Vertical & Horizontal Handoff for Next Generation Wireless Network

Rupali Madankar
Vidarbha Institute of Technology
Rashtrasant Tukdoji Maharaj Nagpur University
Nagpur, India
rupalimadankar@gmail.com

Prof. Vinay Keswani
Vidarbha Institute of Technology
Rashtrasant Tukdoji Maharaj Nagpur University
Nagpur, India
vinaykeswani2009@gmail.com

Abstract — Next generation communications will offer a wide range of services available to users anywhere at any time. Users will have access to multiple networks at the same time. So there is a need that the user should be able to roam seamlessly among the multiple access network technologies. Vertical handover decision algorithms are essential components of the fourth generation (4G) heterogeneous wireless networks. These algorithms should be designed so as to provide the required Quality of Service (QoS) to a wide range of applications. In this paper we are presenting the survey of RSSI algorithms designed to satisfy these requirements.

***Keywords*—4G Network,Vertical handoff,AODV,Quality of Service, Handoff.**

I. Introduction

Now a days Next Generation wireless system is providing multiple access networks to the user. So the mobile user will have multiple interfaces and can access a wide range of applications provided by multiple wireless networks. So when the mobile user moves from one place to another there is a need to handover the communication channel from one network to another by considering its features and user requirements. Handover taking place between two different networks is called as vertical handover. This leads to the need of mechanism which will select the best network among different available networks. Vertical handover decision plays very important role in selection of best network. In this paper we are going to focus on the research efforts and recent developments on improving the efficiency in handoff process. Mobility is the most important feature of a wireless cellular communication system. Usu- ally, continuous service is achieved by supporting handoff (or handover) from one cell to another. 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. It is often initiated either by crossing a cell boundary or by a deterioration in quality of the signal in the current channel. Handoff is divided into two broad categories— hard and soft handoffs. They are also characterized by "break before make" and "make be- fore break." In hard handoffs, current resources are released before new resources are used; in soft handoffs, both existing and new resources are used during the handoff process. Poorly designed handoff schemes tend to generate very heavy signaling traffic and, thereby, a dramatic decrease in quality of service (QoS). (In this chapter, a handoff is assumed to occur only at the cell boundary.) The reason why handoffs are critical in cellu- lar communication systems is that neighboring cells are always using a disjoint subset of frequency bands, so negotiations must take place between the mobile station (MS), the current serving base station (BS), and the next potential BS. Other related issues, such as decision making and priority strategies during overloading, might influence the overall performance.

TYPES OF HANDOFFS

Handoffs are broadly classified into two categories—hard and soft handoffs. Usually, the hard handoff can be further divided into two different types—intra- and intercell handoffs. The soft handoff can also be divided into two different types—multiway soft handoffs and softer handoffs.

HANDOFF IN WIRELESS MOBILE NETWORKS

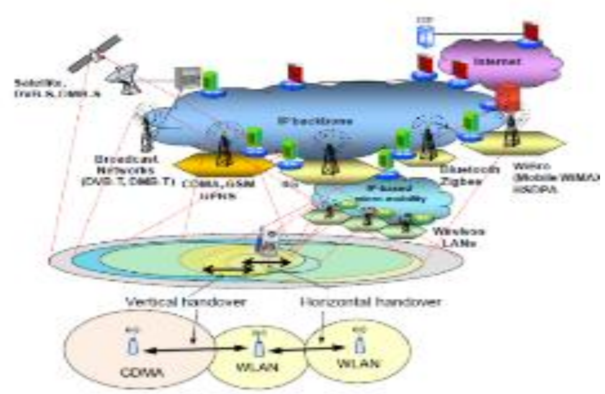


fig1. Horizontal and Vertical Handoff Wireless Network

A hard handoff is essentially a "break before make" connection. Under the control of the MSC, the BS hands off the MS's call to another cell and then drops the call. In a hard hand- off, the link to the prior BS is terminated before or as the user is transferred to the new cell's BS; the MS is linked to no more than one BS at any given time. Hard handoff is primarily used in FDMA (frequency division multiple access) and TDMA (time division multiple ac- cess), where different frequency ranges are used in adjacent channels in order to minimize channel interference. So when the MS moves from one BS to another BS, it becomes im- possible for it to communicate with both BSs (since different frequencies are used). Figur 1 illustrates hard handoff between the MS and BS.

2. RELATED WORK

A Few handoff decision algorithms have been proposed in the literature. In [1], the main goal of the author is to make it possible to balance the bandwidth load across networks with comparable performance. In [2], author present a tutorial on the design and performance issues for vertical hand-off in an envisioned multi-network fourth-generation environment. In [3], the authors implement Analytical Network Process (ANP) for the Network selection. A smart handoff decision mechanism is proposed by [4], Here the authors propose two phases to accomplish the handoff decision: priority phase and normal phase, in priority phase a list of available network is created, while in normal phase a score function is used, in order to choose the best available network from the list, the function consists of three criteria: link capacity, cost and power consumption.

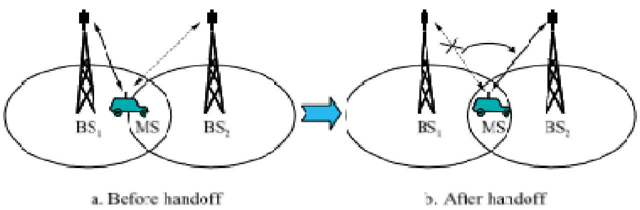
3. PROBLEM STATEMENT

Vertical handover, a term used to indicate the handover between two access nodes of two different technologies, is an issue in heterogeneous networks since each technology has its own mobility management solution. The mobile terminal must be capable of adapting the service content and the communication parameters each time it changes the access network. The two most considered performance criteria for the handover design are latency and packet loss. Generally, multimedia applications,one of main services in 4G networks, require a short handover latency, low jitter and minimal packet loss. Handover is required to be achieved seamlessly. It means that handover is transparent to users experience: users do not recognize handover occurrences at the application perception. Technically, it means that the handover interruption delay should be very small (below 50ms) and the packet loss ratio should be minor to not affect the service quality (tolerant loss ratio differs from different application types). Users want to have a continuous and qualified service and they do not care about which access technology they have connected. The determination of the right handover triggering instant is difficult in heterogeneous networks since many criteria (not only the link quality) should be taken into account in the decision algorithm. If the handover is initiated too early, the ping-pong handover problem may occur. The ping-pong effect causes the instability and service performance degradation. If the handover is initiated too late, mobile terminals may not have enough time for making handover, which leads to connection drop. Despite using different optimization techniques to determine the appropriate handover triggering instant, the interruption may be still present. As the vertical handover of an Software Defined Radio (SDR)- enabled device is a hard handover (i.e., a new connection will be established after the old connection is terminated), the handover interruption is inevitable. Also, the interruption occurs when the cell overlap area is too small for a multi-interface terminal to complete the handover on the target interface before moving out of the serving cell coverage. The handover interruption time is very critical for real-time applications, particularly for streaming services. The seamless video-on-demand streaming in wireless networks for mobile users is a challenging task.

4. IMPLEMENTED WORK

Handoff management is the process by which a mobile node keeps its connection active when it moves from one access point to another. There are three stages in a handoff process. First, the initiation of handoff is triggered by either the mobile device, or a network agent, or the changing network conditions. The second stage is for a new connection generation, where the network must find new resources for the handoff connection and perform any additional routing operations. Finally, data-flow control needs to maintain the delivery of the data from the old connection path to the new connection path according to the agreed- upon QoS guarantees. Depending on the movement of the mobile device, it may undergo various types of handoff. In a broad sense, handoffs may be of two types: (i) intra-system handoff (horizontal handoff) and (ii) inter-system handoff (vertical handoff). Handoffs in homogeneous networks are referred to as intra-system handoffs. This type of handoff occurs when the signal strength of the serving BS goes below a certain threshold value. An inter-system handoff between heterogeneous networks may arise in the following scenarios - (i) when a user moves out of the serving network and enters an overlying network, (ii) when a user connected to a network chooses to handoff to an underlying or overlaid network for his/her service requirements, (iii) when the overall load on the network is required to be distributed among different systems. The design of handoff management techniques in all-IP based next-generation wireless networks must address the following issues: (i) signaling overhead and power requirement for processing handoff messages should be minimized, (ii) QoS guarantees must be made, (iii) network resources should be efficiently used, and (iv) the handoff mechanism should be scalable,reliable,and,robust.

HANDOFF NETWORK



PARAMETERS	VALUE
Number of nodes	30
Routing protocol	AODV
Interface queue length	50
Mac layer	802_11
Simulation area	300*300 m
Performance Metrics	Throughput,jitter,delay,energy

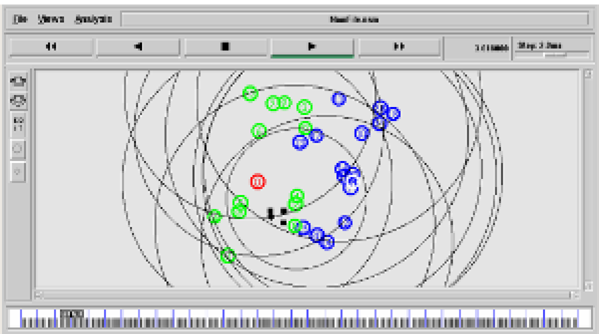
Fig2. Handoff between the MS and BS

5.OBJECTIVE OF PRESENT WORK

The main objective of present work is to design and develop the network which gives error free reception to the user and provide a best quality of service to the user.

6.SIMULATION PARAMETERS

7. SIMULATION SCENARIO



8.SIMULATED RESULT

Simulation Scenario for Delay:

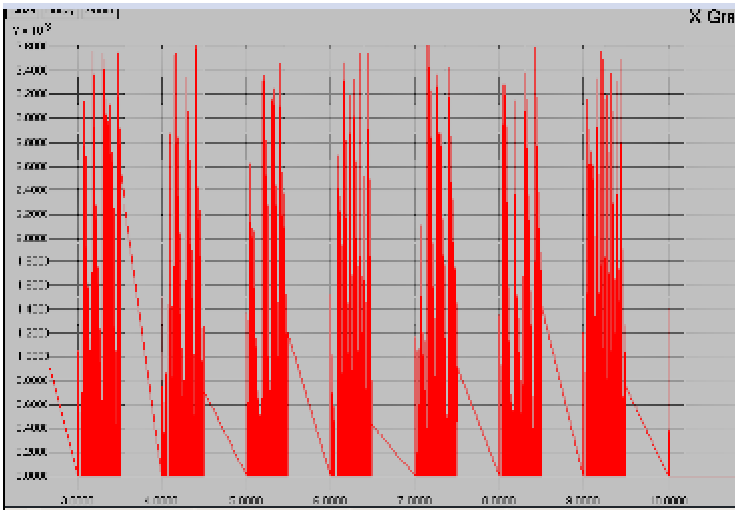


Fig. Delay Graph

Delay Table :

Simulation Time(sec)	Delay (ms)
11.27	3.3
13.25	2.24
26.10	1.13
27.12	0.026

Latency partition for delay parameter

Simulation Scenario for Energy:

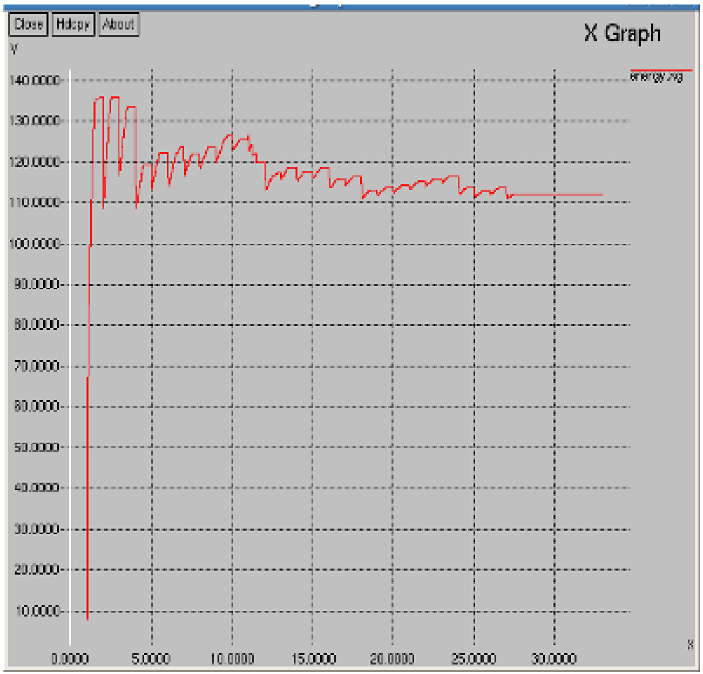


Fig.Energy Graph

Energy Table :

Simulation Time(sec)	Energy (mJ)
10.34	111.24
15.02	116.04
23.09	114.95
27.52	117.49

Latency partition for energy Parameter

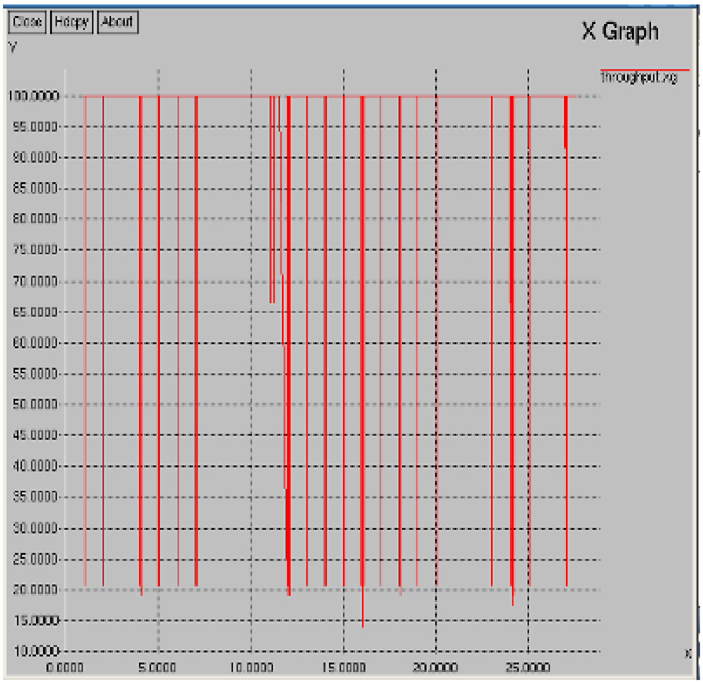


Fig.Throughput Graph

Throughput Table :

Simulation Time (sec)	Throughput (packet/sec)
2.0031	91.67
8.042	20.86
20.034	66.67
25.18	100

Latency partition for throughput Parameter

Simulation Scenario for Throughput:

Throughput :

In computer technology, throughput is the amount of work that a computer can do in a given time period. Historically, throughput has been a measure of the comparative effectiveness of large commercial computers that run many programs concurrently.

The amount of time between a single interactive user requests being entered and receving the application's response is known as response time.

It is defined as the total number of packets delivered over the total simulation time.

Simulation Scenario for Jitter:

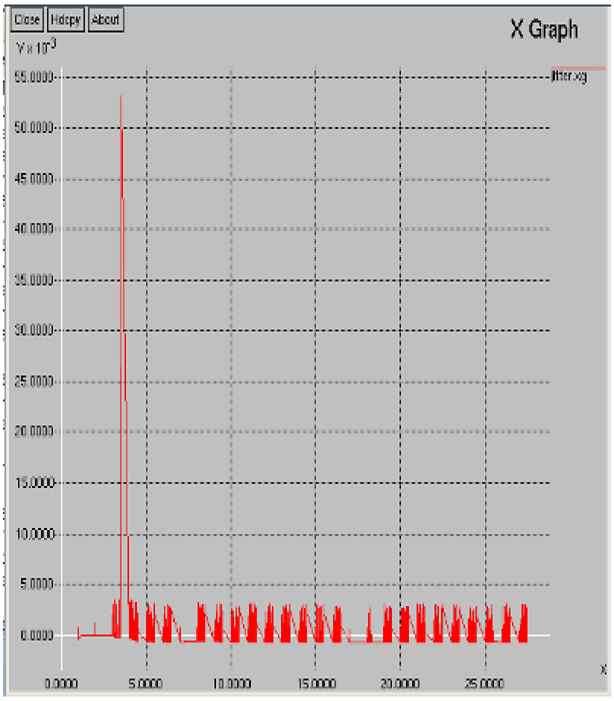


Fig.Jitter Graph

Jitter Table :

Simulation Time (sec)	Jitter (ms)
8.018	**0.81**
10.49	**0.74**
17.06	**0.17**
24.37	**0.09**

Latency partition for jitter Parameter

Jitter :

The jitter initially records is zero. This is because there is only CBR traffic flow, no other background traffic flow. After FTP flow starts, we can see in graph .

9.COMPARISON OF DIFFERENT GENERATION WIRELESS TECHNOLOGY

Generation / Property	1G	2G	2.5G	3G
Driving technology	Analogue signal processing	Digital signal processing	Packet switching	Intelligent signal processing
Representative standard	AMPS, TACS	GSM, I-Mode	GPRS, TDMA, HSCSD, EDGE	IMT-2000 (UMTS, WCDMA, CDMA2000)
Radio frequency (HZ)	400M – 800M	800M – 900M, 1800M – 1900M	800M – 900M, 1800M – 1900M	2G
Bandwidth (bps)	2.4K – 30K	9.6K – 14.4K	171K – 384K	2M – 5M
Multi-address technique	FDMA	TDMA, CDMA	TDMA, CDMA	CDMA
Core network	Telecom networks	Telecom networks	Telecom networks	Telecom networks, some IP networks
Service type	Voice	Voice, short message service	Data service	Voice, data, some multimedia

4G WIRELESS NETWORKS:

Service providers, researchers and engineers have different views of 4G. These include the following standpoints:

1. 4G will provide high data rate at low transmission cost.

Along with telecommunications services ,4G systems will also provide data and multimedia services. To support multimedia services, it is necessary to have high data rate and reliable systems. The data rate of 4G is expected to be 10 times higher than 3G, with about 20 Mbps bandwidth, and peak bit rate up to 100 Mbps for high mobility and 1 Gbps in hot-spots Further more,it is necessary to keep thr service cost-effective. A low per-bit transmission cost will be maintained in 4G.

.2. 4G will always be connected to the best network.

4G systems will be based on a heterogeneous infrastructure comprising different wireless access systems. These systems will complement each other for Different service requirement environments. 4Gmobileusers will benefit from seamless mobility and ubiquitous access to the most efficient combination of available access system "always best connected" mode

3. 4G will provide personalization.

When 4G services are launched, users will be expected from widely different locations, occupations and economic classes. In order to cater to the demands of these diverse users, service providers will need to design personalized and customized services. To achieve this, defined 4G technology from the user's perspective. A user-centric methodology that considers the user as the "cornerstone" of the design was adopted.

4. 4G will be an all-Internet-Protocol based network providing any time and anywhere communications.

Existing wireless systems can be classified into two types: Internet Protocol (IP) based and non-IP based. Many non-IP based systems are optimized for voice delivery GSM,CDMA,IPbased Systems are usually optimized for data services(e.g. 802.11WLAN).4Gnet- works will integrate the set system structure based on all-IP. Using this system, IP packets will be able to traverse distinctive access net- works connected to an IP based backbone network without any protocol conversion Hence all-IP based heterogeneous networks will enable users to use any system anytime and anywhere. Users carry- ing an integrated terminal will be able to use a wide range of applications provided by multiple wireless networks.

10.CONCLUSION

In a highly integrated ubiquitous heterogeneous wireless environment, the selection of a network that can fulfill end-users' service requests while keeping their overall satisfaction at a very high level is vital; a wrong selection can lead to undesirable conditions such as unsatisfied users, weak QoS, network congestions, dropped and/or blocked calls, and wastage of valuable network resources. The selection of these networks is performed during the handoff process when an MS switches its current PoA to a different network due to the degradation or complete loss of signal and/or deterioration of the provided QoS. Traditional schemes perform the necessity of handoffs, and trigger the network selection process based on a single metric such as RSS. These schemes are not efficient and intelligent enough, so they do not take into consideration the traffic characteristics, user preferences, network conditions and other important system metrics. The focus of this research work is on the design and implemention of a scheme that can perform efficient and intelligent vertical handoffs in heterogeneous wireless networks. The main objective of the developed scheme is to minimize the number of unnecessary handoffs while maximizing the sojourn time with a preferred network, resulting in increased end-users' satisfaction levels. To provide services anywhere and anytime there is a strong demand for integration of wireless networks. To achieve seamless mobility in such a diverse networking environment, vertical handoff is crucial.

11. REFERENCES

[1] H.J. Wang, R. H. Katz, and J. Giese, "Policy-Enabled Handoffs across Heterogeneous Wireless Networks", Proc. of ACM WMCSA, 1999.

[2] J. McNair and F. Zhu, "Vertical Handoffs in Fourth-generation Multinetwork Environments," IEEE Wireless Comm., vol. 11, no. 3, June 2004.

[3] K.Radhika, Dr. A. Venugopal Reddy, "An AHP Based Network Selection algorithm for Heterogeneous Wireless Networks " International Journal of Computational Intelligence and Information Security, August 2011

[4] Ling-Jyh Chen, Tony Sun, Benny Chen, Venkatesh Rajendran, Mario Gerla, "A Smart Decision Model for Vertical Handoff", ANWIRE 2004, Athens, Greece.

W. Webb, Wireless Communications: The Future. John Wiley & Sons, 2007.

[5] J. G. Andrews, A. Ghosh, and R. Muhamed, Fundamentals of WiMAX: Understanding Broad- band Wireless Networking. NJ, USA: Prentice Hall PTR, 2007.

[6] "Defining 4G: Understanding the ITU Process for the Next Generation of Wireless Technology," White Paper, 3G Americas, June 2007.

[7] E. Bohlin, S. Lindmark, J. Bjrkdahl, A. Weber, B. Wingert, and P. Ballon, "The Future of Mobile Communications in the EU: Assessing the Potential of 4G," IPTS Technical Report Prepared for the European Commission-Joint Research Centre. Seville. EUR, vol. 21192, 2004.

[8] S. Frattasi, H. Fathi, F. Fitzek, R. Prasad, and M. Katz, "Defining 4G technology from the user's perspective," Network, IEEE, vol. 20, no. 1, pp. 35–41, 2006.

[9] "What Exactly is 4G? Sorting Out the 4G Stew," Anritsu News, Anritsu, Vol. 26 No.123, Spring 2007.

[10] M. Jaseemuddin, "An architecture for integrating UMTS and 802.11 WLAN networks," in Proc. of 8th ISCC.

[11] N. Vulic, S. Groot, and I. Niemegeers, "A comparison of interworking architectures for WLAN integration at UMTS radio access level," in ConWIN05, 2005.

[12] S.-L. Tsao and C. Lin, "Design and evaluation of UMTS-WLAN interworking stategies," in Proc. of VTC 2002-Fall, 2002, pp. 777–781.

[13] C. Omidyar, Mobile and Wireless Communications. Kluwer Academic Publishers, 2003.

[14] 3GPP, "Feasibility study on 3GPP system to WLAN interworking," Tech. Rep. TR22.934 v6.2.0, 2003.

[15] ——, "3GPP system to Wireless Local Area Network (WLAN) interworking; System descrip- tion," TS 23.234 v7.2.0, 2006.

[16] ——, "Radio access network; generic access to the A/Gb interface; stage 2," Tech. Spec. TS43.318 v6.6.0, 2006.