering the QOS parameters that is dealy,load and throught in WiMax.Main focus is minimizing the dealy and load in .So,We make new algo i.e QOS Recovered and we compared with old algo that is WFQ algorithm.QOS Recoverd algorithm is helpful in minimizing the delay and load.Here we presenting a delay graph that differentiate between WFQ algorithm and QOS recovered algorithm.



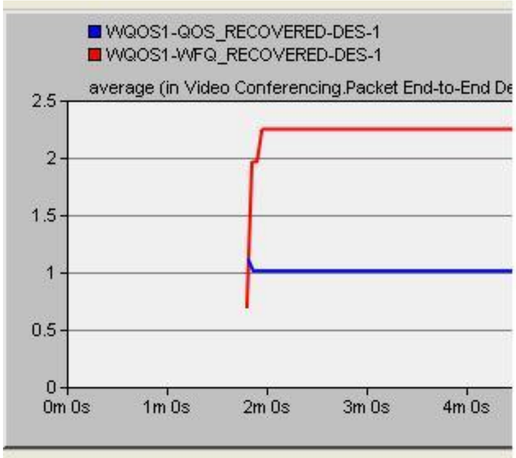
Graph 4.1 Delay Variation Graph in Wimax



Graph 4.2 Load Variation Graph(bits/sec)

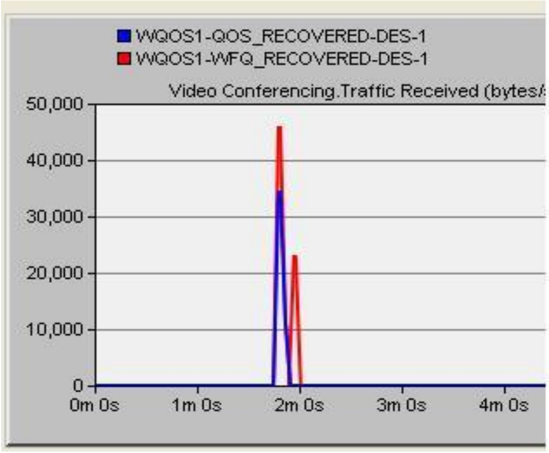


GRAPH 4.3 THROUGHTPUT VARIATION GRAPH

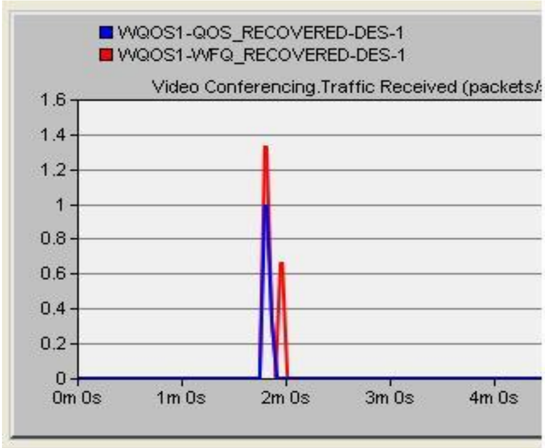


GRAPH 4.4 PACKET END TO END DELAY

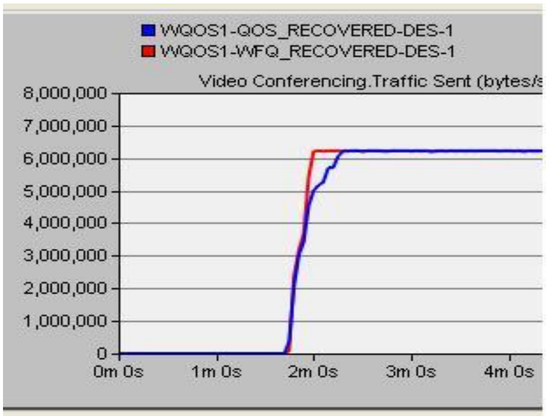
QOS PARAMETERS IN VEDIO CONFERENCING



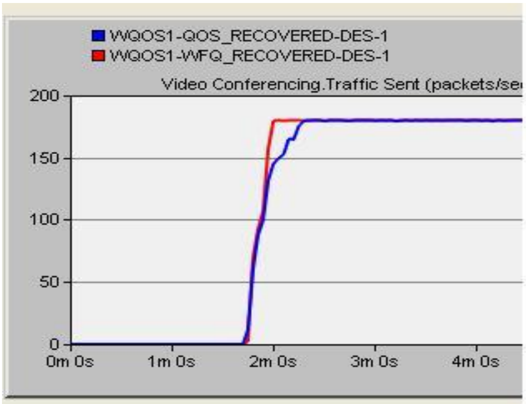
Graph 4.5 Traffic Received(bytes/sec)



Graph 4.6 Traffic Received(Packets/Sec)



Graph 4.7 Traffic Send(bytes/Sec)



Graph 4.8 Traffic Send(Packets/Sec)

V. EXPERIMENTAL RESULTS

5.1 QOS Recovered Algorithm

Modified RED:
Initialization:
Avg 100units
Count0
For each packet generate
Avg queue size is 100;
Check out bandwidth allocation:

If(true){
Process packet;
Count=count+1;}
Else{
Send request randomly
Count=count;
If(request acepted)
Occupy Bandwidth;
Count=count+1;
Else{
Send Request randomly;
Count=count;
}

5.2 Comparison b/w WFQ and QOS Recovered Algorithm

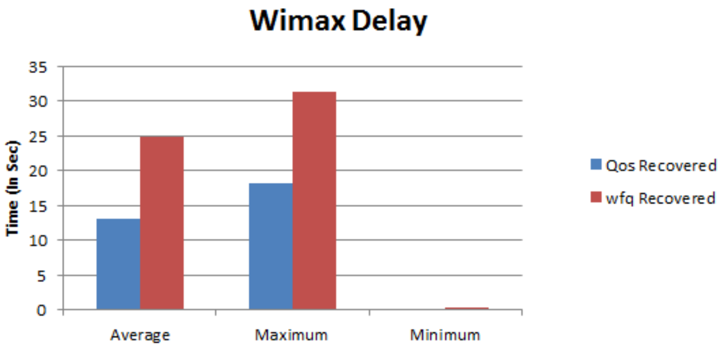


Table 5.1 WiMax Delay

Algorithm	Average	Maximum	Minimum
QOS Recovered	13.002	18.146	.006
WFQ Recovered	24.832	31.285	.296

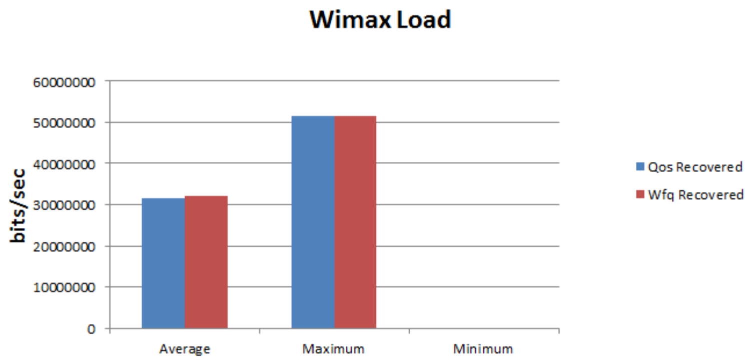


Table 5.2 WiMax Load

Algorithm	Average	Maximum	Minimum
QOS Recovered	31605881	51434539	0
WFQ Recovered	32063498	51584677	0

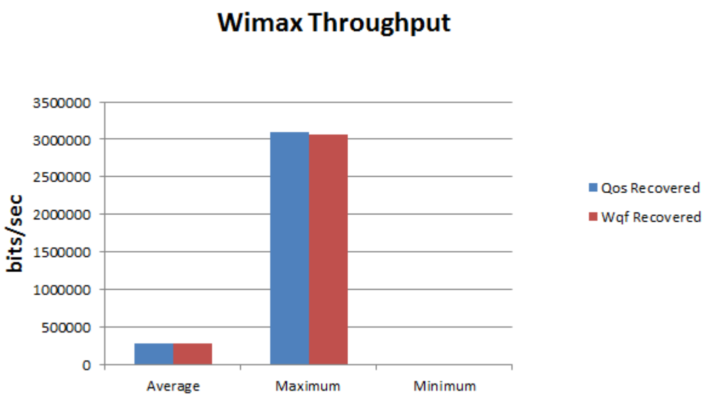


Table 5.3 WiMax Throughput

Algorithm	Average	Maximum	Minimum
QOS Recovered	284049	3095573	0
WFQ Recovered	278525	3095424	0

VI. CONCLUSIONS

Worldwide Interoperability of Microwave Access (WiMAX) is Broadband Wireless Access (BWA) has become the easiest way for wireless communication and a solution to rapid requirement of internet connection for data, voice and video service. BWA is a fast and easy alternative of cable networks and Digital Subscriber Line (DSL) technologies. The IEEE working group has designed a new standard based on BWA systems for last mile wireless access named IEEE 802.16 Wireless MAN. The IEEE 802.16 architecture is designed to achieve goals like easy deployment, high speed data rate, large spanning area, and large frequency spectrum. The IEEE 802.16 standard provides QoS to all different kinds of application including real time traffic in the form of flow type association with each application.

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The basic IEEE 802.16 architecture consists of one Base Station (BS) and one (or more) Subscriber Stations (SSs). Both BS and SS are stationary while clients connected to SS can be mobile. BS acts as a central entity to transfer all the data from SSs in PMP architecture. Any two (or more) SSs are not allowed to communicate directly. Transmissions take place through two independent channels−Downlink Channel (from BS to SS) and Uplink Channel (from SS to BS). Uplink channel is shared between all the SSs while downlink channel is used only by BS. The standard defines both Time Division Duplexing (TDD) and Frequency Division Duplexing (FDD) for channel allocation. Both channels are time slotted and composed of frames. The TDD frame composed of downlink and uplink sub frames. The duration of each of these frames can be controlled by BS whenever needed. Downlink channel is broadcast channel. BS broadcast data to all SS on downlink channel. SSs accept only those packets which are destined to it.

Here we want to provide the better QOS services which include Parameters like delay, jitter, Bandwidth ,load and Throughtput. Our main motive is to minimize the delay, load and maximize the throughtput. So, we used Scheduling algorithm that will provide the solution for minimizing the delay and load. There are many scheduling algorithms like fifo queuing, priority queuing ,fair queuing, weight fair queuing.

IEEE 802.16 can support multiple applications (data, voice and video) with different QoS requirements. The M AC layer protocol defines four QoS services.

- Real -Time Polling Service (rtPS): It is designed for services which generate variable size data packets. but delay requirements should be met e.g. MPEG video.
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- Unsolicited Grant Service (UGS): It is designed for services which require onstant Bit Rate (CBR)

In this we presented various scheduling approaches for satisfying QoS equirements in IEEE 802.16. Algorithms compared are from different approaches so that all available approaches can be covered which can be useful guide for further research in this field. We have tabulated the different parameters on which QoS algorithmscan be compared, which will be useful for developing new QoS algorithms.In this QOS Algorithm,is helpful in minimizing the dealy and load in WIMAX AND Vedio Confercing.

VII. FUTURE WORK

WiMax is Worldwide Interoperability of Microwave Access (WiMAX) to provide wireless communication and a solution to rapid requirement of internet connection for data, voice and video service. For the fast communication, There should be better QOS service. Basically QOS parameters are dealy, load, throughtput, jitter and bandwidth. For better communication we have to minimize the delay and load and maximize the throughput. In this, main motive is to minimize the delay, load and throught. Many Scheduling algorithm are presented for minimizing the dealy,load and maximize the throughtput. Scheduling algorithms are like FIFO, WFQ, WRR, Fair Queuing, priority etc. In previous algorithms there is no technique for minimizing the dealy and load. So We gernate new algorithm i. e QOS Recovered which helpful in minimizing the delay and load. We compared the new algorithm(QOS Recoverd) with old one WFQ(weight fair queuing).In QOS Recovered, we fixed the queue size and nuber of packets are constant. When subscriber station send the packet to base station then the subscriber station does not need to calculate the queue size every time.In this way, they can minimize the dealy, load and maximize the bandwidth. This QOS Recovered algorithm is used in WiMax and Vedio Confercing.

Our future work will be to implement any one algorithm and suggestion for improving its performance in term of throughput and Packet loss and other QOS parameter in WiMax,Voice, Vedio Confercing and also implement the the algorithm if they want to increase the size of queue.

REFERENCES

[1] Niyato and Hossain "presented a queuing theoretic (QT) Algorithm for QoS Support in

IEEE 802.16 wireless Network". Lecture Note in Computer Science, Volume 3619/2012.

[2] Yan Wang , "Focusing on priority based algorithm" Broadband wireless Military Networks with Quality of Service Support".In Proc of. IEEE Milcom 2012.

[3] Ferrari and Verma, "Perposed EDF link scheduler for Analysis of QoS Scheduling in Broadband IEEE 802.16 Based Networks". In Proc of. OPNETWORK 2006 Technology Conference, August 2012.

[4] Sanchez-Guerrero, "proposed mechanisms based on the use of channel conditions. The goals of scheduling are to achieve the optimal usage of resources" volume 2,Jan 2011.

[5] Tzong An-su "A Broadcast Tree-Based Centralized Scheduling Mechanism for IEEE 802.16 Mesh Networks" IEEE internation conference in Sept,2011

[6] Seungwoon Kim and Ikjun Yeom, "TCP-aware Uplimk scheduling for IEEE 802.16". IEEE Communication Letter, Nov 2010.

[7] Tzu-chieh Tsai, Chi-hong Jiang and Chuang-Yin Wang, "CAC and Packet Scheduling Using Token Bucket for IEEE 802.16 Networks".Journal of Communication, Vol 1, No 2, June 2010.

[8] Alexander Sayenko, Olli Alanen, Juha Karhula, Timo Hamalainen "Ensuring the QoS Requirements in 802.16 Scheduling". In Proc of. ACM MSWiM Jan 2010, Montreal.

[9] 802.16d-2004, "Draft IEEE Standard for Local and Metropolitan area networks – Part 16: Air Interface for Fixed Broadband Wireless Access Systems", Nov 2010.