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QOS ANALYSIS OF 3G AND 4G

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ABSTRACT: *Telecommunication networks continue Year after year in coverage areas and technologies because of the growing needs and requirements of users. The purpose of this paper was to compare the QoS between 3G network (UMTS) and 4G network (WIMAX). In UMTS model many users are placed in the network that requests some applications and network traffic is measured and calculated. Regarding the WIMAX model scenario, where several users perform different services, enabling the analysis of network performance by measuring several parameters.*

KEYWORDS: 3G, 4G, UMTS, WIMAX, Traffic Methods, Simulation/Opnet Soft Wear, Throughput.

INTRODUCTION

Next generation wireless networks are designed in order to be operational in areas where there already is signal coverage provided by other networks of different technologies, e.g. 2.5G, 3G, LTE. These new networks have the ability to integrate radio access technologies such as Long Term Evolution and LTE-Advanced over exist in networks: GSM (Global System for Mobile Communications), UMTS / HSPA (3GPP Universal Mobile Telecommunications System / High Speed Packet Access) and Wi-Fi (Wireless Fidelity) . All types of networks mentioned above work with different sets of frequencies and each of them use particular cell sizes. These dimensions can vary from macro-cells that can have an approximately 15km diameter, to pico or femto-cells that are typically used in order to provide additional coverage in small areas or so-called "islands".

Interconnecting these networks is not without a number of difficulties. The main problems include: traffic congestion, interference management in the numerous cases of overlapping channels, continuous adjustment of the small cell coverage, handover procedures between all the networks involved and directing traffic to the network able to offer best performance from the points of view of both the subscriber and the network.

The scope of this paper is choosing the optimal traffic derationing method, when faced with different congestion scenarios, which attempt to resemble real-life situations as much as possible. [1]

There are different types of network simulators. But some of the simulation tools are complicated some are difficult to learn or to use. In this case the OPNET Modeler 14.5 used which is easy to learn because it has well defined user interface and very efficient to use. OPNET Modeler has an easy to use graphical interface that is easy to use. For these reasons I chose this simulation tool. In this simulation, two network models were designed for 3G network(UMTS) and 4G networks (WIMAX) and measure the performance of certain

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parameters such as throughput, jitter, queue delay and delay as well as meet the goal of analyzing the QoS in 3G wireless 4G networks.

The of 3G/4G and future generations of wireless technologies rely on users gratification and affordability for different services. The real time applications such as audio and video conferencing are extremely delaying and loss sensitivity. Implementing QoS in UMTS and WIMAX networks has significate role a great role to play in meeting the limited delays and loss of packet for the real time applications. the search trend which aims to integrate the international mobile telecommunications network UMTS and Wireless Local Area Network (WLAN) to attract the high data rate and low cost of WLAN has attracted many research and standardization bodies in the last few years. Recently, Interoperability around the world to access the microwave (WIMAX), a common name associated to the IEEE 802.16a/d/e wireless MAN standard, which provides specifications for an air interface for fixed, not only addressed problem of the recent tendency, but also supported mobile and mobile customer's on the move in the extended coverage area of cellular network .[2]

UMTS and WIMAX:

Standing for "Universal Mobile Telecommunications System", UMTS is development in terms of capacity, data speeds and new service abilities of second generation mobile networks.[3]

3G/UMTS employs a 5 MHz channel carrier width to deliver significantly higher data rates and increased capacity compared with second generation networks with 1900–1980 MHz, 2010–2025 MHz, 2110–2170 MHz operating frequencies.

3G/UMTS in its initial phase offers theoretical bit rates of up to 384 kbps in high mobility situations such as urban and suburban areas, 144 kbps in rural areas and 2 Mbps in fixed/nomadic environments used for short range applications. Symmetry between uplink and downlink data rates when using paired (FDD) spectrum also means that 3G/UMTS is ideally suited for applications such as real-time video telephony — in contrast with other technologies such as ADSL where there is clear discrepancy between the rates of throughput and the downlink.[4]

WIMAX is the name of a mark intended for labeling compatible equipment with IEEE 802.16 (Broadband Wireless Access) and European ETSI HiperMAN standard. It mainly does not act to allow the direct access but rather to interconnect the various access points on a city scale for today.

WIMAX operates at the bandwidth between 10 to 66 GHz ratified in April 2002 by IEEE. the theoretical data rate is 70 Mbps with a range of up to 50 km. In January 2003 IEEE approved the 802.11a standard which covers frequency band between 2 GHz and 11 GHz. These 11 GHz frequency bands allow non-line of sight performance, where obstacles such as trees and buildings often exist and where base stations may need to be unobtrusively mounted on the roofs of homes or buildings rather than towers on mountains.

The WIMAX systems are very high capacity (up to 134.4 Mbps in a 28 MHz channel), travel long distances travel 50 km or more, do not require the line of sight and to be work at vehicular speeds under 802.16e extension.

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WIMAX systems peruse a goal for the provision of broadband internet services especially in remote areas and especially when fully ubiquitous access is needed.[5]

Simulator parameters

Parameter	***Value of(3G)***	***Value of(4G)***
Transmission Range	10 km	10 km
Data Rate	11 mbps	30 mbps
Simulation Time	1 hour	1 hour
Number of nodes	2	22
Seed	128	128
Total uplink	9.8 bit/sec	5.0944 bit/sec
Total downlink	10.00 bit/sec	6.758 bit/sec
Simulation	500000 events Based on Kernel type Preference	500000 events Based on Kernel type preference
Type of network	UMTS	WIMAX
Area of Movement	Within a logical network	Within a logical network
Power	0.005 w	0.005 w
No of cell	7	7
No. of runs	11	1
Switching technique	Circuit- and packet switched	Fully digital with packet voice
Bandwidth	5MHZ	151.7 MHZ

Simulation

UMTS (3G) Scenario:

The purpose of this scenario in simulation is to study the performance of the UMTS network. Many node models as part of the UMTS specialized model library are grouped in the UMTS and UMTS_advanced object palettes in OPNET modulator such as routers, repeaters, stations, RNC. In our simulation, node models have been used for advanced UMTS and One of the specialized models used in OPNET simulation is the UMTS model based on the 3G (GGSN) specifications. The architecture of this model can be found in simple and advance nodes. The MN model offers functionality related to terminal equipment and mobile termination, responsible for terminating the radio link. The UTRAN part consists of models for Node B and RNC.

During this case study, a simulation scenario was built and run in order to obtain the desired results to achieve the objective. Fig (1) show the network topology for this case; the voice application used , The proposed topology of UMTS network model consists of Node_B, RNC, MN, and SGSN/GGSN nodes. The coverage of one cell is approximately 5km by 5km of area.

The simulation time in all cases of this project is taken to be 1 hour.

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WIMAX (4G) Scenario:

The WIMAX model includes a separate event simulation model that allows us to analyze a network performance in WIMAX networks. The capable nodes on the WIMAX are included in the

WIMAX object panel that includes routers, base stations, workstations, etc. to understand the fundamental work and the performance analysis of WIMAX network technology, we proposed a scheme of the network topology of this case study as shown in Fig(2). The configuration of the WIMAX and Configuration profile provides the identification and attribute of all the applications that you use in this case study network. The one applications are used: Video. The suggestion WIMAX network model contains of one Base Stations and two cells; each cell has eight mobile nodes to service all applications types. A vector-based trajectory is also used in this scenario. The coverage of one cell is approximately 4km by 4km of area.

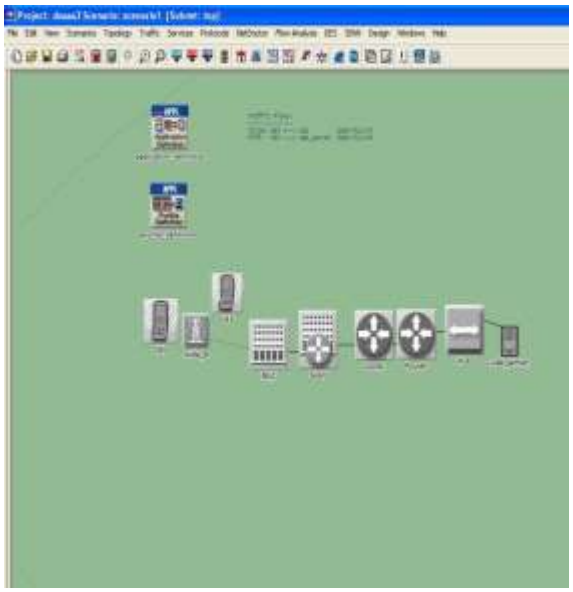

Fig (1): UMTS model scheme

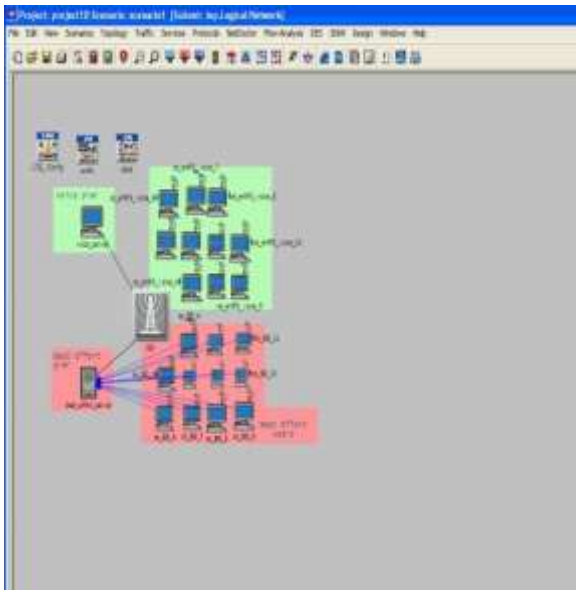

Fig (2): WIMAX model network

RESULTS AND DISCUSSION

The performance is associated with the streaming voice; therefore, before making any conclusions following statics must be analyzed. Packet end-to-end delay, packet sent and received.

After execution of the UMTS and WIMAX simulation we get the following results as shown fig (3) and fig (4) is average in voice packet delay variation:

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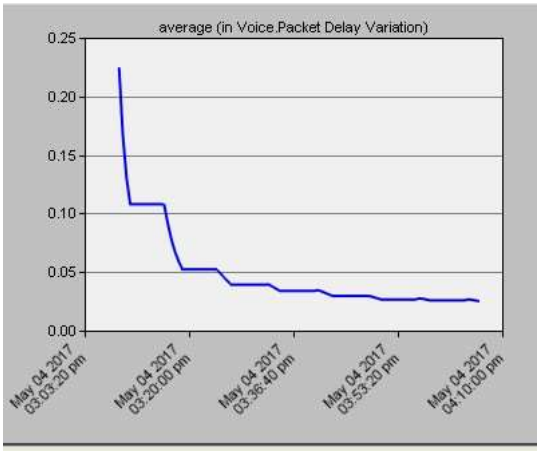

Fig (3):voice packet delay of UMTS

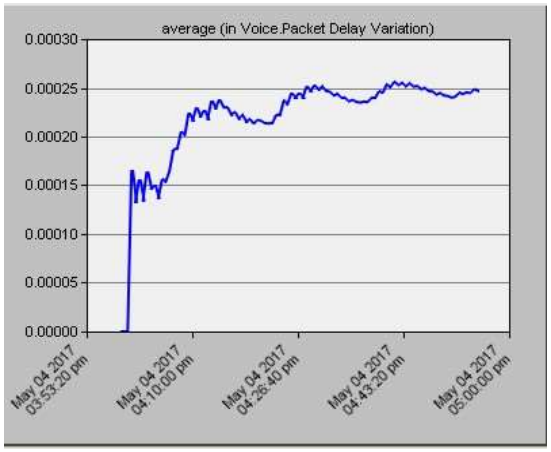

Fig (4): voice packet delay of WIMAX

From fig (3) delay is the time of the sent packet it takes to arrive. UMTS model, the max average delay is about 0.25sec but from fig (4) the max average delay is about 0.00025sec. UMTS model average delay is more than WIMAX model delay.

While the average packet end-to-end delay for UMTS and WIMAX are shown in fig (5) and fig

(6):

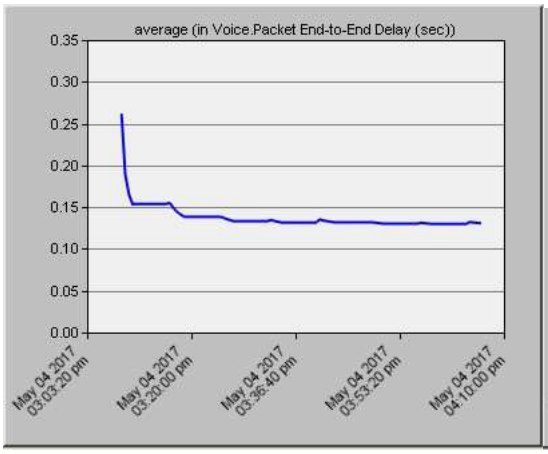

Fig (5): average in voice packet end to end delay of WIMAX

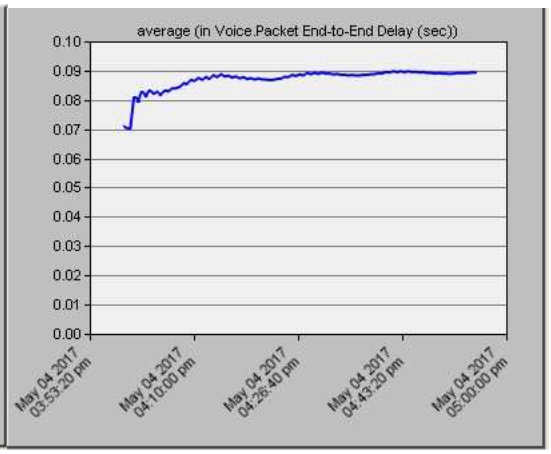

Fig (6): average in voice packet end to end delay of UMTS

From fig(5) and fig(6) WIMAX gives packet end-to-end delay about 0.09sec which o\is better than UMTS the results which is about 0.26sec lesser.

While the average voice jitter for UMTS and WIMAX are shown in fig (7) and fig (8):

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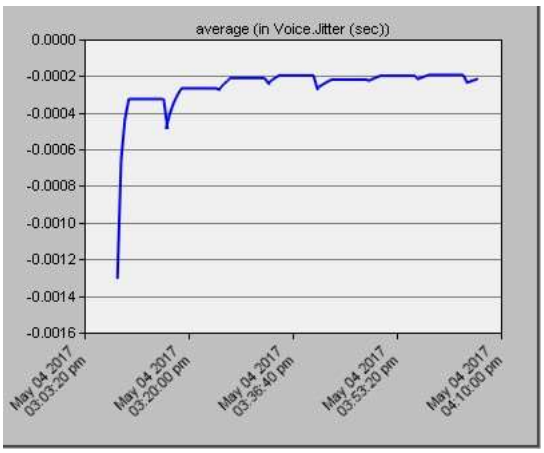


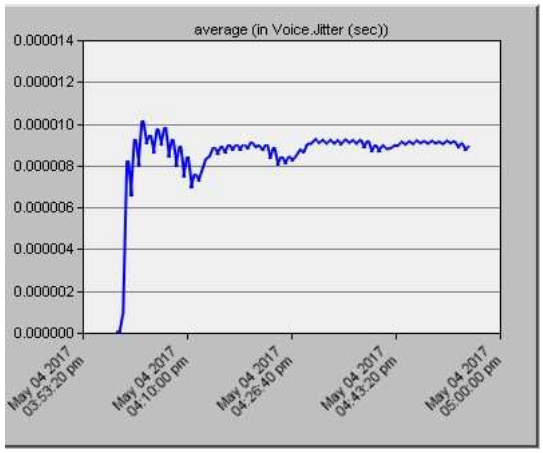
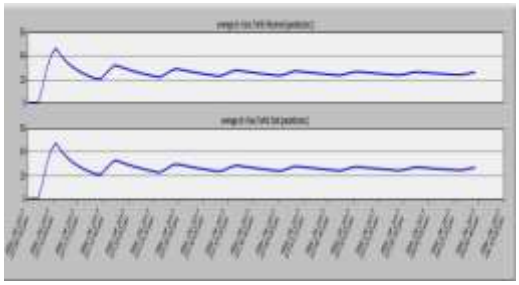


Fig (7): average in voice jitter of UMTS **Fig (8): average in voice jitter of WIMAX**

The jitter value can be negative which means that the time difference between the packets at the destination is less than that at the source, from Fig (7) and Fig (8)

Plot the jitter in UMTS and WIMAX, respectively. It can be seen that UMTS has a large range of jitter variation, ranging from -0.0013sec to -0.0002sec, and takes longer time to converge to the stable stage. For WIMAX, it has a narrow range between 0.0000s to 0.000010sec, accounting for only 6% of that for UMTS. Moreover, it has a fast convergence to the stable state. This phenomenon can be explained as follows: as the number of users increases in UMTS.

While the average in voice traffic received and voice traffic sent for UMTS and WIMAX are shown in fig (9) and fig (10):



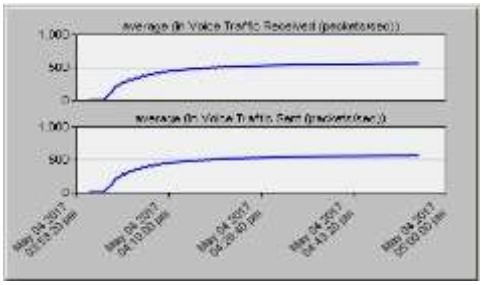


Fig (7): Traffic Received/send (packets /sec) Traffic Received/send (packets /sec) of WIMAX **Fig (8): of UMTS**

Traffic Received (packets /sec) is the statistic known as the average number of packets per second sent to the voice applications by the transport layers in the network is known as Traffic Received (packets /sec).

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It is shown in fig (9) and fig (10) that for almost all the simulations the WIMAX gives better results in terms traffic received; as a compared to UMTS.

CONCLUSION

By comparing two network models the observed result it is concludes that WIMAX is more effective than UMTS. WIMAX network has high Performance, which was shown by the measured and calculated parameters, the WIMAX has higher throughput, and the less delay also the waiting time in the queue in the UMTS is longer than WIMAX queue delay time which caused more jitter in voice applications.

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