Performance Evaluation of QoS in WiMAX Network

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ABSTRACT

Quality of Service is an essential parameter to judge performance of any Network. Our paper focuses on analyzing essential QoS parameters for WiMAX Network. Essential QoS parameters like delay, Jitter, Packet delivery Ratio (PLR), Packet Loss Ratio (PLR) and throughput have been calculated for 500 mobile nodes in a WiMAX network. The worldwide interoperability for microwave access (WiMAX) is one of the newest technologies developed for broadband wireless network which offers high data rates, long coverage area and several types of quality of services to the users. The results are helpful in analyzing QoS parameters for WiMAX Network and it has been found that an optimum value of QoS parameters is obtained with increasing number of mobile nodes for WiMAX Network. It is concluded that our models shorten the time quite a bit for obtaining the performance measures of an end-to-end delay as well as throughput can be used as an effective tool for this purpose.

Keywords---- WiMAX, QoS Parameters, Delay, Data Dropped ratio, Throughput, AMC.

I. INTRODUCTION

WiMAX is a wireless broadband-broadcasting technology based on wireless metropolitan area networking (WMAN) standard developed by IEEE 802.16 researchers. It provides high data rates, last mile wireless access, point to multipoint communication, large frequency range and guarantees QoS for various applications. The topology of network classified WiMAX into two main sets, IEEE 802.16d-2004 (known as Fixed WiMAX) and IEEE802.16e-2005. It promises to deliver the internet throughout the globe connecting the last mile of communication services.

WiMAX Forum is a consortium of over 400 organizations interested in IEEE 802.16 based broadband wireless access. The members include service providers, equipment vendors, chip vendors, researchers, and users. The Forum develops interoperability specifications for equipment using IEEE 802.16 standards. IEEE standards have many options and allow a wide range of parameters.

WiMAX supports various multimedia applications like VoIP, voice conference and online gaming. The IEEE 802.16 technology (WiMAX) is a better alternative to 3G or wireless LAN networks for providing last mile connectivity by radio link due to its high data rates, low cost of deployment and large coverage area and Ease of Use.

The word—Quality is always termed as the degree to which a set of inherent characteristics fulfills a particular requirement. The term Quality of service refers to the probability of the telecommunication network meeting a given traffic contract. In the field of networking it could be termed as the probability of a packet successfully passing between two points in the network. QoS actually is the ability of network element (e.g. an application, host or router) to have some level of assurance that its traffic and service requirements would be satisfied.

II. WIMAX OVERVIEW

In this Section, a brief overview of WiMAX technology is given. WiMAX which is abbreviated as “Worldwide Interoperability for Microwave Access” is currently one of the hottest technologies in wireless which provides broadband connectivity by connecting to the Internet Service Provider even when you are roaming outside home. The family of 802.16 is known as Wireless MAN which is also known as “WIMAX” or wireless broadband. IEEE 802.16-2004 is known as “fixed WiMAX” and IEEE 802.16-2005 or 802.16e is known as “mobile WiMAX”.

Different system architectures and essays have been proposed to meet the demand for higher performance multiprocessor considering cost and power. Article introduced protocols for broadcasting interconnection network and uses simulation to examine the performance of the protocols over the SOME-Bus multiprocessor architecture. It’s successfully applied analytical approach achieving high bandwidth, low
latency and large fan-out. There is a significant study in literature that shows artificial intelligence techniques could be used to predict the performance measures of a multiprocessor architecture. In that study, a broadcast-based multiprocessor architecture called the SOME-Bus employing the DSM programming model was considered. The statistical simulation of the architecture was carried out to generate the dataset.

III. WiMAX ARCHITECTURES

The WiMAX network is a combination of subscriber station (SS) and base station (BS). Here the packets are transferred from source node to destination node after following various scheduling, modulation technique and routing technique.

WiMAX represents a potential technology hastening communication and dethrone existing standards. WiMAX [Intel WiMAX 2009, WiMAX Forum 2009], also known as IEEE802.16, is a long-distance cousin of the IEEE802.11. WiMAX operates independently of cellular network and promises speeds of tera Mbps or higher over distances of ten kilometers.

The following three metrics (throughput, delay and data dropped) are used for evaluating the accuracy of the QoS models:

a) Network throughput

Throughput is measure of number of packets successfully delivered in a network. It is measured in terms of packets/second or bits/second. The value of throughput should be high.

b) Delay

Delay or latency could be defined as the time taken by the packets to reach from source to destination. The main sources delay can be categorized into: propagation delay, source processing delay, network delay and destination processing delay.

c) Data dropped

Packet dropped affects the perceived quality of the application. Several causes of packet dropped or corruption would lead to bit errors in wireless network. Some of the packets are lost due to network congestion or due to noise.

IV. SIMULATION SCENARIOS

In our proposed model, we have simulated WiMAX network on two different network models that vary in number of their base stations and total no. of nodes. A large geographic location has been divided into various cells of hexagonal shape. WiMax performance measurements for the following two simulations were performed:

Scenario 1:
Scenario 2:

Scenario 2, three base stations with three Mobile.

| No. of Node         | Delay   | Throughput      | Data Dropped      |
|---------------------|---------|-----------------|-------------------|
| Scenario 1 (3 mobile stations) | No delay | Good throughput | No data dropped   |
| Scenario 2 (6 mobile stations)  | Slight delay | Better than scenario 1 | Increase in data dropped |

V. CONCLUSIONS

The performance of various QoS mechanisms provided in IEEE802.16 standard is studied for both the fixed and mobile environments and their significance on QoS performance of the WiMAX network is realized. The investigations are also carried out further with the implementation of AMC scheme and its effect on the QoS performance of WiMAX network is studied.

This article provides an overview and performance evaluation of QoS in WiMAX network. The study assessed in this paper WiMAX with multiprocessor architecture interconnected by the interconnection network. OPNET Modeler is used to simulate the architecture and to calculate the performance criteria (i.e. throughput, delay and data dropped) that slightly concerned in network estimation. The comparison between schemes in terms of performance metrics is provided in It is concluded that our models shorten the time quite a bit for obtaining the performance measures of an end-to-end delay as well as throughput can be used as an effective tool for this purpose.

REFERENCES

[1] Bo Li and Yang Qin and Chor Ping Low and Choon Lim Gwee, "A Survey on Mobile WiMAX [Wireless Broadband Access]”, IEEE Communications Magazine, P.P. 70-75, 12(45), December 2007
[2] W. Hrudey and Lj. Trajkovic, “Streaming video content over IEEE 802.16/WiMAX broadband access,” OPNETWORK 2008, Washington, DC, Aug. 2008.
[3] Sahana Bhosale ,R.D. Daruvala, ”Performance Evaluation of QoS Parameters during WiMAX to WiMAX Handoff using NS2 and QualNet”, International Journal of Computer Applications (0975 – 8887) Volume 64– No.9, February 2013.
[4] Dr. Mayyada Hammoshi,” WiMAX Simulation Model to Investigate Performance Factors”, Journal of Convergence Information Technology, Volume 6, Number 1. January 2011.