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# Analysis of Enhancing QoS in Mobile WiMAX Network Applications

A.Suganya PG Student
M.ECommunication System
M.Kumarasamy College Of Engineering,Karur

***Abstract-*** Wireless network is fast growing area. Wireless network has an ability to provide a good quality of service i.e voice, data, video conferencing etc. Different mobile generations are presented i.e 1G to 4G. In this research paper, 4G technology is used. WiMAX is 4G technology. WiMAX is a promising technology for providing wireless last-mile connectivity. Physical and MAC layer of this technology refer to the IEEE 802.16 e standard, to satisfy Quality of Service (QoS) requirements of different applications, such as VoIP, videoconference, FTP, Web. After creating a network check the quality of network i.e Jitter (sec) and delay (sec). Here two types of MAC layer QoS are used and they are UGS and rtPS having application of Voice over IP (VoIP) and MPEG respectively.In this paper we conclude that when the speed of moving mobile node is increased we obtain the low delay and low jitter in network.

***Key words-*** nrtPS, QoS, rtPS, UGS, WiMAX

## I. INTRODUCTION

Quality of Service (QoS) is the service that is used to deliver the different services to the mobile user in appropriate time. Some QoS properties of network are fixed as well as predefined with boundaries.QoS is service that is used to measure the overall performance of network. (WiMAX) is one of the most important broadband wire-less technologies and is anticipated to be a viable alternative to traditional wired broadband techniques due to its cost efficiency. Performance of network is measured to check the speed, accuracy and reliability. Different services are provided to different network traffic. Bandwidth, error ratio, queuing delay, jitter (delay variation) and throughput are a different service that comes under QoS.Extra additional n/w resource is not created by QoS.

Additional bandwidth is not created in the network. The purpose of this study was to examine a case of QoS deployment over a cellular WiMAX network and to examine the capability of a WiMAX network to deliver adequate QoS to voice and data applications. The methodologies taken include creating the WiMAX network, deploying the required \ applications, deploying QoS and its configurations within the WiMAX last-mile, adjusting the QoS configurations within the WiMAX cells to meet voice requirements.Based on this there are many types of services. such as UGS, rtPS, ertPS, nrtPS, BE to get better handover results.

### 1.1 Wimax Architecture

Subscriber station node and base station node are main component in WiMAX architecture.Subscriber station node sends the signal to the base station. Firstly create a connection and request for particular services. After creating a connection sends the packets from one node to other node.

### 1.2 Quality of Service (QoS) in IEEE 802.16

WiMAX QoS standard has 4 different categories that is used for the prioritization of mobile node(traffic):

**1. The UGS (Unsolicited Grant Service)**

In this paper presented of similar to the CBR (Constant Bit Rate) service in ATM, which generates a fixed size burst periodically. This service can be used to replace T1/E1 wired line or a constant rate service. It also can be used to support real time applications such as VoIP or streaming applications. Even though the UGS is simple, it may not be the best choice for the VoIP in that it can waste bandwidth during the off period of voice calls. Once the connection is set up,there is no need to send any other requests. The main QoS parameters are maximum sustained rate(MST), maximum latency and tolered jitter (maximum delay variation).

**2. The rtPS (Real-Time Polling Service)**

However a variable bit rate real-time service

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such as VoIP. Every polling interval, BS polls a mobile and the polled mobile transmits bw-request (bandwidth request) if it has data to transmit. The BS grants the data burst using UL-MAP-IE upon its reception.real time traffic such as MPEG compressed video.

**3.The ertPS (Extended Real Time Polling Service)**

This service is designed to support VoIP with ertPS service is similar to UGS in that the BS allocates the maximum sustained rate in active mode, but no bandwidth is allocated during the silent period.There is a need to have the BS poll the MS during the silent period to determine if the silent period has ended.

**4. The nrtPS (Non-Real-Time Polling Service)**

Is very similar to the rtPS except that it allows contention based polling.

**5. The BE (Best Effort)**

Service can be used for applications such as e-mail or FTP, in which there is no strict latency requirement. The allocation mechanism is contention based using the ranging channel. Another service type called ertPS (Extended rtPS) was introduced to support variable rate real-time services such as VoIP and video streaming. It has an advantage over UGS and rtPS for VoIP applications because it carries lower overhead than UGS and rtPS.

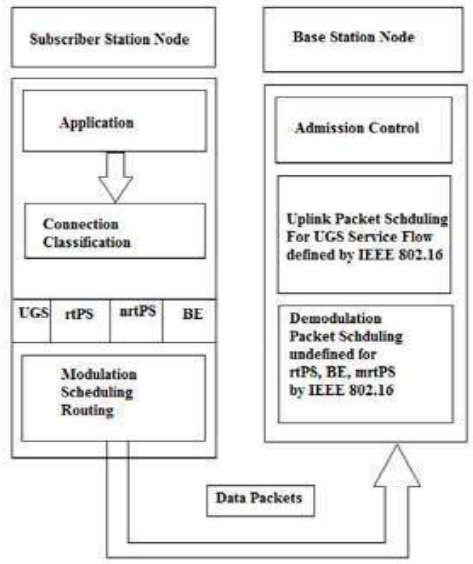


**Fig 1. WiMAX Architecture**

## II. RELATED WORK

First proposed concept that analyze different QoS parameters. Analyze the parameter for WiMAX Network. This research helps in determining the overall performance of 4G n/w and parameters of 4G n/w is critical in nature. A very low value of Jitter, delay and packet loss is achieved for 500 mobile users that exist in network. An AODV protocol helps in achieving the larger value of throughput. In this proposed concept of performance of WiMAX (Worldwide Interoperability for Microwave Access) n/w that check quality parameter for network. Using Multimedia technique, it provides a optimize result for BS (BaseStation). This paper shows overall performance of quality of network that is based on particular location. second, researchers examine concept of WiMAX based network and evaluate the performance for quality of service (QoS) using an idea of IEEE 802.16 technology.

This research used a multiprocessor architecture organized by the interconnection of n/w. OPNET 17.5 TOOL is used to create the architecture and to calculate performance criteria i.e. throughput, delay and data dropped that slightly concerned in network estimation. Authors proposed a work to compare the QoS between UMTS 3G network and WiMAX 4G networks. Two network models were proposed has objective of studying a realistic approach: in UMTS model multiple users are placed in the network requesting some applications and then the network traffic measured and calculated. Regarding the WIMAX model scenario, where several users perform different services, enabling the analysis of network performance by measuring several parameters and they proposed a work to compare the QoS between UMTS 3G network and WiMAX 4G networks.

Two network models were proposed has objective of studying a realistic approach: in UMTS model multiple users are placed in the network requesting some applications and then the network traffic measured and calculated. Regarding the WIMAX model scenario, where several users perform different services, enabling the analysis of network performance by measuring several parameters.

## III. PROPOSED WORK AND SIMULATION

Create a WiMAX n/w with the help of OPNET TOOL 17.5. This network checks quality of service. The WiMAX network should consists of base stations, mobile nodes, application configuration, profile configuration and WiMAX configuration. Application

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configuration profile configuration and WiMAX configuration are used to set the properties of network.

This network shown in figure 3 consists of 2 base station 1 profile configuration, 1application configuration, 1 WiMAX configuration and 16 mobile nodes.

Some of parameters are given below which is used for simulation

**3.1 Delay (sec)**

Delay parameter is checked in WiMAX network. Delay is basically refers to time needed for a packet which is to be travelled from corner to corner of n/w from one moving node to another moving node in the network. The delay typically measured in fractions of seconds. When rate of moving node is greater than before then delay is degraded as shown in given below figure. This results shows that degraded performance of network.

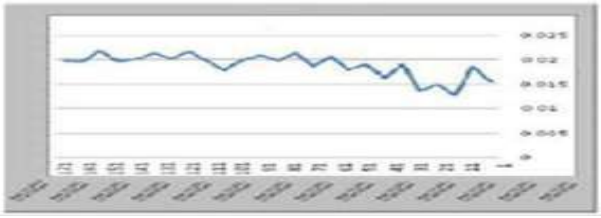

**Fig 3.Delay(sec)**

**3.2 Jitter (Sec)**

Jitter is basically a form of latency. Jitter is measured in the variability over time of packet latency across a network.

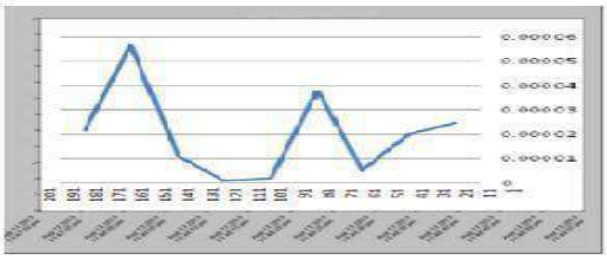

**Fig 4. Jitter(sec)**

**IV. WiMAX Radio Planning for Simulation**

WiMAX deployment with optimization is not easy task so we have done survey between Bhusawal, Balwadi and Jalgam. In this particular area we also considered about number of users. Since we know that WiMAX coverage is 50 km in radius but when we have take practical consideration it's up to 25 to 30 km. We have also observed that one directional antenna and one Omni-directional antenna has been required for last mile operation or for total coverage. The area with location and required range and BS is given in fig.

| Scheduling Type | Polling Method |
|---|---|
| UGS | PM bits used to request the poll for bandwidth needs on non UGS connection. |
| ertPS | Uses unicast polling.<br>BS offers unicast grant like unrequested UGS |
| rtPS | Only allows unicast polling |
| nrtPS | May restrict service flow to unicast polling in tansmission request policy |
| BS | All forms of polling is allowed |

**Fig 5. QoS Classes**

As described in figure two types of MAC Layer Quality of services (QoS) UGS and rtPS are used, with maximum sustained traffic rate of 5 Mbps and minimum sustained traffic rate of 1 Mbps for UGS and with maximum sustained traffic rate of 1 Mbps and minimum sustained traffic rate of 0.5 Mbps for rtPS scheduling types.

**PHYSICAL LAYER OF IEEE 802.16M**

This section contains an overview of some Physical Layer enhancements that are currently being considered for inclusion in future systems.

Because the development of the 802.16m standard is still in a relatively early stage, the focus is on presenting the concepts and the principles on which the proposed enhancements will be based, rather than on providing specific implementation details.

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**MAC LAYER IEEE 802.16D**

MAC layer provides two modes of operation: point-to-multipoint (PMP) and multipoint-to-multipoint (mesh).The functionalities of the MAC sublayer are related to PHY control (cross-layer functionalities, such as HARQ ACK/NACK etc). The Control Signaling block is responsible for allocating resources by exchanging messages such as DL-MAP and UL-MAP. The QoS block allocates the input traffic to different traffic classes based on the scheduling and resource block, according to the SLA guarantees. Thus, delay-prone and non delay-prone applications are allocated to different classes, such that the energy savings be optimized, while satisfying the appropriate QoS e.g those that support web page downloading or emails.

**V. SIMULATION TABLE**

The simulation table defines the parameters which are given in the table such as mobility speed, MAC layer value, Buffered size, Transmission power, routing protocol.

| *Parameters* | *Value* |
|---|---|
| Transmission power | 0.005 |
| Examined Routing Protocol | AODV |
| MAC Type | IEEE 802.11 DCF , IEEE 802.16 |
| Number of nodes | 95 |
| Simulation Area | 1500x1500 Square meters |
| Mobility Speed | 20,60,120 km/Hour(km/h) |
| Trajectory Inf. | MANET/WiMaX mobility scenario , Vector |
| Reception power threshold | -95dBm |
| Data rate | 11Mbps |
| Mobility Model | Random Way point |
| Buffer size | 256000bits |
| FragmentationThreshold (bytes) | 1024 |
| Traffic | ,Oracle VOIP |
| Simulation | 500000 events Based on Kernel type preference |
| Simulation Time | 30 min |
| Seed | 128 |
| Update Interval | 500000 |
| Values per Statistic | 100 |

**VI. CONCLUSION**

This paper is evaluating the performance of WiMAX network under QoS condition. In this research paper jitter and delay of the network is checked. Jitter per second and Delay per second is checked. Implemented network, practically verify the performance of networks. With OPNET TOOL, enlarge the region of network to check the performance of various QoS parameters. In this network perform a handover task after defining a trajectory into the network. Using better QoS, better handover results can be obtained.

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