ISSN 2229-5518

Handoff Analysis for UMTS Environment

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Abstract— UMTS is in one of the third generation mobile telecommunication technologies. And it supports various multimedia applications and services at an enhanced data rate with better security. It also supports mobile users and for that there is a process called handover where new channels are assigned to the user when it moves from a region covered by one node to a region covered by other. In this paper we analyse the effect of handover over the performance of the system.

Index Terms— DPCH, Handover, UTRA

1 INTRODUCTION

Universal Mobile Telecommunications Service is a third-generation broadband which supports packet-based transmission of text, digitized voice and video, and the multimedia here can reach data rates up to 2 megabits per second (Mbps). It also offers a consistent set of services to mobile computer and phone users, no matter where they are located in the world. It is based on the Global System for Mobile (GSM) communication standard that is it is overlaid on GSM. It is also endorsed by major standards bodies and manufacturers as the planned standard for mobile users around the world. It can ensure a better grade of service and Quality of service on roaming to both mobile and computer users. Users will have access through a combination of terrestrial wireless and satellite transmissions.

Cellular telephone systems used previously were mainly circuit-switched, meaning connections were always dependent on availability of circuits. A packet-switched connection uses the Internet Protocol (IP), which uses concept of virtual circuits that is a virtual connection is always available to connect an endpoint to the other end point in the network. UMTS has made it possible to provide new services like alternative billing methods or calling plans. For instance, users can now choose to pay-per-bit, pay-per-session, flat rate, or asymmetric bandwidth options. The higher bandwidth of UMTS also enabled other new services like video conferencing. It may allow the Virtual Home Environment to fully develop, where a roaming user can have the same services to either at home, in the office or in the field through a combination of transparent terrestrial and satellite connections.

2 OVERVIEW

The term handover is also known as handoff. Whenever a user terminal moves into area covered by a different RNC while the conversation is still going on, then new channels are allocated to the user terminal which is now under different control node or MSC. This is carried out to ensure continuity of communication and to avoid call dropping. For this to take place the system need to identify the user terminal and monitor its signal strength and setting of a threshold value below which a call or applications drops and enabling new channel allocation before this level.

There is Handoff margin which needs to be optimized for proper synchronization .It is the difference between signal strength at which handover should occur and the minimum required signal strength .If it is too low then there will be insufficient time to complete the process and if it is too large then unnecessary handovers will occur. The most important thing is the handovers are not visible to the users.

2.1 Handover types

Handovers can be broadly classified into two types namely: Intracellular and Intercellular Handover. In the Intracellular handover, mobile or user terminal moves from one cellular system to another. And in the Intercellular handover, user terminal moves from one cell to other. This is further classified into soft and Hard Handover.
Soft handover

Here we follow make before break concept where the user terminal is allocated new channels first then previous channels are withdrawn. Here chances of losing continuity are very less. But it needs user terminal or mobile to be capable of toning to two different frequencies. Here complexity at user end increases a lot. It is quite reliable technique but here channel capacity reduces.

Hard Handover

Here we follow break before make concept where from the user terminal previously allocated channels are first withdrawn then new are allocated. Here chances of call termination are more than in soft handover. Here at user

terminal complexity is less as it need not be capable of toning to two different frequencies. It provides advantage over Soft handover in Terms of channel capacity but it is not as reliable as soft handover

2.2 Prioritizing handoffs

Handoff requests are more important than new call requests or application requests as call dropping in between will be more annoying for the user then not being able to make a new call. So a guard channel is especially reserved for the handoffs. We also queue the requests made for proper flow and order control.
The most obvious cause for performing a handover is that due to its movement a user can be served in the another cell more efficiently (like less power emission, less interference etc). It may however also be performed for other reasons which may be system load control

2.3 Classification of cells

Active Set: Is defined as the set of Node-Bs the UE is simultaneously connected to (i.e., the UTRA cells currently assigning a downlink DPCH to the UE constitute the active set).

Monitored set: is defined as the set of nodes not in the active set but are included in CELL_INFO_LIST

Detected set is defined as the set of nodes neither in the active set nor in CELL_INFO_LIST but are detected by UT

2.4 Special considerations in UMTS environment

In UMTS environment the different types of air interface measurements are:

Intra-frequency measurements: those measurements which are carried out on downlink physical channels at the same frequency as that of the active set. And the measurement object here corresponds to one cell.

Inter-frequency measurements: those measurements which are carried out on downlink physical channels at frequencies that differ from the frequency of the active set. And the measurement object here corresponds to one cell.

Inter-RAT measurements: those measurements which carried out on downlink physical channels belonging to another radio access technology than UTRAN, e.g. GSM. And the measurement object here corresponds to one cell.

Traffic volume measurements: those measurements which are carried out on uplink channels to analyse the volume of traffic on them. And the measurement object here corresponds to one cell.

Quality measurements: these Measurements are carried out on downlink channels to obtain the various quality parameters, e.g. downlink transport block error rate. And the measurement object here corresponds to one transport channel in case of BLER. A measurement object corresponds to one timeslot in case of SIR (TDD only).

UE-internal measurements: Measurements of UE transmission power and UE received signal level.

UE positioning measurements: Measurements of UE position.

The UE supports a number of measurements running in parallel. The UE also supports that each measurement is controlled and reported independently of every other measurement.

3 WORK DONE

We have designed three scenarios where handovers occur when the user terminal moves from area of one node to other in order to enable communication between source and destination .we made analysis for effect of speed and number of handovers over throughput, average jitter, average end to end delay etc. Here in scenario 1 , shown in figure 1, terrain is 1500 sqms and there are two nodes and UEs moves from area of one node to that covered by the other while application is still in active state so one handover has occurred here, in scenario 2, shown in figure 2, terrain is 2500 sqms and there are three nodes and UEs moves from area covered by one to second than to third one while application is still in active state so two handover occurred and in the scenario 3, shown in figure 3, terrain is 3500 sqms and there are four nodes and UEs moves from area covered by one to second than to third to fourth one while application is still in active state so three handover have occurred. Here we have taken two users one travelling at 16 m/s and other at 20 m/s respectively. The later one is called fast UT (User terminal) while the former one is referred as Slow UT (User terminal)

The screenshots of three scenarios designed to analyse impact of handover on the overall performance of the system are:

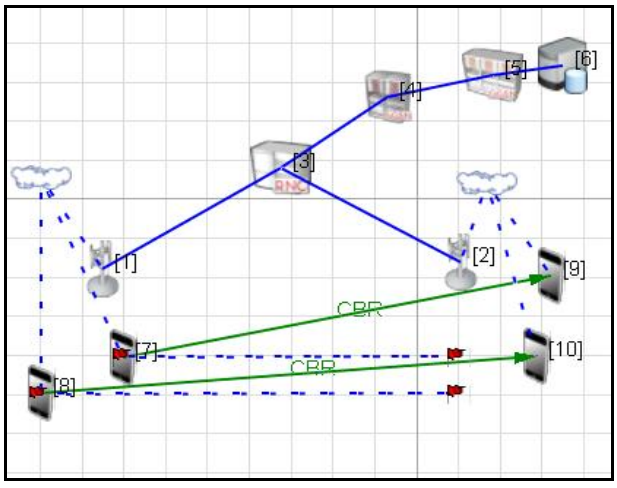

Figure 1: Screenshot of scenario for one Handover

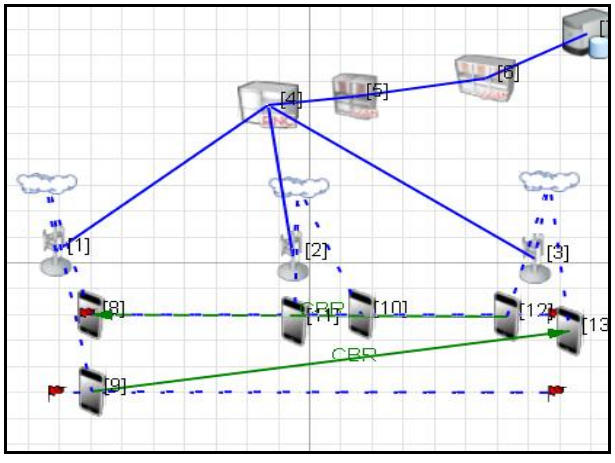

Figure 2: Screenshot of scenario for two Handovers

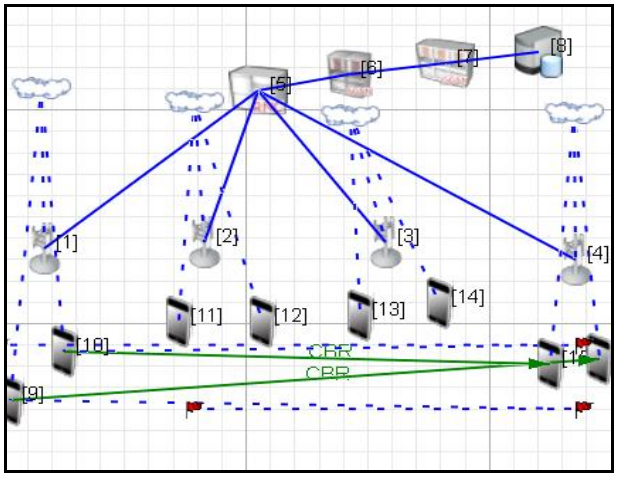

Figure 3: Screenshot of scenario for three Handovers

The values obtained by running the simulations for throughput, Average jitter and End to end delay for various scenarios shown in figures (1-3) are:

Table 1: Throughput values for handovers

Throughput	**Fast UT**	**Slow UT**
One hand-over	4171	4188
Two hand-overs	4169	4189
Three hand-overs	4170	4188

Table 2: Average jitter values for Handover

Throughput	**Fast UT**	**Slow UT**
One hand-over	0.233	0.213
Two hand-overs	0.0556	0.009
Three hand-overs	0.17	0.038

Table 3: `End to end delay values for Handovers

Throughput	**Fast UT**	**Slow UT**
One hand-over	0.67517	0.6755
Two hand-overs	0.45	0.39
Three hand-overs	0.52	0.44

The plots drawn using these values obtained are:

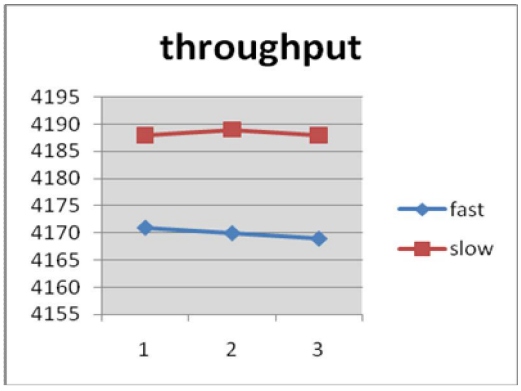

Figure 4: Graph of Throughput for Handover

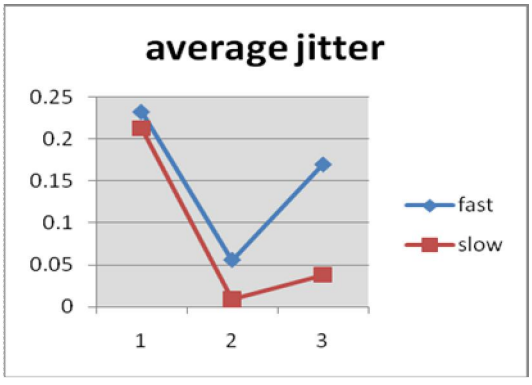

Figure 5: Graph of Average jitter for Handovers

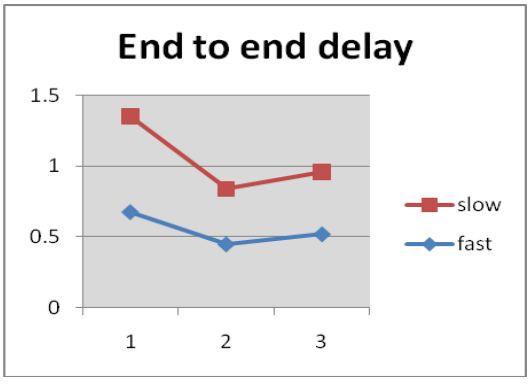

Figure 6: Graph of Average jitter for Handovers

4 CONCLUSION

On analysing the results obtained after running different simulations. We can say that the system has better performance for slow speed users as values of performance determining parameters like Throughput, Average jitter and End to end delay better than that for high speed users. With number of handovers throughput does not vary much, And Average jitter and End to end delay first fall down a bit latter increases. So, overall performance of system is good in case of handover as jitter and End to end delay are not much and Throughput is also good does not vary much.

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