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# Congestion Based Pricing Resources Managemant In Broadband Wireless Networks

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**ABSTRACT:** Congestion based pricing scheduler that incorporates two sub-schemes: a bandwidth provisioning sub-scheme to idententify the bandwidth scarcity to provision in fourth generation (4G) BWA technologies and an efficient packet scheduler sub-scheme. In the existing scheduler the first one to simultaneously control congestion and fairness while providing differentiated QoS guarantees in BWA networks. Simulation results show that the existing scheme realizes our objectives of controlling congestion, providing differentiated QoS guarantees, and catering to proportional fairness among the different network classes and among connections within the same class.

## I. INTRODUCTION

WiMAX is a telecommunications technology that can transmit wireless data over 500 times further than the leading WiFi networks, while maintaining speeds at par with DSL and Cable. This innovative technology has the potential to revamp broadband Internet access I n the same way that cell phones have forever altered the use of phone access. For these reasons, WiMAX is sometimes referred to as WiFi on Steroids. WiMAX, which stands for the Worldwide Interoperability for Microwave Access, has the ability to exchange information on multiple machines using radio waves that are transmitted from WiMAX base stations.

WiMAX is based on the Institute of Electrical and Electronics Engineers (IEEE)802.16 standard, which defines the technical features of the communications protocol, and is also known as Broadband Wireless Access and as a Wireless Metropolitan Area Network (Wireless MAN). Current WiFi networks operate on the 802.11 standard, which reach a maximum range of about 300 feet and a speed of up to 54 Mbps. However, the 802.16 standard can extend to a 30-mile radius with wireless data transmitting up to 70 Mbps. With this significant increase in range and speed, WiMAX has the potential to extend the connectivity bubble over many remote areas that have never before had Internet connectivity.

The past few months have seen a storm of debate about the economics and return on investment of Wi-Fi hotspots. What almost all the arguments entirely ignore is the standard lurking on the horizon, which will turn current assumptions on their head. This is the 802.16x wireless metropolitan area network (WMAN) specification, which is being developed and promoted by the WiMAX industry group, whose most powerful members are Intel and Nokia. As with Wi-Fi, the WiMAX label has now become widely acceptable as a name for the standard itself.

### 1.1 WIMAX IEEE 802.16

Intel has called 802.16 “the most important thing since the Internet itself”, and even allowing for a dose of self-serving, it is not talking entirely in hyperbole. In July, WiMAX showed off its first system profiles and interoperability tests at the WCA annual conference in Washington DC, in a significant step towards making the 802.16a standard, ratified by the IEEE in March, a commercial technology.

While a fully mobile version of WiMAX is in the wings, this first release will cover fixed wireless, and its supporters are focusing in particular on broadband last mile in unwired areas, and on backhaul for hotspots. Intel will start to make WMAN chips this year

The non-profit group takes a similar role to the Wi-Fi Alliance in WLANs, backing development of wireless Man products based on 802.16 and working on standards certification and interoperability testing.

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The initial version of the standard operates in the 10-66GHz frequency band and requires line of sight towers, but the 802.16a extension, ratified in March, uses the lower frequency of 2-11GHz, easing regulatory issues, and does not require line of sight. It boasts a 31 mile range compared to Wi-Fi's 200-300 yards, and 70Mbps data transfer rates.

Systems based on the mobile version of the standard, which should ship towards the end of next year, about six months after fixed wireless products, will be able to achieve long distance wireless networking and will have far greater potential than Wi-Fi hotspots to provide ubiquitous coverage to rival that of the cellular network.

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1.2 Wimax Networks Around The World

WiMAX Networks around the World Beginning in 2004, WiMAX network have rapidly emerged in areas all over the globe. Many Internet Service Providers have launched Metropolitan Wireless Area Networks for backhaul to the Internet or to connect several Wi-Fi mesh networks over long distances.

The reach of WiMAX has enabled Internet access where never seen before.

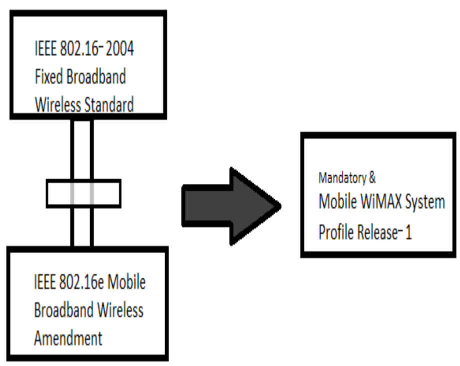


Fig 1.1Mobile WiMAX System

Internet is now available on trains in the United Kingdom, boats can receive WiMAX transmissions on the French, Italian and Spanish Riviera's, and remote tribes in Africa are finally able to join the world of telecommunications.

## II. RELATED WORK

2. 1 Congestion Pricing

Congestion pricing or congestion charges are a system of surcharging users of a transport network in periods of peak demand to reduce traffic congestion. Examples include some toll-like road pricing fees, and higher peak charges for utilities, public transport and slots in canals and airports. This variable pricing strategy regulates demand, making it possible to manage congestion without increasing supply. Market economics theory, which encompasses the congestion pricing concept, postulates that users will be forced to pay for the negative they create, making them conscious of the costs they impose upon each other when consuming during the peak demand, and more aware of their impact on the environment.

The application on urban roads is limited to a small number of cities, including London, Stockholm, Singapore, and Milan, as well as a few smaller towns. Four general types of systems are in use; a cordon area around a city center, with charges for passing the cordon line; area wide congestion pricing, which charges for being inside an area; a city center toll ring, with toll collection surrounding the city; and corridor or single facility congestion pricing, where access to a lane or a facility is priced. Implementation of congestion pricing has reduced congestion in urban areas, but has also sparked criticism and public discontent. Critics maintain that congestion pricing is not equitable, places an economic burden on neighboring communities, has a negative effect on retail businesses and on economic activity in general, and is just another tax. A survey of economic literature on the subject, however, finds that most economists agree that some form of road pricing to reduce congestion is economically viable; although there is disagreement on what form road pricing should take. They primarily argue that recent advances in technology have significantly reduced the previously high transaction costs of toll collection. Fuel taxes are not effective in reducing highway congestion, and tolls are the direct method. Also, concerns regarding fossil and urban transport high emissions of greenhouse gases in the context of climate change have renewed interest in congestion pricing, as it is considered one of the demand-side mechanisms that may reduce oil consumption.

2.2 Quality of Services

QoS guarantees are necessary if the link capacity is limited – i.e. when the total demand is greater then the offered bandwidth, or when measuring Latency & Jitter parameters of various CID's. When dealing with real-time streaming multimedia applications, for example voice over IP or video streaming, the QoS definitions are with high importance since these often require fixed bit rate and may be delay sensitive, as opposed to normal Data traffic which is insensitive to delay.

QoS works by slowing unimportant packets down, or in the cases of extreme network traffic, throwing them away entirely. This leaves room for important packets to reach their destination as quickly as possible. Basically, once your router is aware of how much data it can enquire on the modem at any given time, it can "shape" traffic by delaying unimportant packets and "filling the pipe" with important packets FIRST, then using any leftover space to fill the pipe up in descending order of importance.

Since QoS cannot possibly speed up a packet, basically what it does is take your total available upstream bandwidth, calculate how much of the highest priority data it has, put that in the buffer, then go down the line in priority until it runs out of data to send or the buffer fills up. Any excess data is held back or "requeued" at the front of the line, where it will be evaluated in the next pass.

"Importance" is determined by the priority of the packet. Priority range from "Low" or "Bulk" (depending on the router), to "High" or "Premium". The number of levels and the exact terminology depends on your router. As the names imply, "Low"/"Bulk" priority packets get the lowest priority, while "High"/"Premium" packets get the highest priority. QoS packets may be prioritized by a number of criteria, including generated by applications themselves, but the most common techniques you will run into with Consumer grade routers are MAC Address, Ethernet Port, and TCP/IP Port.

## III. NOVEL SCHEDULING SCHEME

The design of scheduling algorithms in WiMAX networks is highly challenging because the wireless communication channel is constantly varying. The key issue to meet the QoS requirements in the WiMAX system is to allocate the resources among the users in a fair and efficient way, especially for video and voice transmission. However, the amount of allocated resources depends on the Modulation and Coding Schemes (MCSs) used in the physical layer. The aim of the MCSs is to maximize the data rate by adjusting transmission modes to channel variations. The WiMAX supports a variety of MCSs and allows for the scheme to change on a burst-by-burst basis per link, depending on channel conditions. To manage resource allocation and grants an appropriate QoS per connection, other scheduling schemes are proposed. These scheduling schemes rely on different algorithms to handle different classes of services for matching their QoS requirements. To have a comprehensive introduction, a representative cross-layer scheduling algorithm with QoS support is briefed as follows.

In this algorithm various metrics of different class are considered to calculate priority of each connection. These metrics are briefly described as below:

UGS: PER (Packet Error Rate) and Service Rate. Because it requires guarantee on throughput, latency jitter up to some tolerance of packet loss i.e., voip.

RTPS: PER and Max. Delay after which packet is useless i.e., streaming video.

NRTPS: PER and min. Reserved Rate i.e., FTP.

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BE: No any guarantee needed but PER should be maintained i.e., http .e-mail.

So, based on these parameters and channel condition priority of particular connection is calculated. First of all fixed number of timeslots are separately allocated for UGS services. After that remaining slots are allocated to particular service among rtPS, nrtPS and BE services according to priority.

The queues for real-time Polling Service (rtPS) are managed with an Earliest Deadline First (EDF) algorithm, which is sensitive to delay latency and reliable for real-time services.

An opportunistic scheme which is similar to the PF algorithm is deployed for the queues supporting non-real time Polling Service (nrtPS), while the queues for Best Effort (BE) traffic are managed based on a Best-Rate discipline. In order to differentiate the priority of the four types of services such that rtPS>nrtPS> BE, the class coefficients are assigned to the queues of each service type.

## IV. SIMULATION

### 4.1 SIMULATION ENVIRONMENT

Nodes are randomly placed over a simulation grid of 5000m× 5000m. Number of subscriber stations simulated is 1 to 30. Each subscriber station can simultaneously have different types of connections including voice, video, FTP or background traffic.

### 4.2 TRAFFIC MODEL

For connections' traffic model, adopted traffic model presented, (a model specifically designed and tested for WiMAX simulation). This model implements VoIP traffic for the ErtPS class, video streaming traffic for the rtPS class, FTP traffic for the nrtPS class and background traffic for the BE class.

| PARAMETER | VALUES |
|---|---|
| No of cells | 1 |
| No of nodes | 16 |
| BS bandwidth | 50Mbps |
| Transmission range | 250 meters |
| Network area | 1000 x 1000 |
| Connection type | TCP |
| Service types | BE, nrtps, rtps |
| Simulation time | 1000 seconds |
| Interval | 0.01 sec |

Table 4.1 Simulation Parameters

## V. PERFORMANCE EVALUATION

AVERAGE DELAY:

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The time between the arrival of a packet to the departure of the packet from the node. The value is reported in milliseconds (ms) and is averaged over the number of packets.

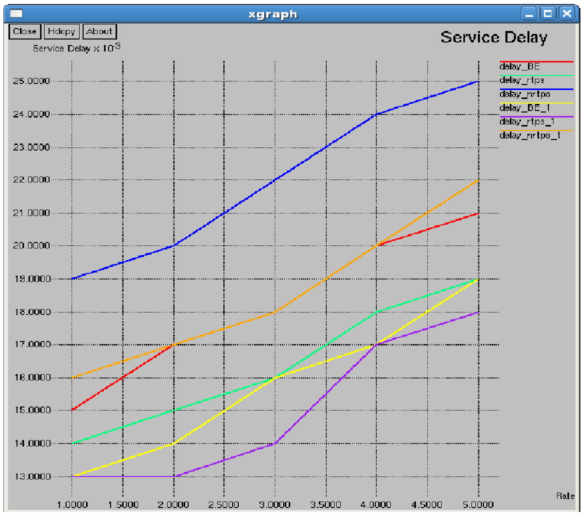

Figure 5.1 Data rate VS Delay

AVERAGE THROUGHPUT:

The rate of packets success-fully transmitted during the simulation time. This metric is used to understand the effect of load, congestion and relative priority of the classes and connections.

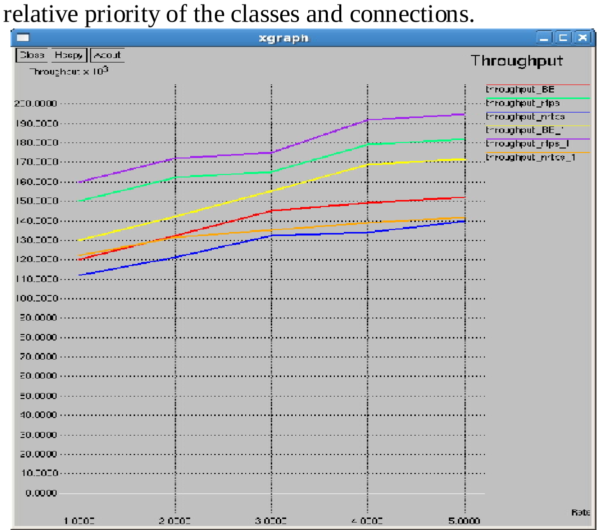

Figure 5.2 Data rate VS Throughput

## VI. CONCLUSION

Delay is the very important problem in congestion based pricing management. That will reduce by using two various algorithms. One is bandwidth provisioning algorithm is designed to calculate the number of time slots per class. The scheduling algorithm proposed in Section V allocates time slots amongst connections within the same class.

Both average delay and packet loss will allow us to determine how effectively the scheme satisfies the QoS requirements of real-time connections. In congestion based pricing model delay is the very important drawback ,by using that bandwidth and game theoretic scheduling algorithm reduces delay and avoid the congestion and increased the QoS, and provide the fairness among classes, and also increased the performance of network.

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