[International Journal of Communication Networks and Security](https://www.interscience.in/ijcns)

Volume 2 | Issue 1 Article 4

January 2013

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Abstract- In cellular communication networks, the geographical area is divided into smaller regions, called cells. In each cell, there is one Mobile Service Station (MSS) as well as a number of Mobile Hosts (MH). The communication between MSSs is, in general, through wired links, while the links between an MH and MSS is wireless. A Mobile Host can communicate with other Mobile Hosts in the system only through the Mobile Service Station in its cell. This kind of architecture is shown in Fig. 1. There are two kinds of channels available to an MH: communication channel and control channel. The former is used to support communication between an MH and the MSS in its cell, while the latter is set aside to be used exclusively to send control messages that are generated by the channel allocation algorithm.

1.INTRODUCTION

In this paper, henceforth, unless specified otherwise, the term channel or wireless channel refers to a communication channel.

When an MH wants to communicate with another MH, it sends a request message to the MSS in its own cell. The request can be granted only if a wireless channel can be allocated for communication between MSS and MH. Since channels are limited, they should be reused as much as possible. But, a channel cannot be used at the same time by two cells if they are within a threshold distance called the minimum channel reuse distance (Dmin), because it will cause interference. Such an interference is called co channel interference. A cell, say Ci, is said to be an interference neighbor of another cell, say Cj, if the distance between them is less than Dmin. So, if a channel r is used by a cell Ci, then none of the interference neighbors of Ci can use r concurrently. If using a channel in a cell causes no interference, then we say that this channel is available for the cell. When an MH needs a channel to support a call, it sends a request message to the MSS in its cell through a control channel. When the MSS receives such a message, it tries to assign a channel using a channel allocation algorithm.

2. LITERATURE SURVEY

Two basic approaches to channel allocation are as follows:

1. Centralized approach: In centralized approaches , request for channel is sent to and processed by a central controller, called Mobile Switching Center (MSC). MSC is the only one that has access to system wide channel usage information. It allocates Channels and ensures no co channel interference occurs. But, this approach is neither scalable nor robust because the MSC could become a bottle-neck when the traffic load is heavy and the failure of the MSC will bring down the entire system.

2. Distributed approach: In distributed channel allocation algorithms, there is no central controller such as MSC. The MSSs share the responsibility to allocate channels. Each MSS makes decision independently based on its local information. They exchange information if necessary, in order to compute the set of available channels such that using them causes no co channel interference. In a distributed channel acquisition algorithm, one of the following two approaches is usually adopted: On demand/ reactive approach and Proactive approach.

On demand/reactive approach, when a cell needs a channel to support a call, it first checks whether there are available channels in the set of channels allocated to it. If such channels exist, then it picks one such channel to support the call. Otherwise, it sends messages to its interference neighbors, asking for their channel usage information. Based on the information received in the replies, it computes the set of available channels. It picks an available channel r using channel selection algorithm in such a way that using r achieves a good channel reuse pattern, and sends messages to its interference neighbors to borrow that channel. If all the neighbors to whom that channel has been allocated agree to lend that channel, the channel borrowing process is complete. Proactive approach: A cell notifies its interference neighbors about the channel usage information whenever it acquires or releases a channel.

So, each cell is always aware of the set of available channels. When it needs a channel, it just picks one of the available channels using the underlying channel selection strategy and uses it to support a communication after ensuring that none of its neighbors are using that channel. Most algorithms using On demand/reactive approach require that a cell that wants to borrow a channel (we call it borrower hereafter) needs to get reply from each interference neighbor before using a channel. Under this approach, even if one of the neighboring cells has failed, a channel cannot be borrowed and, hence, this is not fault tolerant. The main contribution of this paper is that we propose a distributed and fault-tolerant channel allocation algorithm which reuses channels efficiently.

2. PROBLEM FORMULATION & METHODOLOGY

This project analyzes a channel allocation algorithm in a cellular network. The system has been designed with focus on centralized approaches to allocating channels. But, centralized approaches are neither scalable nor reliable. Recently, distributed dynamic channel allocation algorithms have been proposed, and they have gained a lot of attention due to their high reliability and scalability. But, there is a need of algorithm that is fault-tolerant and makes full use of the available channels. It can tolerate the failure of mobile nodes as well as static nodes without any significant degradation in service.

2.1. THE CHANNEL SELECTION STRATEGY

When a cell Ci, which wants to borrow a channel from its neighbors, receives replies from neighbors, it begins to compute the set of channels which it can borrow. The goal of the channel selection strategy is to select a channel in such a way that selecting this channel will cause least interference to neighbors, thus maximizing the channel utilization. We adopt a priority-based strategy to assign each channel a priority. The cell Ci always selects the channel with the highest priority to borrow. Next, we explain how to compute the priority for each channel. For each primary channel r of cell Cj, Cj keeps track of the set of cells which borrowed r successfully from it and have not released r yet. When Cj receives a request message from Ci (i.e., Cj and Ci are interference neighbors), it computes the set of primary channels which can be included in the reply message to Ci. If it is using a primary channel r, or it has lent r to a neighbor Ck such that Ci and Ck are neighbors, then r will not be included in the reply message to Ci, thus, Ci will not be able to borrow r. Otherwise, Cj assigns a priority to primary channel r and includes r in the reply message to Ci. The priority of a primary channel r is assigned by Cj in the following way:

1) If Cj has lent r to some neighbors, and none of them is a neighbor of Ci, then it assigns a high priority H to r, i.e., Pr (j) = H
2) If Cj has granted some neighbors' request for the same primary channel r, and at least one such neighbor is a neighbor of Ci, then it assigns a low priority L to r, i.e., Pr (j) = L
3) If primary channel r is an available channel in Cj (i.e., Cj neither lent nor granted r to any of its neighbors), then Cj assigns medium priority M to r, i.e., Pr (j) = M (where H >>M > L).

By following the rules mentioned above, a cell Cj always encourages a neighbor Ci to borrow a primary channel r which it has already lent to a noninterference neighbor of Ci, because Cj cannot use r anyway. If Ci borrows r from Cj, then this borrowing does not cause more interference to Cj. At the same time, Cj discourages Ci to borrow a primary channel r which it has already granted to a neighbor Ck's request for the same channel r, where Ck and Ci are neighbors. The goal is to minimize the degree of contention.

2.2. ALGORITHM EXPLANATION

The proposed a fault-tolerant channel allocation algorithm for cellular networks, assumes the Resource Planning Model is used and adopts a proactive approach. In each cell, the primary channels have higher priority to be allocated.

a) When Ci needs a channel to set up a call: It computes Freei. If Freei = null, then Ci sets a timer and sends a request to each cell Cj belongs to INbi. Else, a channel r belongs to Freei is picked to support the call and added to Ui. When the call terminates, r is deleted from Ui.

b) When Ci receives a request from Cj: It computes Ri. If Ri not equal to null, then sends reply(Ri) to Cj; else discards the request.

c) After Ci gets reply from all its interference neighbors or times out: It sets a new timer, sets Availi = null, and does the following:

(c.1) For every r , Availi = Availi U {r} if the following two conditions are satisfied:

1. r does not belong to Ui (i.e., r is not being used by Ci);
2. For every Cj belongs to IPCi®, Ci got reply(Rj) and r belongs to Rj.

(c.2) If Availi not equal to null, then a channel r belongs to Availi is picked as per the channel selection strategy and Ci sends a transfer(r) to all cells in IPCi®. Otherwise, the call is dropped.

d) When Ci receives a transfer(r) message from cell Cj:

(d.1) It computes Freei. If r belongs to Freei, then Ci sends Granti(r) to Cj and adds Cj to Granti(r).

(d.2) Else if r belongs to Ui or Lenti(r) ∩T INbj not equal to null, then Ci sends a refuse(r) to Cj.

(d.3) Else let S = Granti(r) ∩INbj. If S = null, then Ci sends a grant(r) to Cj and adds Cj to Granti(r).

(d.4) Else if for every Ck belongs to S, Cj's request timestamp is less than that of Ck's request, then Ci sends a conditional_grant(S,r) to Cj and adds Cj to set Granti(r).

Otherwise, Ci sends a refuse(r) to Cj.

e) If Ci receives responses to its transfer(r) message from each cell in IPCi(r) before the timer expires, it checks for the following three conditions:

(e.1) Each response is either a grant(r) message or a conditional_grant(S,r) message.
(e.2) There is at least one grant(r) message.
(e.3) For every Conditional grant(S; r) and for every Cj belongs to S, a grant(r)from some Ck has been received by Ci, where Ck belongs to (IPCi(r) ∩ IPCj(r)).
If E.1, E.2, and E.3 are met, then Ci sends use(r) to each Cj 2 IPCi(r) and uses channel r to support the call. r is added to Ui. When the call finishes, Ci removes r from Ui and sends release(r) to each Cj belongs to IPCi(r).

3. WORK DONE

3.1. PREVIOUS WORK

The channel allocation algorithm in cellular network follows the centralized approaches, request for channel is sent to and processed by a central controller, called Mobile Switching Center (MSC). But, this approach is

- neither scalable nor robust because the MSC could become a bottle-neck when the traffic load is heavy
- And the failure of the MSC will bring down the entire system.
- Bad performance
- It will not co operate with failure of MSC case
- MSC make use of static information

3.2. PROBLEM RECOGNITION

Centralized approach: In centralized approaches, request for channel is sent to and processed by a central controller, called Mobile Switching Center (MSC). MSC is the only one that has access to system wide channel usage information. It allocates Channels and ensures no co channel interference occurs. But, this approach is neither scalable nor robust because the MSC could become a bottle-neck when the traffic load is heavy and the failure of the MSC will bring down the entire system.

4.PROPOSED SYSTEM AND DESCRIPTION

In this project we are focused on the channel allocation issues in cellular networks where the Base Stations (also known as Mobile Service Stations) are mobile. This imposes more challenges since the neighborhood information changes dynamically. Here, we restrict our discussion to channel allocation in cellular networks where mobile service stations are static. We also discuss dynamic load balancing strategy for the channel assignment problem in cellular mobile environment. The proposed algorithm: load balancing with selective borrowing (LBSB) is a centralized approach. In this algorithm, a cell can be classified either as a hot or a cold cell according to the value of its degree of coldness. The degree of coldness of a cell is defined as the ratio of number of available channels in this cell and the number of channels which have been allocated to this cell beforehand. The goal of the algorithm is to migrate unused channels from cold cells to hot cells. This algorithm solves the teletraffic hot spot problem in cellular networks. A hot spot is defined as a stack of hexagonal rings of cells and is termed complete if all the cells within it are hot. Load balancing is achieved by using a structured channel borrowing scheme, in which a hot cell can borrow channels only from adjacent cells in the next outer ring. Thus, unused channels are migrated into a hot spot from its peripheral rings. We have to check whether a cell needs to borrow a channel, it has to wait until it gets reply messages from all its interference neighbors.

The proposed a fault-tolerant channel allocation algorithm for cellular networks, assumes the Resource Planning Model is used and adopts a proactive approach. In each cell, the primary channels have higher priority to be allocated. When a cell Ci needs a channel, it selects an available channel r. If r is a primary channel, then it marks r as a used channel, and informs all of its interference neighbors about this. If r is a secondary channel, then it sends a request message to each interference neighbor which has r as a primary channel. If all these neighbors agree to lend channel r to Ci, then Ci can use the borrowed channel r. Otherwise, Ci needs to find another secondary channel to borrow. Whenever a cell acquires or releases a channel, it informs all its interference neighbors about this. Due to this proactive approach, the algorithm achieves short channel acquisition delay at the expense of higher message overhead. The algorithm is fault tolerant because the number of Ci's interference neighbors which have r as a primary channel is small, compared to the total number of Ci's interference neighbors. In order for cell Ci to borrow a secondary channel from neighbors, Ci does not need to receive reply message from all of its interference neighbors. Even when most of Ci's interference neighbors fail, Ci may still be able to borrow channel r as long as its neighbors which have r as a primary channel do not fail and r is not being used by these neighbors.

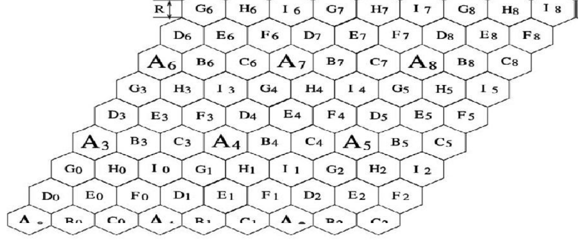

Fig: Partition of cellular network

In our proposed algorithm, we use the Resource Planning Model (shown in Fig. 2). Each message is time stamped. Outdated messages can be detected by comparing timestamps and discarded. For each primary channel r of cell Ci, Ci keeps track of the set of cells which borrowed the channel r successfully from Ci and have not released it yet. When cell Ci needs a channel to set up a call, it assigns a primary channel to support the call if there exists such a primary channel. Otherwise, it sends request message to all its interference neighbors. When such a request message is received, each cell Cj (j not equal to i) will check whether a certain primary channel r can be included in its reply message.

5. CONCLUSION

Distributed dynamic channel allocation algorithms have gained more attention because of their high reliability and scalability. However, some of them did not address fault tolerance issues very well. Most of them did not make full use of the available channels. In this paper, we proposed an efficient fault-tolerant channel allocation algorithm which makes efficient reuse of channels. Under our algorithm, a cell that tries to borrow a channel does not have to wait until it receives a reply message from each of its interference neighbors. A cell can borrow a channel as long as it receives reply messages from each cell in a subgroup in its interference neighborhood and there is at least one common primary channel which is not being used by any cell in this subgroup. Moreover, the channels are reused more efficiently.

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