Analysis of WiMAX Networks with Bandwidth Allocation Algorithms (Round Robin and Strict Priority)

Khan Mubeen Ahmed, Bandhu Kailash Chandra

ABSTRACT--- IEEE 802.16 is today playing a promising and challenging role in wireless network and thus it is considered to be a substitute solution to agitated technologies. Availability of network in all the way is an important challenge for WiMAX networks. Lesser availability of network in rural, hilly, lakes and sea shores is a major issue today. Various algorithms in wireless networks are available for allocation of data and services today. This paper focuses on evaluating the performance of WiMAX networks with increasing number of nodes and distances. This paper proposes two important algorithms Round Robin for Relay and Strict Priority in WiMAX Networks. By analyzing it in WiMAX networks, in terms of throughput and Goodput, could play a supportive role for industries and researcher for implementing it in real scenarios. Implementing these algorithms in WiMAX networks at base stations could be efficient for sustaining maximum number of users in terms of data usage and calls.

Index Terms: 802.16, Light WiMAX Simulator (LWX), Broadband Wireless Access (BWA), Round Robin (RR), Strict Priority (SP)

I. INTRODUCTION

A solution for fast internet services, data and voice services is Broadband Wireless Access (BWA), which is also an alternative to cables and wired network technologies [1].The working group of IEEE has developed various standards which is based

Wireless access systems [2]. Using these technologies one can achieve huge data rate with maximum coverage with various frequency spectrums along with mobility too in the available networks. The IEEE 802.16 technology is less cost competitive ubiquitous technology that supports moveable and fully transportable operations offering incorporated with accent, film and facts services. Areas where large wire connectivity and crowd is more, point to multipoint architecture can be easy implement with lesser cost used by IEEE 802.16. In this architecture various subscriber stations are connected with one main Station. All subscriber stations could transfer data to Main Station called Base Station and they themselves could transfer data with base stations and are synchronized with Base stations. This architecture is called point to multipoint (PMP) architecture. The UL Map is used in the beginning of each frame for transmission to all Subscriber Stations [3]. Transporting data with Light WiMAX could play a promising role in WiMAX networks. Allocation of proper bandwidth for data usage could play an effective role on IEEE 802.16. Using Light WiMAX, user can use various algorithms for calculating the performance analysis of networks. Enhancement and change into the existing algorithms could also give better results in this research work. One of the important research area is to allocate a suitable algorithm, related to this field is analyzed here.

II. BANDWIDTH ALLOCATION ALGORITHMS

Round Robin algorithm has various benefits and flaws. One Important advantage is that it doesn't face the problem of starvation. Processes share a defined time slice on the processor to process. Time slice is defined as the allocation of fixed time intervals of time slices that are provided by the base station. A time slice is simply an amount of time that each job process in contention for use of the Base station [4]. The amount of time that is spent on each process given by base station is called time slice per iteration of Round Robin Algorithm. Jobs which comes first are processed first and are preempted after a time slice. If the job is finished on the allotted time or if not completed then will return to the tail of the job queue and will have to wait until next visit time. And this is the biggest disadvantage since all jobs are on same priority. All the small time interval processes are in favored by Round Robin favors short virtual processes while long process time jobs are panelized by Round Robin [5].

A proper time slice should be given to all the process otherwise it may face other problems. If the value of time slices is too small than the value of context switching time increases in relation to actual work done by the base station. For a better output it should be such that it must be of adequate length so that maximum jobs can be completed in one time slice[6].

Another important feature of priority scheduling is that it suffers the problem of undernourishment. A process losses control of the base station through one of the following task completion, a higher priority task becoming ready or a wait condition [7]. A Higher Priority processes neglects the lower priority process. In case of non priority preemptive scheduling, long time is taken by non priority preemptive at base station could create starvation problems. To avoid the problem of starvations aging and weighting could be implemented with the basic Round Robin.

III. NETWORK SETUP AND SIMULATION STUDY

The setup used a network without relay stations to analyze the evaluations of Light WiMAX with Round Robin and Strict Priority Algorithms for channel allocation. The

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simulation topology shown below contains one BS, and various SSs. For downlink data transfer in various cases are used to analyze the performance from BS to SSs. The individual TCP connections are created from BS to SSs in downlink packet transmission. Two different bandwidth allocation techniques are used to allocate the channel bandwidth to multiple SSs which is gradually increases along with time for data transfer from BS to SSs. The performance analysis is done as per the picture given below.

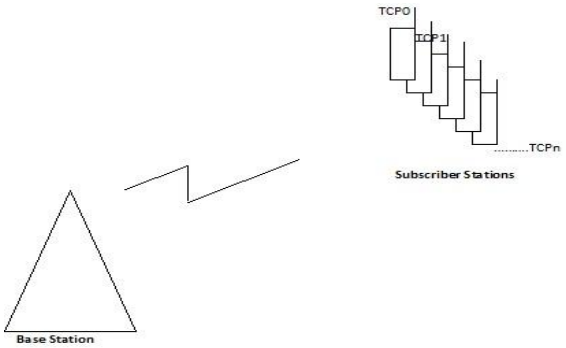

Fig. 1 Connection of Base Station with Subscriber Stations with RR and SP

IV. SIMULATION PARAMETERS

Various parameters are used to calculate the performance evaluation without Relay stations, includes following simulation parameters given in table I:

TABLE I. SIMULATION PARAMETERS USED

Parameters	Values
Routing Protocols	AODV
Transmission Protocol	TCP
Bandwidth Allocation Algorithm	Round Robin and Strict Priority
Simulation Time	300 Sec
Number of Nodes	10,20,……..100

V. PERFORMANCE METRICS

To evaluate the performance, following metrics are considered:

- *Throughput:* Raw bytes sent by a source per second.
- *Goodput:* successfully received bytes per second.
- Dropped packets

VI. RESULTS

From the graph it is observed that for lesser number of nodes, more Throughputs is obtained and this is because of the privileged sort modulation techniques are used with orthogonal Frequency Division Multiplexing. When number of nodes increases more and more bits are transferred in single orthogonal frequency division multiplexing symbols and hence throughput increases. When multiple paths are used by wireless channel, than it also suffers delay spread (especially in NLOS conditions).

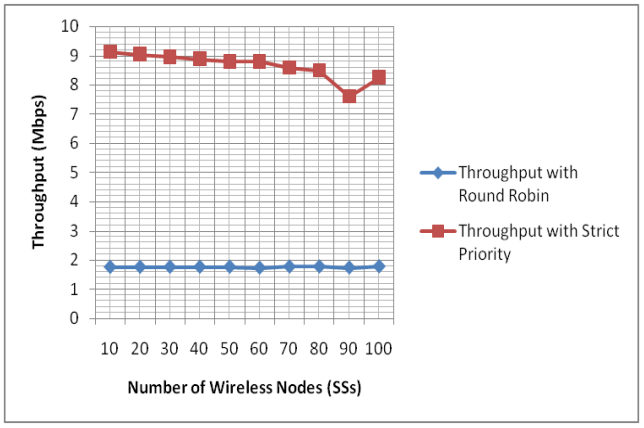

Fig. 3 Base Station with Number of Nodes and Throughput with RR and SP

It is also observed that Strict Priority gives better results as compared to Round Robin Algorithms. It is observed that Throughput of Round Robin is obtained 9.12 Mbps for least number of subscriber stations. And as the subscriber stations increase its value decreases up to 8.24 Mbps. While in case of Strict Priority it is observed that the initial value of Throughput obtained is 1.758 Mbps and for maximum number of subscriber station it is obtained to be 1.77 Mbps. When number of subscriber stations increases, full utilization of Base station happens and use wider channels. The system capacity may be increased If above condition is satisfied.

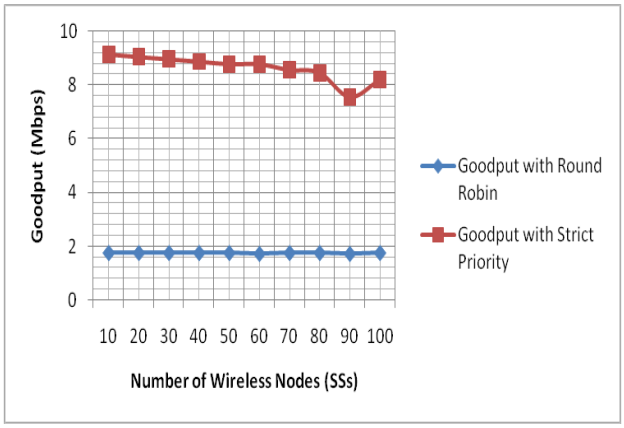

Fig. 4 Base Station with Number of Nodes and Goodput with RR and SP

It is observed from fig 4 that for lesser nodes maximum Goodput is obtained. It is observed that the value of Goodput in Round Robin algorithm initially obtained is 9.12 Mbps and for 100 subscriber station it is obtained to be 8.19 Mbps for SP. While in case of RR it is 1.754 Mbps for least subscriber and obtained 1.74 Mbps for maximum subscriber stations. This is due to the fact that as more and more number of packets per second is transferred, the data transmission capacity of channel also increases and hence is

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obtained highest in lesser subscriber stations. As number of nodes from base increases, it is observed the coverage of base station ends and the Goodput becomes lesser.

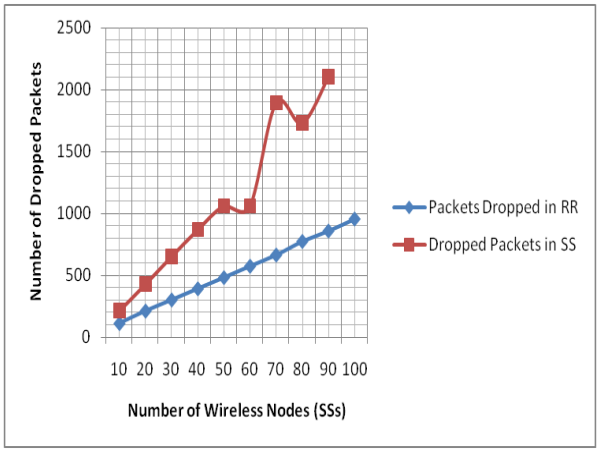

Fig. 5 Dropped Packets with Number of Nodes

Higher dropped packets are observed in strict priority in WiMAX networks than Round Robin Algorithm. This is due to the fact that, when packets are sending with maximum power than in case of strict priority higher priority packets are send initially and lower priority packets are kept in waiting state. And as the traffic load increases due to long waiting time are dropped [8]. It is observed that from fig. 5 below that Dropped packets are also increased since high modulation cannot be maintained over the entire length of the link or in a Non Line of sight environment. For such cases the error rates rises and the adaptive modulation feature drops the modulation to lower density modulation. WiMAX being able to provide 114 dropped packets in case of RR for one subscriber [9][10].

VII. CONCLUSION

In this paper WiMAX network system is analyzed with two important bandwidth allocation algorithms named Round Robin and Strict Priority [11]. Better results are obtained in Strict Priority than Round Robin station and obtained 956 for 100 subscriber station. Similarly obtains 210 for one SS in case of SP and 2103 in case of 100 SS. The rate of data transfer changes in the entire network depends on coverage area and on whether the SSs it is Line of Sight or Non Line of Sight. For Non Line of Sight Subscriber stations, more drops happen due to change of modulation techniques. Also it is observed that, when number of nodes increases throughput is also obtained higher in case of Strict Priority. When lesser nodes are used in case of strict priority then obtained Throughput is more than abundant number of nodes. Similarly for Goodput also, better value in terms of strict priority is obtained as compared to Round Robin. When number of nodes increases, it is observed that dropped packets are obtained higher in case of strict priority than round robin due to long wait.

VIII. FUTURE WORK

Various other bandwidth allocation techniques with different types of connections and with various Services parameters can also be carried out for calculating the performance of base stations. This whole analysis could also be done with various cyclic prefixes, with frame periods and with various frame symbols.

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