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An Efficient Communication MCHO Protocol used Cellular Networks Technology

[1] Umesh Sehgal, [2] Rajeev Sharma

Research Scholar

Assistant Professor

Chandigarh Group of Colleges, Chandigarh

Email id: - umeshsehgal_ind@yahoo.com

Abstract: Cellular communication is a technology which mainly makes the mobile phones to communicate with each other. In Cellular communication the end user that is the mobile phone user doesn't stay at a particular place but moves from one place to another. Handoff is allotted as handover. The channel change due to handoff may be through a time slot, codeword or combination of these for TDMA, FDMA and CDMA or a hybrid scheme. For cellular communication systems, mobility and limited radio coverage of a cell requires calls to be handed over from one base station system (BSS) to an another BSS.There are occurrences where a handoff is unsucceful.Lots of research was conducted regarding this in the late 80's main reason was found out. Because frequencies cannot be reused in adjacent cells, when a user moves from one cell to another, a new frequency must be allocated for the call. If a user moves into a cell when all available channels are in use, the user's call must be terminated. In this paper the inter technology handovers where a calls connection is transferred from one access technology to another GSM/UMTS handoff to Wi Fi and Vice versa.

Keywords: Cellular communication, Wireless networks, Sensor networks, MAHO.

1. Introduction

In telecommunications there may be different reasons why a handover might be conducted:

- When the phone is moving away from the area covered by one cell and entering the area covered by another cell the call is transferred to the second cell in order to avoid call termination when the phone gets outside the range of the first cell [4].
- When the capacity for connecting new calls of a given cell is used up and an existing or new call from a phone, which is located in an area overlapped by another cell, is transferred to that cell in order to free-up some capacity in the first cell for other users, who can only be connected to that cell [6].
- In non-CDMA networks when the channel used by the phone becomes interfered by another phone using the same channel in a different cell, the call is transferred to a different channel in the same cell or to a different channel in another cell in order to avoid the interference;

2. Comparison

In addition to the above classification of *inter-cell* and *intra-cell* classification of handovers, they also can be divided into hard and soft handovers[1].

- **Hard handover**
  Is one in which the channel in the source cell is released and only then the channel in the target cell is engaged. Thus the connection to the source is broken before or 'as' the connection to the target is made for this reason such handovers are also known as *break-before-make*. Hard handovers are intended to be instantaneous in order to minimize the disruption to the call. A hard handover is perceived by network engineers as an event during the call. It requires the least processing by the network providing service. When the mobile is between base stations, then the mobile can switch with any of the base stations, so the base stations bounce the link with the mobile back and forth.[6] This is called 'ping-ponging'. Hard handoff can be further divided s intra and inter cell handoffs.
- **Soft handover**
  Is one in which the channel in the source cell is retained and used for a while in parallel with the channel in the target cell. In this case the connection to the target is established before the connection to the source is broken, hence this handover is called *make-before-break*. The interval, during which the two connections are used in parallel, may be brief or substantial.[2] For this reason the soft handover is perceived by network engineers as a state of the call, rather than a brief event. Soft handovers may involve using connections to more than two cells: connections to three, four or more cells can be maintained by one phone at the same time. When a call is in a state of soft handover, the signal of the best of all used channels can be used for the call at a given moment or all the signals can be combined to produce a clearer copy of the signal. The latter is more advantageous, and when such combining is performed both in the downlink (forward link) and the uplink (reverse link) the handover is termed as *softer*. Softer handovers are possible when the cells involved in the handovers have a single cell site. Soft handoffs can be classified as multi ways and softer handoffs.

Handover can also be classified on the basis of handover techniques used. Broadly they can be classified into three types:

1. Network controlled handover
2. Mobile phone assisted handover
3. Mobile controlled handover

An advantage of the hard handover is that at any moment in time one call uses only one channel. The hard handover event is indeed very short and usually is not perceptible by the user. In the old analog systems it could be heard as a click or a very short beep; in digital systems it is unnoticeable. [5] Another advantage of the hard handover is that the phone's hardware does not need to be capable of receiving two or more channels in parallel, which makes it cheaper and simpler. A disadvantage is that if a handover fails the call may be temporarily disrupted or even terminated abnormally. Technologies which use hard handovers usually have procedures which can re-establish the connection to the source cell if the connection to the target cell cannot be made. However re-establishing this connection may not always be possible (in which case the call will be terminated) and even when possible the procedure may cause a temporary interruption to the call.

One advantage of the soft handovers is that the connection to the source cell is broken only when a reliable connection to the target cell has been established and therefore the chances that the call will be terminated abnormally due to failed handovers are lower.

3. Handoff Prioritization

Handoff fails for many reasons like, if no channel is available in the candidate cell. One of the ways to reduce the handoff failure rate is to prioritize handoff. [3] Handoff algorithms try to minimize the number of handoffs which give poor performance in improvement can be obtained by prioritizing handoff. Two basic methods of handoff prioritization are guard channels and queuing of handoff.

- **Guard Channels**: Guard channels improve the probability of successful handoffs by reserving a fixed or dynamically adjustable number of channels exclusively for handoffs. An adaptive number of guard channels can help reduce this problem [1].

- **Queuing of handoff**: Queuing is a way of delaying handoff. The MSC queues the handoff requests instead of denying access if the candidate BS is busy. [7] The probability of a successful handoff can be improved by queuing handoff requests at the cost of increased new call blocking probability and a decrease in the ratio of carried to admitted traffic since new calls are not assigned a channel until all the handoff requests in the queue are served.

In cellular wireless networks, it is very important to deal with Mobile station handoff between cells in order to maintain a continuous and QOS guaranteed service. [13] There are four basic types of handoff protocols are:-

- Network controlled handoff (NCHO)
- Mobile assisted handoff (MAHO)
- Soft handoff (SHO)
- Mobile controlled handoff (MCHO)

For voice calls ,it not only causes annoyance to the users dropped calls also imply increased wireless bandwidth consumption since a dropped call has to be established, leading to unavoidable consumption of time and bandwidth. [11] The GSM technology, on the other hand, uses MAHO handoff in which the MSC makes handoff decisions solely on a single criterion of RSSI measurements reported by an MT.The guard channel approach as well as the MAHO scheme can individually result in unnecessary loss of handoff calls.

4. MAHO Compare MCHO

Mobile assisted handoff is a process that is used to allow a mobile phone to assist the base station in the decision to transfer the call to another base station. The mobile radio assists by providing RF signal quality information that typically includes the received signal strength indication RSSI and bit error rate.MAHO is an official term of the GSM system. [12] The mobile device transmits on one slot receives on one slot and has 6 idle slots available in each frame.

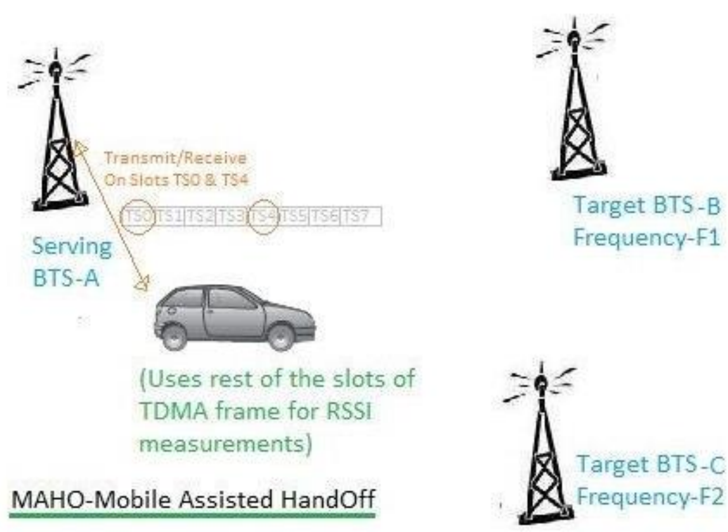

Figure 1.1 MAHO Architecture

In Figure 1.1 mobile assisted handoff used in TDMA based frame structure typically used in GSM system.TS4 time slots for conversations with BTS-A. In order to perform handoff mobile continuously performing RSSI measurements.RSSI stands for received signal strength indication. [6] From the neighbor cell measurements, mobile decides on which cell or BTS to handoff.

When a mobile user travels from one area of coverage or cell to another cell within a call's duration the call should be transferred to the new cell's base station.

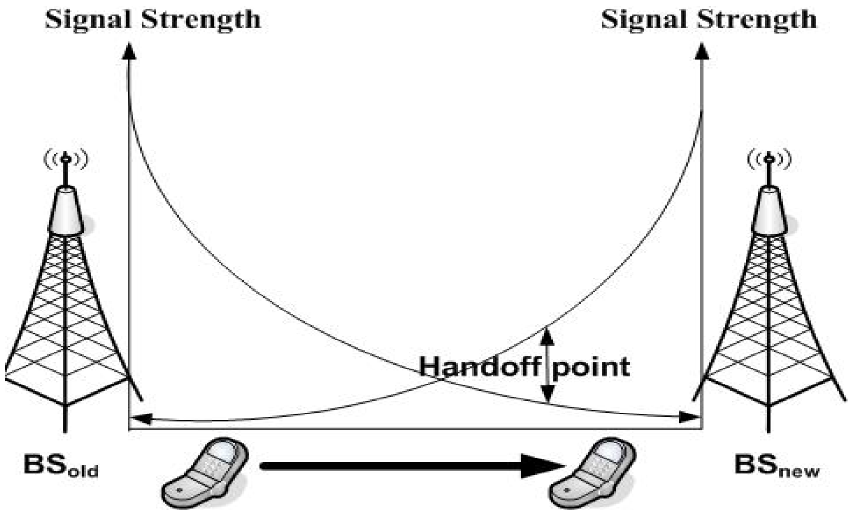

Figure 1.2 MCHO Process

A better method is to use the averaged signal levels relative to a threshold and hysteresis margin for handoff decision.[6] Furthermore, the condition should be imposed that the target base station's signal level should be greater than that of the current base station.

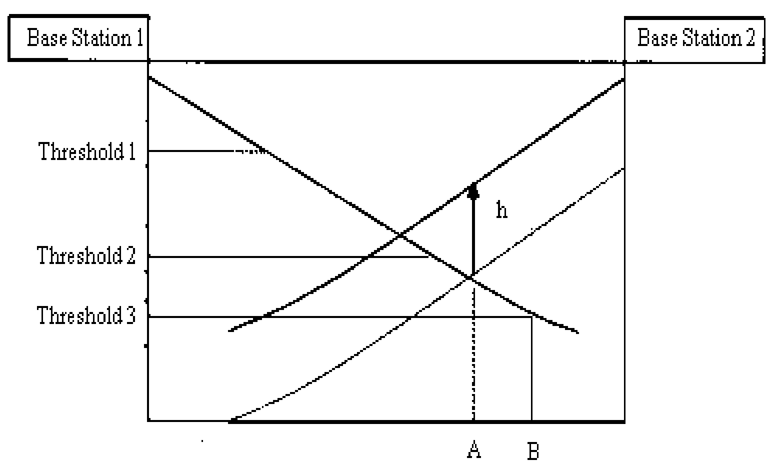

Figure 1.3 Base station hysteresis margins

The handoff should take place at point A for the choice of Threshold 1 or Threshold 2. The handoff should take place at point B for Threshold 3. In has now been shown in practice that using the hysteresis margin greatly reduces the number of unneeded handoffs.[4] However, there is a delay factor involved here. It will be shown later that one may set up optimum trade off values for the parameters threshold and hysteresis to obtain a tolerable delay.

Because of the increasing demand for wireless services, the available channels within the cells become insufficient to support the growing number of users. [5] To increase the system capacity, techniques such as *cell splitting* and *sectoring* may be implemented. Using *microcells* also improves cellular system capacity, and it is an attractive alternative to the two former mentioned techniques. [2] While the group of cells may maintain a particular area of coverage, the co-channel interference is reduced. Decreasing the co-channel interference increases the system capacity without *trunking* inefficiency degradation inherent to sectoring. However, innate to microcells is the increase in frequency of handoffs. So we seek efficient decision algorithms to achieve less unnecessary handoffs, yet more reliable handoffs with low blocking probability and low probability of lost calls. Mobiles moving around in microcells will face line of sight (LOS) handoffs and non line of sight (NLOS) handoffs. In the case of NLOS, completely reliable handoffs are difficult to achieve.[9,7,11] A problem with microcells is the so called *corner effect*. When a mobile station moves around a corner such as at a street intersection, there can be a sudden drop in the received signal level. It loses its LOS component with the serving base station.[7] Now if the mobile user does not link up with this new base station B fast enough, the call gets dropped. Furthermore, the mobile can cause interference to the new base station. The base station is unable to regulate the power of the mobile and users within this cell are blocked.

A problem with faster handoff is that we lose the benefits associated with signal averaging and hysteresis. As was mentioned before, this was helpful in mitigating unnecessary handoffs and ping ponging. The handoff must be fast.[13] Now recall that in order to initiate a handoff the movement of the mobile station from one cell to another must be detected. A reliable method to make this detection and to accommodate the movement is to measure the received signal strength to the base stations and from the user.

$$P_u := \left[\int_{-\infty}^{\infty} f(x)\cdot\left(\frac{1}{2}\cdot \mathrm{erf}\left(x - \frac{h - \Delta L}{\sigma}\right)\right) dx\right]\cdot\left[\int_{-\infty}^{\infty} f(x)\cdot\left(\frac{1}{2}\cdot \mathrm{erf}\left(x - \frac{h + \Delta L}{\sigma}\right)\right) dx\right]$$

$$\frac{1}{\sqrt{2\cdot\pi}}\cdot e^{-\frac{x^2}{2}}$$

$$\delta_{hM} := \frac{T}{2} + K_{rv} \cdot \frac{10^{\frac{h-\sigma}{K_2} - 1}}{10^{\frac{h-\sigma}{K_2} + 1}}$$

$$v_{estimate} := \frac{n+1}{k} + \frac{a^{n+1} \cdot e^{-k \cdot a} - b^{n+1} \cdot e^{-k \cdot b}}{\sum_{i=0}^{n} \frac{n!}{(n-i)! \cdot k!} \cdot \left(a^{n-i} \cdot e^{-k \cdot a} - b^{n-i} \cdot e^{-k \cdot b}\right)}$$

$$k := \prod_{i=1}^{n} c_i \cdot t_i$$

Strategy 1) All the users that are new are placed in a microcell. The idea is to simply move the user to a larger cell if the dwell time spent in that microcell is short in relation to a threshold parameter T.

Strategy 2) Like strategy 1, all new users are put into the service of a microcell. However here, users are updated regularly between cell levels base on continuous dwelling duration measurements.

Strategy 3) Make a record of all past cell dwell times spanning a call. Use ML estimators to approximate the speed. Make an appropriate level handoff decision based on those estimates.

Strategy 4) This is similar to strategy 3 except that MMSE is used to estimate mobile station speed.

In MCHO, the MS is completely in control of the handoff process. This type of hand off has a short reaction time and is suitable for microcellular systems. A MS keeps on measuring signal strength from all the surround base stations.[9] If the MS find that there is a new BS who has a stronger signal than that of an old BS, it may consider to handoff from the old BS to the new BS given a certain signal threshold is reached. Handoff can be seen as a Blind procedure, if it is only based on the comparison of measurements without the information of location. [11,7] Efficient handoff algorithms can enhance system capacity and service quality cost-effectively.

Three basic mechanisms used to evaluate the performance of handoff algorithms include [8]:

- Analytical approach,
- Simulation approach, and
- Emulation approaches.

This Analytical approach can quickly give a preliminary idea about the performance of some handoff algorithms for simplified handoff scenarios.[10] This approach is valid only under specified constraints. For real-world situations, this approach is complex and mathematically intractable.

This simulation approach is the most commonly used handoff evaluation mechanism. Several simulation models suitable for evaluation of different types of handoff algorithms under different deployment scenarios have been proposed and used. Simulation models usually consist of one or more of the following components: the cell model, propagation model, traffic model, and mobility model. [12,8] The emulation approach uses a software simulator consisting of a handoff algorithm to process measured variables. The main disadvantages are that this approach requires periodic measurement efforts and is not suitable for comparison of different handoff algorithms on the same platform.

5. Conclusion

As we are moving towards the fifth generation mobile systems, the need for improving coverage, systems. An classification of different types of handoffs are also explained and a comprehensive survey on vertical handoff decision making parameter's and decision making algorithms that helps in selection of most suitable vertical handoff decision making algorithm for selecting best network. It is the first time that DNCBP is used as a means of making handoff algorithm decision. In addition; future work includes reasonable weight selection on vertical handoff decision function.

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