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Efficient Cellular Network in Hybrid Channel Allocation Scheme by using Directional & Omni Directional Antenna

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Abstract

Today is the world of mobile and we need high speed without any break during call. As the traffic is increasing regularly day-by-day, and the available channels are also limited, the efficient utilization of channels is very much required. We can categories channel allocation schemes into three: fixed channel allocation, dynamic channel allocation and hybrid channel allocation called as FCA, DCA and HCA respectively. The overall channels are divided into two disjoint set, say S1 and S2, in hybrid channel allocation. The set of nominal channels (i.e. S1) is assigned to each cell, and this assignment is done on FCA basis. The set of remaining channels (i.e. S2) are kept in a central pool and these are assigned dynamically.This paper presents a study of hybrid channel allocation in which we suggest to give services to the user by directional and omni directional antennas. At the corner of the cell structure, we suggest giving service by using directional antenna and at the middle of the cell we can use the omni directional antennas. It will provide a better and efficient service to the end user.

Keywords: *BS – Base Station, MS- Mobile Station, MSC –Mobile Switching Center*

INTRODUCTION

Communication has been focus point for exchange of information between parties that are located physically apart. The telephones have replaced the traditional way of communication that is postal letters and the also telegrams. Also the term `mobile' has been A revolution in the communication systems as it has opened-up innovative applications that were limited to one's imagination. Since last two decades, mobile communication has become an integral part of our society. The Mobile communication systems have improved the way of living.There are two phases of channel allocation algorithm: 1) a channel acquisition phase and 2) channel selection phase. In channel acquisition phase the main task to gather information of free on hand channels from nearby cells. Within minimum reuse no same channel must be there. The channel selection phase chooses a channel from the number of available free channels. This phase is concern for better channel utilization in terms of channel reuse. In the first phase (channel acquisition phase) of the distributed dynamic channel algorithm, there are two approaches: 1) search and 2) update. In the search approach, any cell, if it needs a channel then it searches all of its interference neighbors to get the current free available channel set. This set is used to select one channel-by-channel selection schemes.In the update approach, every cell keeps with it, the information about channels which are free available. If a cell requires a channel, the channel selection scheme pickup one available channel and confirms with all of its interference neighboring cells whether it can use the selected channel or not.
If any cell acquires or releases a channel, at any time, then it informs to its interference neighbors. Hence, each cell in the system knows the channels that are available from its interference neighboring cell.
By doing The channel allocation schemes can be classified into three categories: 1) Fixed Channel Allocation (FCA), 2) Dynamic Channel Allocation (DCA) and 3) Hybrid Channel Allocation (HCA).

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Fixed Channel Allocation (FCA)

A set of channel is allocated permanently to every cell of the system. When any user requests a channel for communication, it searches the free channel in its own cell and if free channel is available, then it is assigned to the user otherwise the request will be blocked. In FCA strategy, every cell is assigned a fixed number of voice channels. A communication with a cell can only be made if there is an unused channel of that particular cell. Channel of a cell which is used are blocked and subscriber has to wait. The advantage of FCA is that it is simplest channel assignment strategy because it needs very simple circuitry. The downside of FCA is that it provides worst channel utilization. In FCA, a set of channels is enduringly given to each cell, as per the allowed reuse distance.

•Channel belong to the poll can we give service of channels of that particular cell.

• A call arriving in for a cell, and suppose there is no channel available, then it is first blocked and then cleared.

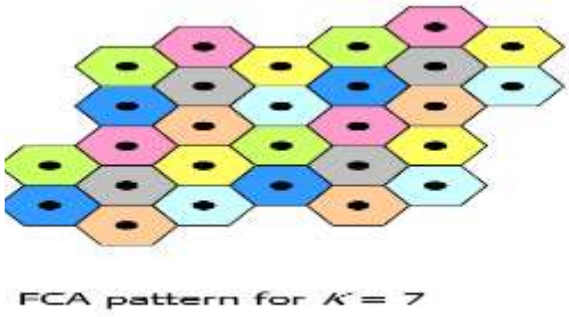

Fig1. Fixed Channel Allocation pattern for k= 7

Dynamic Channel Allocation (DCA)

In the DCA strategy, channels are assigned dynamically, when fresh calls come in the system. This is achieved by keeping all the free channels in a central pool. When a call is completed, the channel which is currently being used is returned back to the central pool. In this strategy channels are for the time being assigned for use in cells for the period of the call.Every time when any cell attempts to make a call, the corresponding Base Station (BS) requests a channel from Mobile Switching Center (MSC). The MSC then give a channel to the asking Base Station. When the call is over the give channel is go back and kept in a central pool.A channel that is being used by a cell can be simultaneously reassigned to another cell in the system, only if the space between the two cells is more than the minimum reuse distance. By doing so, we can avoid co-channel interference. DCA has less change of blocking then FCA. In DCA capacity of trucking increase of the network, because all the channels are available to all cells, hence DCA gives better quality of service. But in heavy traffic condition DCA results in heavy load on switching center.

Hybrid Channel Allocation (HCA)

The hybrid channel allocation (HCA) method is the grouping of fixed channel allocation (FCA) and dynamic channel allocation (DCA). In this, some of the channels are given permanently to all cell where as the other channels are owed dynamically. In HCA schemes, the overall channels that are available for service are divided into two sets:

1) fixed channels and 2) dynamic channels.

The dynamic set increase flexibility of the system and is shared by all users in the system.

The fixed set has 'nominal channels' which are permanently given to cells same like in the FCA schemes. The channels from this set, in all cases, are to be preferred for use by their respective cells

The overall performance of hybrid channel allocation scheme is intermediate between FCA and DCA schemes.

When any call requires service from a cell and if all the nominal channels of that cell are busy, the call is given to dynamic set.

Frequency Reuse

Method which reuses frequencies and channel in communication system to improve capacity and spectral efficiency is called Frequency reuse, or Frequency planning. Frequency reuse is one of the main concepts of wireless system.

In mobile cellular systems, Frequency recycles means frequencies are given to Frequency reuse technique of a cellular system.

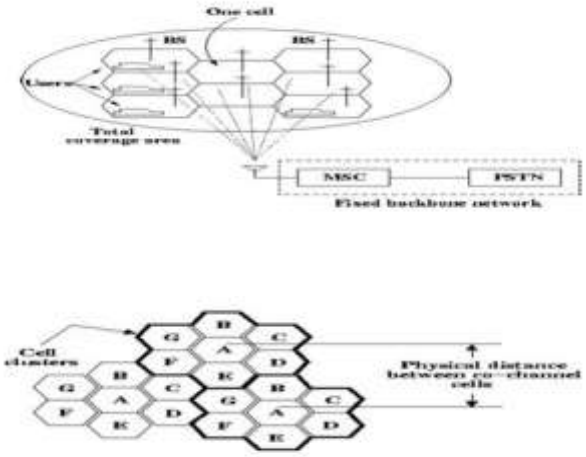

Fig2. - Basic Cellular Structure.

The service is reused in a usual pattern of cells, each enclosed by one base station. The repeating normal pattern of cells is called a 'cluster'. Two cells can reuse the same set of channels are at a suitable distance, called reuse distance, D, that allows tolerable levels of inter-cell interference.In a cellular system two cells can share the one channel given the distance between these cells is at-least the minimum reuse distance D_{min} [2]. If the distance between the two cells is less than the minimum reuse distance D_{min} , they cannot use the same channel because these cells will create interference. Such interference is known as co channel interference. Two cells C_1 and C_2 are called interference neighbors of each other, if geographical distance between them is smaller than the minimum reuse distance Dmin.

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Hando_ Process

In a mobile cellular system, channel shift from one base station to another for have a pair communication during their move from one cell to next with no interruption to the call. In other words, when a mobile station (MS) moves from one cell to another cell, during the conversation in progress, the mobile switching center. Hando_ is a process of auto transfer of call to a new channel without disturbing the chat by MSC. In any cellular system, hando_process is an important task and it must be performed successfully and the users must be unaware of this.

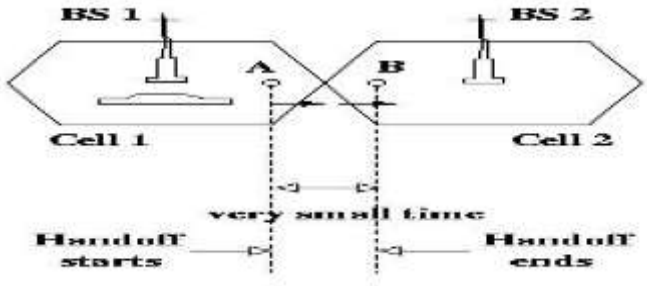

Fig.3 - A schematic diagram of hando_Process

In the mobile systems, the radio spectrum is limited source. It becomes more important to efficiently utilize the spectrum when some of the cells in the network become hot-spot. If the bandwidth available to any cell is not enough so as to sustain the users demand, in that case the cell becomes hot-spot and so the call is be blocked or dropped. The efficient utilization of the channels, improve system capacity. The channel transfer scheme allocates channels to all cells in such way that it reduce chance of call-blocking or call dropping and it also improve the quality of service. We can reduce the probability of call-blocking. For that we design hybrid channel allocation (HCA): a mix of both fixed channel allocation (FCA) and dynamic channel allocation (DCA).The simulation results have shown that the HCA scheme significantly reduces call-blocking probability in case of hotspot scenario i.e. a cell becomes hotspot. The cell which is hot-spot, will request for more than one channels to be allocated to it , and this demand is proportional to the level of hot-spot. A central pool is maintained for each channel which are not assigned to any cell, and on request from the hotspot cell, channels will be assigned. It helps to reduce the probability of call-blocking a cell becomes hot-spot.

The Hybrid Channel Allocation scheme using the Directional Antennas and omni directional antennas

The concept of employing the Dynamic channel allocation scheme with the primary goal of realizing the power consumption beginning at the Base Stations in the respected networks. In this research initiative, we have managed to use the advantages of directional antenna and hence concentrate the transmitted signals towards the intended users and thus reduce the transmission power need to transmit the signals to the users in the particular cellular network. Simulation has been with a system modeled designed and the situation with the Mobile Stations (MS) stationed at different positions and the over throughput and the power efficiency is estimated. This usage of directional antennas also provide for the effective cancellation of the interference resulting from the neighboring Mobile Stations. At any given instant the bandwidth in the available cellular system is the limited resource and this resource has to be effectively distributed and used efficiently and this thereby leads to the better performance of the cellular systems.

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The available total bandwidth is divided into the set of available carriers and they are further subdivided into channels which will be effectively used for the communication purposes. There are generally two types of channels which are namely the communication channels and the control channels and they are serving the two important purposes of communication transfer and the control information exchange and it is here that the channel allocation algorithm uses up the channel to transfer the channel control information.In cellular/mobile communication networks two different users can share the same channel if they are well separated by the minimum required distance which is referred to as the minimum reuse distance and otherwise the same channel cannot be used due to the existence of the co-channel interference. Hence the Base Station in the neighboring cells are required to assess the position from the other users and take care that the same channels is not used up for the transmission purposes which will lead to the bad performance of the overall system.

When a mobile station (MS) wants to access the channels in order to place calls then it first sends a request message to the Base Station then it becomes the responsibility of the Base Stations in order to allocate the channels following one of the three different types of channel allocation schemes. The clear difference between the three types is illustrated in the following Figure below

Omni Directional antenna and Directional Antennas in Hybrid channel allocation

In mobile communication system , an omni directional antenna is a class of antenna which radiates equal signal power in all directions perpendicular to an axis, with power varying with angle to the axis (elevation angle), declining to zero on the axis.

A beam or directional antenna is an antenna which receives or radiates with greater power in specific directions and allow increased performance with reduced interference from unwanted sources. Omni directional antennas can receive signals from all the directions equally good, whereas Directional antennas can receive signals from one direction only. Directional antennas can detect a weaker signal than an equivalent Omni directional antenna. Directional antennas do this by decreasing its ability to pull in signals from other directions.

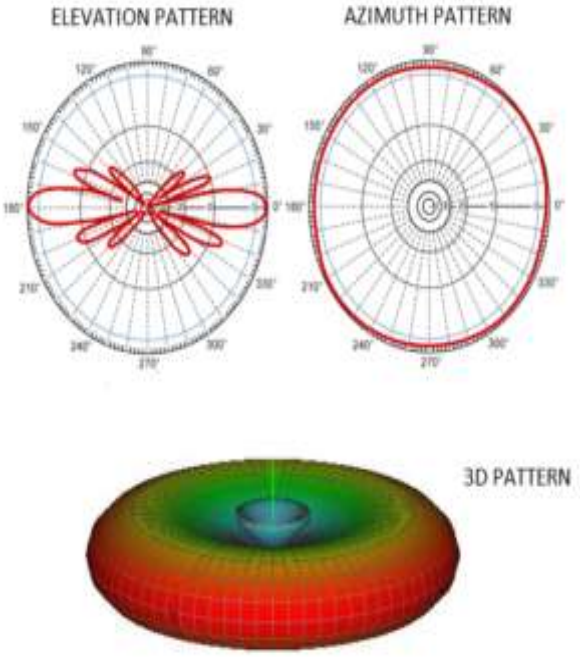

Fig.4- Antenna Radiation Patterns

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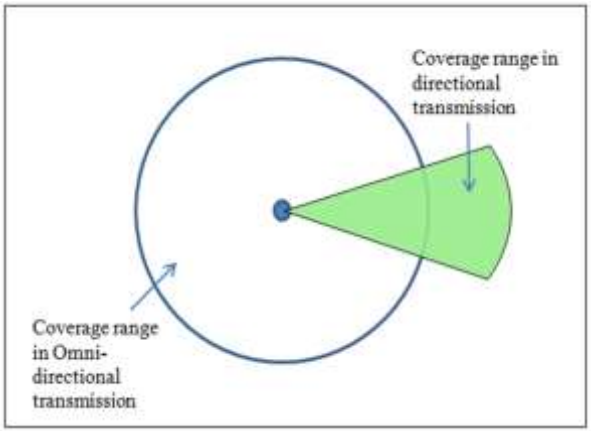

Fig.5- Coverage Range of Antenna

In our study we would like to give service to the user by both the antennas. At the corner of the cell structure we will give service by using directional antenna and at the middle of the cell we can use the omni directional antennas.

Conclusion and Future Work

In this Paper we had first try to define all the special type of channel allocation ie, Fixed channel allocation, Dynamic channel allocation and hybrid channel allocation. Then we had focus on hybrid channel allocation on which we had done descriptive study of hybrid channel allocation using omnidirectional and Directional Antenna. In our study we had found that a frequency within the cell of a network can we utilized relevantly and also we can make efficient cellular network if we use both the antenna. We will use directional antenna at the boundary of each cell so that we can use its features more affectively at the boundary and omnidirectional antenna at the center of our cell so that it provides its better service at the center of our cell.
In Future work we will work on the simulator METLAB to find the calculated value for this hypothesis with will provide us the clear picture of our study. There may be many drawbacks for using this antenna we can work on that.

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