Open access Journal International journal of Emerging Trends in Science and Technology

Execution of Soft Handover in UMTS Using OPNET Simulator

Authors
Shivani Acharya[1], Trilok Gaba[2]

[1] M.Tech scholar, Computer Science Dept,
B.I.T.S, Bhiwani, Haryana, India.
Email id: *shivaniacharya90@gmail.com*
[2]Assistant Professer, Computer Science Dept,
B.I.T.S, Bhiwani, Haryana, India.
Email id: *trilok_gaba@yahoo.in*

Abstract
Mobility is the main advantage of mobile cellular systems. Ability to communicate anywhere, at any time was the great success of wireless communications in 90's. Now a day's, continuous service is achieved by supporting handover from one cell to another. It is regularly initiate either by crossing a cell boundary or by deterioration in quality of the signal in the current channel. Handover is a key concept to achieving mobility. Handover stands for event which is start when user equipment moving to another base station and leave the previous base station. It makes possible for a user to travel from one cell to another, with no interrupt is known as seamless connection. In this paper, execution of soft handover is made using OPNET MODELER.4 user equipment perform handover which is present for a city in "INDIA". Parameter of UMTS handover such as active cell size, cell added to the set and cell removed from the set, ATM throughput (bits/sec) are test out.

Keywords: UMTS- Universal Mobile Telecommunication System, QOS – Quality of Service, RNC – Radio Network Controller, GGSN Gateway GPRS Support Node, SGSN- Serving GPRS Support Node

1. Introduction

In this era the mobile communications are commonly seen as one of the most advanced form of human communications ever. In the last decade GSM technology is a leading revolution generation wireless system. UMTS is a part of the IMT-2000 family of 3G mobile communication system. The UMTS network is also called as Global System for Mobile communications (3GSM) because it evolved from that system and the air interface (WCDMA) for the UMTS network is based on Wideband Code Division Multiple Access (WCDMA) and includes the High Speed Packet Access (HSPA) specification. This architecture is as according to the third generation project (3GP) requirements. Besides providing changes in the network infrastructure the UMTS specifications point out the evolution path from GSM circuit switched networks towards packet switched technologies offering higher transmission rates [1].

In mobile communication, Handover is a process when a user switches to another channel without any interruption. It enables the users to receive their calls anywhere and at any time. In Handover process the existing link is replaced by another cell. The network controller decides from the measurement reports about the link quality that the hand over process is needed to another cell or not. The main aim of the handover process is to permit the mobile users to roam freely from one mobile network to another either the network are same or different.

Obligation of Handover process:

- When the movement of the user equipment/cell phone is very fast.
- The movement of the user's equipment from one cell to another during an ongoing session.

• The experience of interference phenomena by the user's equipment from the near cell.

Types of Handover

Different types of Handover are performed in the network.

1. Hard Handover: Hard handover is also known as "break before make" because this type of handover firstly breaks connection and after breaking makes a new connection with BS.
2. Soft Handover: Soft handover also known as "make before break" because this type of handover firstly build connection and after building a new connection with BS, break connection with old node-b.
3. Vertical Handover: Vertical handover is normally used where the network service issues between 3G and 2G technology. E.g. UMTS and GSM [1]
4. Horizontal Handover: Vertical handover is normally used where the network service issues between 2G and 2G technology. E.g. GSM and GSM [1]

1.1 Soft handover

Soft handover is the one handover in which connection is established before breaking the connection. This handover is known as "make before break". In Soft handover, a mobile at the same time communicates with two or more cells belonging to different BSs of the identical RNC (intra-RNC) or different RNCs (inter-RNC). When a call is in a state of soft handover, the most excellent signal is used or all the signals can be collective to generate a clearer copy of the signal.

Soft handover network consists of user equipment, node B, RNC, GGSN, SGSN and Server. The GGSN include all GPRS functionality that is needed to support GSM and UMTS packet services. The SGSN monitors user location and performs security functions and access control. The GGSN contains routing information for packet-switched (PS) attached users. It provides interworking with external PS networks such as the packet data network (PDN). The model's CN nodes include both SGSN and GGSN functionality. The Circuit Switched Network consists of no. of server. HLR server is used to store the home location of user equipment. VLR server is used to store the random location of user equipment.

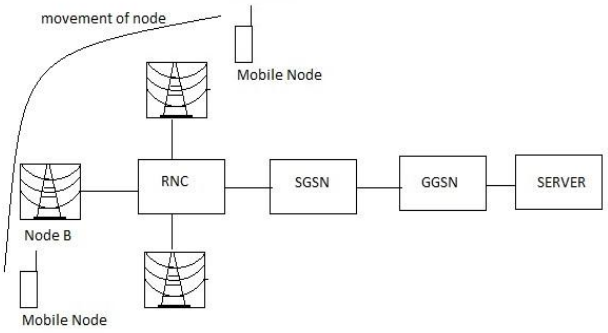

Fig1. Architecture of Soft Handover

Soft Handover is divided into 3 phases [7]: measurement, decision and execution. In measurement Phase: Calculate the ratio of Ec/No based on the RSCP (Received Signal Code Power) AND RSSI (Received Signal Strength Indicator) Using this Ec/No, each pilot [3] to decide on which cell UE is connected to.

$$Ec/No = \frac{RSCP}{RSSI}$$

RSCP is the power of decoded pilot channel. The performed Ec/No is sent by UE to Base Station and further send to RNC for decision of Handoff. In Decision Phase, RNC compares the measurement report with the predefined criteria. After decision phase, execution of soft handover is accomplished.

Advantages And Use Of Soft Handover:

- Reduce fading of signal through macro diversity.
- Overcome Node B power which in turn decreases interference and increases capacity.
- Reduced UE power (up 4dB), decreasing interference and increasing battery life.
- does not lose contact with the system during handoff execution

1.2 OPNET

The OPNET Modeler tool provides the power of the graphical program during which the users will model and simulate their networks. For developing completely different communication structures and implementing different eventualities, totally different tradable layers square measure gift within the atmosphere of the modeling. Users will build a detail model consistent with the need to try to do the analysis of the system. The systems square measure designed within the object destined

method, on compilation of the model its produces a separate event simulation within the C language. When playacting the simulation, the results square measure analyzed with the various statistics associated with the performance provided by the OPNET.

In the first section introduction is explained, in the rest of the paper about the tool, design of the idea of the paper and the execution of soft handover in OPNET tool is explained with the simulation results.

2. Literature Review

Various researchers have worked on simulating different UMTS network using various simulation tools e.g. Qualnet, OMNET, NS2 as well as OPNET. Furthermore, there exists a wide range of techniques or methods for evaluating and proposing various enhancements in the UMTS network. The most of the work conducted, has been either 2G to 3G or 3G to 2G. Its simulation-based studies carried on mobile communication networks. This section describes outlook of these methods that have been designed specifically for enhancements and performance evaluation of Universal Mobile Telecommunication Network. Previous researches (Junaid Ahmed Zubairi & Mike Zuber) focused on SUNY FREDONIA CAMPUS NETWORK [6] and performance of network has been shown performing a series of simulation test with different parameters. Using this idea, execute a network in a city of Haryana at India.

This paper focused on handover parameter of UMTS network in various simulated environments using OPNET MODELER. This paper has been based on modelling and simulating a UMTS scenario and it has been verified that UMTS handover performance can be improved by fine tuning to Timer 3350.

3. Simulation Model

Using OPNET MODELER, create an UMTS network. This UMTS network consists of 29 UE and 7 BS's and 1 RNC and 1 UMTS CN node.

Using this UMTS network, implementation of soft handover between 4 UE's is done. As well as see the 2D movement of mobile node. In Global statistics, ATM Throughput (bits/sec) parameter is checked. In Object statistics UMTS handover parameter for 4 mobile nodes are checked.

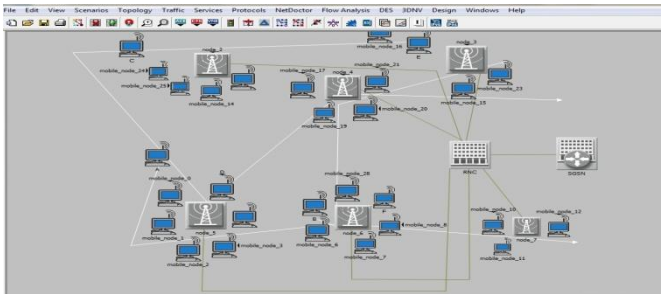

Fig. 2 UMTS network in a city in India

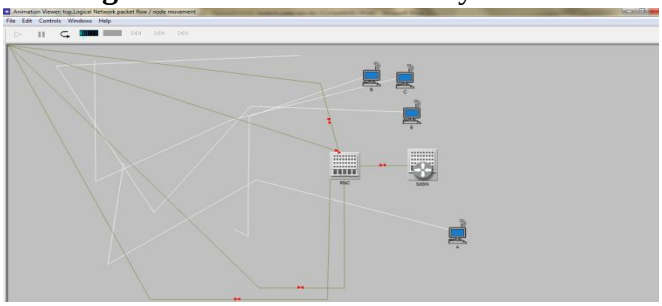

Fig. 3 Movements of UE

Total 4 UE's change their position after moving. In fig. 2 animated view is shown. After animation, 42354 total requests are processed.

UE E has the longest path to reach to destination. Due to longest path UE E is unable to maintain connection with Cn_east. To maintain a connection with cn_east, increase the time of "Timer 3350" After increasing timer value to 60 sec, Cn_east is able to maintain their connections with E UE.

The simulation parameters are shown in table below:

Parameter	*Value*
Transmission Range	1 km
Data Rate	20 mbps
Simulation Time	4 min
Number of nodes	29
Traffic Type	Constant Bit Rate
Seed	128
Values Statistic	100
Update Interval	100
Simulation	500000 events Based on Kernel type preference
Trajectory Inf.	Random
Area of Movement	Within a city
Events	62638
Speed	87,239(event/sec)
No. of runs	5
Host	Local Host
Port Offset	0
Timeout (sec)	3

Global Statistics: Test out the UMTS parameter that includes ATM load (bits/sec) and ATM throughput (bits/sec).

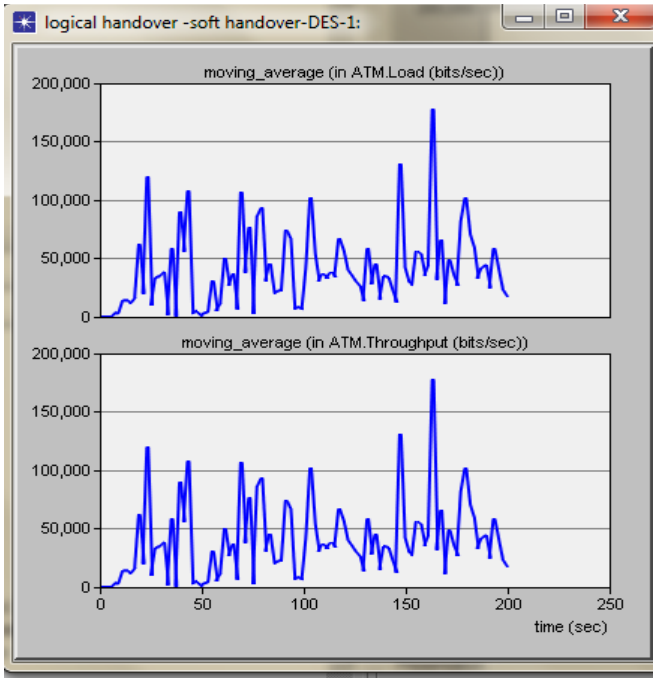

Fig. 4 UMTS ATM load(bits/sec) and throughput(bits/sec)

Fig. 4 shows the ATM load represents the ratio of the number of bits generated to the current simulation time for all modules of this type. ATM throughput represents the ratio of the number of bits received to the current simulation time for all modules of this type.

Object Statistics: - In object statistics we check the comparison of UMTS handover parameters. In UMTS Handover check the comparison of active cell set count, cell added to active set and cell removed from the active set.

- **Moving Average UMTS Parameter for comparison**

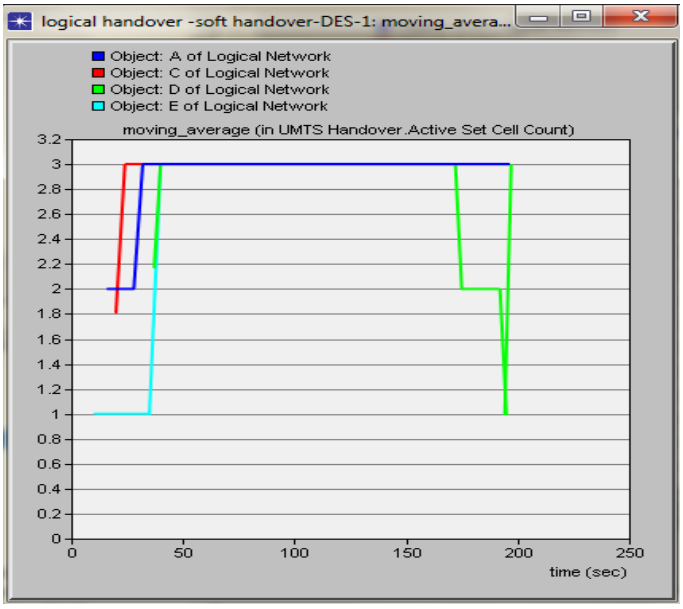

Fig 5 Comparison of UMTS Handover Active Set Cell Count between 4 UE

Fig. 5 shows number of the cells in the Active Set of the surrounding UE, which varies during soft handovers. The repeating statistic values indicate Active Set cell replacement events.

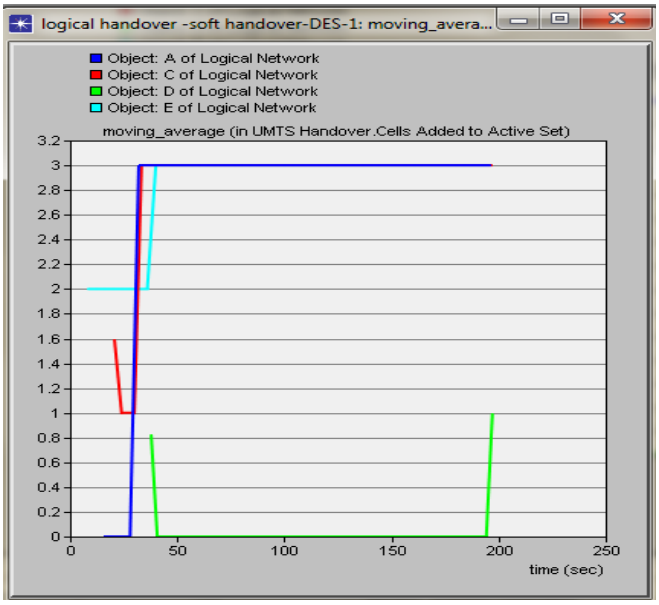

Fig 6 Comparison of Handover Cell Added To Active Set between 4 UE

Fig 6 shows the Cell IDs of the cells that are added to the Active Set of the surrounding UE throughout the simulation initially and during handovers.

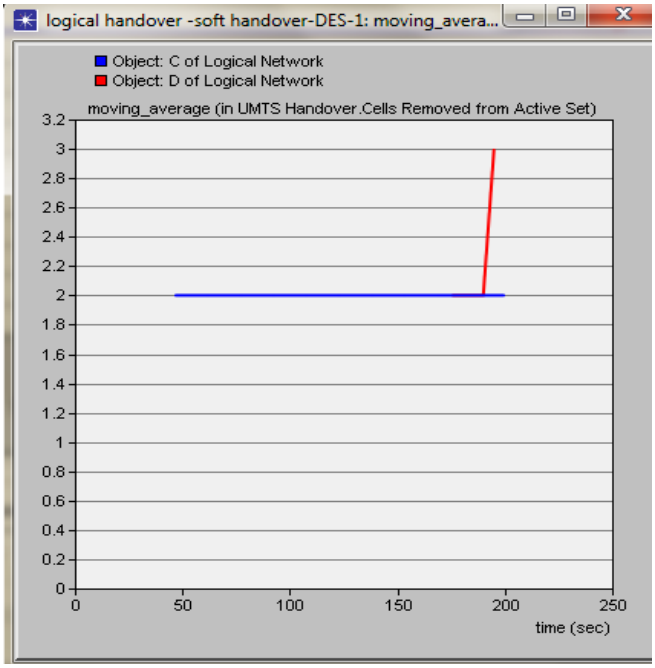

Fig 7 Comparison of UMTS Handover Cell Removed To Active Set between 4 UE

Fig. 7 shows the Cell IDs of the cells that are removed from the Active Set of the surrounding UE throughout the simulation during handovers. In UE A and E no cells are removed.

Global Statistics Packet Info:

- Module Centric Packet Information's

Table 2 Packet information

No. of node	*No. of Packets Created*	*No. of Packets Copied*	*No. of Packets Destroyed*	*No. of hand-over*
29	10564	9363	534	E
20	9416	8260	425	D
12	6250	4651	252	C
5	3714	2302	670	A

4. Conclusion

The research paper is working to evaluate the performance of soft handover in a city area network under UMTS handover conditions. The paper presented a few results for network. 4 user equipments are configured to perform handover task in network. The results show comparative performance of handover. After performing an animated view of network, 42354 total requests are processed by UMTS network. Zig-Zag movements of UE's are implemented using Fixed Interval. By increase the value of Timer 3350 UE's are enabling to maintain connection with Cn_East. Using this simulation tool virtually create a network and check the performance.

5. Future Work

Before implementing a network, virtually check the performance of networks. Using OPNET MODELER, we increase the area of network as well as increase the no. of handover to check the performance of parameters. By increasing the timer value we can achieve a better handover. By joining more than 2 cities build a network and check the performance as well as check the Qos.

References

[1] A. Abdulhadi, H. Abbas Al-Rubiae,H. Galil Al-Qurabi," Evaluation and Comparison of Soft and Hard Handovers in Universal Mobile Telecommunication (UMTS) Networks", Kerbala University , Vol. 8 No.1 Scientific. 2010.

[2] G.Ramamurthy, M. Mortazawimolu," Handover between GSM (2G), UMTS (3G) and Wireless Local Area Networks (WLANs)", Deep Study Report for Advanced Telecommunications, May 2008.

[3] Z. Becvar, J. Zelenka, R. Bestak, "Comparison of handovers in umts and wimax", 16627 Prague 6, Czech Republic 2012.

[4] [Online] Available: http://www.umtsworld.com/technology/handover.htm

[5] Mobile Communications by Jochen Schiller

[6] Tero Isotalo, Jarno Niemelä, Jakub Borkowski and Jukka Lempiäinen "Impact of Pilot Pollution on SHO Performance" [Online] Available:http://www.cs.tut.fi/tlt/RNG/publications/docs/topology/SHOpPP pDT.pdf

[7] Thomas Neubauer "UMTS – Universal Mobile Telecommunications System", Research Group Mobile Communications, Technical University [Online] Available http://www.nt.tuwien.ac.at/mobile/projects/UMTS/en/

[8] S. Chia and R. J. Warburton, " Handover Criteria for a City Microcellular Radio System," in Proc 40th IEEE VTC, 1990, pp 276.

[9] Junaid Ahmed Zubairi & Mike Zuber "SUNY FREDONIA CAMPUS NETWORK SIMULATION AND PERFORMANCE ANALYSIS USING OPNET" [Online]. Available http://www.cs.fredonia.edu/zubairi/opnet/op2k_jz.pdf

[10] V. Vassiliou, J. Antoniou, A. Pitsillides, and G. Hadjipollas "SIMULATING SOFT HANDOVER AND POWER CONTROL FOR ENHANCED UMTS" [Online] Available:http://www.researchgate.net/Simulating_soft_handover_and_powe r _control

[11] S. Ali, N. Saleem, T. Tareen, "Measuring the Performance of Handover Mechanisms in UMTS for Diverse Traffic Services Classes to Improve QoS",International Journal of Computer Applications (0975 – 8887) Volume 55– No.11, October 2012.

[12] Review Of Research Journal, Vol 2 Issue 8 May 2013, ISSN No : 2249-894X.

[13] D. Gundlegård, J. M Karlsson," Generating Road Traffic Information from Cellular Networks – New Possibilities in UMTS", New Possibilities in UMTS, 2006, 6th International Conference on ITS Telecommunications, 1128-1133, Chengdu, China.

[14] S. Chia and R. J. Warburton, " Handover Criteria for a City Microcellular Radio System," in Proc 40th IEEE VTC, 1990, pp 276.