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Comparison between Soft Handover and Hard Handover in UMTS

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Abstract: ***This paper addresses some Quality of service uses concerning soft handover and hard handover in UMTS system for both uplink &downlink cases. The performance of the addressed algorithms for the above mentioned topic is evaluated under different scenarios for user equipment (UE) .This is conducted using OPNET simulation package.***

Keywords: handover, umts

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. 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]

The hard handover [2] is simple but they cannot be used to support multimedia services due to high blocking probabilities. This motivated development of lower blocking probability soft handover algorithms [3, 4] for CDMA/ WCDMA 3G mobile systems along with power control algorithm to eliminate near-far effect.

However, growing demand for supporting higher multimedia data rate, streaming video, and Internet services on 3G networks has been demanding further minimization of soft hand- over and its failure.
Handover is a process when a user switches to another channel without any interruption [5]. From a high level Perspective handover provides the following:

- Continuity of call
- Optimum radio link selection
- Traffic distribution

2. 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. Handoff in UMTS can be classified as [6]:

3. 1UMTS hard handover

The name hard handover indicates that there is a "hard" change during the handover process.Hard handover are used for changing the radio frequency band of the connection between the User Equipment (UE) and the UMTS Terrestrial Radio Access Network (UTRAN) in UMTS, and changing the cell on the same frequency when there is no network support for macro diversity (where several antennas are used for transferring the same signal). These methods are selected when soft and softer handover are not possible.For hard handover the radio links are broken and then re-established. Although hard handover should appear seamless to the user, there is always the possibility that a short break in the connection may be noticed by the user. UMTS hard handovers may be used in a number of instances:

- When moving from one cell to an adjacent cell that may be on a different frequency.
- When implementing a mode change, e.g. from FDD to TDD mode, for example.
- When moving from one cell to another where there is no capacity on the existing channel and a change to a new frequency is required.

Soft Handover

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 hand over success rate and reduction of call drop probability and elimination of inference [7]

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4. Feature Related for Soft and hard Handover

The Soft Handover has many advantages when comparing to traditional handover (Hard Handover etc). it improved the seamless communication and the main feature of the soft Handover is that there is no break in transmission that’s why it is called as a make before break while in hard handover there is a break during hand over and therefore the chances of success of handover becomes less that’s why it often called break before make. Another feature includes the lower load on to the network and the soft handover process also eliminates the interference which is also a big feature of

WCDMA system due to soft handover this interference elimination happens on uplink channel. There are many other features which are related to Soft handover like better communication for users, greater capacity with maintaining the same Quality of service, it gives a more time to get to the desired BS which directly effect the blocking probability and reduce it and it also reduce the call dropping probability [8].

Although there are many advantages of soft handover and it contain pretty good feature there are some disadvantages of soft handover as compared to traditional handover like it increase the complexity and also consume extra resources in downlink direction.

5. Simulation

On OPNET, our work consists in the design of UMTS networks, the operating system with a soft handover and hard handover. In this cases, the network architecture and the position of the nodes is consisted of two controlled by the same RNC-Node-b connected to the upper layers as defined in the UMTS. The network also includes of two mobile users whose movements were defined by equipment has been configured in a more or less optimally meet our needs for comparison. When all done correctly the simulation runs smoothly. Finally "view results" function to display the statistical results.

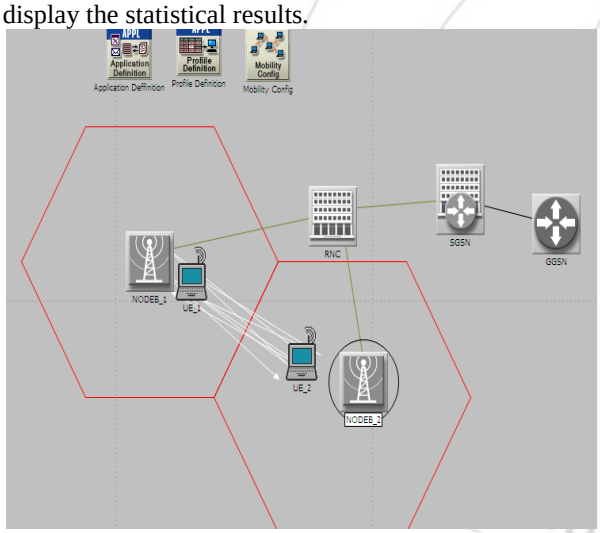

Figure 1: UMTS simulation

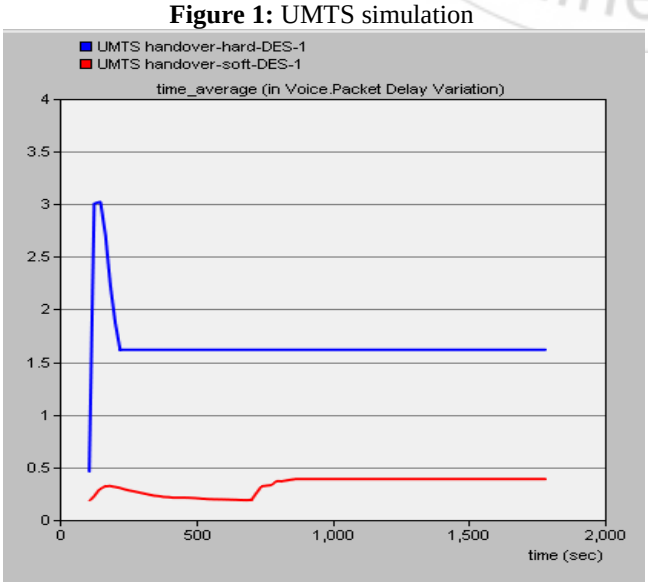

Figure 2: Time -average (in voice packet delay variation)

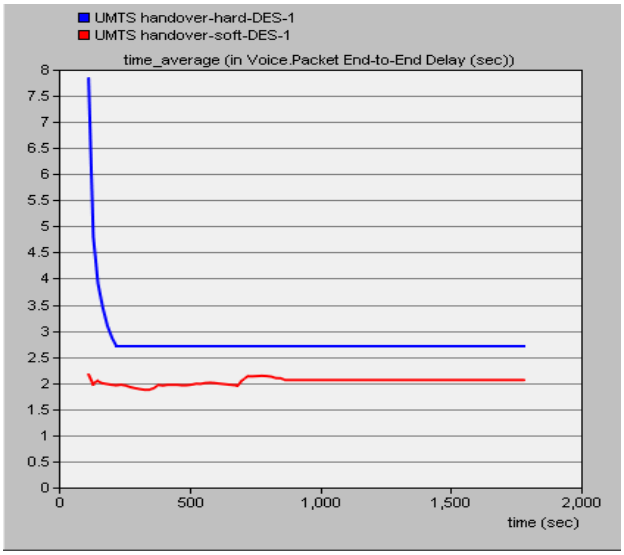

Figure 3: Time-average (in voice packet end- to-end delay)

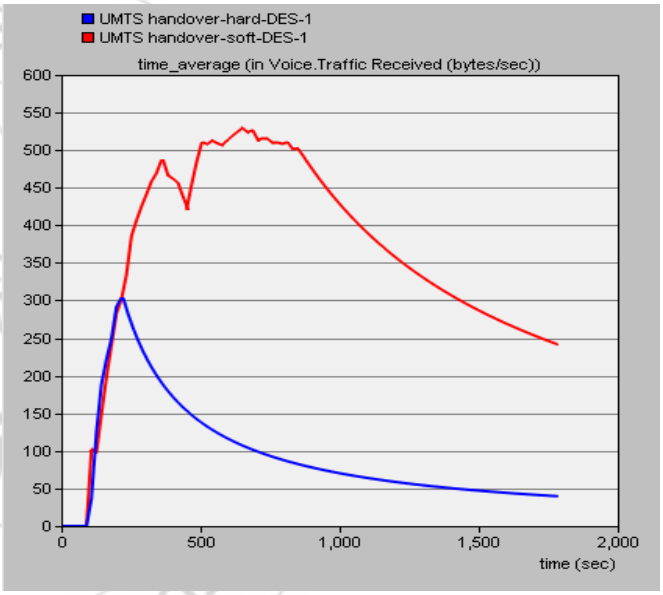

Figure 4: Time-average (in voice traffic received (bytes/sec))

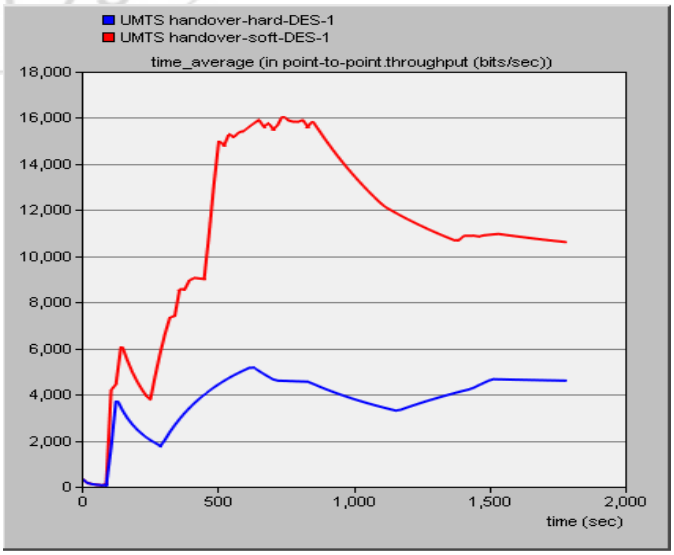

Figure 5: Time- average (in point-to-point throughput (bits/sec)

6. Results Dissections

The obtained results of simulation runs are presented in fig 2, 3, 4&5. Fig2 illustrates voice packet delay variation.

According to the obtained results, the delay in hard handover is greater than its counterpart in soft handover .This is also the case for end to end delay as shown by fig3.

Fig4 illustrates the time average in voice traffic received. According to simulation results it is clear that the time average in voice traffic received is higher for soft handover over compared to hard handover.

Fig5 shows that, the throughput is higher in the case of soft handover. According, the soft handover has a better performance compared with hard handover from delay, traffic received& throughput points of view.

7. Conclusions

This paper presented utilizes OPNET simulation package to compare between soft handover and hard handover in WCDMA based on UMTS Network for different scenarios for user equipment. The metrics used for the comparative study are delay, traffic received and throughput. According to simulation results, soft handover has a better performance compared with hard handover.

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