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Channel assignment strategy by means of using feasible expectation technique in cellular network

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Abstract
Channel assignment in a particular cell is very critical. How the channels are to be assigned for simultaneous use in different cells directly affects the throughput of such system. In this paper we proposed a new approach to assign the channel in a particular cell in which we combine the benefits of probability channel reservation scheme and the channel borrowing scheme. The objective is to make observations about how the performance of the system can be improved.

Keywords: channel assignment, cells, cellular network

1. Introduction
As a mobile station (MS) moves from one cell to another, its ongoing call is handed-off from the old cell to a new cell. This requires that the call be accommodated by the new cell. Since dropping a handoff call is more annoying than blocking a new call from user's perspective, handoff calls should be given higher priority than new calls. It has been shown that the method by which handoff is achieved has a significant impact on the network's performance [8]. Due to the inherent bandwidth limitation in wireless cellular networks, micro/pico cellular architectures are attractive for achieving higher system capacity [9].

2. The Handoff Mechanism
Handoff is a process whereby a MS communicating with one BS is transferred to another BS during a call. Cellular systems deploy smaller cells in order to achieve high system capacity due to the limited spectrum. The frequency band is divided into smaller bands and those bands are reused in no interfering cells [1-3]. Due to the smaller cells an active mobile station (MS) move to several cells during an ongoing conversation. This active call should be transferred from one cell to another one in order to achieve call continuation during boundary crossings. Handoff (or handover) process is transferring an active call from one cell to another. The transfer of current communication channel could be in terms of time slot, frequency band, or code word to a new base station (BS) [1-4]. If new BS has some unoccupied channels than it assigns one of them to the handed off call. If all of the channels are in use at the handoff time there are two possibilities: to drop the call or to delay it for a while. Different handoff techniques are proposed in literature and two of the most important metrics for evaluating a handoff technique are forced termination probability and call blocking probability. The forced termination probability is the probability of dropping an active call due to handoff failure and the call blocking probability is probability of blocking a new call request [2, 5-6]. The aim of a handoff procedure is to decrease forced termination probability while not increasing call blocking probability significantly.
In the early mobile telephone systems handoff capability was not provided. Handoff was first used by the AMPS system, then renamed handover by the European systems.

3. Channel Assignment Strategy
Channel assignment refers to the allocation of specific channels to the cell sites or the mobile units. How the channels are to be assigned for simultaneous use in different cells directly affects the throughput of such system. In selecting a channel assignment strategy, the objective is to achieve a high degree of spectrum utilization for a service.

4.1 Fixed Channel Assignment (FCA) Strategy
4.1.1 Basic Fixed strategy
In this strategy each cell has a permanent assignment of a set of channels and the same set of channels reused some distance away. Using the fixed channel assignment (FCA) strategy, an arriving call can only be served by the permanent set of channels. If all permanent channels are occupied, new calls are blocked.

4.1.2 Simple Borrowing Strategy (SBS)
In the simple borrowing scheme a channel set is nominally assigned to each cell. When a call arrives in a cell, a set of nominal channels is assigned to serve the call. If all nominal channels are busy, a nominal channel of the neighboring cells is borrowed to serve the call, if that borrowing does not interfere with existing cells, otherwise the call is blocked. The simple borrowing scheme gives lower blocking than the fixed assignment scheme under light and moderate conditions. In heavy traffic conditions the channel usage efficiency drops drastically, causing a rapid increase in blocking probability.

4.1.3 Hybrid Assignment Strategy (HAS)
Combining the advantages of the simple borrowing scheme and fixed channel assignment scheme a hybrid assignment

scheme (HSA) was proposed. In the hybrid assignment scheme the set of nominal channels assignment to each cell is divided into two subsets A and B. subset A can be used only locally i.e. with in the cell while other can be borrowed.

4.1.4 Borrowing with Channel Ordering (BCO) Strategy

Borrowing with Channel Ordering strategy has the two distinct features. One is the ratio A/B (A and B denote the number of elements in subsets A and B repectively) automatically varies according to traffic load. Second all nominal channels are ordered such that the first channel has the highest priority to be assigned to the next local cell, and the last channel is given the highest priority to be borrowed by the neighboring cells. In BCO strategy, after a channel is borrowed it is locked in the co-channel cells within the channel reuse distance of the borrowing cell. By locking means that the channel can neither be used to serve a call nor it can be borrowed. BCO strategy has the lowest call blocking under all traffic conditions.

4.2 Flexible Channel Assignment (FCA) Strategy

Flexible channel assignment strategy is essentially a form of fixed channel assignment where the fixed assignment is altered regularly according to predicted change in the traffic load. The MSC hold a set of flexible channels and assign these to those cells whose permanent channels have become inadequate under increasing traffic load. The distribution of these emergency channels among the cells in need of them is carried out by the MSC in either on a scheduled or predictive manner.

4.3 Dynamic Channel Assignment (DCA) Strategy

In dynamic channel assignment, channels are assigned to cells only when they are required, and thus the assignment changes dynamically with real time traffic load. In dynamic assignment strategies cells have no channels to themselves but refer all call attempts to the MSC, which manages all channel assignment in its region. Each time a call attempts arrives the base station (BS) asks the MSC for the channel with the minimum cost to be assigned. The MSC decides on a call-by-call basis, which channel to assign to which call attempt by searching for the available channel for which the cost function is minimum.

5. Related work

All channel assignment strategies having some merits and demerits. Cheaper base station equipment, mobile cellular networks are increasingly adopting pic / microcelluluar architectures. The smaller cell size however lead to increased handoff as user move from one pico cell to another during the course of a typical call connection. Thus it is important assign that efficient channel assignment schemes be design to handle the frequent handoff events in such network. In this we have use the concept of the probability

Assumptions

a. The cellular layout is consider hexagonal with cell radius equal to R.
b. The maximum number of full duplex channel is C
c. The new call arrival and handover call arrival process is Poisson.
d. Block calls are cleared.

Each cell is assigned a set of frequency channels and must deal with two types of calls, one is new call and second is handoff calls. Handoff calls refer to an ongoing call which is transferred from one cell to another due to mobility. The proposed scheme works in a fixed channel assignment environment. Each cell has a fix no of channel to support the new and handoff calls. Handoff calls will be handle according to probability. In this scheme base station calculate the handoff probability of a call to enter in its adjacent cell. After calculation the handoff probability base station transfer it to the Mobile Switching Center (MSC). Mobile Switching Center assigns the channel for the handoff calls based on that calculated handoff probability. Here allotment of the channels for handoff calls will be at three level

1. Allotment of reserve channels for handoff call if available
2. Allotment of free channels for handoff calls if all reserve channels are busy
3. Allotment of borrow channel (Channels which borrow from neighbor cell) if all reserve channels and all free channels are busy.

Possible cases

a) If all neighbor cells have reserve channel

Here we assume seven frequency reuse plan. Suppose a call arrives in a cell, then that cell has the six neighboring cells and the call can be enter into any one out of six neighboring cell depend on the mobility. So handoff probability will be 1/6 to enter into one neighboring cell. If all the neighboring cells have the available channel then adjacent cells reserve the channel according to the probability. Suppose there are 30 channels available in each cell then 5 channels will be reserve to handle the handoff calls remaining channel 25 will be for the new calls.

Table 1

Cells	Available Channel	Handoff probability	Reserve Channel for New call	Reserve Channel for Handoff call	Borrow Channel
1	30	1/6	25	5	Nil
2	30	1/6	25	5	Nil
3	30	1/6	25	5	Nil
4	30	1/6	25	5	Nil
5	30	1/6	25	5	Nil
6	30	1/6	25	5	Nil
7	30	1/6	25	5	Nil

In this case if a call arrive in a cell and that call moves into neighboring cell then reserve channel for handoff calls will be allotted to it. In this case we assume that reserve channels for handoff calls are available.

b) If some neighboring cells have all busy reserve channel for handoff call

Suppose some calls enter in a cell and neighbor of this cell cell 2 and cell 5 have not any free reserve channel for that call

then that call will be handle by the free available channel in these cell (reserve channel for new call).

Table 2

Cells	Available Channel	Handoff probability	Reserve Channel for handoff call	Reserve Channel for New Call	Borrow Channel
1	30	1/6	5	25	Nil
2	30	1/6	All busy(5)	25(Allot from here)	Nil
3	30	1/6	5	25	Nil
4	30	1/6	5	25	Nil
5	30	1/6	All busy(5)	25 (Allot from here)	Nil
6	30	1/6	5	25	Nil
7	30	1/6	5	25	Nil

c) If All Reserve Channels for Handoff and all Reserve Channels for New calls are busy

It is also possible that in some cells all reserve channels for the handoff calls and for the new calls are reserve. In this case that particular cell will borrow the channel from neighboring cell. For example suppose in cell 2 and cell 5 all channels are busy for handoff and for new call. In this case these cells borrow the channels from the neighboring cells.

Table 3

Cell	Available Channel	Handoff Probability	Reserve Channel for Handoff call	Reserve channel for New call	Borrow Channel (B)
1	30	1/6	5	25	
2	30	1/6	5(All busy)	25(All busy)	B(Allot from here)
3	30	1/6	5	25	
4	30	1/6	5	25	
5	30	1/6	5(All busy)	25(All busy)	B(Allot from here)
6	30	1/6	5	25	
7	30	1/6	5	25	

6. Conclusion

In this paper the proposed new approach to assign the channel in a particular cell in which we combine the benefits of probability channel reservation scheme and the channel borrowing scheme. Performance of the system can be improved by using the proposed channel assignment scheme because in this case call will be block after the three level.

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