iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** XI **Month of publication:** November 2017

DOI:

Uplink Development Algorithm using Bandwidth in WiMax Networks

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Abstract: The IEEE 802.16 standard defines the terms for physical (PHY) layers of WiMAX networks is a critical part of the MAC layer specification is packet scheduling, which resolves contention for bandwidth and determines the transmission order of users. Evaluating the performance packet scheduling algorithms is of utmost importance towards realizing large-scale WiMAX deployment. In this paper, we conduct a comprehensive performance study of scheduling algorithms in point-to-multipoint mode of based on bandwidth in WiMAX networks. We first make a classification of WiMAX scheduling algorithms, then simulate a representative number of algorithms in each class taking into account that types of the Bandwidth in IEEE 802.16. We evaluate the algorithms with respect to their abilities to support multiple classes of service, providing quality of service (QoS) guarantees, fairness amongst service classes and bandwidth utilization. To the best of our knowledge, no such comprehensive performance study has been reported in the literature. Simulation results indicate that none of the current algorithms is capable of effectively supporting all WiMAX classes of service. We demonstrate that an efficient, fair and robust scheduler for WiMAX is still an open research area. We conclude our study by making approvals that can be used by WiMax protocol designers.
Keywords: Wimax,Bandwidth, Uplink

I. INTRODUCTION

WiMax (World Wide Interoperability for Microwave Access) is a telecommunication technology designed to provide effective transmission of data using different modes of transmission like mesh and PMP (Point to multipoint). WiMax is a high performance end to end network protocol. Its features are increased data rate, high performance, fair QoS, highly secured communication of data with less packet delay. There are two main types of WiMax services: mobile and fixed. Mobile WiMax enables users to access internet while travelling whereas fixed WiMax stations provide wireless internet access to clients within a fixed radius. So concept of WiMax is introduced to increase the range of network. The basic WiMax IEEE 802.16 architecture consists of Base Station (BS) and Subscriber Station (SS). BS acts as a central entity to transfer all the data from SS in a PMP mode. Transmissions take place through two independent channels: Downlink channel (from BS to SS) and Uplink channel (from SS to BS). Uplink channel is shared by all SSs while Downlink channel is used by BS. The standard IEEE 802.16 supports four different flow classes of QoS and the MAC layer supports a request-grant mechanism for data transmission in uplink direction. This standard does not define a slot allocation criterion and scheduling architecture for any type of service. A scheduling module is necessary to provide QoS for each class.

II. SCHUDELING ARCHITECTURES

The standard provides specification for these different services, but does not specify any scheduling architecture. There have been few scheduling architectures reported in the literature. In this paper we propose a classification of these architectures based on the mechanism or method used in these different propositions. The reminder of this paper is organized as follows: Section II presents our classification of the uplink scheduling algorithm in IEEE 802.16. Section III shows a comparison between these algorithms, in term of advantages and inconvenient. Finally, Section IV concludes this paper and presents our future works. As mentioned before, the scheduling architecture can be classified into two categories: traditional methods, based on classical scheduling algorithms (FIFO, Round Robin, etc) and new methods that are developed for the new standard based on new techniques for the scheduling. This classification is illustrated in Figure 1. A. Traditional methods Most of the mechanisms proposed for the scheduling in IEEE 802.16 are based on algorithms and methods used in other type of networks (i.e. wired network). There are mechanisms that use these algorithms with a simple way and other mechanisms that modify the structure of these algorithms in order to have a more complex architecture that can respond to the standard needs in term of QoS.

A. Unsolicited Grant Services (UGS:)

supports applications that generate fixed-size data packets periodically such as T1/E1 and VoIP without silence suppression. To support real-time needs of such applications and reduce overhead by the bandwidth request-grant process, the BS allocates a fixed amount of bandwidth to each of the flows in a static manner without receiving explicit requests from the SS.

B. Real-Time Polling Services (rtPS)

support real time traffic in which delay in an important QoS requirement. The amount of bandwidth required for this type of service is determined based on the required QoS performances, the channel quality, and the traffic arrival rates of the sources.

C. Non-Real-Time Polling Service (nrtPS)

Provides guarantees in terms of throughput only and is therefore suitable for mission critical data applications, such as File Transfer Protocol (FTP). The BS allows the SS to make periodic unicast grant requests, just like rtPS scheduling service, but the requests are issued at longer intervals.

D. Best Effort Services

Provides no guarantees on delay or throughput and is used for Hypertext Transport Protocol (HTTP) and electronic mail (email), for example. The bandwidth request for such applications is granted on space-available basis.

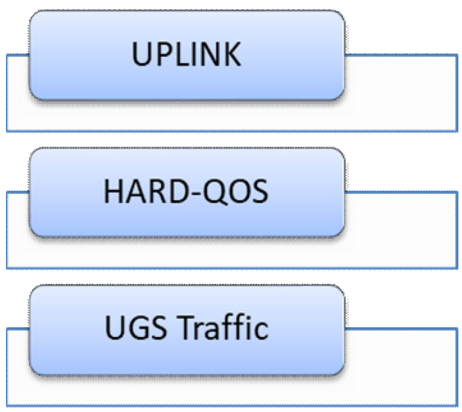

Figure1. Scheduling methods classification

III. BANDWIDTH ENDOWMENT

A. Uplink subframes

WiMAX access is frame based. It manages separately an Uplink and a Downlink subframe. The subframes are duplexed either in time (TDD) or in frequency (FDD). The BS will send, at the beginning of each downlink subframe, two messages managing the scheduling. The UL-MAP will specify the multiplexing among the SSs (by TDMA or OFDMA) of the uplink subframe. The DL-MAP will specify how the downlink subframe will be organized.

B. Specifing the Services

WiMAX specifies four scheduling services to which the uplink connections are mapped. An uplink connection, depending on the service it is mapped to, is bound to use a set of rules specifying the way it requests bandwidth and will be served accordingly. The services are: The Unsolicited Grant Service (UGS), The Real-Time Polling Service (rtPS), the non-Real-Time Polling Service (nrtPS) and the Best Effort service (BE). We detail in the following paragraph the request-grant policies that each of the services can use.

C. Bandwidth request

Bandwidth requests are done in WiMAX on a per connection basis. Several ways are available to allow a connection to request bandwidth or to specify needs. Upon establishing a connection, a specification of the flow using the connection is communicated to the BS. This specification can be considered as the initial bandwidth request made by the connection. Other methods to request bandwidth (or to specify the need to be polled) while the connection is active.

D. Unicast Services

A unicast request opportunity is a period of airtime where only the destined connection can express its needs, – a contention request opportunity is a period where several connections may express their needs in a CSMA/CA fashion contention based access, this kind of opportunities are programmed by the BS if, due to lack of space, it cannot program enough unicast request opportunities. The IEEE 802.16 standard does not give any specifications of the different QoS mechanisms to use. Recent work concentrated on these aspects. Architectures focusing on the different uplink scheduling algorithms to be used for the different classes of service were given in. A QoS architecture was defined in which instantiated the different blocs of QoS architecture (admission control, classifiers, schedulers, traffic shaper and different queuing mechanisms).

E. The Grants

An SS's medium access for Uplink data transmission is done in a contention less, polling based fashion. Within the BS, a scheduling algorithm, which is not specified in the standard, will build the UL-MAP (map of the transmission opportunities granted for the uplink direction). The UL-MAP is built based on the requests the BS received and on the initial per connection information it possesses. Two grant modes were initially defined by the 802.16 workgroup: GPC (Grant Per Connection) and GPSS (Grant Per Subscriber Station). In GPC mode, the UL-MAP specifies the time range each connection in each SS should individually use. This mode is obsolete. In GPSS mode, transmission opportunity is granted to the SS; an uplink scheduler within the SS will grant each of its connections a range in the granted time.

F. Piggyback request

Piggyback requests can be included by some connections in a specific type of headers: the Grant Management sub header, – this same sub header contains the Poll Me bit which, if set, specifies the need of the SS to be polled for a bandwidth request by the BS. UGS: A UGS connection is periodically granted air time without having to specifically request it. The amount of the grant is fixed upon set up of the connection, based on the Maximum Sustained traffic of the flow. A UGS connection is not allowed to use any contention based request period and is not allocated unicast request opportunities. If a UGS connection's transmit depth queue is exceeded (due to a lost UL-MAP or due to clock mismatch) it sets in outbound packets the SI bit (Slip Indicator bit) informing the BS of the situation. The PM bit (Poll Me bit) in outbound UGS packets can be used to request polls for other non-UGS connections. rtPS : An rtPS connection is provided with periodic unicast request opportunities. Those opportunities will be used by the connection to express its needs depending on its queue situation. An rtPS connection is not allowed to use contention request opportunities. nrtPS: An nrtPS connection is provided with regular unicast request opportunities (the standard specifies an interval on the order of one second or less). An nrtPS connection can also use contention request opportunities. BE: A BE connection may be granted unicast request opportunities by the BS. It may also use contention request opportunities in order to express its needs. However few concentrated on the scalability issues. The first step in this direction was putting away from the standard the GPC mechanism which was a serious flaw in terms of scalability. Other work concentrated on the optimal duration of the contention period in order to reduce collision probabilities. Our work focuses on the bandwidth management mechanisms. We propose a redesign of the request mechanisms based on an aggregated management. We also provide flexible and simplified scheduling procedures. Our design will offer rate guarantees and latency bounds to sensitive flows by adopting a Latency Rate server behavior.

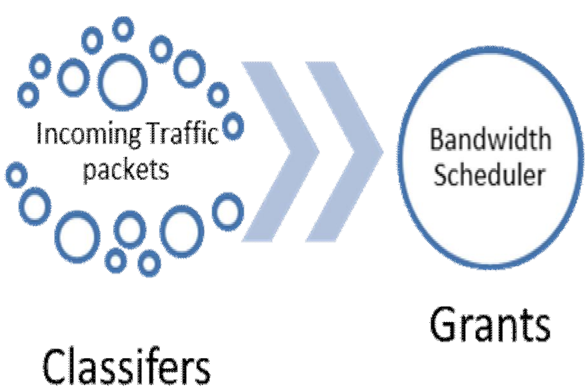

Figure 2. Bandwidth Endowment

IV. UPLINK DEVELOPMENT ALGORITHM

When, b[u][v] is the least bandwidth obtainable on edges (u, v) through the specific interval/slot and b_w[u] is the highest bandwidth next to paths from source 's' to vertex 'u' beneath those limitation that those paths moves over only those vertices where a maximum bandwidth path has been originated previously. The complexity is provided as the O(n2) for a common 'n' vertex graph. Nonetheless, realistic network graphs provides O(n) edges and complexity turns to be O(n log n) when maximum heap is utilized to sustain the b_w values.

A. Uplink bandwidth management module

This module, the responsibility for allocating bandwidth to each SS flow for UL transmission. Its main function is to produce a UL map for all SS according to their bandwidth requirements, to achieve excellent QoS for each flow under the limited information of each queue. It also keeps fairness among different flows and Subscriber Stations under overloaded conditions. It assures the delay guarantee to UGS and rtPS flows. Bandwidth is allocated to each SS in the following way.

Amount of bandwidth allocated to each SS in regular intervals by the QoS parameters of connection associated with each connection. Amount of bandwidth requested by each SS for UL transmission. Amount of bandwidth required periodically by SS's UGS flow. BS distributed UL bandwidth among various SSs in the following way.

B. Bandwidth allocation

Bandwidth allocates bandwidth to each UGS UL flow according to QoS parameters negotiated during connection setup. These parameters include Maximum Sustained Rate and SDU size to define the interval for allocating bandwidth. If the number of UGS flow increases then Tolerated Jitter is used as an ordering parameter. If two flows are equal in Tolerated Jitter, then Maximum Latency is used to break a tie. Bandwidth Allocation to rtPS: BS fulfills the requirements of rtPS flow whenever there is an entry in its queue. So BS provides unicast polling request to each rtPS flow to meet the QoS. BS fulfills the BW request of rtPS flows for different SSs. Maximum Latency is used as an ordering parameter. If two flows are equal in Maximum Latency then priority will be given to that flow which has lower Maximum Sustained Rate and Minimum Reserved Traffic Rate. Bandwidth Allocation to nrtPS: BS provides unicast request opportunities to each nrtPS flow to meet the QoS. After fulfilling the requirements of all UGS and rtPS flows, BS provides the requested bandwidth to different SS for nrtPS flow and Traffic Priority parameter used as an ordering parameter. If two flows are equal in Traffic priority then priority will be given to that flow which has lower Maximum Sustained Rate and Minimum Reserved Traffic Rate as compared to other nrtPS flows. Bandwidth Allocation to BE: After fulfilling the requirements of all UGS, rtPS, and nrtPS flows, BS fulfills the requirements of all BE flows by allocating bandwidth according to Maximum Sustained Rate and Last Polling Time. The parameter Traffic Priority is used as an ordering parameter. If two flows are equal in Traffic priority, then priority will be given to that flow which has less bandwidth as compared to the other, and that is calculated from Maximum Sustained Rate.

C. Uplink scheduler

SS Uplink Scheduler After allocation of bandwidth from UL Bandwidth Management module, SS uplink scheduler , responsibility is to schedule packets from the respective queues of UGS, rtPS, nrtPS and BE. First we schedule UGS packets, because there is fixed bandwidth allocation from BS side. UGS packets are queued by FIFO mechanism. rtPS Packets are queued by Earlier Deadline First mechanism, and ordering parameter is Maximum Latency. nrtPS Packets are queued by Earlier Deadline First mechanism and ordering parameter is Maximum Latency and Traffic Priority. BE Packets are queued by First Come First Serve mechanism. We use a variant of WFQ scheduling algorithm that is Self Clocked Fair Queuing (SCFQ), to schedule rtPS, nrtPS and BE packets that avoid to costly computation of round number in WFQ. A weight is calculated dynamically for each class of scheduling services by the size of the queue and a constant (weight) priority connections with each flow and bandwidth distributed among flows by calculated weight.

D. Downlink management module

This Module has responsibility for allocating bandwidth to each SS for DL transmission. Its main responsibility is to produce a DL map for all SSs according to their bandwidth requirements. To allocate DL bandwidth among different SSs is easier than UL bandwidth allocation, because BS has all information for each scheduled service flow. It is also the responsibility of this module to keep fairness among different flows and SS under overloaded conditions. The module assures the delay guarantee to UGS and rtPS flows as we increase the number of flows. BS distributes UL bandwidth among various SSs by the following strategies. Bandwidth Allocation to UGS: BS fulfills the requirements of UGS flow whenever a UGS packet is queued in its queue. BS allocates bandwidth to flow according to packet size. If the number of UGS flow increases then Tolerated Jitter is used as an ordering parameter. If two flows are equal in Tolerated Jitter, then Maximum Latency is used to break a tie. Bandwidth Allocation to rtPS: BS satisfies the requirements of rtPS flow whenever number of rtPS-packets is in its queue. The parameter Maximum Latency is used as an ordering parameter. If two flows are equal in Maximum Latency, then that flow has the priority, which has less allocated bandwidth, and it calculated from Maximum Sustained Rate and Minimum Reserved Traffic Rate. While ordering flows, there is one important aspect where a flow, which is much closer to maximum latency, is crossing a deadline. Here it is better to drop the packets instead of allocating very costly bandwidth. Bandwidth Allocation to nrtPS: BS fulfills the requirements of all nrtPS flows according to size of packets that are queued in its queue.

E. Bandwidth traffic priority

The parameter Traffic Priority is used as an ordering parameter. If two flows are equal in Traffic priority, then that flow has the priority, which has, less allocated bandwidth as compared to the other, and that is calculated from Maximum Sustained Rate and Minimum Reserved Traffic Rate. Bandwidth Allocation to BE: At last it fulfills the requirements of all BE flows. Traffic Priority is used as an ordering parameter to allocate bandwidth among BE service flows. In the second stage, BS allocates DL bandwidth to all SSs. Service flows that have not gotten bandwidth in the current frame will get it in the next. Downlink Bandwidth Management BS Downlink Scheduler D. BS Downlink Scheduler After bandwidth allocation from downlink bandwidth management module, BS Downlink Scheduler's is to schedule packets from the respective queues of UGS, rtPS, nrtPS and BE according to allocated bandwidth. First we schedule UGS packets, because there is fixed bandwidth allocation, so that it can meet QoS efficiently. After scheduling UGS packets, the remaining bandwidth is allocated among rtPS, nrtPS and BE flows. These packets are scheduled by SCFQ scheduling algorithm, which finds the finish number of each packet before its introduction into the respective queue, and this algorithm also updates the round number after each arrival and departure of packets. Weight is calculated by the mechanism described in SS Uplink Scheduler.

F. Fragmentation Module

This module is mainly responsible for allowing efficient use of granted bandwidth relative to the QoS requirements of a connection. We do not fragment the UGS connection, because there is fixed allocation of bandwidth. This process is performed before BS scheduler and SS scheduler schedule the packets. Its main task is to fragmenting the packets whose size is greater than that allocated for a packet. In these cases header overhead increases, but this can be compensated for through efficient utilization of bandwidth allocated to each SS.

G. Algorithm 2: Uplink Bandwidth

1) if F lowi.T ype of Service == UGS OR rtP S then
2) N = Calculate Slot Cost(F lowi. Rate);
3) if N < Total Available Slots the
4) Admit(F lowi);
5) T otal Available Slots− = N; SSj .Rate+ = F lowi. Rate;
6) else

V. CONCLUSION

In this paper, the thing addressed to solve the crucial scheduling process which acquires channel circumstance as a feedback for improved bandwidth utilization of IEEE 802.16 wireless systems. Here, a static IEEE 802.16 network is measured.In fact, it estimates and measures current sending and receiving rate of each flow of information between different nodes of a network. Firstly, the amount of bandwidth allocated to different services are defined which identifies the priority of these services. Secondly, the compensation mechanisms for bandwidth allocation techniques are adopted according to QoS needs for identifying bandwidth allocation on different nodes. Different issues like packet delay, limitation of data, packet loss, traffic priority network, Downlink management module, Fragmentation Module , Bandwidth allocation.

REFERENCES

[1] S.Gandhimathi, A.Srivishnuparaneetharan, M.Madhushudhanan, "Ensuring QOS in WiMAX Networks," International Journal of Computer Science and Mobile Computing, Vol.2, Issue. 7, July- 2013, pg. 186-189

[2] R. Mahmood, M. I. Tariq and M. S. H. Khiyal, "A Novel Parameterized QoS based Uplink and Downlink Scheduler for Bandwidth/Data Management over IEEE 802.16d Network" International Journal of Recent Trends in Engineering, Vol 2, No. 1, November 2009.

[3] Mohamad El Masri, Slim Abdellatif, Guy Juanole, "An Uplink Bandwidth Management Framework for IEEE 802.16 with QoS Guarantees" IFIP Networking, May 2009, Aachen, Germany. pp.651-663.

[4] Luís Felipe M. de Moraes and Paulo Ditarso Maciel Jr., "An Alternative QoS Architecture for the IEEE 802.16 Standard," In the Proceedings of 2006 ACM CoNEXT conference.

[5] Q. Albluwi, N. Abu Ali, H. Hassanein, "A Dynamic Frame Partitioning Scheme for IEEE 802.16 Mesh and Multihop Relay Networks," IEEE International Conference on Communications, 2009, Page(s): 1-5

[6] Ayman Khalil and Adlen Ksentini, "Classification of the Uplink Scheduling Algorithms in IEEE 802.16", *European Wireless conference*, June 2008.

[7] Mikael Gidlund and Gang Wang, "Uplink Scheduling Algorithms for QoS Support in Broadband Wireless Access Networks," Journal of Communications, Vol. 4, No. 2, March 2009.

[8] Kaur, A., Singh, H., & Sharma, P, "Bandwidth allocation scheduling algorithms for IEEE 802.16 WiMax Protocol to improve QoS," Proceedings in International Journal of Computer Applications, Vol. 98(11), July,2014, 16–22.

[9] Claudio Cicconetti, Alessandro Erta, Luciano Lenzini, and Enzo Mingozzi, "Performance Evaluation of the IEEE 802.16 MAC for QoS Support" IEEE Transaction on Mobile Computing, 1st ed, vol. 6, January 2007

[10] Jianfeng Chen, Wenhua Jiao, Qian Guo, "Providing integrated QoS control for IEEE 802.16 broadband wireless access systems," Vehicular Technology Conference, IEEE 62nd, vol 2, 2005.