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Performance Evaluation for UMTS and WiMAX in Handover

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Abstract: ***In this paper, we take voice as an application scenario to study the differences of Quality of service(QoS) between UMTS and WiMAX, We have designed and implemented WiMAX and UMTS simulation modules in OPNET and carried out extensive simulations to analyze the Mean Opinion Score (MOS), packet end-to end delay, jitter and packet delay variations for different type of voice traffic in these two networks.***

1. Introduction

Mobility is the main advantage of mobile cellular systems. Ability to communicate anywhere, at any time was the main reason for great success of wireless communications in 90's. Handover is a key concept in providing mobility. Term handover stands for event when mobile station starts to communicate with another base station. It makes possible for a user to travel from one cell to another, with no interrupt seamless connection. In GSM system, handover was realized in a way that mobile station stops communication with serving base station and after short disconnection passes to another base station, so called "break before make" concept or hard handover. In UMTS we have soft handover, which is technique whereby mobile station–UE (user equipment in UMTS) in transition from one cell to another communicates with both base stations – (Node B in UMTS) simultaneously. Softer handover is very similar to soft handover; the difference is that in softer handover UE communicates with two sectors of the same Node B.[1] In IEEE 802.16e are defined three types of handover :Hard handover, Macro Diversity Handover and Fast Base Station Switching Hard handover is mandatory in WiMAX systems. Other two types of handover are optional.

UMTS overview

UMTS (Universal Mobile Telecommunication System) is a growing cellular technology and it is famously acknowledged as 3G mobile communication system. It offers high data transfer speed, speech, email, web browsing, multimedia, video telephony, and the audio streaming. UMTS offers enhanced video conferencing and high speed internet access and wide range of multimedia services. Call handover without dropping the connection with the Node B is main issue. The UE (User Equipment) moves from one location to other that indicates that the user can vary its location any time everywhere with any speed. The function of handover technique is to ensure the user connectivity without disturbing the call. UMTS uses the WCDMA (Wide band Code Division Multiple Access) technology that offers high rate, on demand bandwidth and higher capacity as compared to 2nd Generation technology.

WiMAX overview

Worldwide Interoperability for Microwave Access (WiMAX) is a based on the standards defined in the IEEE 802.16 specifications. The 802.16 standard can be used in a point-to-point or mesh topology using pairs of directional antennas. These antennas can be used to increase the effective range of the system .The salient features of the mobile WiMAX (IEEE 802.16e) are high data rates up to 63 Mbps for Down Link (DL) and 28 Mbps for Up Link (UL), Quality of Service (QoS), scalability, security and mobility supporting handover schemes with latencies less than 50 ms[2]. Also the deployment cost of the Mobile WiMAX (IEEE 802.16e) is very low.[3]. Worldwide Interoperability for Microwave Access (WiMAX, IEEE 802.16e) was standardized to support mobility to the end user with wider coverage and faster speed.

Handover in UMTS

UMTS is known as the third generation mobile communication network led by 3GPP which is able to provide a range of 3G services. Handover in UMTS can be classified as [4]:

Hard Handover

In Hard handover all the old radio links in the UE are removed before the new radio links are connected. Hard handover could be seamless or non-seamless. Seamless hard handover means that the handover is not effectible to the user. Normally a handover that requires a change of the carrier frequency (inter-frequency handover) is always similar as hard handover. From real-time bearer it means a short disconnection of the bearer and for non-real-time bearers hard handover is lossless. Hard handover can take place as intra or inter-frequency handover. Hard handover is also called the conventional handover it has some advantages like the user cannot hold more than one channel at all time and mobile doesn't need complex hard where to receive two channel at the same time The other hand hard handover has some disadvantage also like there are many chances of call drop during hard handover which increase the call drop probability [5].

Soft Handover

Soft handover was actually introduced by CDMA technology. Compared to the conventional hard handover it got few advantages. But in other hand it also has the some disadvantages. In Soft handover the UE can be connected to more than one channels at the same time, it is also known as make before break because it keep the previous channel from source until it gets the channel from source cell. Although soft handover increase the complexities but it has many advantages also like the high handover success rate and reduction of call drop probability and elimination of inference. [6]

Softer handover

When the same BS receives two signals from a single user due to multipath this is called softer handover it uses one carrier frequency so it is an intra-frequency handover.

Handover in Wimax

The basic mean of WiMAX handover is to provide the continuous connection when a Mobile Station (MS) migrates from an air-interface of one BS to another air-interface provided by another BS. In the IEEE 802.16e are defined three types of handover [7]: Hard handover, Macro Diversity Handover and Fast Base Station Switching.

Hard Handover

During hard handover the MS communicates with only just one BS in each time. Connection with the old BS is broken before the new connection is established. Handover is executed after the signal strength from neighbor's cell is exceeding the signal strength from the current cell.

Macro Diversity Handover

When MDHO is supported by MS and by BS, the "Diversity Set" is maintained by MS and BS. Diversity set is a list of the BS's, which are involved in the handover procedure. Diversity set is defined for each of MS's in network. MS communicates with all BS's in the diversity set .For downlink in MDHO, two or more BS's transmit data to MS such that diversity combining can be performed at the MS. For uplink in MDHO, MS transmission is received by multiple BS's where selection diversity of the received information is performed. The BS, which can receive communication among MS's and other BS's, but the level of signal strength is not sufficient is noted as "Neighbor BS".

Fast Base Station Switching

In FBSS, the MS and BS diversity set is maintained similar as in MDHO. MS continuously monitors the base stations in the diversity set and defines an "Anchor BS". Anchor BS is only one base station of the diversity set that MS communicates with for all uplink and downlink traffic including management messages. This is the BS where MS is registered, synchronized, performs ranging and there is monitored downlink channel for control information. The anchor BS can be changed from frame to frame depending on BS selection scheme. This means every frame can be sent via different BS in diversity set.

2. Simulation Setup

To evaluate the performance of WiMAX and UMTS for voice traffic, we have designed and implemented WiMAX and UMTS simulation modules in OPNET network simulator [9] based on OPNET's discrete event simulation model library .we measure four parameter presented over a simulations. All mobile users in the same simulation use the same configurations.

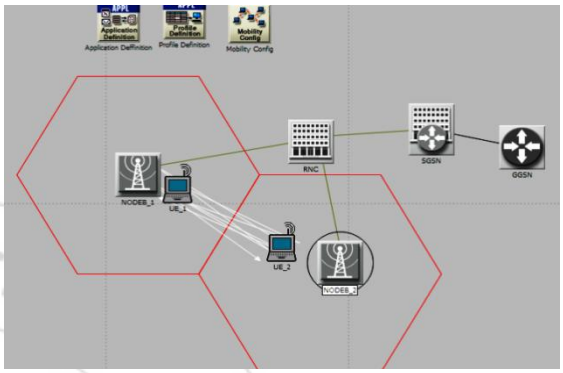

Figure 1: proposed model

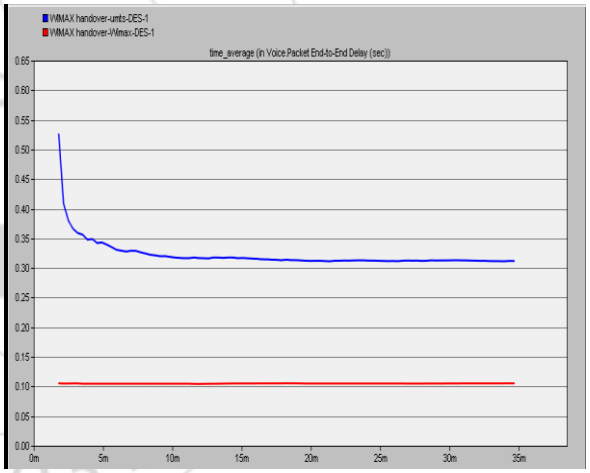

Figure 2: time-average (in voice packet delay end to end)

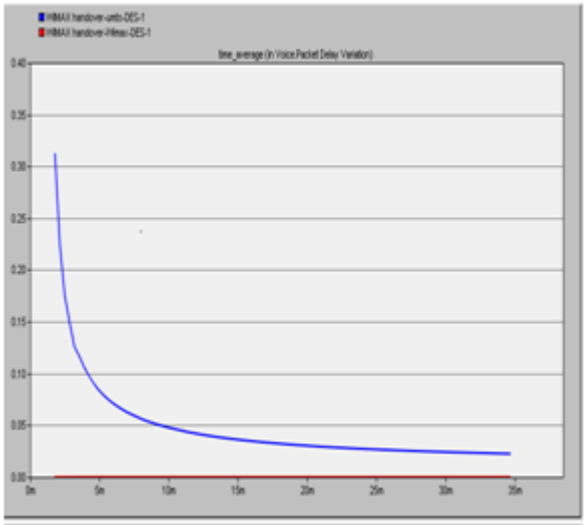

Figure 3: time-average (in voice packet delay variation)

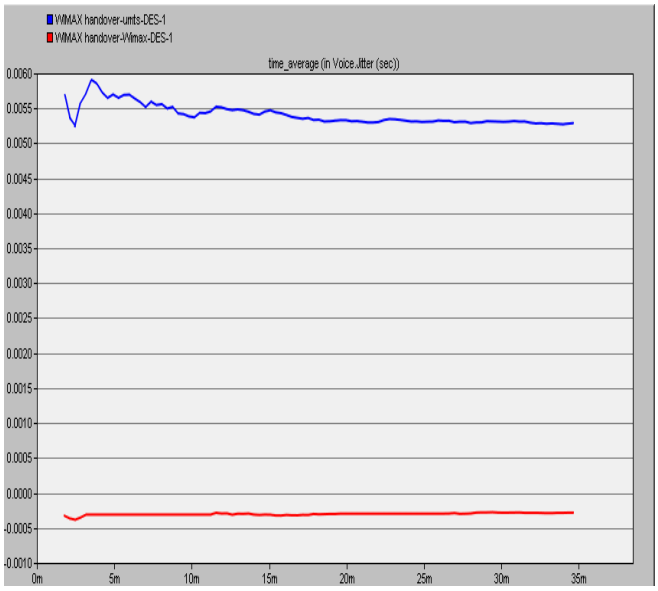

Figure 4: time-average(in voice jitter(sec)

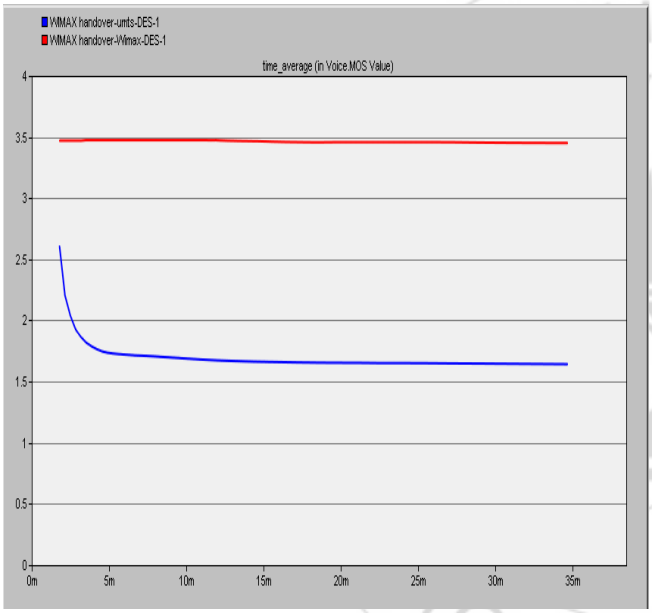

Figure 5: time-average(in voice MOS value)

3. Results and Discussions

In this paper we compare the performance of voice in WiMAX and UMTS through extensive simulations. The obtained results of simulation runs are presented in fig 2, 3, 4&5. Fig2 illustrates voice packet end to end delay. According to the obtained results, the delay in UMTS is greater than its counterpart in WiMAX. This is also the case for packet delay variations. as shown by fig3. Fig4 illustrates the time average in voice jitter. According to simulation results it is clear that the time average voice in jitter is higher for UMTS over compared to Wimax. Fig5 shows that, the MOS is higher in Wimax than UMTS. Accordingly, the Wimax has a better performance compared with UMTS.

4. Conclusions

This paper utilizes OPNET simulation package to compare between UMTS and WiMAX on handover for different scenarios for user equipment. We have analyzed several important critical parameters such as MOS, end-to-end delay, jitter and packet delay variation. According to simulation results, WiMAX has a better QoS to support voice compared with UMTS.

References

[1] SOFT HANDOVER AND DOWNLINK CAPACITY IN UMTS NETWORK Igor A.Tomić1, Miroslav L.Dukić2 1 MOBTEL "Srbija" – BK PTT 2 Electrical Engineering Faculty, Belgrade-XII Telekomunikacioni forum TELFOR 2004, Beograd, Sava Center, 23.-25.11.2004.g.
[2] WiMAX ForumTM, 2006
[3] www.maravedis-bwa.com.
[4] Pierre, C.: Efficacies du handover vertical danles reseaux sansfil. http://mescal.imag.fr/membres/corinne.
[5] UMTS, UMTS/IMT-2000 "Assessing Global Requirements for the Next
[6] http://www.umtsworld.com/technology/handover.htm
[7] WiMAX Forum: Mobile WiMAX – Part I: A Technical Overview and Performance Evaluation, February 2006.
[8] [Online]. Available: www.opnet.com