ISSN (Print) : 2319-5940
ISSN (Online) : 2278-1021

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 2, Issue 11, November 2013

A COMPARATIVE STUDY OF DIFFERENT TYPES OF HANDOFF STRATEGIES IN CELLULAR SYSTEMS

Abhinav kumar[1], Hemant Purohit[2]

M.tech Student JIET, Jodhpur, India[1]

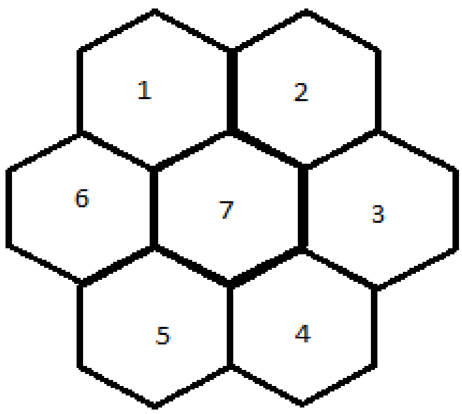
Associate Professor (EEE), JIET-SETG, Jodhpur, Imdia[2]

Abstract— The Mobility in wireless cellular communication systems is its backbone so as to enhance the quality of service and maintain the continuous service. Handoff is an important task in maintaining the continuity of call in cellular systems and its failure can result in ongoing call termination. So handoffs are necessary for providing an enhanced QoS (Quality of Service) to users and provide a ubiquitous coverage. In order to successfully implement the handoff process, the system designers make a proper optimum signal level at which point handoff will initiate. During the handoff process some parameters like relative signal strength, relative signal strength with threshold, relative signal strength with hysteresis and relative signal strength with hysteresis and threshold are to be considered carefully. So this paper shows the brief description about the different handoff techniques in cellular systems moreover it compares all the handoff strategies on the basis of execution time, S/I ratio, RSS (Relative Signal Strength), call handling difficulty, handoff made and generation methods. Handoff strategies are very used in wireless communication where it can be know that which handoff strategy is not using in very efficient manner and it can also find the brief comparison between all handoff strategies which are used in mobile communication.

Keywords: Handoff, Queuing, QoS, Guard channels.

I. INTRODUCTION

Wireless communication is exhibiting its fastest growth period in history; due to enabling technologies which permit a wide spread deployment. Now a day's cellular systems are the most popular system used in the telecommunication industries. The data services or voice speeches are conveyed very easily by the mobile terminal. A cellular system provides a wireless connection to the PSTN for any user location within the radio range of the system. Cellular systems have a large number of users over a large geographical area, within a limited frequency spectrum. Cellular radio systems provide a high quality service, which is comparable with the landline telephone system. The data services or voice speeches are conveyed very easily by the mobile terminal. A cellular system provides a wireless connection to the PSTN for any user location within the radio range of the system. Cellular systems have a large number of users over a large geographical area, within a limited frequency spectrum. Cellular radio systems provide a high quality service, which is comparable with the landline telephone system. So in cellular mobile networks, the large geographical coverage area or region is divided into small services area. They are called cells.



Figu

re 1.1

within its region. Before communication between two users in a network, the frequency band is divided into smaller bands. These bands are reused in non-interfering cells and the group of frequency bands or channel should be assigned. When a mobile user or mobile terminal crosses the cell boundary or passes out of the range, the signal gets unacceptable. The transition and the process to make the transition are called handoff.

The term handoff does not mean a physical change in the assigned channel but rather that the different base station handles the radio communication task.
Thus handoff is the process where the call transfers a mobile station from one base station to another base station or one cell boundary to another cell boundary i.e. shown in below Figure 1.2 [10, 11]

ISSN (Print) : 2319-5940
ISSN (Online) : 2278-1021

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 2, Issue 11, November 2013

Once a call is in progress the MSC adjusts the transmitted power of the mobile and changes the channel of the mobile unit and base station in order to maintain call quality as the subscriber moves in and out of range of each base station. This is called a handoff. So handoff is needed in two situations where the cell site receives weak signals from the mobile unit.

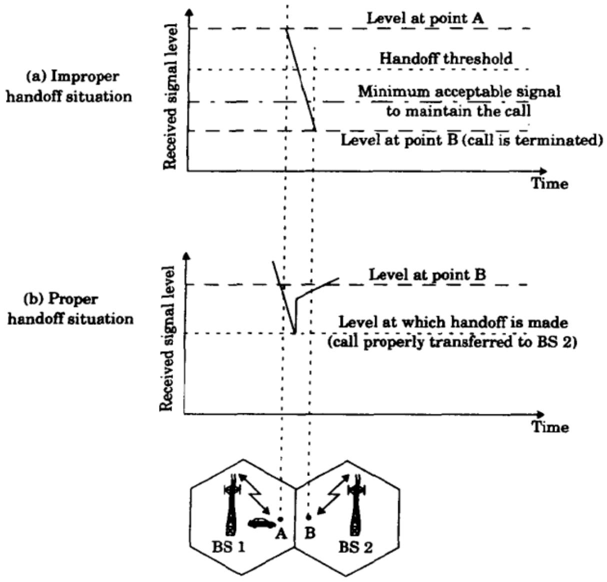


Figure 1. 2 Handoff strategies at cell boundary [10]

A. Handoff two principle

(a) It is based on emotion strength (where emotions are frequency, amplitude).

(b) Based on carrier to interference ratio (that is cell boundary for hand off should be 18 dB in order to good quality of voice signal).

At the cell boundary, say -100 dBm to -95 dBm, which is the level for requesting a handoff in a noise limited environment and when the mobile unit is reaching the signal strength gaps within the cell site as shown in Figure 1.3

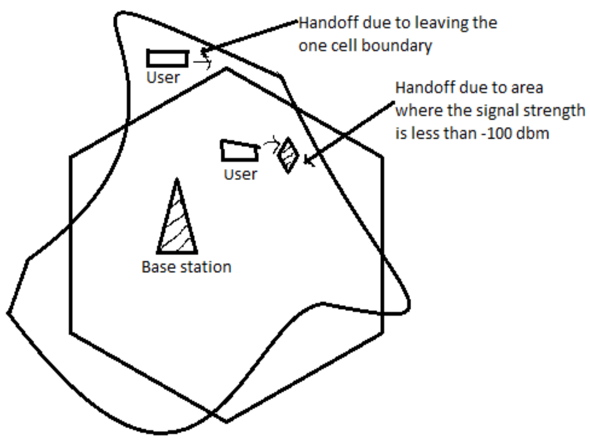
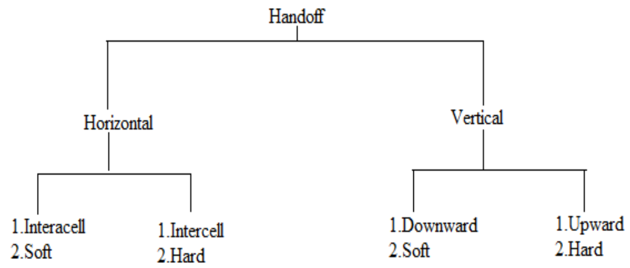


Figure 1.3: Handoff Occurrence.

II. TYPES OF HANDOFF



A. HORIZONTAL HANDOFF

In cellular network can be further classified into intra-cell and inter-cell handoffs. In intera-cell handoff means when a user moving with mobile terminal within a network or cell and the radio channels changes in order to minimize inter channels interference under the same base station.[7,13]

Horizontal handoff or intra-system handoff is a handoff that occurs between the APs or BSs of the same network technology. In other words, a horizontal handoff occurs between the homogeneous cells of a wireless access system. For example, the changeover of signal transmission of an MT (Mobile terminal) from an IEEE 802.11g AP to a geographically neighboring IEEE 802.11g AP is a horizontal handoff process. The network automatically exchanges the coverage responsibility from one point of attachment to another. Each time a MT crosses from one cell into a neighboring cell supporting the same network technology. Horizontal handoffs are mandatory since the MT cannot continue its communication without performing it. Furthermore the intercell handoff will occur when a Mobile terminal moves into the adjacent cell of the any base station. For this reason all mobile terminals connection should be transferred to the new base station.

Horizontal Handoff Phase The horizontal handoff procedure may be distinguished in the following four phases:-

(1) ***Measurement:*** During this phase link measurements (e.g. Received Signal Strength (RSS), Signal to Interference Ratio (SIR), distance measure, Bit Error Rate (BER) are carried out at both parts: the Base station and the Mobile Terminal.

(2) ***Initiation:*** The objective of this phase is to decide whether a handoff is needed. The handoff process should be accomplished, whenever the received signal quality deteriorates inside a cell, or between two adjacent cells, or when the MT is moving along the common boundary of two cells. Several signal strength methods for handoff initiation can be found.

(3) ***Decision***: The objective of this phase is the selection of the new channel, taking into account the actual resource availability and the network load. The decision-making process of handoff may be centralized or decentralized (i.e.,

ISSN (Print) : 2319-5940
ISSN (Online) : 2278-1021

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 2, Issue 11, November 2013

the handoff decision may be made at the Mobile Terminal, or at the network). From the decision process point of view, one can find at least the following three different kinds of handoff decisions
1. Network Assisted handoff
2. Mobile controlled handoff
3. Prioritization handoff

B. *Vertical handoff*

The switching between points of attachment or base stations, that belong to the different network technologies is called Vertical handoff and is required in heterogeneous networks. Vertical handoff or inter-system handoff is a handoff that occurs between the different points of attachment belonging to different network technologies.[1, 11] For example, the changeover of signal transmission from an IEEE 802.11g AP to the BS of an overlaid cellular network is a vertical handoff process. Thus, vertical handoffs are implemented across heterogeneous cells of wireless access systems, which differ in several aspects such as received signal strength (RSS), such as bandwidth, data rate, coverage area, and frequency of operation. The implementation of vertical handoff is more challenging as compared to horizontal handoffs because of the different characteristics of the networks involved.[1] We can say that it is the process of changing the mobile terminal active connection between different wireless technologies. Now vertical handoffs can be further classified into downward vertical handoff and upward handoff. The process of Vertical handoff can be divided into three steps, namely system as discovery, handoff decision and handoff execution. In Downward vertical handoff the mobile user channel changes to the network that has higher bandwidth and limited coverage, while in upward vertical handoff the mobile user transfers its connection to the network with lower bandwidth and wider coverage.[1,13,15]

III. Parameters for Vertical Handoff

The decision for vertical handoff may depend on various parameters like Bandwidth, Received Signal Strength (RSS), and Signal to inference ratio (SIR), cost, latency, security, velocity, and battery power, user preferences, service capacities and Quality of Service (QoS). From the literature surveyed, different research scholars have given different views and techniques to achieve vertical handoff. In order to design a Vertical Handoff (VHO) mechanism for next generation wireless networks, it is essential to study the existing VHO mechanisms. The study of existing mechanisms will assist in the identification of important parameters for VHO mechanism. As of now, a few approaches for VHO have been found in the literature.[10, 14]

(1) ***Available Bandwidth:*** Bandwidth is a measure of the width of range frequencies. It refers to the data rate supported by a network connection or interface. It measures how much data can be sent over a specific connection in a given time. In order to provide seamless handoff for Qos (Quality of Service) in wireless environment, there is a need to manage bandwidth requirement of mobile node during movement. Bandwidth is generally known as the link capacity in A Novel Decision Scheme for Vertical Handoff in 4G Networks is introduced and two Handoff decision schemes for Heterogeneous networks are presented.

In the first scheme they introduce a score function to find the best network at best time from a set of neighboring networks. Score function uses Bandwidth, RSS and Access fee as its parameters. Second scheme makes use of classic triangle problem to find the best network from a set of neighboring networks. This problem considers the three parameters Bandwidth, RSS and Access fee as the three sides of a triangle. If an equilateral triangle is obtained with these parameters of a network, that network will be the best among the set of networks. The best decision model meets the individual user needs, and improves the whole system performance by reducing the unnecessary handoffs. Since the second algorithm performs handoff only, if the constraints are above the threshold value.

The call dropping probability is reduced and holding time is increased. A novel framework to evaluate the VHO algorithm design impact on system resource utilization and user perceived QoS is presented [2, 3, 17] This framework can be used to compare the performance of different vertical handoff algorithms.

The results provides a quantitative means to evaluate the critical impact of the handoff algorithm design on satisfying the active real-time application requirements while improving the overall resource utilization. A call flow for vertical handover procedure and a soft QoS scheme was proposed using Dynamic Programming (DP) approach for an efficient radio resource management in an environment where several different radio access networks (e.g. WLAN and WCDMA) co-exists.[3,15] The soft QoS scheme is compared with hard QoS scheme for optimizing resource allocation using a Greedy and DP approach during upward vertical handover.

The proposed soft QoS scheme is more efficient in network utilization than existing hard QoS scheme. A seamless and proactive vertical handoff scheme was designed based on the architecture that aims to provide always the best QoS for users. Evaluation algorithms are derived to estimate the conditions of both WiMAX and WLAN networks in terms of available bandwidth and packet delay. The results obtained prove the feasibility and effectiveness of the proposed schemes. An access network selection algorithm was presented by extending the traditional Analytic Hierarchy Process (AHP) multiple criteria decision making technique that suits the QoS requirements of applications.[17, 20] The algorithm considers the criteria that include available bandwidth, end-to-end Delay, Jitter, Packet Loss, Cost and security of the network and Wi -Fi, Wi -Max and CDMA networks as the alternatives. The algorithm is simulated using Java and the pair-wise comparison matrices are stored in two dimensional arrays.

Applications that require three types of traffic classes namely voice traffic; video traffic and multimedia traffic were considered. The matrices are checked for consistency

ISSN (Print) : 2319-5940
ISSN (Online) : 2278-1021

IJARCCE

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 2, Issue 11, November 2013

and proven to be consistent [14, 15] Composite weights of the available networks are evaluated and the network that is having the highest composite weight is selected as the target network. Since the algorithm is based on AHP, it gives both qualitative and quantitative evaluation of the alternatives which means that it determines the optimal target network and also evaluates how best the target network is suitable for a specific traffic class.
An intelligent approach for vertical handover decision was introduced. A model is proposed which gathers events from link layer, network layer and transport layer and takes decision based on fuzzy rules. The model chooses different variables, i.e. available bandwidth, signal strength & network load. System simulation is done using Surgeon Fuzzy Inference system and Fuzzy inference collects input values of selected parameters from event collector as crisp inputs and then evaluates them according to rules. The composed and aggregated output of rules evaluation is defuzzified and crisp output is obtained. [4, 8]
The output of the fuzzy system is handover decision and an intelligent decision will be taken based on output values. An UMTS-WLAN integrated architecture was proposed with dynamically updating database at UMTS network which keep track of network condition such available bandwidth and designed algorithm for handoff decision when Mobile Node (MN) need to switch to other network due to poor network service.
Whenever MN needs to switch to other network it takes the network condition information from database and make decision on handoff. The proposed scheme is simulated and compared with existing RSS based handoff scheme and the proposed scheme gave better performance in terms of Packet Delay Ratio (PDR), total number of handoff, total time taken for handoff, total packet loss and channel utilization.[2,3,13]

(2) ***Speed:*** It is the speed at which the Mobile Terminal (MT) is moving. In vertical handoff algorithms, the speed factor has a large and important decisions binding effect. Other than that, traditional handoff decision algorithms horizontal handoff.[6]

When the users travel at high speed within a network coverage area is discouraged the idea to initiate vertical handoff process because after a short period of time the user will have to go back to the initial network because it will get out from under cover network host.
The ability of Information Technology in 4G in Wireless Networks is demonstrated by proposing a vertical handoff scheme. It discusses its operation like handoff decision making, network selection and handoff execution. RSS and MN speed are the primary handoff metric. The MN speed is obtained by the GPS system and the RSS information is gathered from RSS measurement function. The vertical handoff system influences the packet drop rate in tight and loose integration approach under different load conditions.

(3) ***Received Signal Strength (RSS)***: RSS is the most widely used criterion because it is easy to measure and is directly related to the service quality. Majority of existing horizontal handover algorithms use RSS as the main decision criterion, and RSS is an important criterion for VHD algorithms as well, but it is not enough for an overall decision. It is the strength of the signal received, as the RSS of the neighboring network rises above the threshold the Vertical Handoff is feasible i.e. the handoff takes place if and only if RSS of the BS or Access Point (AP) is above the threshold.
The different RSS threshold values for handoff are found depending on factors like the velocity of the MT, the latency of the handoff process the type of network the MT is presently in and the type of network with which the MT is trying to initiate handoff and the size of the CN/WLAN/HIPERLAN cell the MT is presently residing.[6, 4]
It ensures least amount of handoff failure probability, thus providing sufficient QoS for delay sensitive and real time services. A handoff decision process based on RSS, MN speed and Network traffic offers seamless vertical handoff to end users across 4G wireless networks. Modifying the Client side Mobile IP is illustrated and with this modification the handoff system is simple, scalable and cost effective. The handoff system influences the packet drop rate in tight and loose integration approach under different load conditions. RSS is considered as the triggering factor, i.e., a network will be considered as an alternative only if its RSS is above threshold.

(4) ***Power Consumption:*** The wireless devices running on battery need to limit the power consumption. If the battery level decreases, switching for a network to another network with low power consumption can provide a longer usage time. The power requirement becomes a critical issue especially if the hand held battery is low.[3]
In such situations, it is preferably transferred to an attachment point, and this will extend battery life. The attachment to the closest AP or BS is known to consume the least power for individual mobile devices at a given instant. So if battery level is low, the MT must handoff to the closest AP or BS provided RSS is above threshold. The number of users also increases the congestion and in turn even the nearest AP or BS consumes more power.

(5) ***Throughput:*** Network throughput refers to the average data rate of successful data or message delivery over a specific communications link. Network throughput is measured in bits per second (bps). Maximum network throughput equals the TCP window size divided by the round-trip time of communications data packets. As network throughput is considered in dynamic metrics for making decision of VHO, it is one the important requirement to be considered for the VHO.[16]

(6) ***Network Load***: Network load is to be considered during effective handoff. It is important to balance the network load to avoid deterioration in quality of services [12] Variations in the traffic loads among cells will reduce the traffic-carrying capacity. To provide a high quality

communication service for mobile subscribers and to enhance a high traffic-carrying capacity when there are variations in traffic, network load must be paid attention. A model is developed that analyzes the case in which a vehicle is kept at different positions of a highway, and the network ranking optimizes the "best" network in multiple constraint environments. This evaluation technique requires knowledge of vehicular speed, RSS, type of application (bandwidth requirements), network traffic load, usage cost of service and initial delay for connection establishment.

(7) ***User Preferences:*** When handover happens, the users have more options for heterogeneous networks according to their preferences and network performance parameters. The user preferences could be preferred networks, user application requirements (real time, non-real time), service types (Voice, data, video), QoS (It is a set of technologies for managing network traffic in a cost effective manner to enhance user experiences for wireless environments) etc. User Preferences can also be considered for VHO in next generation wireless networks.

(8) ***Cost***: A multi criteria algorithm for handoff should also consider the network cost factor. The cost is to be minimized during VHO in wireless networks. The new call arrival rates and handoff call arrival rates can be analyzed using cost function. Next Generation heterogeneous networks can combine their respective advantages on coverage and data rates, offering a high QoS to mobile users. In such environment, multi-interface terminals should seamlessly switch from one network to another in order to obtain improved performance or at least to maintain a continuous wireless connection. Therefore, network selection cost is important in handoff decisions.

IV. Difference between Horizontal and Vertical Handoff

There are some important differences between horizontal and vertical handoffs that affect our strategy for implementing vertical handoffs. These are:

- Many network interfaces have an inherent diversity that arises because they operate at different frequencies. For example, the room-size overlay may use infrared frequencies. The building-size overlay network may use radio frequencies, and the wide-area data system may use yet different radio frequencies. Another way in which diversity exists is in the spread spectrum techniques of different devices. Some devices may use direct sequence spread spectrum (DSSS), while other may use frequency hopping spread spectrum (FHSS). Some of our optimizations to reduce handoff latency will take advantage of this diversity.[8]

- In a single-overlay network, a MH is ideal within a range of single base stations at a time. The MH is usually within range of multiple base stations only during a handoff. In a multiple-overlay network, a mobile device can be within a range of several base stations simultaneously for long periods of time.

- In a single-overlay network, the choice of "best" base station is usually obvious: the mobile chooses the base station with the largest signal strength, perhaps incorporating some amount of threshold and hysteresis. In a multiple-overlay network, the choice of the "best" network cannot usually be determined by factors, such as signal strength. This is because the networks have varying characteristics. For example, an in-building RF network with low signal strength may still yield better performance than a wide-area data network with high signal strength.[10]

A. Hard handoff and Soft handoff

Handoffs can also be classified into hard and soft handoffs depending on which base station is serving the Mobile terminal in the crucial period during handoff execution when there is a communication between the users in question with more than one base station.
So hand off is the way to maintain the call connection during change in base station. It happens in two different manners. One is the hard hand off and second one is the soft hand off. When the received signal strength (RSS) is low, the switch over mobile station from base station 1 to base station 2 makes the call connection is quite difficult. The call may be terminated. This is called hard handoff and visible in Figure 1.4.
Soft handoff defines the ability to select instantaneous received signals from a variety of base stations. Furthermore it allows continues calls without termination or any interference. Generally hard handoff occurs in GSM (Global system for mobile) and soft handoff occurs in CDMA (code division multiple access).
Hard handoff is applicable in GSM system as shown in Figure 1.4. It is applicable, when the mobile station is disconnected from serving the base station 1before connection with neighboring base station 2.
In the case of hard handoffs, a Mobile terminal is served by only one base station (or by only one access network in the case of the vertical handoff) at a time. It connects with the new base station or the new network only after having broken its connection with the serving base station [11, 13]. This is referred to as "break before make" connection. In hard handoffs, the data do not have to be duplicated and therefore, the data overhead is minimized. However, excessive service interruptions could result in an increased call dropped rate. Hard handoff is used by the systems, such as Global System for Mobile Communications (GSM) and General Packet Radio Service (GPRS) where Time Division Multiple Access (TDMA) and Frequency Division Multiple Access (FDMA) are applied. Hard handoff is also the mandatory method to perform handoffs in the WiMAX (Worldwide interoperability for Microwave Access) technology.[5, 7]

ISSN (Print) : 2319-5940
ISSN (Online) : 2278-1021

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 2, Issue 11, November 2013

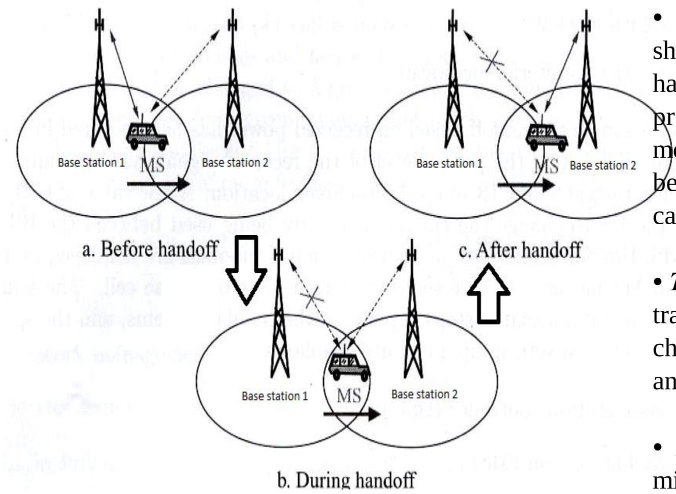


Figure 1. 4: Hard handoff

In soft handoff, the mobile terminal may be served by more than one base station (or by one than one access networks). Soft handoff can be used to extend the time needed to take a handoff decision without any loss of QoS. However, since the data are transmitted to all links, frequent soft handoffs may result to an increased data overhead. The cellular Code Division Multiple Access (CDMA) systems use soft handoff techniques, due to the fact that in these systems a mobile node may communicate with more than one coded channels, which enables to communicate with more than one base station.

A soft handoff or a make before break handoff occurs if the MT can communicate with more than one point of attachment during handoff. In this case, the MT's connection may be created at the target point of attachment before the old point of attachment connection is released. For example, an MT equipped with multiple network interfaces can simultaneously connect to multiple points of attachment in different networks during soft handoff. [1]

B. Desirable Handoff features

An efficient handoff algorithm can achieve many desirable features by trading off different operating characteristics. Some of the major desirable features of a handoff algorithm are described below. [1]

• ***Fast:*** A handoff algorithm should be fast so that the mobile device does not experience service degradation or interruption. Service degradation may be due to a continuous reduction in signal strength or an increase in co-channel interference (CCI). Service interruption may be due to a "break before make" approach of handoff. [1, 12]

• ***Reliable:*** A handoff algorithm should be reliable. This means that the service should have a good quality after handoff. Many factors help in determining the potential service quality of a candidate BS or AP. Some of these factors include received signal strength (RSS), signal-to-interference ratio (SIR), signal-to-noise ratio (SNR), and bit error rate (BER).

• ***Communication quality:*** The communication quality should be maximized through minimizing the number of handoffs [1,8] Excessive handoffs lead to heavy handoff processing loads and poor communication quality. The more attempts at handoff, the more chances that a call will be denied access to a channel, resulting in a higher handoff call dropping probability.

• ***Traffic balancing***: The handoff procedure should balance traffic in adjacent cells, thus eliminating the need for channel borrowing, simplifying cell planning and operation, and reducing the probability of new call blocking.

• ***Interference prevention***: A handoff algorithm should minimize global interference. Transmission of bare minimum power and maintenance of planned cellular borders can help achieve this goal.

• ***Context-awareness***: A handoff algorithm should be context-aware. The algorithm should adapt to its surroundings and acquire and utilize user, mobile terminal, and network information to improve QoS, connectivity and maintain a high level of user satisfaction.

V. METHOD OF HANDOFF

Basically two methods are available, may be implementing on practical environment.

In type 1, the signal strength threshold level for handoff is -100 dBm in noise limited system and -95 dBm in interference limited system. In type 2, the value of C/I at the cell boundary for handoff should be 18 dB in order to have good quality of voice.[19]

In type 1 system, base station receiver at each cell site measures all the signal strength of cell mobiles at the cell site. The received signal strength (RSS), itself include interference.

$$RSS = C+I \quad .... \quad (1)$$

Where I is the interference and C is the carrier power, Suppose we fixed the threshold level for RSS, then because of the I, which is sometimes very strong, the RSS level is higher and far above the handoff threshold level. In this situation handoff should take place theoretically but practically handoff should not take place.[10]

In another situation suppose when I is very low but RSS is also, then the voice quality usually good even though the RSS level is low, but unnecessary handoff takes place. Therefore it is an easy but not very accurate method of determining handoffs.

Handoff can also be controlled by method 2, in which we measure the carrier to interference ratio. In this method threshold value of C/I is fixed at receiver of the base station. The value of C decreases as the distance from base station receiver increases and value of I is independent regarding distance but dependent on the location. If the value of C decreases and I increases, handoff should take place. It is

ISSN (Print) : 2319-5940
ISSN (Online) : 2278-1021

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 2, Issue 11, November 2013

hard to measure C/I during a call so we measure the level of I before the call is connected and level of C+1 during the call. Thus (C+1)/I can be obtained. Handoff is handled in difference ways in different systems and involves a number of factors. Here we give a brief overview of different techniques. [8, 13]

VI. DIFFERENT TYPE OF HAND OFF STRATEGIES

Handoff is the process where the call is transferred one base station to another base station. So During that process there are ten type of handoff strategies are as follows-

Network Initiated Handoff (NIH):- Network initiated handoff is made in the first generation analog cellular system where the signal strength measurement is made by the base station and supervised by the MSC. Hence the hand off is made very slowly in Figure 1.5

Resource Application Area:

a. Overlapping and Coverage of (different) wireless access technologies

b. Resource optimization or administrative decisions

c. Network can trigger the handover

d. Application for inter-domain handover steering of roaming

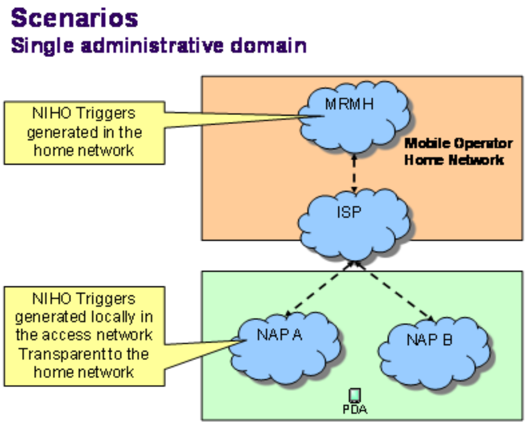


Figure 1.5: Network initiated handoff [10]

Prioritization handoff (PH): - The basic concept of all handoff prioritization approaches is to give handoff requests precedence over the new session requests in some way. Handoff prioritization schemes provide improved performance at the expense of a reduction in the total admitted traffic and an increase in the blocking probability of new calls. However, the improvement in performance is related with the way that each scheme gives priorities to handoff calls. Therefore, several handoff prioritization schemes, that support different services and different traffic requirements, may be found in the literature. [2, 5]

A.*Summary of handoff schemes based on Prioritization schemes*[9]

Table: 1

Prioritization	Advantages	Disadvantages
Static channel reservation	Simplicity	Inflexible to traffic change situation
Dynamic channel reservation	flexible to traffic change situation	Computation and signaling overhead
Static queuing	Easy to implement	Difficult to accommodate multitime traffic
Dynamic queuing	Reflection of the dynamics of the user of the motion	Computation and signaling overhead
Channel transferred	Increases systemefficiency	signaling overhead
Subtracting	Increases system efficiency	Quality of service degradation
Genetic Schemes	Improve channel utilization	Delay needed to assign channel
Hybrid	Improves channel utilization Decreases blocking probabilities	Difficult to find the optimum combination

Network assist hand off (NAH): - Every mobile station measures the received power from surrounding base station and continually reports the results for serving the base station. This is the second generation which uses TDMA technology. It is used in GSM or IS-95 CDMA. The time it takes between the handoff decision and its execution approximately is 1 second. In this handoff the call is handed over between the base stations much faster than the first generation. It is suited for micro cellular where handoffs are more frequent. In the mobile assisted handoff the network requests the Mobile Terminal to measure the signal from the surrounding Base Stations [15][16] The network makes the handoff decision based on reports from the Mobile Terminal. Mobile assisted handoff is used in the GSM (the handoff time between handoff decision and its execution is approximately 1 second). One or IS-95 CDMA. More details concerning the three different decision strategies can be found.

Submitting author is responsible for obtaining agreement of all coauthors and any consent required from sponsors before submitting a paper. It is the obligation of the authors to cite relevant prior work.

Mobile controlled handoff (MCH): - The mobile station regularly monitors the signals level of the surrounding base station and the interference on all channels. A handoff can be initiated if the signal strength of the serving base station is below a threshold, where the call can be served by other base stations. This type of handoff has a short reaction time (of the order of 0.1second). MCHO is used in DECT (Digital Enhanced Cordless Telecommunications) standard. The MT requests from the target BS a channel with the lowest interference. Digital European Cordless Telephone (DECT) is a sample cellular system using MCHO with 100-500 ms handoff execution time. [7, 17]

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 2, Issue 11, November 2013

Power difference handoff (PDH):- The handoff occurs depending on a preset value of Power difference (Δ). This margin given by Δ = Pr handoff – Pr min handoff cannot be too big or too small. If Δ is too big, the unnecessary handoff would be a burden on the MSC. If Δ is too small there may be insufficient time to complete a handoff before a call disconnects due to weak signal. That's why the value of margin is chosen carefully to meet this requirement.

Intersystem handoff (ISH):-

If a mobile moves from one cellular system to another cellular system controlled by the different MSC, intersystem handoff will occur. When a mobile signal is weak in a given cell and the MSC can't find another cell within its system to which it can transfer the call in progress, the intersystem handoff would occur. Intersystem handoffs are used to seamlessly connect roamers between MSCs.[10] A standard interface is used over the signaling network to allow different MSCs to pass typical signal measurement (handoff) data, as well as HLR and VLR information, while the subscriber move between different wireless networks. In this way, it is possible for subscribers to maintain calls while transit between different markets.

Umbrella approach cell hand off (UACH): - In [10, 11] practical consideration in cellular system when the cellular system designs for a wide range of mobile velocities. High speed vehicles move from the cell within a matter of seconds. Whereas users walking by foot may never need handoff during a call. But the MSC can quickly become an obstacle if high speed users constantly pass very small cells. For this kind of problem the umbrella approach cell handoff has been made. Using the different antenna height and different power levels, it is possible to enlarge and minimize cells which are co-located at a single location. This is known as an "Umbrella approach technique". It is used to provide big area coverage to high speed users, while providing small area coverage to users who are travelling at low speed. It ensures that the number of handoff is minimized for high speed users and provides additional microcell channels for foot-logger users.

Network controlled handoff (NCH): -

NCH is used in first generation cellular system such as AMPS (Advanced mobile phone system) TACS (Total Access Communication System) where the Public switching telephone system is responsible for the overall handoff decision. In that the network serves the necessary Received signal strength (RSS) measurement and handoff decision. The handoff execution has taken many seconds due to heavy network load. Base station measure the signal from the mobile station.[16, 21] The network initiates the handoff process when some of the handoff processes are met.

Multi layer handoff (MLH): -

In order to decrease the number of handoff and to increase the system capacity used Multilayer handoff approach. A number of microcells are overruled by a macro cell and the users assigned each cell according to their speeds. Because the micro and macro cells coverage area is 500 meters or 35 km respectively. Slow users are assigned to microcells and fast users assigned to macro cells. Hence the total number of handoff reduced, as the macro cells not only used for fast users but also for slow users when the microcells are congested. This process is also called as take back.[8,11]
There are the following four types of handoff: Microcell to microcells, microcell to macrocells, macrocells to macrocells and macrocells to microcells.[12,17,19] In the future, the global coverage can be assigned using hierarchical cell structures where the HCS has picocells for the indoor communications. Hu and Rapp portare also described and proposed as a model for three-layer hierarchical network consisting of microcells, macrocells, and spot beams. Microcells and macrocells are terrestrial part of the network whereas spot beams correspond to satellite part. The users can be overflowed from lower layers to the upper layers but a take back is not allowed here.
In a bonus-based algorithm is proposed where it is compared with classical and macro algorithms. If in the classical algorithm [3, 14], a user is assigned to a microcell or overflowed to a macro-cell, the capacity of the microcell is full. After the user speed estimation is done, the user is assigned to the appropriate layer using overflow and take-back. This scheme results in too many handoffs known as the ping-pong effect. The macro algorithm is similar to the classical algorithm with one exception. [15, 16] When a user is assigned to the macro-cell it is not permitted to be taken-back to the microcell, which decreases the number of handoffs. The bonus-based algorithm tries to prevent unnecessary handoffs to the microcell when fast users temporarily slow down. For each fast user, a time bonus is given. The user can use this time bonus during temporary slowdowns. If a user exceeds the timer, it is assigned as a slow user and is taken-back to the microcell layer.

Micro cellular handoff (MCH):- In microcell cellular system one handoff problem is cell dragging. Cell dragging result from walker users that provide a very strong signal to the base station. Such situation occurs in urban areas where the LOS radio path between subscribers and base station. To solve the cell dragging problem handoff threshold and radio coverage parameters must be adjusted carefully. The microcells are cells with small radii and employed in highly populated areas such as city buildings and streets to meet high system capacity by frequency reuse. In [2] a fast handoff algorithm for hard handoffs is proposed to remove fast fading fluctuations resulting in algorithm that reacts more quickly to corner effect. They propose a technique called local averaging, in which the averaging time interval is smaller than averaging time interval of common handoff algorithms and improve handoff performance. The authors proposed an improved version of the algorithm by adding a drop timer to local averaging technique which decreases the

ISSN (Print) : 2319-5940
ISSN (Online) : 2278-1021

IJARCCE

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 2, Issue 11, November 2013

unnecessary handoffs. [8, 15] Then, they compare their proposal with a common averaging technique which uses an exponential window. A direction biased algorithm is proposed in [15][16] where all the BSs in handoff decision are grouped in two groups. One set of BSs are those in which MS is approaching and the other set includes the BSs in which the MS moves away. In handoff initiation an encouraging hysteresis (h_e) is used to first group where a discouraging hysteresis (h_d) is applied to the second one. The relation between these hysteresis values are $he \leq h \leq h_d$. A signal strength based direction estimation method is used for determining the mobile positions the parameters have been discussed.

So to better handoff, we have to prepared a table which is give us to better handoff process. Above the theoretical aspect I have create a table: 2 which shown in below the paragraph where the all handoff strategies and its required parameters has shown.

So comparative handoff strategies shown in the table:1. In that table the required parameters are shown.

Hand-offs	Parameters				
	Generation and Method	RSS (8-100 dB)	Execu-tion Time	Quality (5dB -25 dB)	Handoff made
NIH	First Gen Analog system	Weak due to analog system	More than 1Sec	More SI ratio	Very slowly
NAH	Second Gen TDMA tech.	Stronger than NIH	1 Sec.	Less	Faster than first Gen.
MCTH	MCHO is used in DECT standard	Stronger than NAH	100-500 ms	less	handoff has a short reaction time 0.1 Sec
PH	Second Gen. used Guard and Queuing method	Aprox 20db	Depends on TDD and FDD	less	In Guard drop call but in queue less drop calls
PDH	2nd Gen	Depends on Δ	More than 1 sec	More	Too hard
ISH	Used in 3rd and 2nd gen	Strong	More than 1 sec	Less	Softly
UAH	2rd Gen TDMA tech used for big area coverage	Very Strong	0.1msec	Less inference	Very fast than the others
NCH	1st gen AMPS and FDMA tech.	Not strong due to Network serves	Many Seconds due to heavy load	More	Hard
MLH	2nd and 3rd gen.	Strong due to coverage area 35km	is very less compare to all	Less	Soft
MCH	This basically UACH part used in small area	Approx 10db	0.1 msec	more	Soft for footsloggers users
NIH	First Gen Analog system	Weak due to analog system	More than 1Sec	More SI ratio	Very slowly
NAH	Second Gen TDMA tech.	Stronger than NIH	1 Sec.	Less	Faster than first Gen.

Table 2

VII. CONCLUSION

Here we have studied comparative strategies of handoff in cellular networks. We have raised the following most common criteria:

- Relative signal strength
- Relative signal strength with threshold
- Relative signal strength with hysteresis
- Relative signal strength with hysteresis and threshold

We have thoroughly studied handoff strategies and have learned, that handoff is the process where changing the channels like frequency, time slot, spreading codes or combination of them, are associated with the current connection during a call. The service of wireless communication depends on the handoff strategy**.** Now it has been observed that comparative parameter in all handoff strategies is shown in below the Table. Here we can find out, which handoff strategy is suitable for the call continually**.**

Above discuss the all handoff strategies where it shown that which handoff is required suitable parameters to minimize the handoff , so in above discuss , it has been cleared that the soft handoff occurred in the vertical handoff where all

'ERENCES

[1]Gregory P. Pollioni, "Trends in Handover Design", IEEE Communications Magazine, vol. 34, pp. 82-90, March 1996.

[2]M. Gudmundson,"Analysis of Handover Algorithms", 41st IEEE Vehicular Technology Conference, pp. 537-542, 1991.

[3]S. Tekinay, and B. Jabbari, "A Measurement-Based Prioritization Scheme for Handovers in Mobile Cellular", Networks," IEEE J. Select. Areas Commun., vol. 10, no 8, pp. 1343-1350, 1992.

[4]Mark D. Austin and Gordon L. Stüber, "Direction Biased Handoff Algorithms for Urban Microcells", Proceedings of 44th IEEE Vehicular Technology Conference, vol. 1, pp. 101-105, 1994.

[5]J-S. R. Jang and C-T. Sun, "Neuro-Fuzzy Modeling and Control", Proceedings of the IEEE, March 1995.

[6]Nishint D. Tripathi, Jeffrey H. Reed and Hugh F. VanLandinoham, "Handoff in Cellular Systems", IEEE Personal Communications, vol. 5, pp. 26-37, December 1998.

[7]P. Marichamy, S. Chakabarti and S. L. Maskara, "Overview of Handoff Schemes in Cellular Mobile Networks and Their Comparative Performance Evaluation", IEEE Proc. Vehicular Technology Conference (VTC'99)-Fall,Amsterdam, The Netherlands, pp. 1486-91, Sep.1999.

[8]S. Choi and K. Sohraby, "Analysis of a Mobile Cellular Systems with Hand-off Priority and Hysteresis Control", IEEE INFOCOM 2000, vol. 1, pp. 217-224, March 2000.

[9] S. ShirvaniMoghaddam, V. TabatabaVakili and A. Falahati, "New Handoff Initiation Algorithm (Optimum Combination of Hysteresis & Threshold Based Methods)", Vehicular Technology Conference (VTC 2000), vol. 4, pp. 1567-1574, 2000.

[10] Theodore S. Rappaport, "Wireless communications principle and practice", Second Edition Pearson, ISBN 978-81-317-3186-4, 2001

[11] William Stallings, "Wireless Communication and Networks" , Second Edition Pearson , ISBN 978-81-317-2093-6, 2002

ISSN (Print) : 2319-5940
ISSN (Online) : 2278-1021

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 2, Issue 11, November 2013

[12] Carolin I. Bauer1, Dr. S. John Rees2ye , "Classification of handover schemes within a cellular environment" , PIMRC IEEE 0-7803-7589-0/02, ©2002.
[13] D. P. Agrawal and Q. An-Zeng, "Handoff in Wireless Mobile Networks", John Wiley & Sons, INC, 2002.
[14] Alexe E. Leu and Brian L. Mark, "Modeling and Analysis of Fast Handoff Algorithms for Microcellular Networks", Proceedings of the 10th IEEE MASCOTS'2002, pp. 321-328, Oct. 2002.
[15] A. Iera, A. Molinaro and S. Marano, "Handoff Management with Mobility Estimation in Hierarchical Systems", IEEE Transactions onVehicular Technology, vol. 51, pp. 915-934, Sept. 2002.
[16] W.–S. Soh, and H. S. Kim, "QoS provisioning in Cellular Networks Based on Mobility Prediction Techniques," IEEE Commun. Mag., vol. 41, no.1, pp. 86-92, 2003.
[17] Xioadongwang and H. Vincent Poor, "Wireless communication System Advanced Techniques for signal Reception", Second Edition Pearson, ISBN 978-81-7758-873-6, 2003
Alexe E. Leu and Brian L. Mark, "An Efficient Timer-based Hard Handoff Algorithm for Cellular Networks", IEEE Wireless Communications and Networking (WCNC 2003), vol. 2, pp. 1207-1212, 2003.
AggelikiSgora, Student Member, IEEE, and Dimitrios D. Vergados, Member, IEEE, " Handoff Prioritization and Decision Schemes in Wireless
Cellular Networks: a Survey", IEEE Communication Surveys & Tutorials , Vol. 11, No. 4, 1553-877X/09 Fourth Quarter 2009.
[18] Ram Kumar Singh,AmitAsthana, AkankshaBalyan, ShyamJi Gupta, Pradeep Kumar, "Vertical Handoffs in Fourth Generation Wireless Networks", International Journal of Soft Computing and Engineering (IJSCE) ISSN: 2231-2307, Volume-2, Issue-2, May 2012