

Effect of soft handoff on Code-division-multiple-access in cellular network

¹Ankur Kumar Meena, ²Sanjay Kumar

^{1,2}School of Engineering & Technology, Jaipur National University, Jaipur

¹ankurmeena8777@gmail.com, ²sanjaysatyam786@gmail.com

ABSTRACT

Soft handoff refers to a feature used by the CDMA and WCDMA standards, In this paper presents a soft handoff study in code-division multiple-access (CDMA)in cellular systems are introduced in the soft handoff there are many multiple base stations that are involved in the communication with the mobile station. To improve the handoff performance on the boundaries between two base stations by providing channel diversity. On the other hand, there are additional resources used during soft handoff. The efficiency of the effect of sectorized and unsectorized is taken into consideration. The use of soft handoff improves the capacity of forward link and also the signal –to-interference ratio (SIR).In this paper we shall see the soft handoff in CDMA in data services.

Keywords: CDMA, Soft handoff, Sectorization.

1. Introduction

The transfer of information between two or more distant points that are not connected by any electrical device is considered to be a wireless communication. Since multiple users want to communicate in a specific geographical area, there is a need for a communication system through which they can communicate. CDMA (code division multiple access) is a digital telephone system that helps in multiple accesses. CDMA it also refers to some protocols used in second generation and third generation of wireless communication. CDMA does not divide the stream by time or frequency but encodes the data with a special code to do multiplexing. The demand for wireless communication has a need for different multimedia services like real-time, high data-rate which CDMA is capable of handling with the efficiency of the spectrum and efficiency of the coverage. As all the cells in CDMA have the same frequency, connection with the new cell is possible before leaving the current cell.

1.1. Classification of CDMA

The classification is based according to the modulation method used to have a spectrum signal through four major techniques:-

- Data Signal -CDMA
- Frequency Hopping-CDMA
- Time Hopping -CDMA
- Hybrid CDMA

The CDMA has the potential to increase the capacity of cellular communication. The CDMA features are

- interference limited
- efficient
- Power and frequency limitations are more.

In a mobile communication system the process of transferring a phone call from one station to another station without uninterrupted supply is called a handoff. There are two types of handoff [2]:

- **Soft hand off** – is when the phone is connected to many base stations at the same time.
- **Hard hand off**- this happens only when the phone is connect to one tower at a time and is applicable for GSM.

2. System model of CDMA

CDMA is a technique which is vital and potential for multimedia services. In the CDMA there are two traffic channels, forward traffic channel, reverse traffic channel. There is no need for extra channel to finish a soft handoff. A CDMA cellular network, the mobile station (MS) works efficiently by measuring and computing the received data signal from its surrounding base station [4]. The process keeps repeating. When the signal measured reaches a well-defined value it becomes an active set. The capacity of the cellular indicates the admissible users that are not to be exceeded to have a quality in its functioning. Their Capacities are closely related based on their interference they can tolerate.

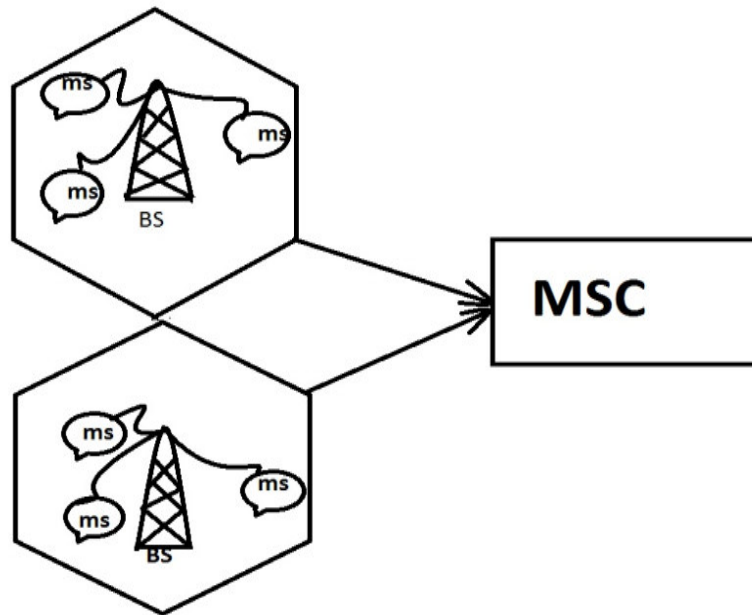


Fig1 CDMA

There is well-defined efficient bandwidth utilization. Some of the techniques [3] that used to reduce the interference are:-

- Space diversity technique
- Beam foaming
- Soft handoff
- Multiuser detection

3. Soft Hand off

Soft Handoff is most preferred when the IS-95 standard is used while transmitting [the base station]. Power is dynamically adjusted in the course of the operation. In a soft handoff a conditional decision is made before the handoff is done. In the base station the handoff is done based on the pilot strength measurement which is the key to perform the hand off. Soft handoff provides good communication quality and smooth transition from one cell to another [1]. The signals that are transmitted from the mobile are reached by a BS (base station), even those that do not belong to them. It provides micro diversity because there is more than one BS engaged in a communication. A typical handoff is when there is a need for a mobile to change its frequency or switch the carrier, the frequency is negated. Idea of a soft handoff scheme is to ensure that there is connectivity with the old base station while the new base station has been assigned to take control over the communication link.[6]

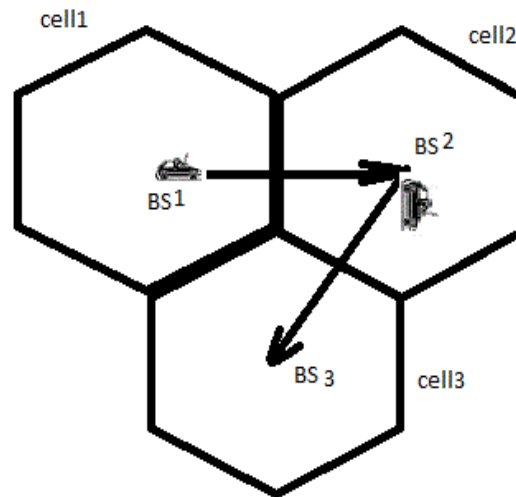


Fig2 Soft handoff

A three sector cells that are clustered are take into consideration which is uniformly distributed. From the above fig2 we see that the UE when travelling from one place to another it automatically changes the BS without interference. Every BS supports the link to be forwarded to the mobile. When the soft handoff channel increases the number of mobile channel decreases. The CDMA increases the proportion according to the cell sectors.

4. Effect of Soft Handoff

Soft handoff promises a better result in its performance when thought of hard hand off. The effect of soft handoff in system in sectorized and unsectorized cells is discussed below.

4.1 Sectorized Cell

The sectorized cell increases as compared to the number of sectors per cell[7]. In the CDMA system there are two types of handoff when the mobility takes place

- handoff between two sector in different cells
- handoff between two sectors within a cell

4.1.1 Forward Link Capacity Loss

For a sectorized antenna pattern whose patterns overlap at the boundaries the soft handoff is used and cannot be used by other hand offs. The antenna pattern does not fit perfectly into the sector which gives more interference in the forward and reverse links.

4.1.2 Forward – Link Capacity Gain

This is due to the macro diversity on the forward link. In CDMA forward link there is a gain of 21db(127chips)[7].

4.2 Unsectorized Cell

When the macro diversity is provided by the soft handoff the quality of joining the BS signal improves the reverse link. But it is difficult to join these signals at the MSC. To overcome this difficulty and combining scheme is utilized to select the frame which has the minimal number of errors. The link quality is improved as more users are accommodated.

4.2.1 Forward – Link capacity Loss

This is due to the application of soft handoff in the unsectorized cells.

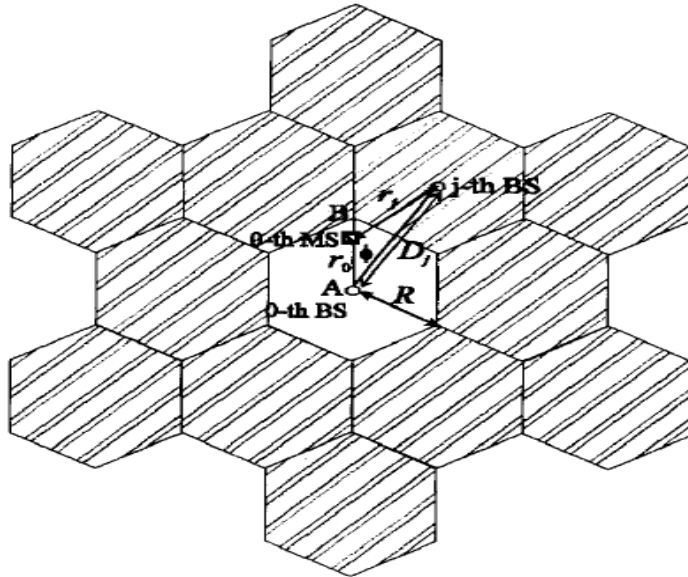


Fig3 -Forward Link interference from the nearby 12 co channel cells and Co channel cells are shown shaded[7].

4.2.2 Forward Link Capacity Gain

This is due to the macro diversity provided by combining the BS signals that are transmitted simultaneously which are much smaller than a single BS. The Gain in signal to interference ratio(SIR) increases the system capacity.

5. Conclusion

Soft handoff promises a better result in its performance when thought of hard hand off. The performance can be analyzed using simulations. It helps to improve performance but also causes dropping of call in voice services but it is considered for multimedia services where high data-rate is needed. It reduces delay. It is an intriguing technology. Soft handoff parameters have a much greater impact on data services. Increase in antenna at the base station increases the throughput and reduce delay significantly.

References

- [1] N.P.Singh, Brahmjit Singh, Effect of Soft Handover parameter on CDMA cellular Networks, Journal of Theoretical and Applied information Technology, 2005-2010
- [2] Qing –An Zeng and Dharma P. Agarwal, Handoff in wireless mobile networks, Dept of Electrical engineering & computer Science, University of Cincinnati, 2001
- [3] Performance Analysis Of Cellular CDMA in presence of beam forming and soft Handoff, S. D. Roy and S. Kundu, Progress In Electromagnetic Research, PIER 88, 73–89, 2008
- [4] V.K.Garg, IS-95 CDMA and cdma2000:cellular/PCS systems implementation, Engle Wood Cliffs, NJ: Prentice, 1999
- [6] Soft Handoff in CDMA systems, Krishna B Rao, Lakshmi Narayan Mishra, University of Texas, Dallas
- [7] Chin-Chun Lee, Member, IEEE, and Raymond Steele, Fellow, IEEE” Effect of Soft and Softer Handoffs on CDMA System Capacity” IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY, VOL. 47, NO. 3, AUGUST 1998.