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# Packet Loss Rate Optimization in Heterogeneous Wireless Networks using Channel Scanning Technique

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***Abstract*—In wireless networks, efficient vertical handover (VH) algorithms are required in maintaining an acceptable level of quality and a continuous connectivity. The seamless transfer of user's service from existing operator to a new operator bearing dissimilar radio access technology is necessary. In heterogeneous wireless networks there are various parameters which focus on providing better QoS namely Bit Error Rate (BER), jitter, idleness, throughput, packet loss, delay and so on. The paper analyse the heterogeneous wireless environment using the packet loss rate and propose a multiscan approach to perform handoff that enables mobile nodes to use between WLAN and cellular network interfaces for channel scanning and multipath transmissions by optimizing the packet loss rate. The experimental results shows that the multiscan technique provides a well desired VH environment suitable for continuous VH reducing packet loss rate.**

***Keywords*—heterogeneous wireless networks, vertical handover, multiscan , transmission group scheduling, packet loss.***

## I. INTRODUCTION

Heterogeneous wireless network includes the deployment of various wireless technologies in combination with evolved Mobile Terminals (MTs) with multiple network interfaces. Handover in wireless environment can be classified into vertical handover (between different types of networks) and horizontal handover (between different cells of the same network).In heterogeneous networks, vertical handover can be initiated for convenience rather than connectivity reasons. Two major challenges in vertical handover management are automation and seamlessness aspects in network switching.

The Figure.1 shows the vertical handover between heterogeneous wireless networks. Efficient vertical handover algorithms are required in maintaining an acceptable level of call quality and continuous connectivity between WLAN and cellular networks these networks complement each other to provide ubiquitous high speed and seamless connectivity to mobile users. Seamless means smooth transition from one network to another network. The WLAN can offer much higher data rates but cover smaller geographic area, whereas cellular networks provide ubiquitous connectivity but low data rates, their complementary characteristics make this combination of these two networks favourable. This combined network will provide both high data and wide area coverage. There are many aspects involved in their interworking, such as security, mobility and quality of service.

The rest of this paper is outlined as follows. Section II discuss about the related works. Section III introduces the system model for vertical handover in the heterogeneous environment and detailed analysis of vertical handover process. Section IV discuss about the transmission group scheduling which helps in reducing the call drop rate by decreasing or increasing the transmission range depending on the number of users present. Section V proposes new techniques to reduce the packet loss rate and multi scan technique is proposed for handover between WLAN and cellular networks to optimize the packet loss.

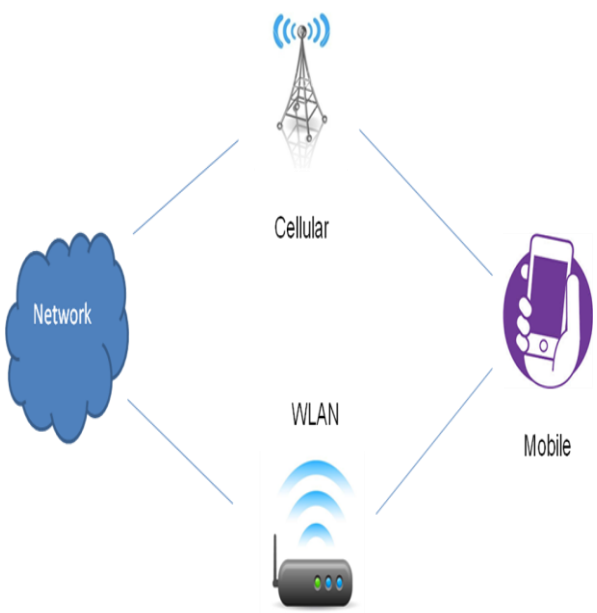


Figure 1. Vertical handover in heterogeneous wireless network

## II. RELATED WORKS

There has been other works that use different ways to use the vertical handover. In [6] Fang Zhu and janise McNair have proposed the policy enabled handoff decision algorithm to optimize the handoff decision process in the development of handoff cost function that accounts for the dynamic values that are inherent to a vertical handoff, the incorporation of a network elimination process in the vertical handoff metric, to potentially reduce delay and processing power in the handoff calculation, and the optimization of the handoff cost function for different types of user services spread among multiple networks.

A utility based network selection scheme for multiple services in HWN offering QoS requirement are discussed by[6]. In this scheme, based on the micro economic market theory utility function represents the satisfaction level of a user or an upper layer application in terms of QoS. The goal of the model is to achieve the optimal resource allocation by maximizing every network's total utilities and efficiently adjusting price to guide user's action.

## III. SYSTEM MODEL

The WLAN and cellular networks experiences different levels of signal strength from base station and access point. The quality of a voice call over WLAN depends on signal strength reduction, user flexibility, etc, which in turn causes delay and packet loss. A vertical handover algorithm initiates handover between cellular and WLAN in a way that the desired level of continuity and call quality is achieved.

### *A. Voice Over Heterogeneous Wireless Networks*

The present cellular networks allows us to consider it as ubiquitous, while the WLAN offers its services over a rather limited region. The large scale path loss and the small scale fading causes signal strength reduction over a wireless transmission medium. At every area the MT possesses along its direction, the neighborhood mean sign quality decides the bundle mistake likelihood right then and there. In this manner, the MT encounters a probability loss packet (PLP) that differs over the long run. The Gilbert states that a particular packet's probability of packet loss is depend on past packet. When a bundle is obtained, the following parcel's likelihood of misfortune is signified as p, and the PPL taking after a lost bundle is indicated as q. The variation in the AP-to-MT, the signal strength is determine the Packet loss rate. The voice quality of a call is all things considered a capacity of this PLR. The threshold for a certain level of quality and that for an outage, it can be specified in terms of the signal strength.

### *B. Vertical Handover Algorithm*

The access network should be selected from handover decision criteria and the handover decision policy represents the influence of the network on when and where the handover occurs. The handover decision is based only on RSS.

```
create class node;
declare int nno;
class check
{
        boolean calldrop;
        boolean packetloss;
        int RSS;
        int thres;
        Node wlan = new node();
        Node cell = new node();
        If( RSS < thres )
        {
                Packetloss = true;
                Calldrop = true ;
        }
        Else
        {
                Cell.add(wlan);
        }
}
Class node
{
        Int nno = 0;
        Void add(node c)
        {
                nno++;
```

In heterogeneous systems, vertical handover must access extra criteria, for example money related expense, offered administrations, system conditions, terminal abilities and user preferences. The blend of all these criterias and the dynamicity of some of them will essentially enchance the quality of the vertical handover process as analysed in [1].

## IV. TRANSMISSION GROUP SCHEDULING

In this section, a new methodology is introduced to avoid call drop for new user, transmission group scheduling is increasing or decreasing the transmission range depend on user present in the coverage area.

### *A. System model*

The network is a unit torus with n number of mobile nodes. The network is divided into m x m equal cells, the length of each cell is 1/m. If t = 0 the node is placed into m x m matrix according to the uniform distribution. The node selects a cell with equal probability of $1/m^2$ of other node and select cell at time slot t = 1, for every time slot they repeat the process and reshuffle the nodes. The data transmit as follows:-

1) If the node $A_i$ is transmitting to node $B_i$ at time slot t and denote by $A_i^t$ and $B_i^t$, the position of $A_i$ and $B_i$.
2) The data transmission from $A_i$ to $B_i$ can be successful if they satisfy the following 2 conditions for any other transmission node $A_j$

i) $|A_i^t - B_i^t| <= r$
ii) $|A_j^t - B_i^t| >= (1+\Delta) | T_i^t - R_i^t |$

Here r is transmission range , $\Delta > 0$ is a protocol specified factor to represent the guard zone around each receiver. The source is select the destination where source want to send the packet via transmission group scheduling scheme operates as follows:

1) The source is in search for destination, If the cell id is active then they transmit packet to the destination.
2) If the destination not in transmission range of source, for the time source remains idle. Otherwise selects a node say A, and flips an unbiased coin.

i) If it is a head, source choose source to relay transmission with A,source checks the receiver A, whether it carries a packet from source. If so, source remains idle. Otherwise, source sends to A a packet destined for destination.

ii) Otherwise, source choose to perform with A the relay to source transmission, if A able to carry a packet then source forward packet to A, otherwise stays idle

.

The transmission group scheduling is to avoid collision among simultaneous transmission links are analysed in [5].

## V. MULTISCAN APPROACH

In this section propose a multiscan approach, mobile nodes will be able to connect to 2 APs using Interface cards. Handoff Manager (HM) will decide to send the packets either single or multi path transmission in Figure 2.

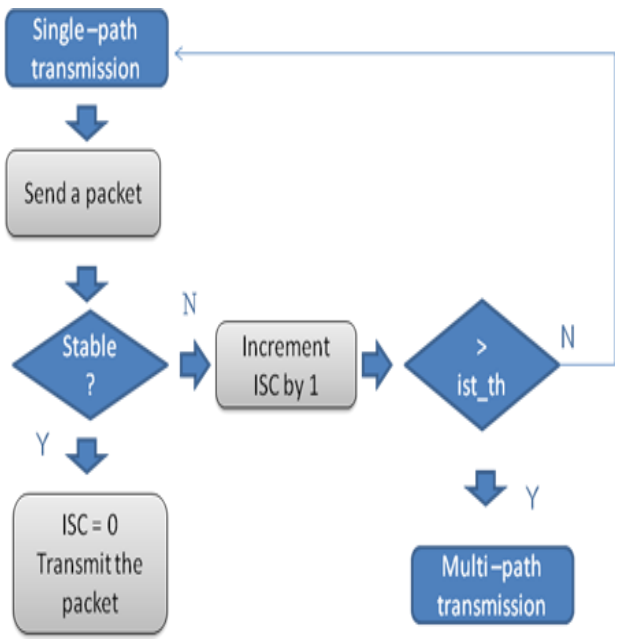


Figure 2. Multiscan Approach

### A. *Singlepath Transmission*

In the single path transmission, handoff manager monitoring the link state, by number of retransmission with pre-defined threshold value. If the condition, indicates the link is not good, then switching to multipath transmission. If the sender sends the packet to receiver, HM increases the instability counter by one, otherwise the HM resets instability counter to 0.

### B. *Multipath Transmission*

In the multipath transmission, source transmits the sign to destination, edge condition checked for each transmission, The node present in the cellular coverage area, search and send the packet to destination node through AP and checks the strength of the signal, if it is unstable, then the AP increments the stability count and periodically checks the stability count with the threshold value. If the node exceeds the threshold value, then switch from single path to multi path transmission transmit the packet through one AP to another AP if the destination is available.

## VI. SIMULATION RESULTS

In this section, the vertical handover is simulated using Network Simulator 2 (NS-2). The simulation model assumes that the mobile nodes are moving in an heterogeneous network, that is capable of accessing WLAN and cellular networks. Let the mobile nodes moving from one network to another network assumes the received signal strength is not more than threshold value. The Table-1 shows the parameters that are used for the simulation.

| PARAMETER TYPES | VALUES |
|---|---|
| Number of Nodes | 100 |
| Mobility Model | Random way point |
| Simulation Area | 1250 m x 1250 m |
| Simulation Time | 50 s |
| Y dimension of topography | 1000 |
| X dimension of topography | 1000 |
| MAC Protocol | IEEE 802.11 |
| Agent used | Agent/TCP |
| Routing Protocol | AODV/DSDV/DSR |
| Application | Application/FTP |

Table-1 Simulation Parameters

### A. *Performance Metric*

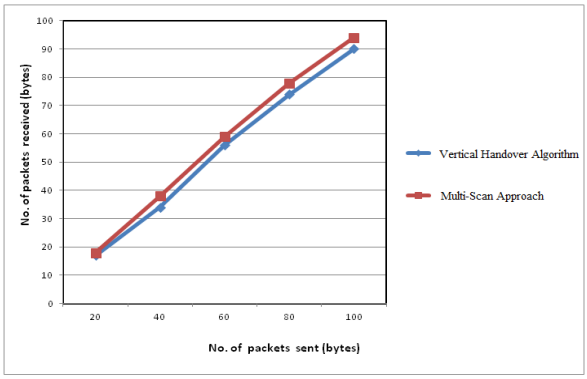


Figure 3. Packet delivery ratio

The Figure 3. illustrates the packet delivery ratio in heterogeneous wireless networks for vertical handover algorithm and multi-scan approach algorithm. The multi-scan approach achieves maximum packet delivery ratio in both wireless and cellular networks (i.e,. Packet delivery ratio= no. of packets received / no. of packets sent).

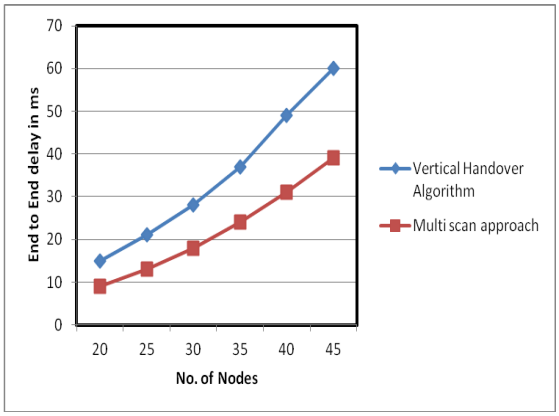


Figure 4. End to End delay vs No of Nodes

The Figure 4. illustrates End to End delay vs No of Nodes for vertical handover algorithm and multi-scan approach algorithm. The multi-scan approach achieves minimize the End to End delay in both wireless and cellular networks.

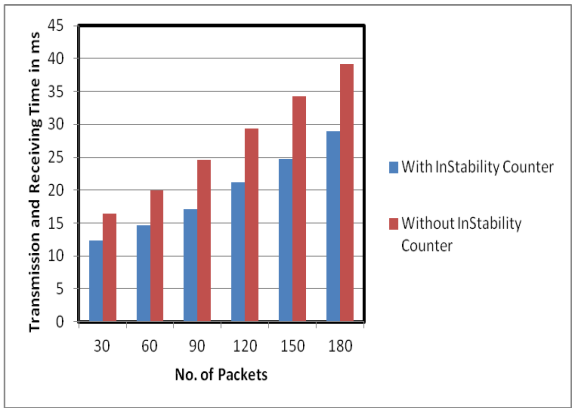


Figure 5. Transmission and Receiving Time vs No of Packets

The Figure 5. illustrates the Transmission and Receiving Time vs No of Packets to compare the result for with instability counter and without instability counter.

## VII. Conclusion

This paper proposes an outline of a realistic performance evaluation, for packet-loss based VH triggering algorithm, for voice over WLAN/cellular. Handoff is a critical function to transmit signal between WLAN and cellular networks. During handoff the communication may be interrupted due to high packet loss. The vertical handover algorithm are used to maintaining a seamless connectivity and voice quality in heterogeneous wireless networks. Gilbert packet loss pattern is employed in vertical handover algorithm to calculate the packet loss rate . The new concept multiscan approach is to scan the channel and multipath transmission to prevent packet loss at the time of handoff between WLAN and cellular networks.The vertical handover cause packet loss by using multiscan approach optimize the packet losses.

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