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# REVIEW ON VERTICAL HANDOFF TECHNIQUES AND ALGORITHMS

Shelej khera

*SEEE ,LPU*

*Shelej.22390 @lpu.co.in*

## Abstract:

*The transfer of calls and data within diverse networks with different features is known as vertical switching. There are various methods and techniques based on which the vertical switching can be implemented. Each technique has its various advantages and disadvantages. In this paper these various techniques and their algorithms are discussed.*

*Key words: Cost, RSS Hybrid*

Introduction: Various ways are projected for implementing transition in mobile communication. Choice of switching ought to be created at right time for permanent resource allocation. Within the vertical Handoff call part, the portable terminal decides if associations ought to prolong in prevailing hand-picked system or transferred to a different arrangement. Choice might rely upon numerous features as well as sort of applications (e.g., colloquial, streaming), information measure and delay needed for the appliance, access price, transmitted power, also the preferences of users. Throughout the execution of vertical switching part, connections within moving terminal are transferred from present to new during flawless manner. Such part additionally carries validation, approval, shift of subscriber's information. Numerous vertical transitions call methods are projected newly.

## 1 Handoff Techniques

There are two techniques of handoff as explained below:

**a)** Concept of Guard Channel: In this method some part of total available channel in the cell is held in reserve for handoff request from ongoing calls and this can be handed off in the cell.

**b)** Concept of Queuing: This technique provides handoff queuing concept as the finite time interval exists between the time the received signal intensity drops below handoff threshold level and the period the call is finished due to inadequate signal level. The traffic pattern calculates the delay size of a particular service area.

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### 1.1 Types of Handoffs

The handoff can be classified in to the two categories and these are categorized according to its features, connection state, and network types.

a) Soft Handoff

i. In mobile communication, soft Handoff mean overlapping of Base Station coverage zones that ensures that the cellular phone set is usually well inside the area of a minimum one repeater or base station. Soft Handoff may be a "Make before break" Handoff. Mobile sets transmit and receive signals from one repeater or base station at a time in some cases. It's costlier than a hard Handoff.

ii. During it, mobile station (MS) uses decision ,however the MS starts interacting with a new base station before terminating communications with the previous base station. Same frequency is used between to base station using soft handoffs. The reception is improved as MSs Move between cells (on cell boundaries) in this technique.

iii. The mobile unit performs "Or of Downs" logic to settle on to fiddle with power during soft handoff. Power level of the mobile station will be increased if power control of both bits 0. The power will reduce if the power control bit from any base station is '1'.

Earlier networks exercise frequency division multiplexing or time division multiplexing. For CDMA, base stations make use of an equivalent channel meant for every transportable freelance to its location. Every set has associate degree identity supported by a code. As a result no amendment in frequency or temporal order happens as mobile device moves from one base station to other, not much dead zones are there. Due to this, connections cannot get disturbed and are not broken.

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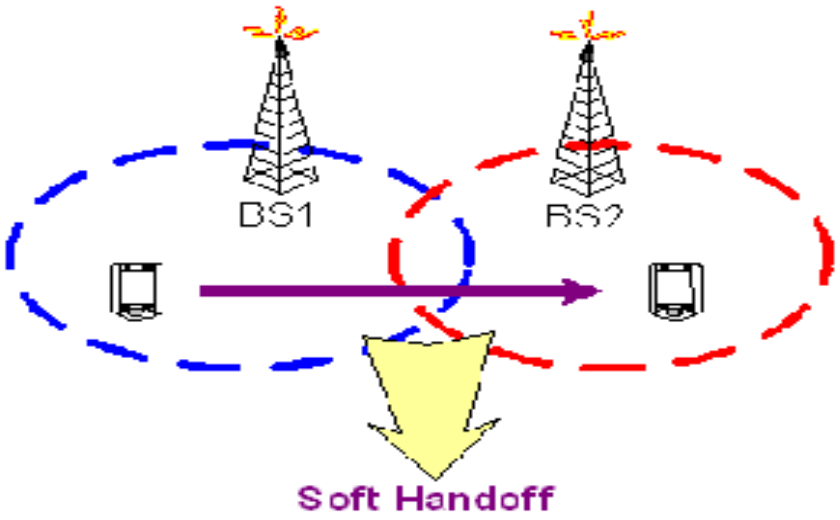


Figure 1: Soft Handoff in Mobile Communication

b) Hard Handoff

A hard Handoff is primarily enforced once the user is being connected to a base station with a special frequency than the present base station. This Handoff is characterized by actual break within the association during shifting from one cell or base station to a diverse base station.

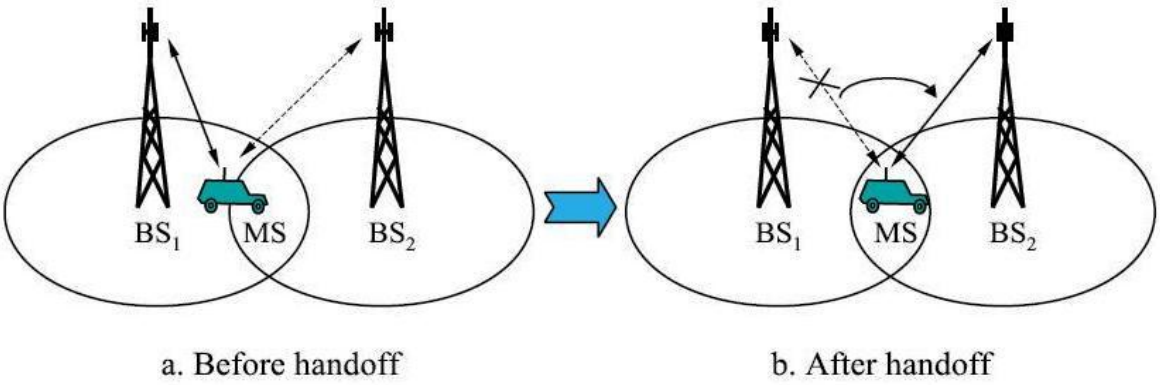


Figure 2: Hard Handoff in Mobile Communication

### 1.2 Intra and inter-cell handoffs

In former the supply and target is same, therefore identical cell and solely old channel is modified throughout transition.. Aim of this type of transition is to alter channel that can interfered, attenuated by replacement of less attenuation channel.

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Hard type of transition is allowable between various soft areas, however not among constant soft zone members.

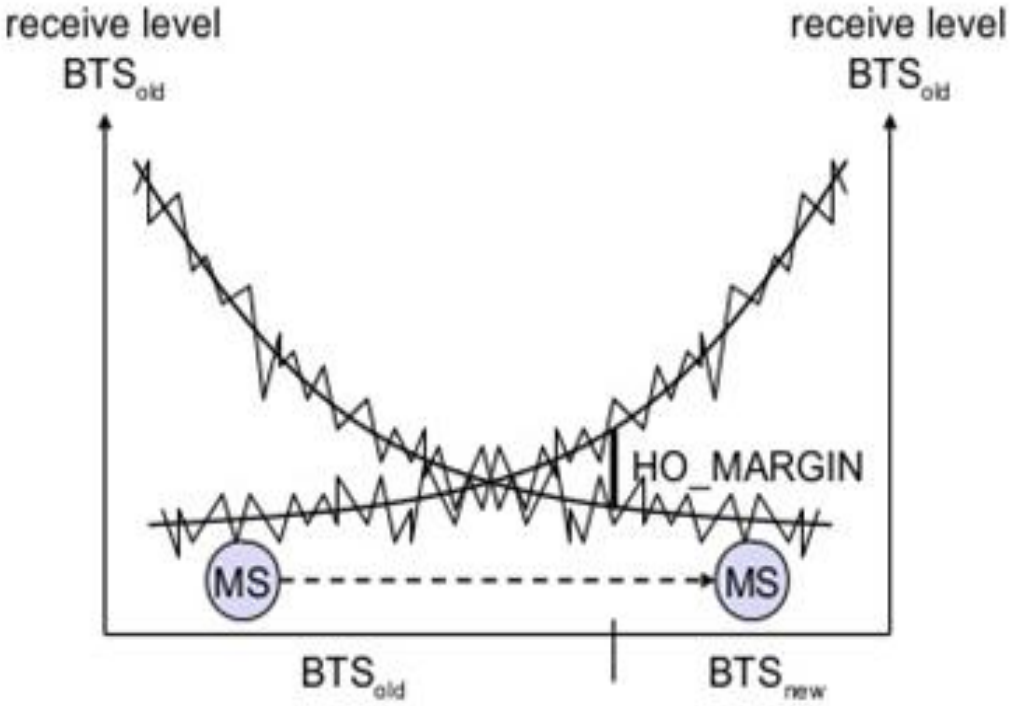


Figure 3: Handover Decision

### 1.3 Horizontal Handoff

This type of switching is outlined as a Handoff between bases stations that uses an equivalent form of wireless network structure. It is often standard description of Handoff with same systems like telecommunications broad region information , native space networks.

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### 1.4 Vertical Handoff

Vertical Handoffs between bases stations is combination of the various wireless network technologies. Vertical Handoffs are divided into two categories: associate degree vertical Handoff in upward direction may and vertical Handoff in downward direction (more information measure in unit area). This type of switching also associates degree right away lower or higher area or the moving user might "skip" associate degree overlay..

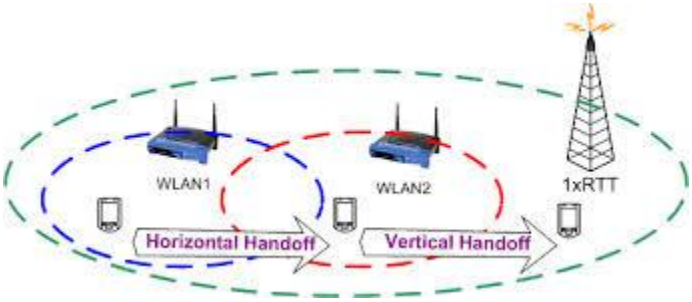


Figure 4: Horizontal vs. Vertical Handoff in Mobile Communication

#### 1.4.1 Network-Controlled Transition

For this method, considering easurements of Mobile Stations the network makes a switching decision at Base Stations. Network facilitates appropriate resource allocation and knowledge of the quality of signal for every users at a single point.

#### 1.4.2 Handoff Assisted by Mobile

During this process, the measurements are made by MS (Mobile Station) and the decision is done by network. This refers to allocating and release of radio channels and switching management. Approximately one second is the handoff time between handoff decision and execution in such a circuit-switched global system for mobile.

#### 1.4.3 Handoff Controlled by Mobile

During this technique, each Mobile Station is totally up to the mark of switching method. That sort of transition encompasses tiny time interval (approximately 0.1 second). The signal strength is measured by mobile station from close base stations. Transition starts when strength of present base station signal is not up to that of other base station by a precise limiting value.

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### 1.4.4 Initiation of Handoff

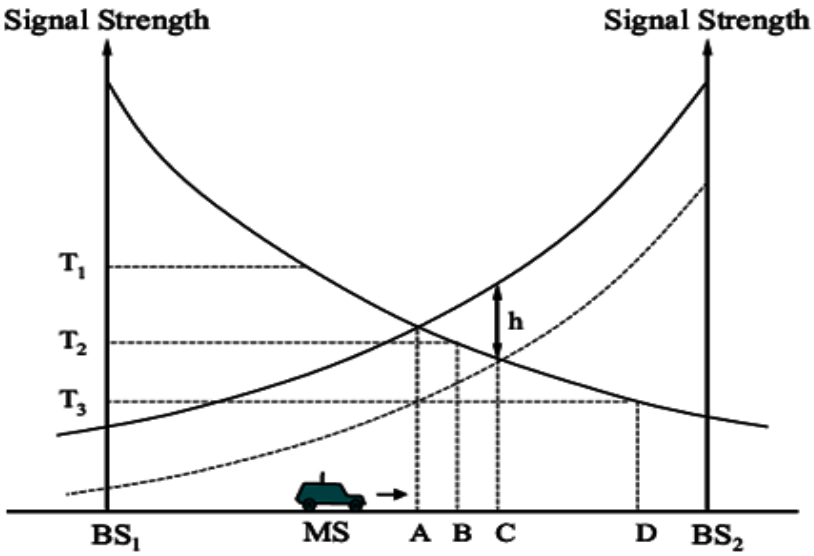
Hard Handoff happens once recent association breaks before brand new association gets activated. The performance analysis of hard Handoff relies upon numerous initiation criteria. It is estimated that time average of signal is taken, to eliminate speedy fluctuations as the multipath nature of radio atmosphere. Mean strength of signal of BS1 decreases because the Mobile Station travels a far from it. If the mobile station approaches it mean signal strength of BS2 will increase.

### 1.6 Strength of Relative Signal

This technique selects the strongest received base station in any time. The choice is predicted on average menstruations of the signal received. From the Figure 17, it is often analyzed that at position A Handoff occurs. This technique is determined to impress too several needless handoffs, even once the signal of this base station remains at a suitable level.

a) Strength of Relative Signal having Threshold

This technique permits mobile station handy off as long as the present signal is weaker enough therefore alternative is that stronger out of two is taken.




b) Strength of Relative Signal with Hysteresis

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The theme permits a subscriber to hand off given that support location is adequately stronger by natural phenomenon periphery, compared to present. Handoff occurs at C. The methodology removes questionable ping-pong impact,.

### 1.7 Techniques of Prediction

These techniques are based on handoff call on expected future worth of strength of received signal. Methods are projected for higher outputs for reducing within variety of uncalled transition, than strength of signal, as well as threshold strategies.

### 1.8 Initial-Access Channel Assignment Schemes for Handoff

There is tracking of the movement of an MS once it's not during a decision. Once a mobile station is during decision, it transmits multi channels for communicating with base station. Once mobile station goes out of present cell and enters a neighboring cell, the mobile station has to get two channels from nearby cell so as decision continues. The method of transferring decision from present cell to nearby cell is termed hand-off. To a cell, hand-off decision may be decision which is ongoing in a nearby cell and desires to be continuing within the cell owing to the movement of mobile station. In distinction, replacement decision may be a decision that has started within the cell. The quantity of channels allotted to every cell is prescribed. Channel assignment deals with a way to assign accessible channels .The best theme is the fully shared theme (FSS), during which all accessible channels measure shared switching calls and novel calls. No difference is formed between a hand-off decision and a replacement decision. Fully shared scheme is broadly utilized in present cellular networks owing to its simple nature. Additionally, Fully shared scheme has the benefit of maximizing use of wireless channels. The limitation is the accumulated rate of dropping of switching calls. It is less fascinating to drop hand-off decision than replacement decision. Dropping likelihood of switching calls is taken into account considering main metrics that meet standard of calls service.. Once an mobile station finds that received signal strength of the present base station is below a definite value, referred to as switching threshold, switching operation gets started.

### 1.9. Flow of Handoff

The below diagrams explained the basic flow chart of handoff queuing based on number of calls received.

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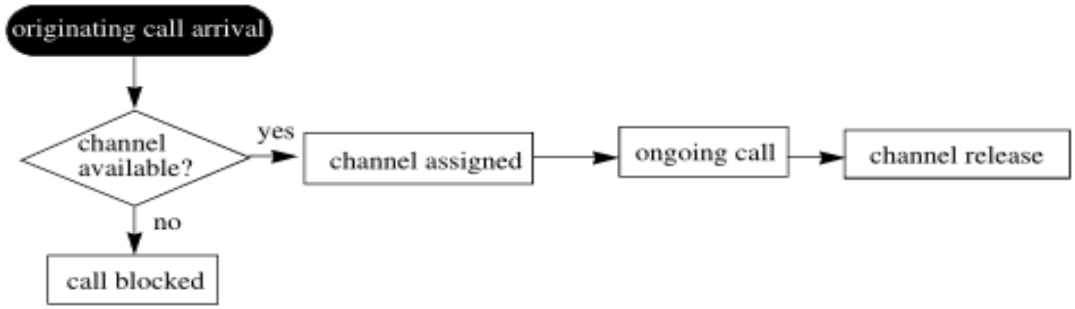
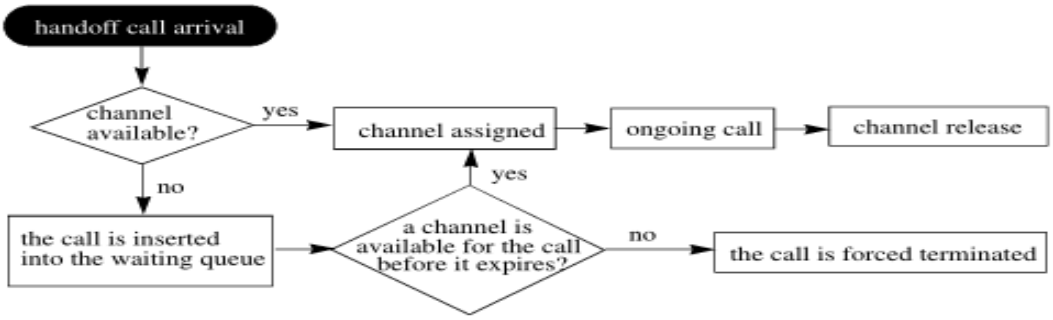
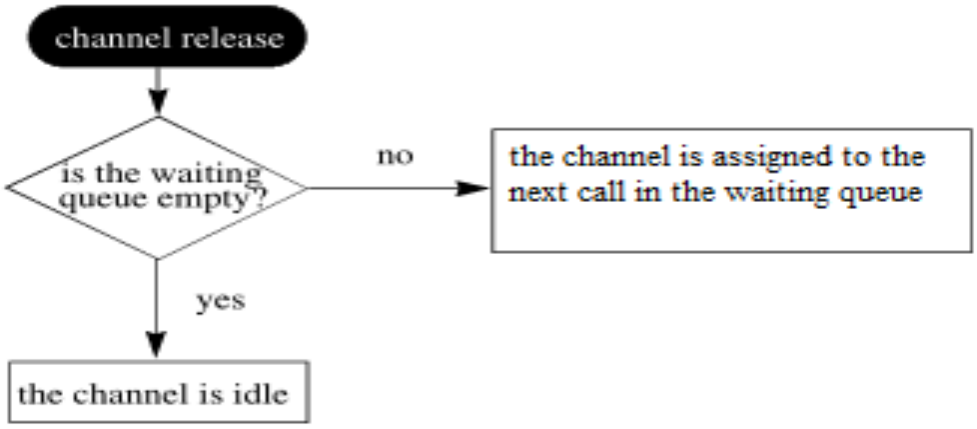



Call Originate




Call Arrival




Assign Channel and Release Channel

### 1.10 Vertical transition Decision (VTD) Conditions

Various features are considered for vertical handoff decision algorithms. These are explained as follows:

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i. **Power of Received Signal**: It is main parameters in decision in vertical handoff. Received signal strength is measured easily and it directly relates to service quality. Horizontal handover algorithms mostly use this parameter.

ii. **Network connection time:** It is the most essential parameter. This time means the extent that user has been associated to the current position.

iii. **Available Bandwidth :** Available bandwidth is the computation of accessible information resources.

iv. **Consumption of Power:** If the battery of mobile terminal is little burning up of power is main concern.

v. **Security**: When integrity of the transmitted data is vital, systems having advanced level of security should be selected over other one that offers lower level of security of data.

vi. **Preferences of User**: Individual user's choice can show the way for selecting type of network .

## 1.14 Classification of VHD Algorithm:

### 1.14.1 Received signal based techniques:

This is the mainly the most central technique in the these types of algorithms. The vertical switching verdict techniques assess the received signal potency of the present correlation alongside others to compose switching transitions.

. The major benefit of this technique is that it reduces failures rate of handover, unrequited switching and breakage of connections but it increases delay of handoff.

### 1.14.2 VHD Algorithms Based on Bandwidth:

This algorithm uses accessible bandwidth as foremost criteria for switching.. Remaining bandwidth and requirements of user are considered in taking decision that to switch from wireless restricted region system or Wireless extensive vicinity set of connections (WWAN) and vice versa. Location of movable unit is also taken in to deliberation. The switching to desired right of entry network is done, stipulation the portable workstation has inoperative state. seeing that on hand bandwidth is well thought-out as most important parameter, it provides good quality throughput designed for vertical handoff decision. Lesser switching latency is achieved for applications which are delay sensitive. An algorithm is designed between wireless restricted region system as well as extensive band Code Division Multiple Access (WCDMA), to get better on the whole system throughput. Signal level to

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interfering Noise signal Ratio (SINR) is considered. These calculation of wireless local area network is changed to corresponding SINR for assessment with SINR of channel of WCDMA

This gives the subscriber's superior throughput than handovers based on strength of signal received as the obtained throughput depends directly on signal level to interference signal level. On the other hand ping-pong effect is introduced by these algorithms.

### 1.14.3 VHD Algorithms Based on Cost Function:

Group of network and other parameters such as like strength of received signal, accessible bandwidth, service expenditure, network casing region, safety measures, and battery control are chosen in these types of decision algorithms for estimating the work quality of desired networks. Handoff decision is made accordingly. The use of cost function makes this method useful. In these decision algorithms normalization along with weights allocation techniques are given within the system. The uppermost weight function be chosen as intention for switching. Advantages of such type of algorithm are reduced decision delay of handoff, high throughput and reduced blocking rate of handover.

### 1.14.4 Hybrid Algorithm:

Different parameters in the handover decision are used in a hybrid algorithm. These algorithms use artificial neural networks (ANN) and fuzzy logic. The parameters of present networks be composed by movable devices along with are transmitted to a middleware acknowledged as different networks switching administrator by accessible associations. system management apparatus, characteristic collector along with artificial neural network training are its three main components. A multilayer feed forward ANN selects best relinquish depending on choice of users. Superfluous switching in addition to effect of ping-pong is removed in this technique.

Conclusion: In this paper different handoff techniques and classification of handoffs have been discussed. Some of the vertical handoff algorithms have also been discussed. Any technique can be used based on the requirement and application considering certain conditions such as latency ,hand off factor ,bandwidth etc.

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