Analysis of Delay of Priority MPCS Scheme in WiMAX Network

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***Abstract*— Today the demand for the high quality applications using the broadband technique has been increased tremendously. The Worldwide Interoperability for Microwave Access (WiMAX) network is one of the latest technologies in the wireless field. The major aim of WiMAX is to transfer the information by using the wireless communications with quality of service in a secured environment. Scheduling is performed to load balance a system effectively and to achieve a target quality of service. IEEE 802.16 defines the five different QoS service classes for WiMAX. The different researchers proposed various scheduling algorithms to enhance the QoS like PCS, MPCS etc. To overcome the limitations of the MPCS, a new Priority MPCS proposed in this research work. The proposed Priority MPCS is the modified version of the MPCS algorithm. New scheme is designed and implemented. The results prove that the Priority MPCS is better than the MPCS algorithm.**

***Keywords*— WiMAX Network, Scheduling algorithms, QoS, MPCS, Priority MPCS.**

I. INTRODUCTION

Today the demand for the high speed broadband wireless networks, multimedia services and internet access has increased as these applications are used in every fields of the life like e-trading, commerce and industry, education, communications, research, space, broadcasting, and even entertainment as well as infotainment. Each and every field is using high speed network.

Consequently the requirement for the broadband wireless access has grown drastically due to the increase in the number of users of Internet. Due to high mobility of users and need for data access at all the times, an efficient high speed broadband connectivity is much more required. So WiMAX (Worldwide Interoperability for Microwave Access) which is a trade name is used to group a number of wireless technologies have emerged from Institute of Electrical and Electronics Engineers to meet the increasing demands of the various end-users [1]. It is deployed to serve the end users. The WiMAX technology is based on Standard IEEE 802.16 that offers the mobile broadband connectivity to users.

The WiMAX provides Quality of Service (QoS) that supports five different categories of services which are as following - Unsolicited grant services (UGS), Real-time polling services (rtPS), Non- real-time polling service rate (nrtPS), extended real-time polling service (ertPS) and Best-Effort services (BE) [1]. These scheduling class services must ensure that there is guaranteed efficiency and fairness will be present.

The architecture of the WiMAX is based on the IEEE 802.16 standard. According to the IEEE 802.16 standard WiMAX technology supports two modes of operation –
1. Point to Multi Point (PMP) mode
2. Mesh mode.

A PMP mode provides the network access to a broadband Internet service provider. The mesh mode requires the supporting multi hop adhoc networks by the Subscriber Station (SS) [2].

IEEE 802.16 group is responsible for developing standards for the wireless interface of broadband wireless access and its associated functions. The Layers of IEEE 802.16 are shown in fig 1.3. IEEE 802.16 protocol standard has two-layer structure, a physical layer and another is MAC layer. The MAC layer includes three sub layers [3]:

a. Service specific convergence sub layer (CS),
b. MAC common part sub layer (CPS),
c. Privacy sub layer.

MAC layer of IEEE 802.16 provide the Quality of Service (QoS) assurance mechanism to support voice and video real-time services. It added the support for mesh topology network that adapt to a variety of physical layer environments [3].

There are lot of resources in the network. To distribute resources properly scheduling algorithms are required. Scheduling algorithms are responsible for distributing resources among all users in the network, and provide them with a higher QoS. Scheduling is one of the main components of the MAC layer which helps to assure QoS in various service classes. The main scheduling algorithms are Weighted Round Robin (WRR), Channel Condition Independent Packet Fair Queue (CIF-Q), Channel State Dependent Packet Scheduling Algorithm (CSDPS), Weighted Fair Queuing (WFQ), Packet Fair Scheduling (PFS), Strict Priority (SP), Round Robin (RR), Weighted Round Robin (WRR), etc. [4]-[5].

The complete research paper is divided into five sections. In Section I, the brief idea of WiMAX, IEEE 802.16, Quality of Services, etc. are given. In Section II, the previous work has been discussed. In Section III, new scheme is proposed. In Section IV, the simulation and results of proposed scheme is given. In Section V, the conclusion of the work and future work is given.

II. LITERATURE SURVEY

The scheduling algorithm in WiMAX is still an undefined area, designing an efficient scheduling algorithm that can provide high throughput with minimum delay is definitely a challenging task for system developers [1]. To improve the scheduling in WiMAX, lot of research papers written by the different authors. The techniques and methods given by different authors are discussed below –

In [6] Kire Jakimoski et al. proposed priority based uplink scheduling scheme for IEEE 802.16 standard. In [4] Mohit Kumar Saini et al. discuss the resource allocation in WiMAX network using Water Filling and Adaptive scheduling. In [5] Ravinder Singh et al. proposed scheduling algorithm which improves the performance of the system. In [7] Gihad Yousif Gafar Mohammed et al. investigate the performance of the VoIP traffic over WiMAX networks. In [8] Aneel Oad et al. proposed Earliest Expiry First (EEF) algorithm. In [9] P. S. Kumaresh et al. proposed an uplink dynamic weighted scheduling approach for WiMAX. In [10] Zuber Patel et al. proposed packet queuing scheme called Low Latency Weighted Round Robin (LL-WRR). In [11] Dr. B. Sridevi et al. proposed a new approach by which a critical area is found. In [12] M. Deva Priya et al. implemented scheduling algorithms.

In [13] Mahmoud Ahmad Albawaleez et al. proposed a Priority Control Scheme (PCS) that provide better QoS for real time delay sensitive packets in uplink and downlink channel. In [14] Alka Yadav et al. proposed the MPCS scheme. The MPCS is the modified version of the PCS algorithm. The MPCS proposed and implemented.

III. PROPOSED WORK

To overcome the limitations of the MPCS, new scheme is proposed. The Priority MPCS is the modified version of the MPCS scheme. In the network area, there are number of nodes. Each node has the packets that are transmitted to the base station. The packets are received from the upper layers in the station. In the each node, the packets are classified in two categories – Voice packet and non voice packet. In this research work the voice packet transmission is considered. Now the stations have different number of packets for transmission.

The station priority is calculated. One third of the maximum packet in stations is taken as the threshold value. If the station has the number of packets greater than or equal to threshold than Station Priority value is set to one otherwise it is set to zero. Now each station has the priority value either zero (low) or one (high). The packets are present in the station queue. If the station has high priority, then two packets are transmitted otherwise one packet is transmitted. The Station Priority plays an important role in transmission of packets. The AP transmits the packets in normal way.

IV. SIMULATION AND RESULT ANALYSIS

The implementation of Priority MPCS is performed. Nodes and the Access Point are implemented in the simulation area in a random way by using the random function. In this area 10, 20 and 30 nodes are taken for the experiment purpose. For each time there are different packets taken for uplink and downlink traffic. 10, 20, 30, 40 and 50 packets considered for the experiment. Different number of nodes and packets are taken and experiments are performed. The results are obtained. The following results are obtained for MPCS and Priority MPCS by performing different experiments –

A. MPCS

The MPCS algorithm is used and delay results are obtained. The nodes are taken 10, 30 and 50 for the experiments. Each node has maximum 10, 20, 30, 40 and 50. The delay results are shown in table 4.1 for different values of nodes and packets.

The delay increases as the number of packets increases. This is due to the increase in the number of packets. Large number of packets requires more time to transfer. The delay results are also shown in the fig. 1, fig. 2, and fig. 3 for node = 10, node = 30 and node = 50 respectively. All figures show approximately straight line between the number of packets and the delay.

B. Priority MPCS

The Priority MPCS algorithm is used and delay results are obtained. The nodes are taken 10, 30 and 50 for the experiments. Each node has maximum 10, 20, 30, 40 and 50. The delay results are shown in table 4.2 for different values of nodes and packets.

The delay increases as the number of packets increases. This is due to the increase in the number of packets. Large number of packets requires more time to transfer. When compare with table 4.1, it can be seen that that the delay is less in Priority MPCS than the delay in MPCS. The delay results are also shown in the fig. 4, fig. 5, and fig. 6 for node = 10, node = 30 and node = 50 respectively. All figures show approximately straight line between the number of packets and the delay. The delay is very less in comparison with delay in MPCS.

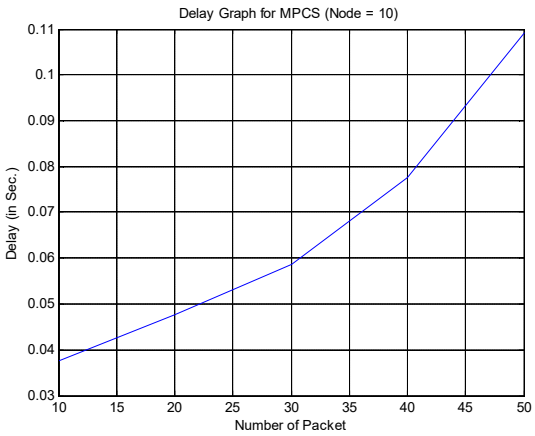

Fig. 1 Delay graph for MPCS at Node = 10

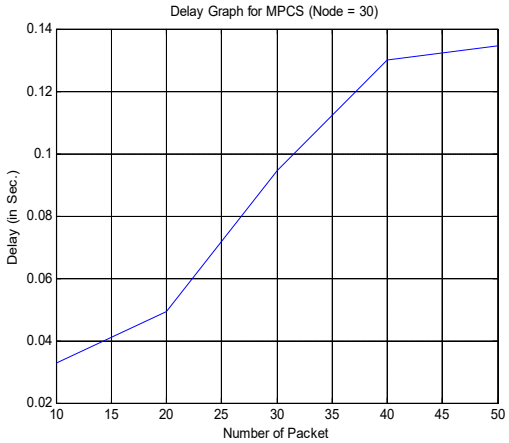

Fig. 2 Delay graph for MPCS at Node = 30

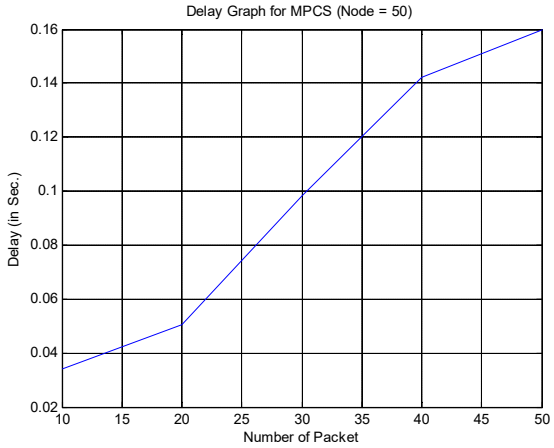

Fig. 3 Delay graph for MPCS at Node = 50

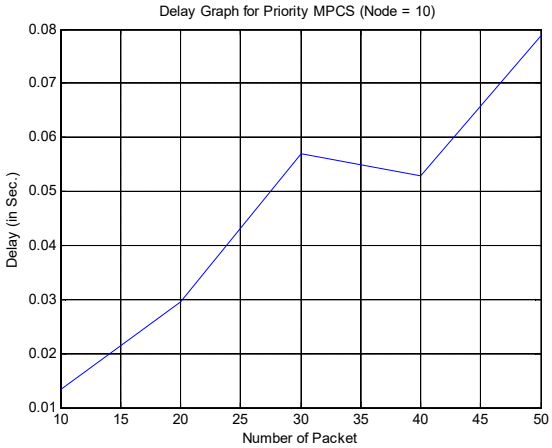

Fig. 4 Delay graph for Priority MPCS at Node = 10

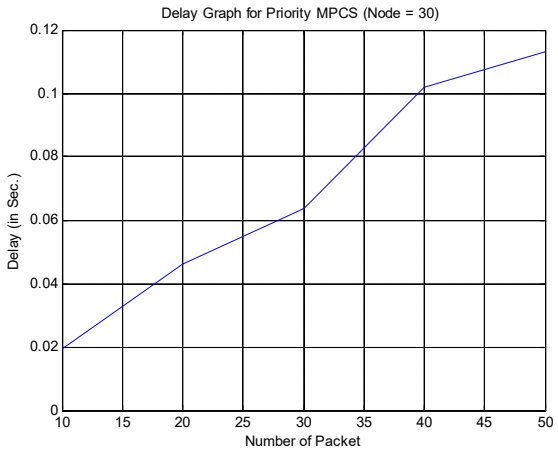

Fig. 5 Delay graph for Priority MPCS at Node = 30

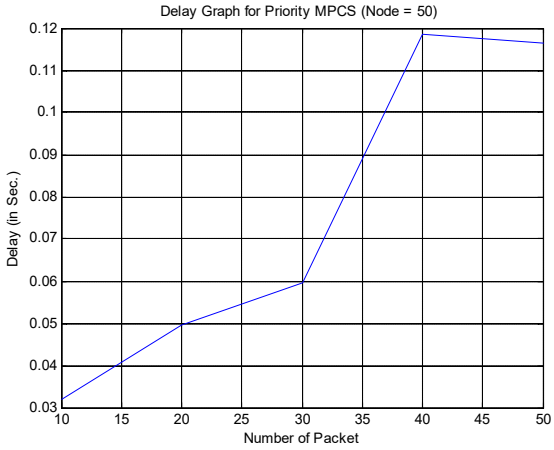

Fig. 6 Delay graph for Priority MPCS at Node = 50

C. Comparative Delay Graph

(i) Node = 10

The graph is shown in fig. 7 between the Packet per node and Delay in Sec for the MPCS and Priority MPCS. It is seen that the MPCS gives the higher delay than the Priority MPCS. This is due to the equal priority of all the stations in the MPCS. In Priority MPCS delay decreases due to using the priority of stations and sending two packets each time.

(ii) Node = 30

The graph is shown in fig. 8 between the Packet per node and Delay in Sec for the MPCS and Priority MPCS. It is seen that the MPCS gives the higher delay than the Priority MPCS. This is due to the equal priority of all the stations in the MPCS. In Priority MPCS delay decreases due to using the priority of stations and sending two packets each time.

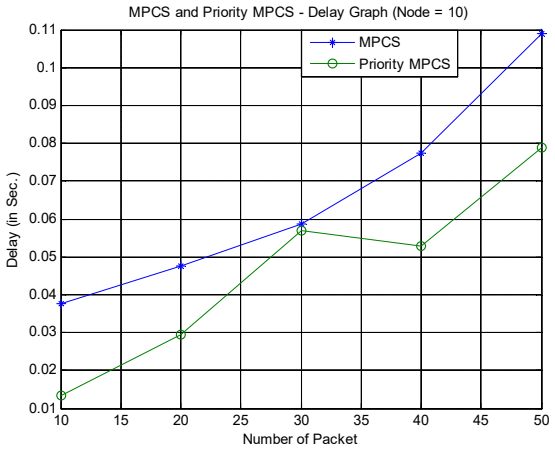

Fig. 7 Comparative Delay graph for MPCS and Priority MPCS at Node = 10

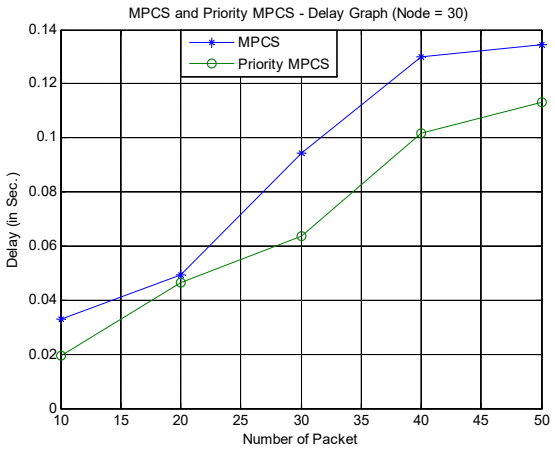

Fig. 8 Comparative Delay graph for MPCS and Priority MPCS at Node = 30

(iii) Node = 50

The graph is shown in fig. 9 between the Packet per node and Delay in Sec for the MPCS and Priority MPCS. It is seen that the MPCS gives the higher delay than the Priority MPCS. This is due to the equal priority of all the stations in the MPCS. For packet value 10 and 20, there is less improvement but for packet value 30, 40 and 50 much more reduction in delay. In Priority MPCS delay decreases due to using the priority of stations and sending two packets each time.

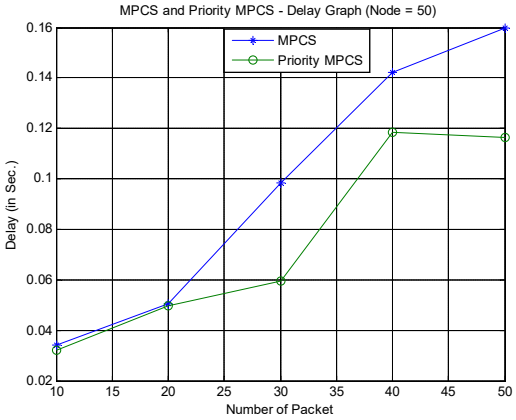

Fig. 9 Comparative Delay graph for MPCS and Priority MPCS at Node = 50

V. CONCLUSIONS AND FUTURE WORK

In this dissertation, a new scheduling algorithm, called Priority MPCS has been proposed. It uses the voice traffic in the WiMAX. The station priority is calculated by using the load on the station. The packets are stored in the storage and multiple packets are transferred. It is tried to reduce the delay. The reduction in the delay improves the Quality of Services. The new algorithm is designed, implemented in the MATLAB and results were obtained from different experiments. From the results it is seen that the Priority MPCS provides the better results than the MPCS. The Priority MPCS has the very less delay than the MPCS. The decrease in the delay improves the Quality of Services. In future the different large number of packet and node value can be taken and further enhancement can be performed.

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