The Effect of Handover on UMTS Services

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ABSTRACT

Mobility is an important factor in cellular networks so handover should be used to avoid the termination of call when user signal travel from cell to another in UMTS network. In this paper, the OPNET modeler 14.5 was used to simulate two scenarios of UMTS network the first one with handover support and the second without and study the effect of handover on performance factors such data traffic sent and data traffic received on FTP, HTTP and E-mail and the results appear that handover is very important to use with mobile cellular networks.

Key words: Cellular networks, UMTS, Handover , FTP , HTTP, E-mail.

1. INTRODUCTION

In telecommunication system, handover occurs to avoid termination of call when the user moving from one cell to another in very fast mode by releasing the connection from the old cell and establishing a new connection to a new cell [1]. If new connection is established before old connection is released (break before make), data reception is interrupted for a short period of time and can be avoid the service disruption by establishing connections simultaneously by a mobile host to multiple access points and the connect to new cell before breaking its connection from the old cell (make before break) [2]. Handover necessary for mobility and user preferences. Handover will occur when received signal level drops below a certain threshold value and Actually consider a time average of the received signal instead of the instantaneous level [3]. In order to get the high quality of service with faultless communication in a network, handover should be implementation. In telecommunications systems the second generation suffered from low data rate so the third generation mobile systems (UMTS) are needed to replace the old systems so in this paper we study and analysis the effect of handover on UMTS services like HTTP, FTP and E-mail by simulating the network in OPNET modeler 14.5.

2. THE TYPES OF HANDOVER

Depending on W-CDMA technology, there are three basic types of handover: hard handover, soft handover and softer handover

2.1. HARD HANDOVER

This type of handover occurs when user signal transfer from one cell to another that means the connection between the UE and the first Node-B is broken and established a new connection between the UE and new Node-B [4].

2.2. SOFT HANDOVER

This type of handover occurs when the user signal connected with more than one BS (Node-B) simultaneously [5].

2.3. SOFTER HANDOVER

This type of handover occurs when one BS receive from two adjacent sectors two UE through multi-path propagation [6].

3. UNIVERSAL MOBILE TELECOMMUNICATIONS SYSTEM (UMTS)

Is the third generation of mobile telecommunication system that developed by ETSI (European Telecommunications Standards Institute). It is provide multimedia services like voice, video and data, with ensured QoS up to a capacity of 2Mb per user by achieving a novel architecture for its radio access network, called UTRAN [7]. It supports both Time division Duplex (TDD) and Frequency division Duplex (FDD) performing different operations. It is based on the IP technology having user achievable peak data rate of 350 kbps [8].

4. THE COMPONENTS OF UMTS NETWORK

The UMTS network consists of three domains: The User Equipment (UE), the UMTS Terrestrial Radio Access Network (UTRAN) and the CoreNetwork (CN). UE is a collection of a variety types of equipment with different levels of employment such as PDAs, cellular phones, laptops, etc. it consists of two parts: Mobile Equipment (ME) and Subscriber Identity Module (USIM)[9]. UTRAN is an encompass term of for the Radio Network Controllers and Node B's. This communications network can carry traffics frequently to IP based Packet Switched from Circuit Switched. It is a point of contact between UE and a CoreNetwork [10]. CoreNetwork domain consists of two parts: Packet Switched and Circuit Switched that plays a basic role in mobile communication system to provide a necessary capabilities as switching and routing, mobility management, charging and billing, call and session control and security protection [11].

5. THE PROPOSED NETWORK AND COMPONENTS

The simulation model for the UMTS network under study is illustrate in (Figure 1). It consists of "3" servers (FTP server, HTTP server and E-mail server) that connected to hub, router, GGSN, "2" SGSN, "4" RNC and "12" Node-B each of them has "3" UE connected with it. Application definition symbols also used to specify application using available application types, names and the corresponding description in the process of creating our application like HTTP, FTP, E-mail and specify the encoder parameters for each of encoder schemes while creating the user profiles on the profile definition symbol to generate application layer traffic. Two scenarios of UMTS network are implemented: the first one with handover support and the second without handover support to study the effect of handover on performance factors such data traffic sent and data traffic received on FTP, HTTP and E-mail.

Fig1. Simulation the Proposed UMTS Network

6. NETWORK SIMULATION RESULTS AND DISCUSSIONS

In our UMTS subnet there are three servers as in the interactive class and there are three type of the traffic: FTP, HTTP, E-mail. The performance metrics that the paper is concerned with are: data traffic send (byte/sec) and data traffic received(byte/sec). The duration of simulation is 3600 minutes and 512 for seed. All figures signals started after (15 sec) of the simulation time because all UE needed some time to connect with nearest Node-B. The blue line represent the UMTS network with handover support and the red line represent the UMTS network without handover support and the results are summarized in table1.

Figure (2): show that the data traffic sent signal for E-mail(Average bytes per second traffic submitted to the transport layers by all E-mail applications in the network) reach to (4513 byte/sec) with handover support and without handover support reach to (2672 byte/sec).

Figure (3):show that the data traffic receive signal for E-mail (Average bytes per second forwarded to all E-mail applications by the transport layers in the network) reach to (5569 byte/sec) with handover support and without handover support reach to (2451 byte/sec).

Figure (4):show that the data traffic sent signal for FTP (Average bytes per second submitted to the transport layers by all FTP applications in the network) reach to (21018 byte/sec) with handover support and without handover support reach to (2672 byte/sec).

Figure (5):show that the data traffic receive signal for FTP (Average bytes per second forwarded to all FTP applications by the transport layers in the network) reach to (19629 byte/sec) with handover support and without handover support reach to (13974 byte/sec).

Figure (6): show that the data traffic sent signal for HTTP (Average bytes per second submitted to the transport layer by all HTTP applications in the network) reach to (5683 byte/sec) with handover support and without handover support reach to (4232 byte/sec).

Figure (7):show that the data traffic receive signal for HTTP (Average bytes per second forwarded to the HTTP applications by the transport layers in the network) reach to (5259 byte/sec) with handover support and without handover support reach to (4612 byte/sec).

Fig2.Data traffic sent for E-mail

Fig3.Data traffic receive for E-mail

Fig4.Data traffic sent for FTP

Fig5.Data traffic receive for FTP

Fig6.Data traffic sent for HTTP

Fig7.Data traffic receive for HTTP

Table1. Comparison between UMTS performance metrics with handover support and without handover support

UMTS Parameters	With Handover Support	Without Handover Support
Data traffic sent for E-mail	4513 byte/sec	2672 byte/sec
Data traffic receive for E-mail	5569 byte/sec	2451 byte/sec
Data traffic sent for FTP	21018 byte/sec	2672 byte/sec
Data traffic receive for FTP	19629 byte/sec	13974 byte/sec
Data traffic sent for HTTP	5683 byte/sec	4232 byte/sec
Data traffic receive for HTTP	5259 byte/sec	4612 byte/sec

7. Conclusions

Three types of the traffic: FTP, HTTP, E-mail were investigated by UMTS network through two performance factors: : data traffic sent and data traffic receive by using OPNET modeler. The results represented that handover has an effect on UMTS signal that keep the signal in range (avoid call termination) when the UE transfer from one base station to another with an excellent connection.

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