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# Reduced call drop rate in a 4G network using vertical Handoff algorithm

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**Abstract**—Mobile communication towers are used in many in personal and industrial purposes. It provides a continuous connectivity to a Mobile Nodes (MN) and permits them to change their connection point from current access point to new base station while needed. Handover has become an essential part of mobile communication system because of the limited coverage area of cells. In this paper, investigate the various handover management technologies for providing pure mobility between different access techniques such as GPRS, UMTS, and WI-FI, WiMaX. Vertical handoff refers to a network node changing the type of connectivity it uses to access a supporting infrastructure, usually to support node mobility. Vertical handover can be triggered by various parameters like RSS, bandwidth, packet receiving rate, etc. So in this paper Minimizing delay in vertical handoff to reduced call drop rate in 4G network.

**Keywords**— 4G, Vertical Handoff algorithm, Mobile terminal, access point, base station.

## INTRODUCTION

The evolution of 4G networks will increase the growth in development of a diverse range of high-speed multimedia services, such as at location-based services, mobile entertainment services, e-commerce, and digital multimedia broadcasting. 4G wireless networks will allows the seamless intersystem roaming across heterogeneous wireless access networks and packet-switched wireless communications [6].

### 1.1 Literature survey:

In literature survey we explain the evolution of cellular communication system as 1stgeneration, 2nd generation and 3rd generation are described. Then GSM architecture explaining briefly then go to the handoff basics and their technique vertical handoff and horizontal handoff. So we show Following of cellular mobile communication:

**Evolution of Cellular Communication:**

**1G-**The first-generation mobile systems were the analogue (or semi-analogue) systems, which came in the early 1980s - they were also called NMT (Nordic Mobile Telephone). They offered mainly speech and related services and were highly incompatible with each other. 1G refers to analog cellular technologies; it became available in the 1980s [3].

**2G-**The 2G mobile communication system is a digital system; this system is still mostly used in different parts of the world. This generation mainly used for voice communication also offered additional services such as SMS and e-mail. In this generation two digital modulation schemes are used; Like time division multiple access (TDMA) and the code division multiple access (CDMA) .

**3G-**Third generation (3G) services combine high speed mobile access with Internet Protocol (IP)-based services. The main features of 3G technology include wireless web base access, multimedia services, email, and video conferencing. 3G systems offer high data rates up to 2 Mbps, over 5 MHz channel carrier width, depending on mobility/velocity, and high spectrum efficiency.
In heterogeneous wireless networks, the mobile devices or mobile terminal will have multiple network interfaces in order to access different wireless networks. Such mobile devices not only support network access and great connection flexibility, but also support mobility between other networks. The ability to achieve wireless access anytime, anywhere and any place has become common expectation as it provides freedom and considerable flexibility in mobility. Vertical handover or vertical handoff refers to a network node changing the type of connectivity it uses to access a supporting infrastructure, usually to support node mobility. Mobile users to be connected to the 4G system using the best available access network that suits their needs. For example, given the complementary characteristics of WLAN (faster data rate and short-distance access) and UMTS (slower data rate and long-range access).Following figure 1.1 shows the example of Heterogeneous Wireless Networks.

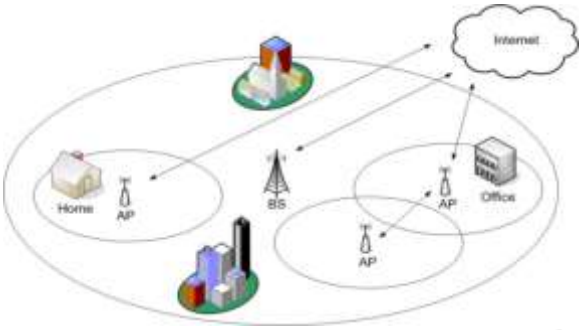


Figure 8.1 An example of Heterogonous wireless network

**1.2Handover:**

Handoff is the process of changing the channel (frequency, time slot, spreading code, or combination of them) associated with the current connection while a call is in progress. When a MS moves away from its current AP, it must be reconnected to a new one to continue its operation. The search for a new AP or base station (BS) and following registration without any loss is known as handover [5]. Following figure 1.2 shows the handoff conversation from base station to other base station.

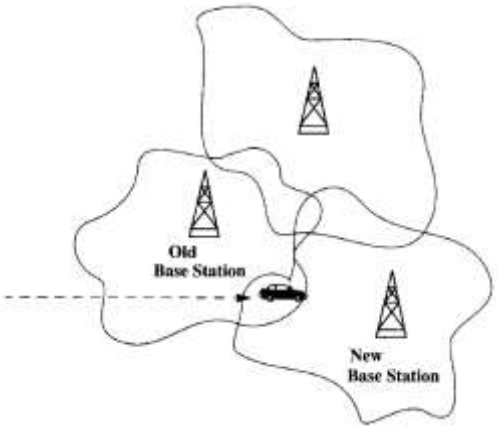


Fig 1.2 Handoff conversation

When a MS moves away from its current AP, it must be reconnected to a new one to continue its operation. The search for a new AP or base station (BS) and following registration without any loss is known as handover and the time required to complete a handover process is known as handover latency. Figure 1.2.1 shows the scenario of horizontal and vertical handover.

- *Horizontal Handover:* A mobile node moves with the single network from one AP or BS to the other one is called as „Horizontal handover". For Example, mobile node is moving from AP of Wi-Fi network to AP of same network.
- *Vertical Handover:* A mobile node moves with the different network that is from one BS to the other AP or BS of another network is called as „Vertical handover". Example is AP of Wi-Fi network to BS of Cellular network and vice versa.

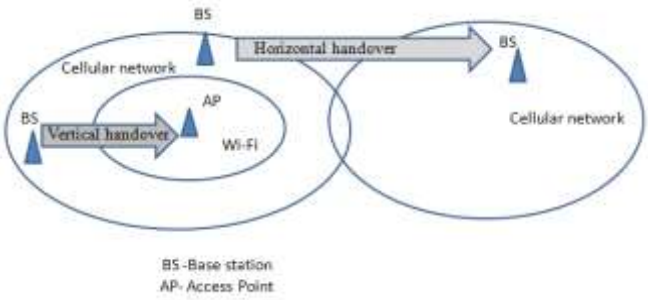


Fig 1.2.1 Horizontal and Vertical handover

Now we will show fourth generation of wireless network is expected to include heterogeneous wireless network that coexist and use a common IP core to offer a diverse range of high data rate multimedia service to end users since the network characteristics that component each other. In that case vertical handoff will remains an essential component for 4G wireless network due to switching of mobile users amongst heterogeneous network. The aim is to provide high data rate services to the users which are in low data rate areas then ad hoc routes are used as high data rate channels. Such a system is called unified cellular and ad hoc network. Another way of using characteristics of cellular and ad hoc network in order to enhance the performance of the cellular system known as converged ad hoc and cellular network system.

**4G**- The 4G network will consist of internet protocols such as to facilitate the subscribers by enabling the selection of every application and any environment. In 4G cellular networks high bandwidth with high data rate is required, also in 4G a quicker and optimized strategy of handover is required to make the clear and reliable communication. The 4Gnetwork system will run with the cooperation of 2G and 3G and also will impart IP based wireless communication. The main target in 4G will be video streaming on IP based protocol, such as IP TV [3].

4G is one of the upcoming technologies which will support heterogeneous network, many network will be integrated to provide seamless service for wide area to end users. Future 4G technology aims to provide seamless service across all the networks around the world, support high-speed multimedia services and access to high volume of information including data, pictures, and videos. Some of challenges in 4G networks we will face that is All-in-one: All-in-one solution means 4G should support any combination of radio access networks. In heterogeneous wireless networks, the mobile devices or mobile terminal will have multiple network interfaces in order to access different wireless networks. Such mobile devices not only support network access and great connection flexibility, but also support mobility between other networks. The ability to achieve wireless access anytime, anywhere and any place has become common expectation as it provides freedom and considerable flexibility in mobility.

Vertical handoff can be triggered by various parameters like RSS, bandwidth, data rate, cost etc. Call drop rate is a big problem in the 4th generation networks. A vertical handoff based on congestion parameters in the cell is used in a converged ad hoc and cellular network system. This results in less call drop rate.

**2. Related work:**

Fourth generation mobile communication system tend to mean different things to different people, for some it is merely a high capacity new radio interface while for others it is internetworking of cellular. Hand off takes place when a cellular phone user move from the range of one cell to another cell's range and the signal is passed from first base station to the next one. Handover is the process of maintaining user's active sessions when a mobile terminal changes its connection point to the access network (called point of attachment) for example, a base station or an access point. Depending on the access network that each point of attachment belongs to, the handover can be either horizontal or vertical [4].The vertical handoff process can be divided into three main steps namely handoff initiation, handoff decision, and handoff execution.

**i)Handoff Initiation Phase:**

In order to trigger the handoff event, information to be collected about the network from different layers likes Link Layer, Transport Layer and Application Layer. These layers provide the information such as RSS, bandwidth, link speed, throughput, jitter, cost, power, user preferences and network subscription etc. Based on this information handoff will be initiated in an appropriate time.

**ii)Handoff Decision Phase:**

The mobile device decides whether the connection to be continued with current network or to be switched over to another one. The decision may depend on various parameters which have been collected during handoff initiation phase.

**iii)Handoff Execution Phase:**

Existing connections need to be re-routed to the new network in a seamless manner. This phase also includes the authentication and authorization, and the transfer of user's context information.

So, fourth generation of wireless network is expected to include heterogeneous wireless network that coexist and use a common IP core to offer a diverse range of high data rate multimedia service to end users since the network characteristics that component each other. In that case vertical handoff will remains an essential component for 4G wireless network due to switching of mobile users amongst heterogeneous network.

Handoff can be classified into two types i.e., Horizontal Handoff (Symmetric), which means the handoff within the same wireless access network technology. Vertical Handoff (Asymmetric) means handoff among heterogeneous wireless access network technology. Since VHO is an asymmetric process, the MT (Mobile Terminal) moves between two different networks with different characteristics. So, it is necessary to select the best network which provides high performance. The VHO operation should provide a minimum overhead, authentication of the mobile users and the connection should be maintained to minimize the packet loss and transfer delay.

**3. Existing System:**

In the vertical handoffs makes two things clear-

- A vertical handoff brings more delay to the system
- It also causes some calls dropped during the handoff process.

These issues can make interruption to the data services in the converged ad hoc and cellular network system (CACN), so efficient vertical handoff is required [2].

A. Call block probability in cell:

A fixed spectrum is allotted to a particular cell to a cellular network. So there are limited numbers of channels available to the users. If all channels are occupied at a particular time then the new user is blocked to make a call. There is a probability that call is blocked in such a situation. This

Probability is called call blocking probability. Call blocking probability *B* in a single cell is given by Formula[2]:

$$B = \frac{(T)^M / M!}{\sum_{i=0}^{M} (T)^i / i!} = f(T,M) \quad \text{…. (I)}$$

Where, T is the traffic density of the cell and M is the number of cellular band channels.

If an MH is taking a handoff to BSi , the call blocking probability of BSi can be calculated as:

$$B_i = \frac{(T)^M / M!}{\sum_{i=0}^{M} (T)^i / i!} = f(T,M) \quad \text{….. (II)}$$

In order to avoid congesting BSi , an MH takes a handoff to BSi only when.Bmax is the threshold of call blocking probability and shows the saturated situation of a BS.

B.Transmission drop rate:

Traffic diversion stations employed in the cells have been limited bandwidth. So a limited traffic can be diverted by these Traffic diversion station (TDS). Due to this limitation, some of the traffic can be dropped during its diversion process. The rate at which the traffic is dropped during

diversion process is known as transmission drop rate of a TDS. It is given by formula:

$$D = \frac{(T_T)^{M_T} / M_T!}{\sum_{i=0}^{M_T} (T_T)^i / i!} = f(T_T, M_T) \quad \text{...(III)}$$

TT defines the traffic density in a TDS and MT shows the number of TDS band channels.

If an MH is taking a handoff to TDSi , the transmission drop rate of TDSi can be calculated as *Di*.

$$D_i = \frac{(T_T)^{M_T} / M_T!}{\sum_{i=0}^{M_T} (T_T)^i / i!} = f(T_T, M_T) \quad \text{..(IV)}$$

An MH takes a handoff to TDSi only if .

Di ≤ D max. D max is the threshold value of transmission drop rate,

**3. Proposed method:**

**Algorithm-1: Call blocking probability**

*if (xk is a voice handoff call) then*

*if (Ri(t) + bv _ ci) then*

```
        accept call;
 else
        reject call;
         end if
else /* new voice or new/handoff data call */

if (Ri(t) + bk _ ci) & (rand(0, 1) <aki ) then
        accept call;
else
       reject or block call;
end if
end if
```

firstly receive voice call as XK then accept condition as Current transmission rate and current voice call rate as same proportion then accept call otherwise reject the call. When new call receive then Current transmission rate and current voice call rate as same if random probability less than all received call then The call will be accept Otherwise Block call;

**Algorithm-2 Transmission Drop Rate**.
Paper are based on the handoff failure probability pf, which can be related to the call dropping probability pd[1], as follows

**Step 1**: Discover the available networks based on RSS.

**Step 2:** Calculate quality of network i, Qi=W1*Bi + W2*(1/Di) + W3*(1/Ci) + W4*Ti Where Bi -> Bandwidth, Di -> Delay, Ci -> Cost, Ti-> Throughput

**Step 3:** Select the network with highest Qi

**Step 4:** Trigger the handover start the transmit data.

**Step 5:** Calculate the success rate of all packets.

Its depends on how much call should be drop Firstly initialize network In this algorithm I is here current quality of network. Then check the parameters all voice calls delay greater than theoretical delay. If All call cost greater than theoretical cost and all call throughput greater than theoretical throughput then this conditions current QOS is very better, but meanwhile the network condition are different than above conditions, then transmission drop rate may be increase.

It means that for a given pd, the equivalent pf can be easily computed based on given equations[1]. Therefore, it is assumed that a target handoff failure probability pQoS must be guaranteed for voice calls. Notice that, exponential assumption is a necessary condition in deriving. For the handoff probability under general calls duration and cell residency distributions.

**4. Simulation result:**
The given research work reflect the node creation placed particular distance. Wireless node placed intermediate area. Each node knows its location relative to the sink. The access point has to receive transmit packets then send acknowledge to transmitter.

| Parameter | Existing 3G | Proposed 4G |
|---|---|---|
| Packet delivery ratio | 95% | 99% |
| Throughput | 150bps | 190bps |
| Drop packet | 5% | 1% |
| Packet error rate | 5% | 0.56% |
| End to end delay | 3.1ms | 2.4ms |
| Bit error rate | 3b(per kb) | 1b(per kb) |

| | | |
|---|---|---|
| Energy consumption | 33 joules | 28 joules |

**Table1: Simulation Comparison with Existing Approach**

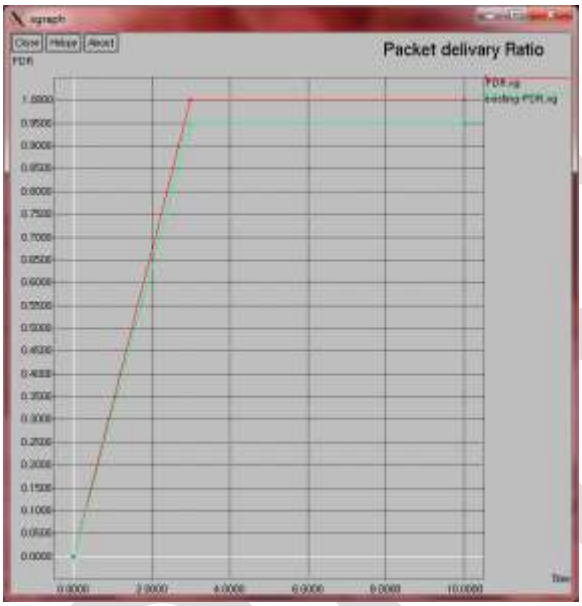


**Figure 4.1 Packet delivery ratio**

Figure 4.1 shows the call dropping rate for existing as well as proposed research work. In the given simulation highlight the different tests with multiple node scenarios. The overall call dropping rate is very low than existing

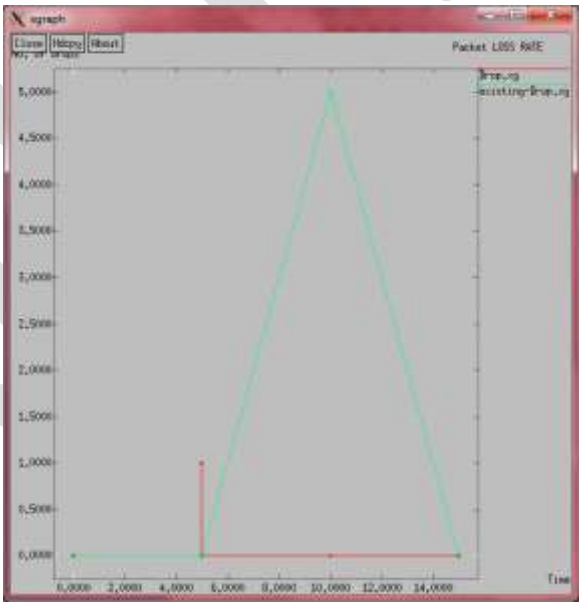


**Figure 4.2 Packet loss rate.**

Figure 4.2 reflect the overall packet loss rate of system it shows its very less than existing. System calculates the overall packet loss rate base on the total packets sent by sender node. If more additional traffic is introduce by handoffs, the content of together vertical handoff algorithms, is affected and overall call drop rate increase. The vertical handoff considering saturation can redirect more extra traffic introduced by handoffs to neighbor cells so that it shows superior recital.

## CONCLUSION AND FUTURE SCOPE

Simulation results shows the call drop rate and the delay introduced by the vertical handoff should be minimum so research should be oriented towards this topic. The success of 4G mobile communication will depend upon the new services and contents made available to users. 4G mobile phone technology promises faster communication Speeds (100 Mbps to 1 Gbps), capacity and diverse usage formats..These new applications must meet user expectations, and give added value over existing offers. After completion of proposed research work we test the whole system. System achieves the maximum packet delivery ratio with minimum call dropping rate. The call drop rate and the delay introduced by the vertical handoff should be minimum so research should be slanting towards this work.

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