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Vertical Handover in Long Term Evaluation (LTE)

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Abstract: ***In mobile network the handover process is very important to allow the call continuation with high mobility. However the high handover rate increases the signaling load. In this paper a vertical handover in LTE (Long Term Evaluation) was proposed according to two scenarios; the first scenario initialize the handover according to the signals strength and the second scenario initialize the handover according to the costs optimization. A MATLAB simulation code is written and the results of the two mechanisms are given***.

Keywords: Vertical handover, LTE, Wimax

1. Introduction

Handover is avery important process in any mobile communication network because it allows the call continues with high mobility and to supply quality of services of the users. There are two types of handover process horizontal handover, vertical handover, the handover between one type of networks that have the same access technique called horizontal handover, Wireless technologies such as LTE, WLAN, WiMAX, etc were developed with different Standards and these technologies offer variety of services, one of the forthcoming challenges in network management is a network node that automatically changes its connection type to access a supporting infrastructure. When a computing device could connect to the Internet via two different network technologies, it is automatically connected to the available network. This shuffling or changing from one network to the other is the vertical handover. Vertical handover enables the exploitation of higher bandwidth and lower costs for networks like wide local area networks. It also provides extended coverage for cellular networks. The term interworking is used to express interactions between heterogeneous networks with the aim of providing an end-to-end communication. LTE can support inter system handover between LTE and 3G latency systems such as UMTS, GSM, etc.

Explains Vertical Handover:

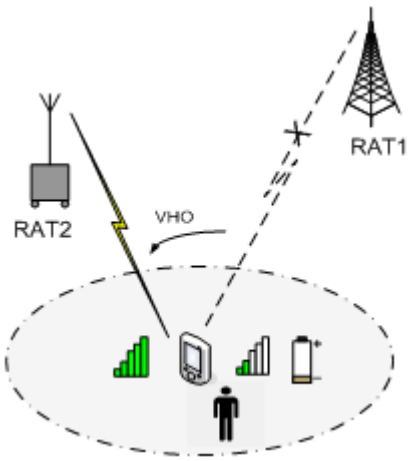

Figure 1: VerticalHandover

Many Mobile terminals have dual technology in their Mobile terminals to connect to the Internet; Mobile terminals may use wireless LAN (WLAN) or cellular network connection technologies. WLAN provides higher bandwidth at very low rates. A cellular network is not as reliable, is often costly, and available bandwidth is dependent on network traffic. The WLAN is configured by default on the Mobile terminals. However, upon WLAN failure, the cellular network is available to keep the user connected to the Internet. The movement from one type of technology to the other is the vertical handover, which keeps a user's machine connected to the Internet and provides uninterrupted communication. For a vertical handover to occur, the following must be considered:

- A vertical handover supported device must contain a dual card to connect the two different wireless networks.
- With vertical handover, two wireless technologies are integrated by means of handover-metrics. The wireless technology with the better handover metric is preferred.
- User requirements and preferences, relative-signal strength, overall network conditions and costs are major factors for the handover decision.

Vertical Handover Process

A handover process can be split into three stages handover decision, radio link transfer and channel assignment.

a) **Handover decision:** This process involves the selection of the target point of attachment and the time of the handover.
b) **Radio link transfer:** It is the task of forming links to the new point of attachment.
c) **Channel Assignment:** It deals with the allocation of channel resources. VHD algorithms are useful in the way that they help mobile terminals to choose the best network to connect to among all the available candidates.

2. Overview of LTE

Long Term Evolution (LTE) was developed by the 3rd Generation Partnership Project (3GPP). The LTE standard is officially known as "document 3GPP Release 8". LTE supports peak data rates of 50 Mbps in uplink (UL) and 100Mbps in downlink (DL), with 20 MHz spectrum on both

UL and DL. It supports 300 Mbit/s downlink data rates if we use Multiple Input and Multiple Output [MIMO] antenna technology. LTE supports variable spectrum, which can be used with 1.25, 2.5, 5, 10, 15 and 20 MHz. A cell can cover up to 100 km area with slight degradation after 30 km and reach over 200 users per cell (with 5 MHz spectrum). The major features of LTE are listed below in Table[1]

Table 1: LTE Features

Features	Description
Modulation	64QAM (Quadrature Amplitude Modulation)
Duplexing	Both TDD and FDD
OFDMA for DL	To achieve high peak data rates (300 Mbps-UL, 86.4Mbps-DL)
SC-OFDMA for UL	To achieve Peak to Average Ratio (PAR) of 2 to 6 dB.
UE	Simplified Rx design in UE for high speed Data
Antenna Type	MIMO UL & DL
Scalable	Because of bandwidth up to 20MHz (1.4, 3, 5, 15,20MHz)
Bandwidth	Larger channel bandwidths
Spectral efficiency	Increased
Access Network	Flexible
Interference	Overcomes Multi-path Interference
Link Capacity	Increased
Latency	Low
Interpretability	Flexible
Mobility	Inter-technology Mobility, Mobile IP based IP Mobility

3. Proposed Model

A. Physcial Model

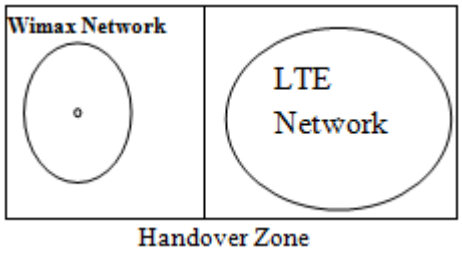

Figure 2: Simulation Region

B. Mathematical Model

SWL=12000 Simulation window length in meter
SWW=6000 Simulation window width in meter

Xposwm=2000 X-position of WiMAX

Yposwm=3000 Y-position of WiMAX

N=8 8 Nodes

Avspeed=8.33 Speed in meter per second

$$\text{Average speed} = \frac{Minmum\ Seed + Maximum\ Speed}{2}$$

$$\text{Average speed} = \frac{0+60}{2} = \frac{60}{2} = 30\text{KM/H}$$

$$\text{Average speed} = \frac{30\times1000}{60\times60} = \frac{30000}{3600} = 8.33\text{M/S}$$

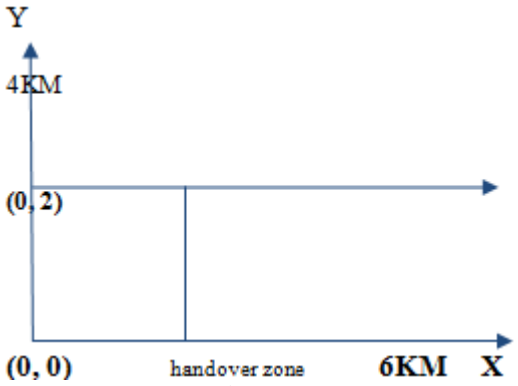

Figure 3:

4. Simulation Scenario

A. Algorithm of Channel Assignment If mobile in Wimax area
Assign channel from Wimax
else if mobile in LTE area.
Assign channel from LTE.
If there is free channel
else if there is no free channel
the assign channel from LTE.

B. Algorithm of Handover
Else if mobile in Wimax area has a channel in LTE and channel in Wimax > 0.
Then release the LTE channel and assignment new Channel in Wimax (Handover execution).

else if mobile in LTE area has a channel in Wimax and channel in LTE> 0
Then release the Wimax channel and assignment new Channel in LTE.

C. Flow Chart

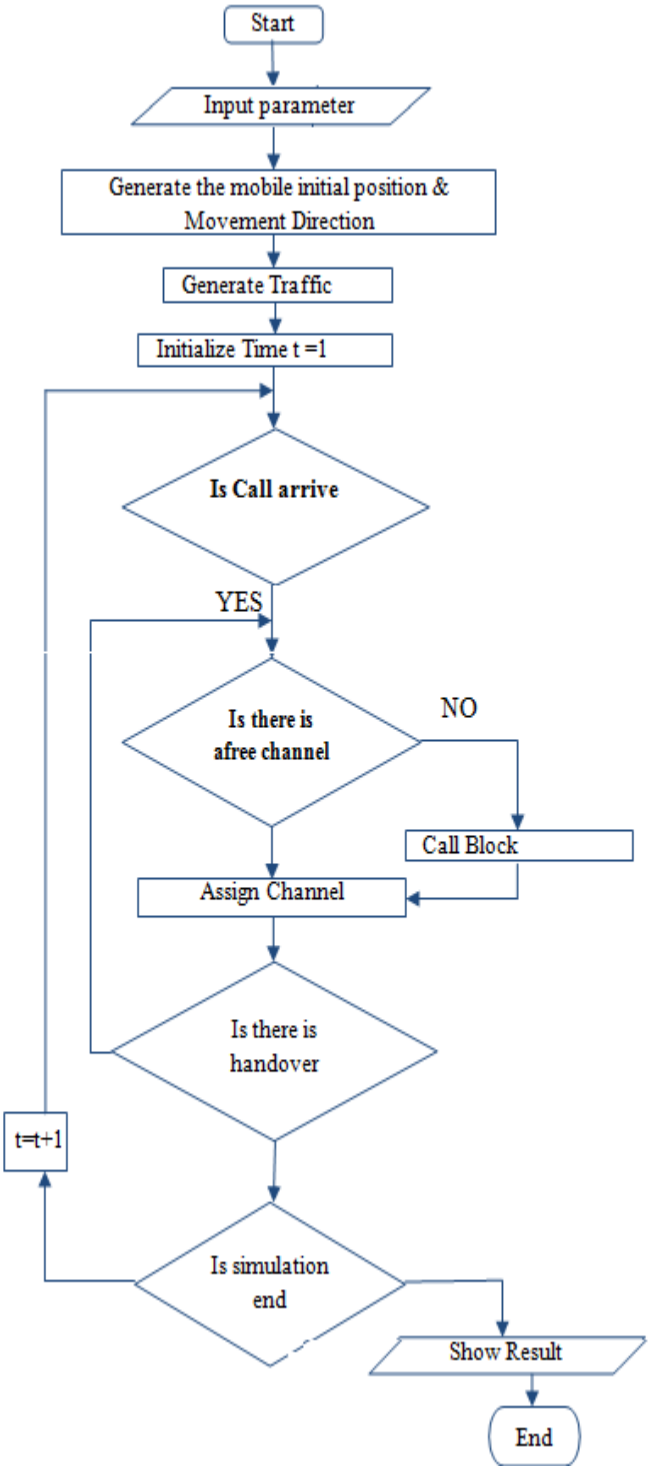

Figure 4: Flowchart represents simulation scenario

5. Simulation Result

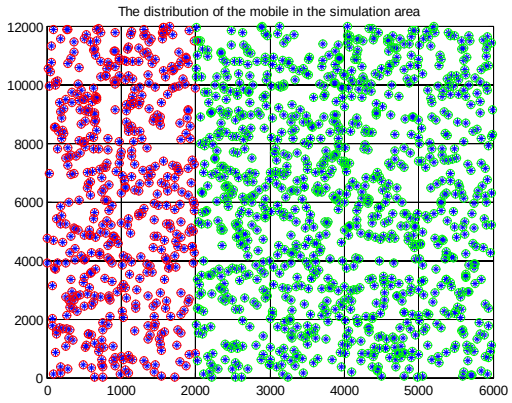

Figure 5: The distribution of the mobile in the simulation area

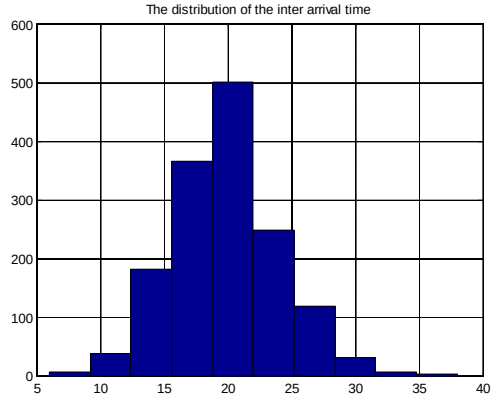

Figure 6: The distribution of the inter arrival time

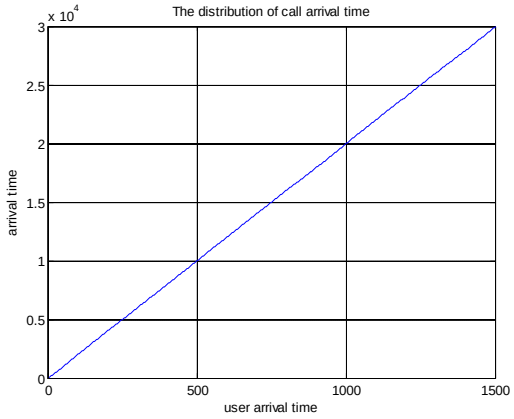

Figure 7: The distribution of call arrival Time

Table 2: Simulation result for Relation between Inter arrival and (handover failure, handover Successes, handover number block)

Inter arrival	FH	SH	NB
10	11	2	0
20	5	1	0
30	5	1	0
40	0	0	0
50	0	0	0

Table 3: Simulation result for Relation between User number and (handover failure, handover Successes, handover number block)

User No	FH	SH	NB
200	3	2	o
600	6	2	0
800	8	2	0
1200	9	2	0
1400	9	3	0

Table 4: Simulation result for Relation between Total Channel in Wimax and (handover failure, handover Successes, handover number block)

TC.W	FH	SH	NB
4	3	1	0
6	4	1	0
8	1	1	2
10	0	0	0
20	0	0	0
40	0	0	0

Table 5: Simulation result for Relation between Total Channel in LTE and (handover failure, handover Successes, handover number block)

TC.L	FH	SH	NB
30	1	1	2
40	7	2	0
50	0	0	0
60	0	2	0
70	0	0	0
80	4	1	0

6. Conclusion

In this paper the authors present the vertical handover in LTE using MATLAB modeler is done, we will give two Scenarios, the first scenario initialize the handover according to the signals strength and the second scenario initialize the handover according to the costs optimization, and Show the Simulation result between (Inter arrival, User number, Total Channel in Wimax, Total Channel in LTE And handover failure, handover Successes, handover number block).

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