Analysis of QoS for Video Conferencing and Voice Application in WiMAX Network

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ABSTRACT
In last few years, there has been significant growth in the area of wireless communication. Quality of Service (QoS) is a critical issue in the design and management of WiMAX (Worldwide Interoperability for Microwave Access) networks. These applications include Voice over IP, multimedia services, like, video streaming, video conferencing etc. The WiMAX Mesh network is based on IEEE 802.16 standard. This paper purposes an architecture to analyze the Quality of Service for Video Conferencing and Voice Application in WiMAX network. For analysis, a WLAN network has been developed using a popular network simulator Opnet 14.0. In the end, results in the form of graphs are presented. Parameters that indicate quality of service, such as, throughput, network load and delay are analyzed for two types of service flows as defined in WiMAX. Results indicate that better quality of service is achieved by using real time service flows designed for specific applications.

Keywords
Differentiated Services, Video Conferencing, VOIP, WiMAX.

1. INTRODUCTION
WIMAX is the technology aimed to provide broadband wireless data access over long distances [6]. It is based on Institute of Electrical and Electronics Engineers (IEEE) 802.16 standard [2], [3]. The WiMAX networks are able to provide high-speed and high-quality broadband wireless access and have received a lot of attention from academia and industry. One of the important purposes of the WiMAX networks is to support different types of traffic such as real-time video or voice traffic over the wireless medium. In the design of WiMAX networks, a key issue is to satisfy the requirements of quality of service (QoS) for different types of traffic. Due to the complexity of QoS demands of new applications, we need to introduce new parameters to be used for comparison analysis of QoS requirements and QoS achievements of various RT and NRT service classes, rather than simply measuring them. RT applications need to be treated with high priority, whereas NRT applications demand to be treated with fairness.

The IEEE 802.16 standard includes the QoS mechanism in the Medium Access Control (MAC) layer (layer 2) architecture. It defines service flows which can map to DiffServ code points. This enables end-to-end IP based QoS. Among other things, the MAC layer is responsible for scheduling of bandwidth for different users. The MAC layer performs bandwidth allocation based on user requirements as well as their QoS profiles. The standard is designed to support wide range of applications. These applications may require different levels of QoS. To accommodate these applications, 802.16 standard has defined five service flow classes. These are summarized in Table 1 [4].

Table1. Service classes defined by WiMAX

	Description	Applications
Unsolicited Grant Service (UGS)	For Constant Bit Rate and Delay dependent applications	VOIP
Real-Time Polling Service (rtPS)	For Variable Rate and Delay dependent applications	Streaming Audio, Streaming Video
Extended Real-Time Polling Service (ertPS)	For Variable Rate and Delay dependent applications	VOIP and silence suppression
Non-Real-Time Polling Service (nrtPS)	Variable Rate and Non-Real-Time applications	FTP
Best Effort (BE)	Best Effort	E-mail, web traffic

These service flows can be created, changed, or deleted by the issuing Dynamic Service Addition (DSA), Dynamic Service Change (DSC), and Dynamic Service Deletion (DSD) messages. Each of these actions can be initiated by the Subscriber Station (SS) or the Base Station (BS) and are carried by three way handshaking.

2. QoS PARAMETERS
Throughput: Throughput is the rate at which a computer or network sends or receives data. It therefore is a good measure of the channel capacity of a communication link and connections to the internet are usually rated in terms of how many bits they pass per second (bit/s).

Delay- delay *is* an audio effect which records an input signal to an audio storage medium, and then plays it back after a period of time [1]. The delayed signal may either be played back multiple times, or played back into the recording again, to create the sound of a repeating, decaying echo.

3. SIMULATION SCENARIO

Creating a simulation scenario that is equivalent to real world scenario is the first step of simulation. In this simulation, the wireless topology considered is several wireless stations and one base station in WiMAX Network. All wireless stations are located such that every station is available to detect a transmission from any other station, and there is no mobility in the station in the system. This means that our results will not be affected by mobility and phenomenon such as hidden node problem.

Fig 1: A sample network model

In this research, twenty nodes have been used. A base station and a single WiMAX server is used to make a perfect network model. All nodes communicate with each other through base station. The simulation experiments are carried out using OPNET (version 14.0) on windows platform. Figure 1 shows a sample network model.

4. SIMULATION RESULTS AND DISCUSSION

In this section we present various metrics for analysis of various types of multimedia applications such as (Video Conferencing & VOIP) [5]. Figure 2 shows the delay of video conferencing in WiMAX Network.

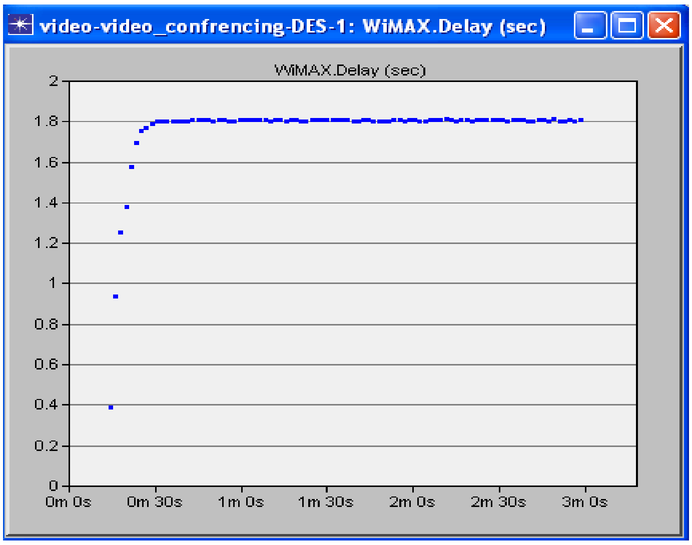

Fig.2: Delay for Video Conferencing in WiMAX Network

The above figure shows that the delay for Video Conferencing is not much higher in WiMAX Network. The delay is approximately 1.8 b/s for Video Conferencing.

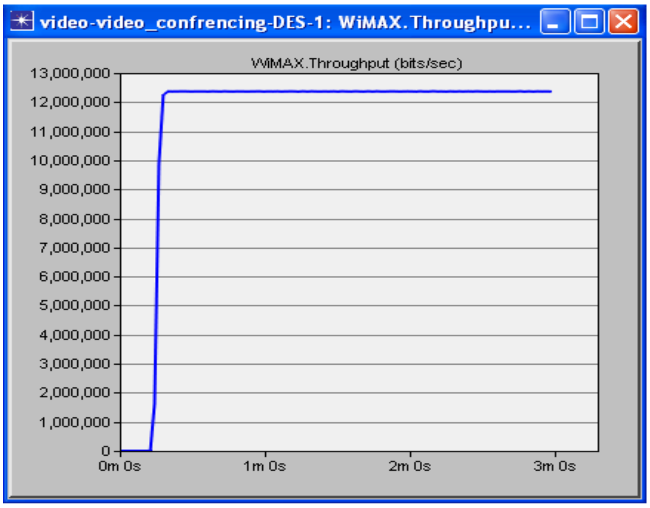

Fig 3: Throughput for Video Conferencing in WiMAX Network

Figure 3 shows the throughput of Video Conferencing in WiMAX Network. Results show that WiMAX network provides maximum throughput for Video Conferencing.

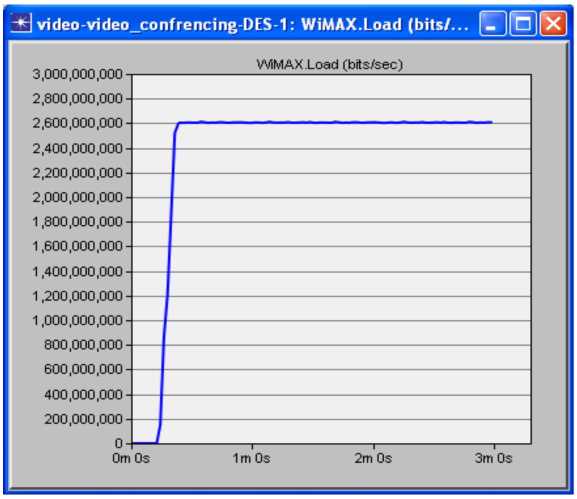

Fig 4: Network load for Video Conferencing in WiMAX Network

Figure 4 shows the network load of Video Conferencing in Wimax network. The load on network is much higher then other applications.

Figure 5 shows delay of Voice Application in WiMAX network. In this figure, it has been seen that the delay of Voice Application in WiMAX network is approximately 22 bits/sec. From this graph, it is clear that the delay increases with respect to time but after a time, delay becomes stable.

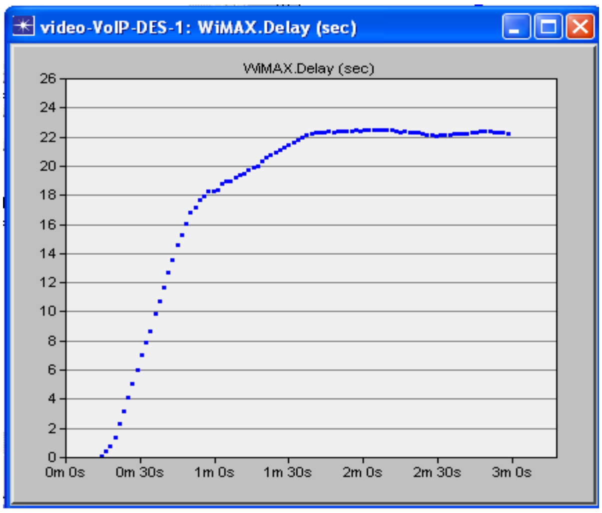

Fig 5: Delay for Voice Application in WiMAX Network

Figure 5 shows the delay for Voice Application in WiMAX Network.

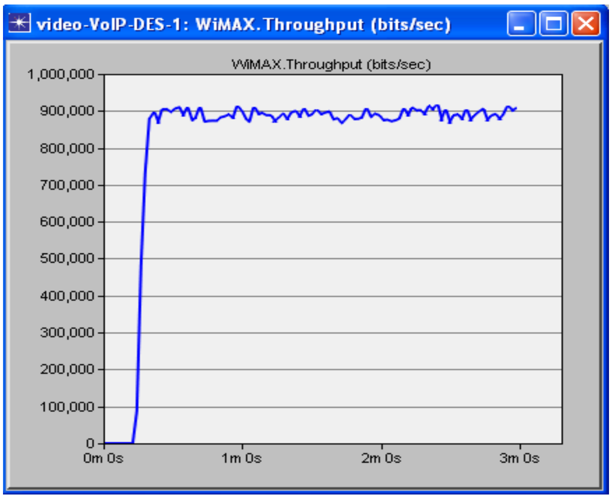

Fig 6: Throughput for Voice Application in WiMAX Network

Figure 6 shows the throughput of Voice Application in WiMAX network. WiMAX network provides stable throughput for voice applications.

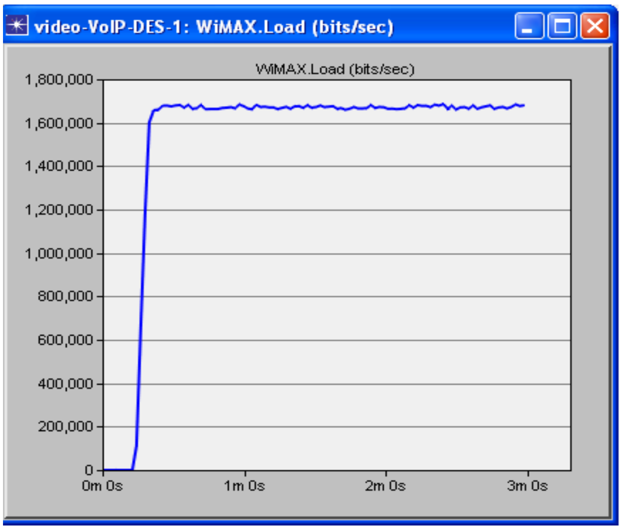

Fig 7: Network load for voice application in WiMAX network

5. COMPARATIVE ANALYSIS OF MULTIMEDIA APPLICATIONS

In this section, we are going to compare both multimedia applications (Video Conferencing and VOIP) with the help of simulation results presented in the previous section. These results help us to analyze various multimedia applications. Figure 8 represents the delay for both the multimedia applications.

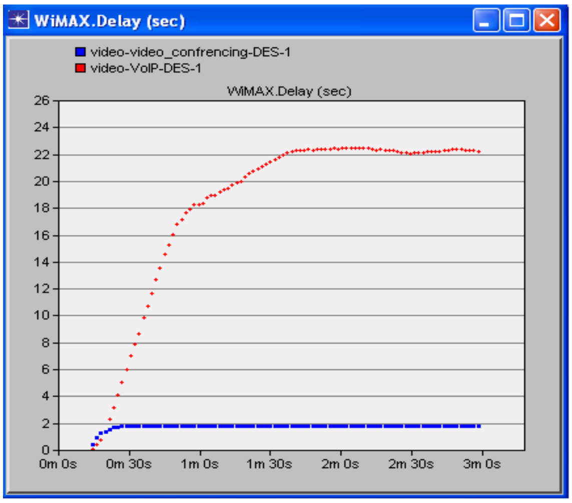

Fig 8: Delay for multimedia applications

Graph shows the delay for both multimedia applications in WiMAX network. In this graph, we can see that Video Conferencing is having less delay to transmit packets in the network (represented by blue line in graph). While voice application is having much larger delay than Video Conferencing application (represented by red line).

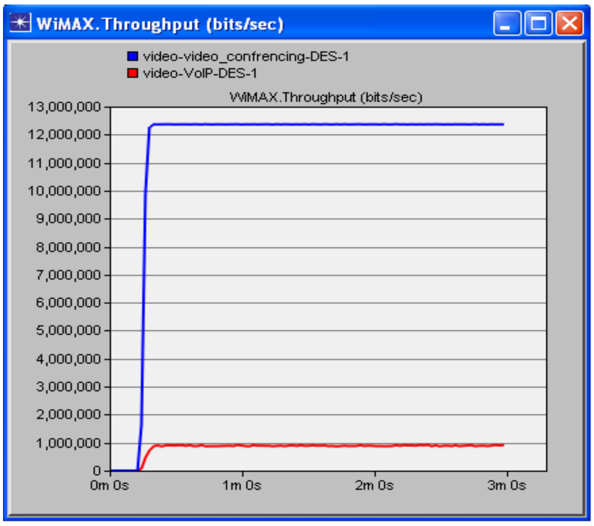

Fig1.9: Throughput for multimedia applications

Figure 9 shows the throughput of different multimedia applications. Results show that throughput of Video Conferencing is much higher than Voice Application. It means Video Conferencing transfers more bits/sec as compared to Voice Applications.

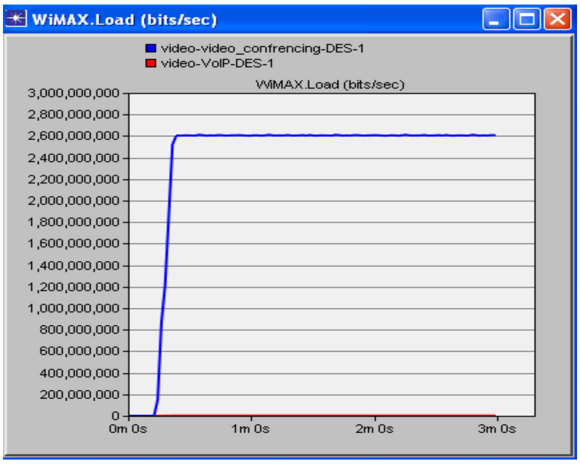

Fig 10: Network load for multimedia applications

Figure 10 represents the network load for different multimedia applications. From this figure, we find that the network load of Video Conferencing is much higher than Voice Application. This is because in Video Conferencing, packet is the combination of both voice and video (frames) data.

6. CONCLUSION

From above experimental study, we found that real time multimedia application like Video Conferencing is having higher load, maximum throughput and minimum delay as compared to non-real time multimedia applications like VOIP.

7. REFRENCES

[1] Lehman, Scott. "Effects Explained: Delay". 1996. Retrieved on June 30, 2006.

[2] IEEE 802.16-2004, "IEEE standard for Local and Metropolitan Area Networks — Part 16: Air Interface for Fixed Broadband Wireless Access Systems," Oct. 2004.

[3] IEEE Std 802.16e-2005, "IEEE Standard for Local and metropolitan area networks--Part 16: Air Interface for fixed Broadband Wireless Access Systems--Amendment 2: Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands," Feb. 2006.

[4] Rohit A. Talwalkar, Mohammad Ilyas, Analysis of Quality of Service (QoS) in WiMAX networks. In Proceedings of IEEE International Conference on Networks, 2008, 1-8.

[5] S.Sengupta, M. Chatterji, S. Ganguly, "Improving Qulity of VoIP Streams over WiMAX", IEEE Transactions on Computers,Vol. 5, 2008, 145-156.

[6] WiMAX forum (2008a) www.wimaxforum.org.