Research Article

Performance Investigation Survey on Different Scheduling Techniques for QoS in 802.16e Networks

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Abstract: Worldwide Interoperability for Microwave Access (WiMAX) networks Provides Several Services on audio,video,data and voice services including different classes of Quality of Services (Qos).WiMAX scheduling algorithm is more challenge as it is responsible for distribute the resources among users. Hence it is very much essential to design an efficient scheduling algorithm for Wimax Network in order to cater the need of High Bandwidth Utilization, reduce the latency and enhance the Qos without starving the low priority class. In this paper we survey the performance of different scheduling algorithm and its related work.

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INTRODUCTION

WiMAX (worldwide Interoperability for microwave access), technology is broadband wireless data communication technology which was derived fromIEEE 802.16 standard. WiMAX 802.16e is developed for to meet the requirement of the mobile users and fixed users in a telecommunication network. This provides point to multipoint wireless networking. WiMAX carries broadband wireless signals up to 40 KM distance for for fixed stations, and 4-30kilometres for mobile stations.Wimax is capable of deliver the bandwidth up to 70 Mbps for fixed and mobile stations.WiMAX adoptsmixture of wireless technologies that are derived from IEEE to meet the rapid need of higher data rate and very long distance transmissionin wireless access. This also enables a high speed connection to the Internet in order to cater multimedia services such as videos audios, trading applications, e-commerce applications, education, research and other applications etc.

WIMAX ARCHITECTURE

IEEE 802.16e standards defines the WiMAX Architecture which consists of a BaseStation (BS) &multiple SubscriberStations (SSs), as described in Figure 1, Multiple Subscriber stations communicate with BS which is responsible for the distributing the resources. Data transmission from SSs are responsible of basestation through two operational modes: Mesh-mode and Point-to-multipoint (PMP), Two separate channels are used for downlink (ie Base Station to Subscriber Station) and uplink (ie Subscriber station to Base station) for successful data transmission. The downlink channels are used dedicatedly by Base station for subscriber data transmission where as uplink channels arecommonly used by all the subscribers to communicate with Base station for data transmission.

In MM (mesh-mode), SS can establishes the connection directly with base Station or via subscriber Station also and in turn that subscriber station connects with the base station.. In this methodology the traffics are routed via base station as well as ss station also. this means that the uplink and downlink channels are defined as traffic in both directions; to and from the BS. In point to multipoint mode(PMP mode), SSs will initiate the connection only with the base station which enables the providers to monitor the network services and assures the quality of services to all customers

QUALITY OF SERVICE (QOS)

The base station that supports the wide variety of applications is ensures the different quality of services that includes:

1. UGS (unsolicited Grant Service): Designed to provides the fixed data rates (CBR) for voice communications.
2. RTPS (real-time Polling Service): This ensures the assured bandwidth and assured latency for real-time data streams that requires varying sized datas at sporadic intervals such as mpeg videos.
3. ERTPS (extended real-Time polling Service): This also ensures assured bandwidth and assured latency for real time applications at sporadic intervals like video conference and voip with silence suppression.

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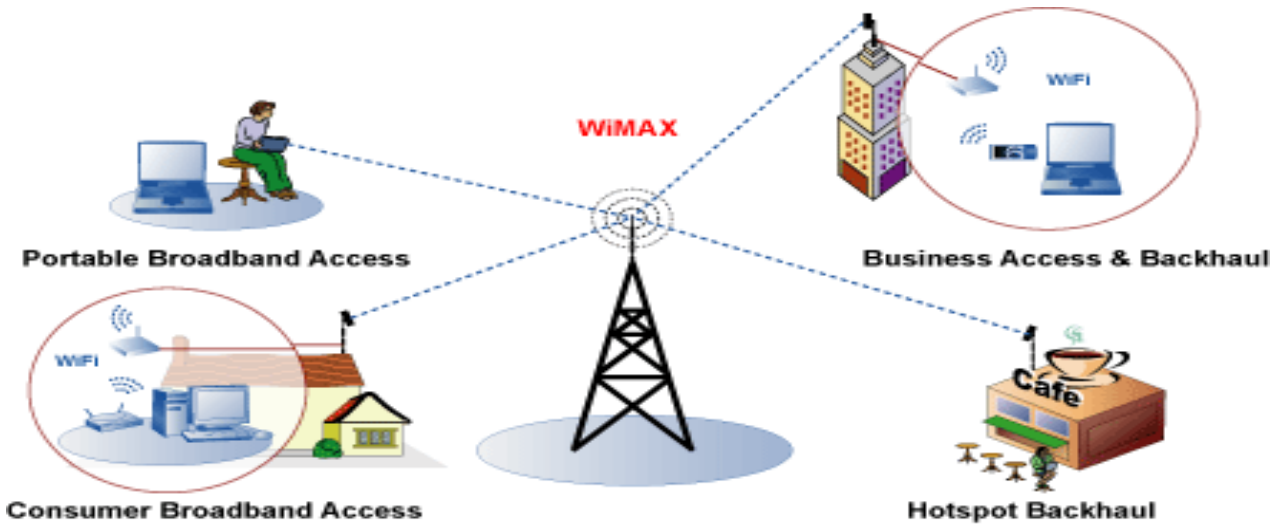

Figure 1: WiMAX Architecture with Single BS and Multiple SS

4. NRTPS (Non-Real-Time Polling Service): This service class made for other than the real time packets which does not assures the guaranteed delay. But this offeres the minimum bandwidth for applications like file transfer protocol.
5. BE (Best Effort): Supports the Data stream which does not require any qos guarantees like hyper text transfer protocols.

WIMAX SCHEDULING ALGORITHMS

All the Subscribers who are sharing the resources are responsible of the Scheduling algorithms in the network, and enable higher QoS for them. The motivation of the scheduling algorithm is to utilize the maximum network bandwidth and achieve the equality among all multiple users as the users requires different services (audio, video, http, voip etc) and each services require different requirement.

Strict Priority- (SP)

Packets are placed in to different Priority queues according to the QOS class in Strict Priority Scheduling Algorithm. It serves the packets from Highest Priority Queues to lowset priority queues. In this scheduling algorithm, Starvation of the bandwidth occurs for least priority class of packets.

WRR-(weighted-round-robin)

In weighted round-robin (wrr), Packets are assigned different priority queues based on various service classifications and then assigned difference percentage of bandwidth. In order to avoid the Starvation in the bandwidth, WRR designed that all the service class of packets are assigned with minimum bandwidth.

WFQ-(weighted fair queuing)

Employed for the traffic which is used for uplink in WiMAX with different packet sizes. Packets Assigns with the finish time, This algorithm ensures fairness in scheduling to the same. The finish times are depends on size of the packet and andweight of the each packetAs a whole, the WFQ algorithm out perForms the WRR due to variying packet size. WFQ algorithm drawback is, As the packet start time stamp is not considered, it slows the system scheduling performance if many packets falls on single priority region.

Diffserv-Enabled

To classify and manage the network is very simple in Diffserv-Enabled Algorithm and it is scalable and measurable mechanism. It guarantees the low latency for critical and non critical services. The traffic classification is based on the principle of 6-bit differentiated service codepoint(DSCP) in the IP packets of the header fieldsand shows the per-hop behaviour (PHB). DSCP replaces the out dated IP precedence in classifying and prioritizing types of traffic.

To ensure the privileged treatment for high priority traffic and to manage the all the service class distinguish, The routers that uses the diffServ are must be configured based on class of service.

4.5 RR-(round robin)

The timeslots are assigned by the scheduler in round robin fashion to each queue in equal portions without priority. It begins with serving a packet with high priority queue and moves to the packet with next low priority queue and serves. This continues until each and every single packet in a queue is served atleastonce.This allocates the equal amount of resources for all the packets that ensures the effective utilization of network resources. It provides very good bandwidth efficiency and it can't guarantee different qos requirements for each queue.

Self-Clocked-Fair (SCF)

SCF is an well-organized scheme in queuing system which meets to all the needs of qos in Broadband implementation.Virtual time stamp is the base principle of this algorithmand This algorithm generates the time stamp internally and mapped to the work in progress. This virtual timestamp function determines the which packet to be processed or served next in order. Since assigning a packet to virtual time stamp is negligible overhead, thus proves an efficient algorithm. The implementation is very easy because of it maintains thefairness attribute in virtual time.

LITERATURE SURVEY

In [1], Ahmed H Raswant investigated his research on thedifferent types of algorithms in WiMAX network and those are Weighted-Fair Queuing (wfq),Round Robind (RR), Strict Priority (SP). In his research he concluded that, SP has minimum delay and highest throughput for QOS class which has high priority.Starvation in bandwidth occurs in the nrtPS and BE classes. According to the priority of the traffic, WFQ and WRR delay values are different.The highest priority class of services are less latency whereas BE has more latency.

In [2] Mohammed SabriArhaifhas investigated his research on different scheduling algorithms in Wimax, such as Strict-Priority,Diffserv-Enabled (Differs), SelfClocked-Fair Round Robin (RR), SelfClocked-Fair (SCF), Weighted-Round Robin and Weighted-Fair Queuing (WFQ). The following observations found in each and every algorithm. WFQ, SR and WRR are more competent in term of end-to-end latency when the total number of mobile station are less than 10. As a whole of asa conclusion the best scheduling algorithms were: WFQ proved less latency, WRR produces the high data throughput

In [3] Sawroop R Puranik had compared all the Scheduling AlgorithmsinIEEE 802.16e (WiMAX) Standardand came to conclusion that, the homogeneous algorithm such as RR,WRR,DS,WFQ,SP and SCP are not suitable for all the QOS class types even though they all have better performance. WFQ is good for end-to-end delay and real time service classes (uGS, rtPS and ertPS)TCP-AU algorithm are well suited for BE Qos Classes, RR Algorithm provides the moderate latency (Jitter) SP is not suited for multimedia data.

In [4] The author has compared the different scheduling algorithms performance in Wimax and found that Output Queue Size and number of Subscriber stations does not affect the throughput of the server and delay in some algorithms. The good Algorithms with resource utilization & queue management and resource utilization are WRR, RR, and SCF & DS in order

In [5] The Author had compared the different scheduling algorithm in wimax MAC scheduler design found that WFQ is the most suitable algorithm for guaranteed delay, throughput and fairness among users with dynamic and proper weight allocation to each queues connections.

In [6] The author of " The proposed Real time scheduling algorithms " had a reviewed many scheduling algorithms by compared with his scheduling algorithm of WRR and MDRR and concluded that these algorithms had shown better results for real time traffic in terms of jitter, throughput and delay and starvation of the bandwidth occurs for low priority class of traffic.

In [7] The author of " Mixed Approach for scheduling process in Wimax for High QOS" compared the scheduling algorithms based on waiting time, packet drops, execution time , turnaround time etc and proposed a scheduling algorithm by considering the distance between user and base station, burst time and latency. In his simulation results, The roundtrip time latency, burst traffic time and weight time are reduced for high priority service class of traffic and also throughput is not considered. He has not discussed about the low priority class of traffic

In [8] The author had researched on comparing multiple Scheduling Algorithms in Wimax Networks and developed a new scheduling algorithms which efficiently works for high priority service class with best throughput He had compared algorithm of WRR, TLS , APF and E-APF results and proved that E-APF perform good throughput, where as this algorithm shows that large delay for when sharing resources among 40nos concurrent subscribers and this results does not talk about the low priority service class.

In [9] The Author had evaluated AFQLA,AFSMD AND AFDW scheduling algorithms to meet the delay requirement and maximize the throughput to serve the rtps sunscriber stations.

From this Literature survey, we can come to conclusion that there are scopes for improving the strict priority Scheduling algorithms without bandwidth starvation on low priority class of traffic.

PROBLEM IDENTIFICATION

From the above analysis, The WiMAX network is fully occupied with network traffics like high and low priority class of traffics. Most of the Scheduling Algorithm has designed to provide best Quality of service (QOS) for high priority class of traffics over Low priority class of traffics which results inturn lower priority class of traffic leads to bandwidth starvation conditions, drops in the packets, very high delay less guarantee for throughput.

CONCLUSION AND FUTURE ENHANCEMENT

The algorithms of scheduling are liable for distributing the network resources among its users to ensure fair degree of QoS. The motivation of the scheduling algorithm is to exploit

the maximum network bandwidth and achieve the fairness among all multiple users as the users requires different services and each services require different requirement (Bandwidth and Latency). By keeping the problem statement in mind, developing a new hybrid strict priority scheduling algorithm for different QoSs is must that should ensures that problem of the bandwidth starvation for low priority class of traffic, reduce the packet loss and also ensure the scheduling efficiency is must and this will be considered as a future work.

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