Adaptive Distributed Dynamic Channel Allocation for Wireless Networks

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COSC6490A Concurrent Object Oriented Programming

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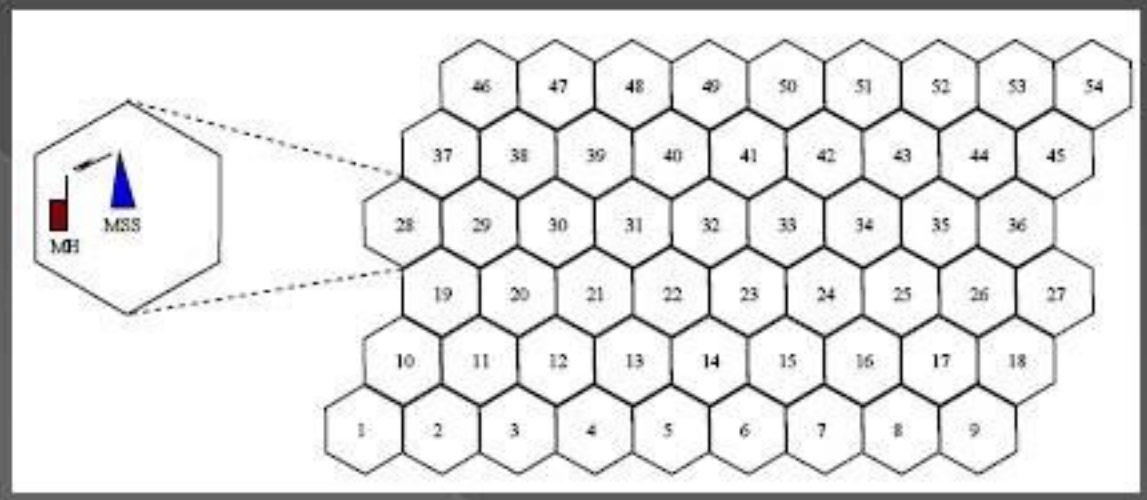
Introduction

Introduction

- Radio spectrum is scarce resource in wireless networks.
- Efficient use of bandwidth is essential for supporting large number of mobile users in cellular network.
- In order to reuse radio spectrum, the current wireless systems use a cellular architecture.

Cellular Architecture



- Geographical area is divided into several coverage area called CELLS.
- Radio spectrum is divided into number of wireless communication CHANNELS.
- Each cell have mobile service station (MSS) and multiple mobile hosts (MH).

Cellular Architecture

- MSS1 finds free channel using channel allocation procedure.
- MSS1 informs MH1 which channel to use.
- MH1 starts using the channel for communication.
- After channel is utilized

Cellular Architecture

- If MH1 travels and moves out of cell1 and enters cells2.
- Old channel in cell1 is released and new channel in cell2 is allocated.
- This released channel of cell1 can now be reused by other mobile host MH.

Distributed Dynamic Channel Allocation Scheme

- Search Scheme
- Update Scheme

Search Scheme

- When cell needs a channel, it sends a request message with time stamp to all neighbouring cell to find the set of currently available channels.
- it then picks one available channel after receiving the response from every cell.
- Cell which is currently searching for a channel postpones the response to any request message with a higher timestamp than its request message until it has completed its search.
- i.e. every new search is postponed until previous are finished.

Update Scheme

- Every cell maintains information of channel used in its neighbouring cells.
- When a cell need a channel, selects free channel, and REQUEST permission with time stamp from neighbouring cells.
- Uses channel only after receiving permission from all neighbouring cells.
- Before using the channel, cell sends acquisition message to update used channel information on all neighbouring cells.

Update Scheme Cont.....

- On waiting for permission, if another cell request for same channel.
- It responds REJECT if its with greater timestamp .
- Responds GRANT with less timestamp and abort its own request.
- It then attemps to acquire another free channel.

Scheme used in this algorithm....

- In the Algorithm to be discussed, uses update scheme or search scheme based on:-

- Number of free available channels
- And number of attempts it has made to acquire channel.

Algorithm

Initially

- Each cell[i] in the system is assigned a set of primary channels PR[i].
- Each cell is in local channel selection mode i.e. have primary channel to acquire.

Local Mode

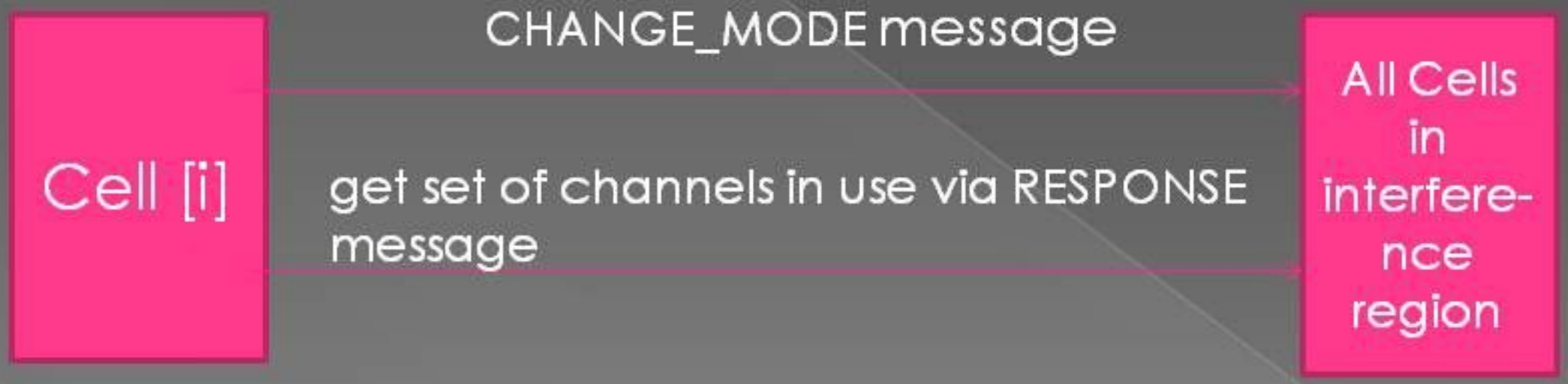
On acquiring channel sends
ACQUISITION message

On releasing channel sends
RELEASE message

- Multiple requests can proceed in parallel, there is no deadlock.

Borrowing Mode

- Number of free primary channels fall below a some threshold based on the channel consumption rate.



Borrow a Channel

- Cell [i] selects one of the free channels r.
- It queries interfering neighbouring cells for permission to use r.
- Borrowing SUCCESS receives grant RESPONSE message from all the cells in IN.
- After communication is over, RELEASE message is sent to all the cells that had sent grant message.

Borrow a Channel

- Borrowing FAILS → receives reject RESPONSE message from one or more cells in IN and tries to acquire another channel.

- In order to bound number of failure or attempts in borrowing update mode, a cell enters borrowing search mode after some predefined n rounds.

- cell in borrowing search mode guarantees that a it will acquire a free channel if there is one available.

Conditions

- Any cells[i] postpones all search or update request with higher timestamps.
- A cell in local mode postpones it's local request with a higher timestamp till an ACQUISITION message for the search request with a lower timestamp is received.
- Thus all requests from cells in an interference region are sequentialized with respect to their timestamps avoiding deadlock.

Conclusion

Conclusion

- No two interference neighbourhood cells acquire same channel.
- The algorithm is deadlock free.

END

Thank You

Questions?