

## Unit II

### Introduction to Cellular concept.

During the Early days of Radio Systems, large coverage area was achieved by a using a single high powered transmitted & antenna mounted on top of tall building.

→ This gave good coverage but was inconsistent to reuse the available frequency & attempt to reuse to give good interference.

→ Also the support for simultaneous calls was limited & regulator agencies which used to allocate the spectrum did not allocated the same in looking with available technology.

→ Hence it become necessary to restructure the limited Radio System spectrum & at the same time cover the large areas. The cellular this problem of spectrum congestion & also the user capacity.

cellular system for mobile communication. Each transmitted typically call a base station covers a certain area, a cell radii can

vary from 10's of meter in buildings, 100's of meters in cities, upto 10's of km's in countryside. The shape of cells are never perfect circles or hexagone, but depend on environment (buildings, mountains, valleys) on whether condition & some times even on system



load. typical systems using this approach are mobile telecommunication systems.

where a mobile station within the cell around the base station communicates with this base station & vice versa.

Advantages of cellular systems with small cells

- 1) higher capacity
- 2) less transmission power
- 3) local reference only
- 4) robustness

Disadvantages

- 1) infrastructure needed
- 2) handover needed
- 3) frequency planning

hand off strategies in MC when a mobile moved into different cells while conversation is in progress. The MSC automatically transfer the call to the new channel belonging to the new base station. This process of transferring the channel between the two cells is called hand off.

This hand off strategy in MC is not



New

only involves identifying a base station but also requires that the voice & control signals be allocated channels associated with the new base station. This part include mobile & wireless comm? Nodes on various handoff strategies in MC.

## Operations on cellular systems

The op<sup>n</sup> of cellular mobile systems can be described as 5 major functionalities & 4 additional utilities. all the functions together make accomplish mobile cellular system.

### 1) Mobile unit initialization

(a) when MUE is turned on, it scans & selects the strongest setup control sys channel used for sys

(b) cell with the different frequency bands repeatedly broadcast on different setup channels.

(c) The receiver select the strongest mue & monitors that channel. with this station has automatically select the BS antenna of the cell



within

vehicle it will operate

(e) Then the handshake takes place b/w the mobile unit & MTSO (mobile telephone switching office) controlling the cell through the BS in this cell.

(f) Handshake is used to identify the user & register its location.

(g) As long as the mobile system is on, scanning is repeated periodically, account for the motion of unit.

(h) If the unit enters the new cell, then the new BS is selected.

(2) Mobile originated call

(a) A MU originates a call by sending the no<sup>n</sup> (MIN - mobile identification no<sup>n</sup>) of the called unit on the pre-selected set up channel.

(b) The receiver of MU checks if the forward channel is idle.

(c) If idle the mobile may transmit over the reverse channel (BS)



- (d) BS sends request to the MTSO
- (e) MTSO attempts its complete connection
- (f) MTSO sends a paging message to a certain BS depending on called no. No
- (g) BS sends paging signal on its own assigned setup channel.

### (3) Call accepted

- (a) called M.U. recognises it no<sup>v</sup> on the Setup channel being monitored & responds to that BS which sends the response to the MTSO
- (b) MTSO set up a circuit b/w calling & called BS.

(c) MTSO selects available traffic channel within each BS's (Base Station) & notify each BS which in turn notify its M.U. (a data message called Alert is transmitted over FVC (First Virtual Machine comm<sup>m</sup> instruct the mobile to ring).

(d) The two M.U. tune into their respective channels.



④ On going call

(a) while connection is maintained  
two MS Exchange voice or mobile  
data through BS & MTSS

⑤ Handoff (Europe country)

(a) MS moves from range of one cell  
to another the traffic channel has to  
change

(b) system makes this change without  
either interruption or called or  
alerting the user

⑥ Blocking start call  
if cell the traffic channel  
are busy. Even after multiple attempts  
a busy tone is returned

⑦ Call transmission  
when one of the user hangs up  
MTSS is in form of and the traffic  
channel are released

⑧ Call drop  
during the connection of because



of interference or weak signal spots the BS can't maintain the minimum required signal strength for a certain period of time, the traffic channel is chopped & MTSO is informed.

③ Call to form:- MTSO connects to the PSTN then fixed remote it can set up calls b/w the mobile user in its area & fixed subscribers via the telephone network of a remote MTSO.

## Planning a Cellular System

In general the planning process starts with the inputs from customer

### 1. Cellular Network frequency planning

The designing process of selecting & allocating the channel for all cellular BS within a system is called frequency ~~reuse~~ reuse or frequency planning. It is an immortal area increase efficiency & quality of the service by optimally using the frequency band.

The customer inputs include customer requirements, business plan, system characteristics & no. of constraints



the target of frequency & interference planning is to minimize the interference at an acceptable capacity level, which has been agreed by the customer after planning system is implemented. The assumption made during the planning process need to be validated & corrected wherever necessary through an optimization process. frequency planning should not take place before the candidate sites have been finalized for complete area.

In 2G Network cell sites are placed & configured manually all by cell in coverage first capacity after manner but with the results are not optimal. In 3G Network a jointly used frequency bands & coverage depends on location & density of mobile users as well as on interference of adjacent cell sites. Thus the deployment of site & its equipment config highly affects the service quality of adjacent cells.

The overall planning process can be divided into 4 parts

- 1) frequency planning
- 2) capacity planning
- 3) coverage planning
- 4) optimization



## Analog Cellular Systems

Entity Nippon Telephone & Telegraph in Tokyo started the first commercial analog cellular system on December 1979. In 1981 the commercial mobile telephone system NMT system was started in Nordic countries although there was a advanced mobile phone system (AMPS) test system operating in 1979. The first commercial AMPS system was not introduced in US until 1983.

The 1st gen<sup>n</sup> of cellular systems used analog radio technology. Analog cellular systems consist of 3 basic elements.

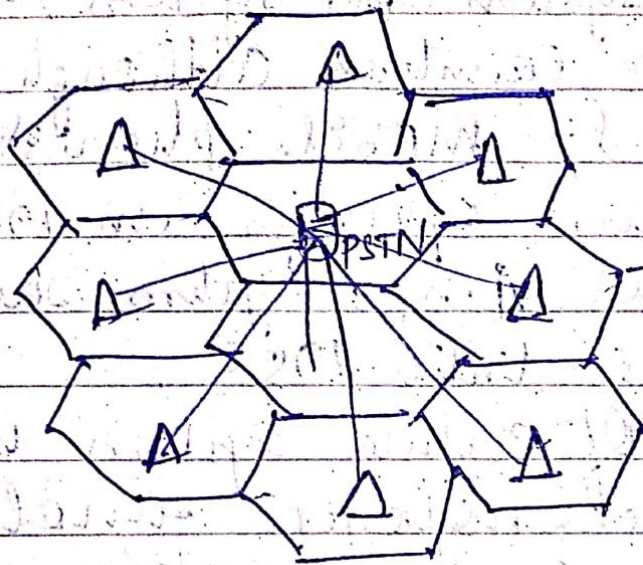
1) mobile telephone (mobile Radio)

2) cell sites

3) MSC Fig shows basic cellular systems in which a program geographic service such as city is divided into smaller radio coverage area cells. A mobile telephone communicates by radio signals to the cell sites within a radio coverage area. These cell sites connect these radio signals for transfer to MSC via wired (land line) or wireless (microwave) communication links.



The MSC routes the call to another mobile telephone in the system, or the appropriate landline facility. These 3 elements are integrated to form a coverage radio system that can connect to the PSTN.



Radio coverage area

Basic cellular system