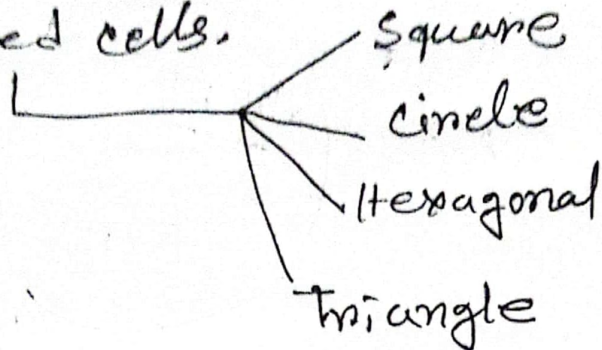


Lecture-10

* Why cell is Hexagonal in shape?

→ In cellular system Land area is divided into a regular shaped cells.



* Criteria of cell shape:-

① Geometric shape

② Area without waverlap.

③ Area of cell should be maximum.

* There are three-shapes that satisfies the area without overlap condition!

① Square →

④ Hexagonal →

④① Triangle →

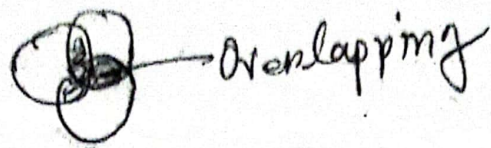
if circle → gap

* Overlapping of cell → Interference.

* Gap below cells :- Less coverage area.

But why choose Hexagonal only?

Circle area is highest but overlapping occurs



Area of triangle $\rightarrow 17.77\%$

" " Square $\rightarrow 63.7\%$

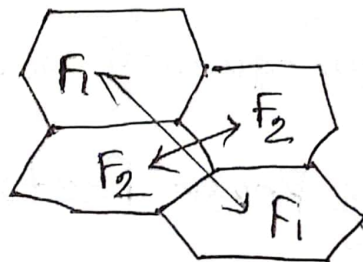
" " Hexagonal $\rightarrow 83\%$

\rightarrow No overlapping, gap

\rightarrow Proper geometric shape

Frequency Reuse

- * It is a concept of reusing a set of frequencies, ^{why? If}
- \rightarrow It enable to expand total system capacity without the need to employ higher antenna.



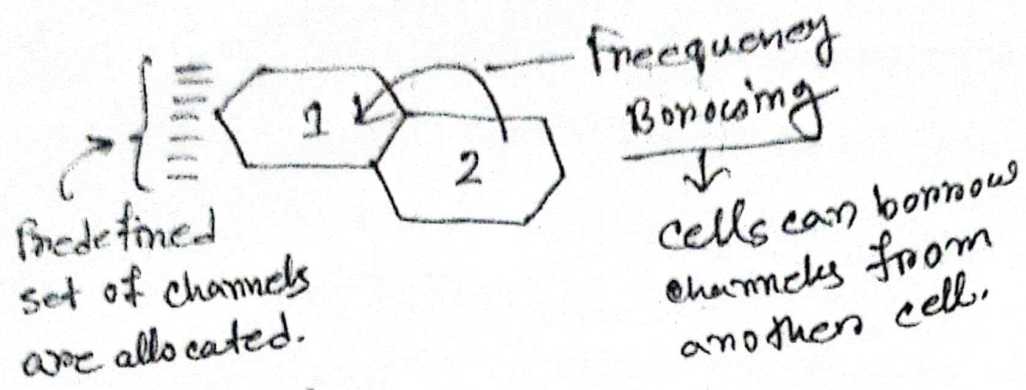
Adjacent cells

Concept

Fixed frequency reuse

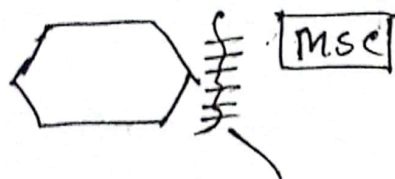
Dynamic frequency reuse.

* Fixed Frequency reuse:-



If all channels are use other service or call can't place.

* Dynamic Frequency Reuse:-



Frequency Bands are requested as per demand (frequency)

* Cell demand.

* Calculating the frequency reuse factor:-

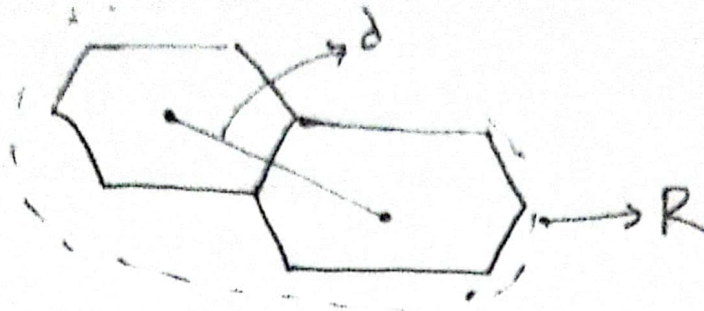
N = Frequency Reuse Factor.

R = Radius of cells.

d = Distance between centre of adjacent cells.

D_{min} = Minimum distance between centre of cells that use same frequency.

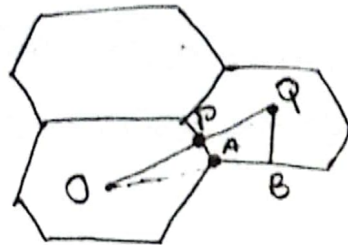
S = Total number of allocated channel.



*For a hexagonal cell pattern:

$$d = \sqrt{3} R$$

$$D_{\min} = \sqrt{3} N \times R \leftarrow \text{Important}$$



$$OQ = ? = d = ?$$

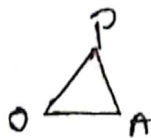
$$OA = R \quad (O \leftrightarrow A \text{ the Radius} = R)$$

$$AB = R/2 \quad (\text{Half of the complete radius})$$

$$OB = OA + AB$$

$$= R + R/2$$

$$= \boxed{3R/2}$$



~~OAP~~

$$OAP = OP = OA \sin 60^\circ$$

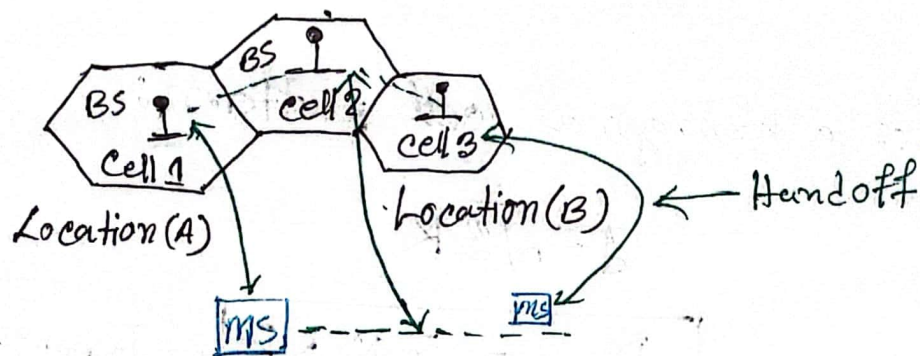
$$OP = \frac{R\sqrt{3}}{2}$$

$$OQ = OP + PQ$$

$$= \left| \frac{\sqrt{3}}{2} R \right| + \left| \frac{\sqrt{3}}{2} R \right| = \sqrt{3} R = d = \text{distance between cell centre.}$$

Hand off

* It is the ability to transfer mobile call from one base station to another base station.

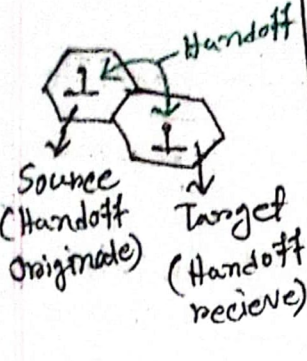
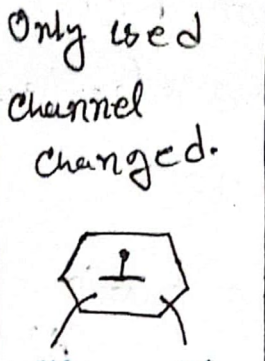
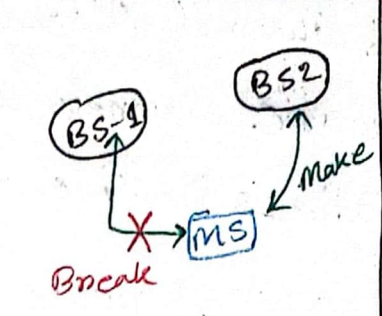
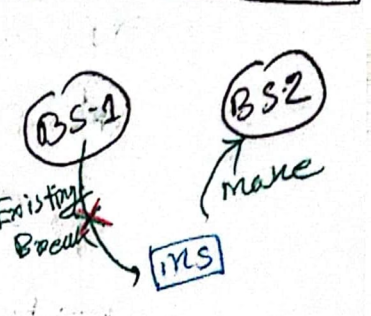


* Reasons for Handoff :-

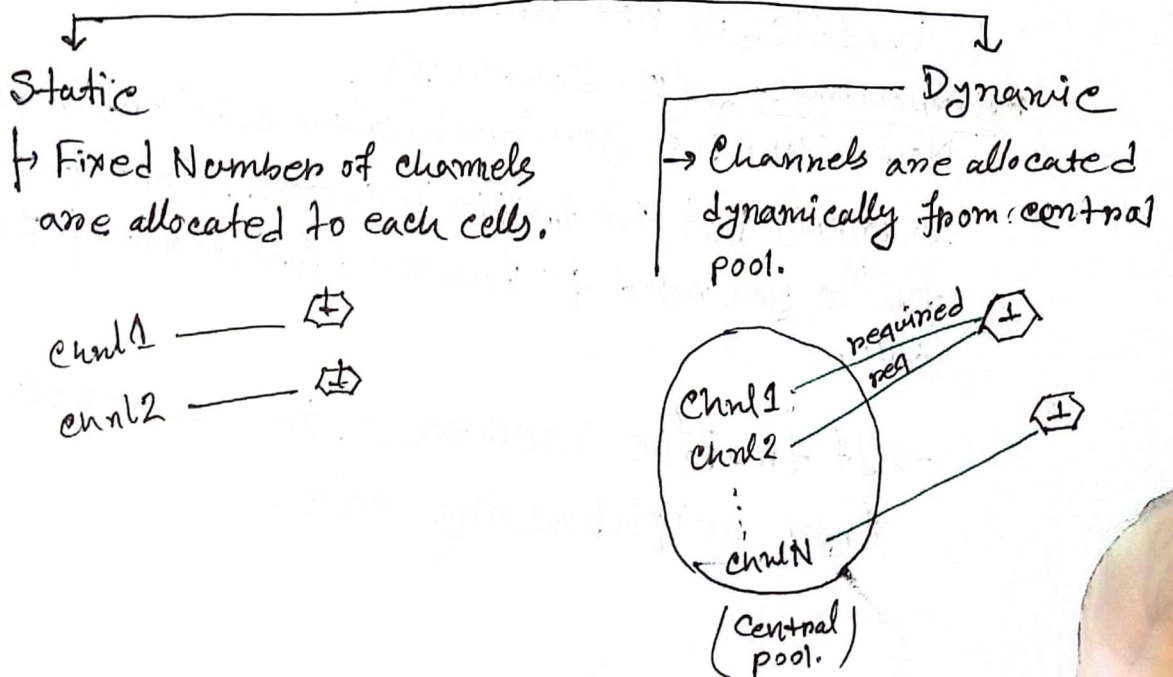
- (i) Mobile device moves one cell to another cell. (main reasons)
- (ii) When capacity of a cell is
- (iii) In non-CDMA, when channel used is interfered by other phone using same channel in different cell.
- (iv) In CDMA, when there is interference from small neighbouring cells.

Types

Inter Cell	Intra-cell	Hard Handoff	Soft Handoff
Source & Target are different cell.	Source & target are in same cell.	(Break before make) ↳ channel in source cell is released & only when channel in target cell is engaged.	(Make before break) ↳ channel in source cell is retained & used for while in parallel with channel in target cell.

Inter cell	Intra cell	Hard Handoff	Soft Handoff
	<p>Only used channel changed.</p> 	<div style="text-align: right;">IMP</div>  <ul style="list-style-type: none"> * Cheap * Only one communication at a time * Small of time there is no signal so Disturbance occurs. * No signal for small amount of time. 	 <ul style="list-style-type: none"> * Expensive * Two communication is used simultaneously * No Disturbance.

Channel Assignment



* Used to assign channels to cells in cellular Netw:-

① Fixed Channel Allocation (FCA)

- * Specific channels are allocated to specific cells
Permanent
- * Static & Don't change
- * Frequency reuse is maximized. (minimum reuse)
(Advantage)

So, frequency reuse number of channel we want to serve as follows:-

$$N = \frac{D}{\sqrt{3} R}$$

D = Frequency reuse distance.

R = Radius

N = Number of channel required to serve the coverage area.

* Disadvantages:

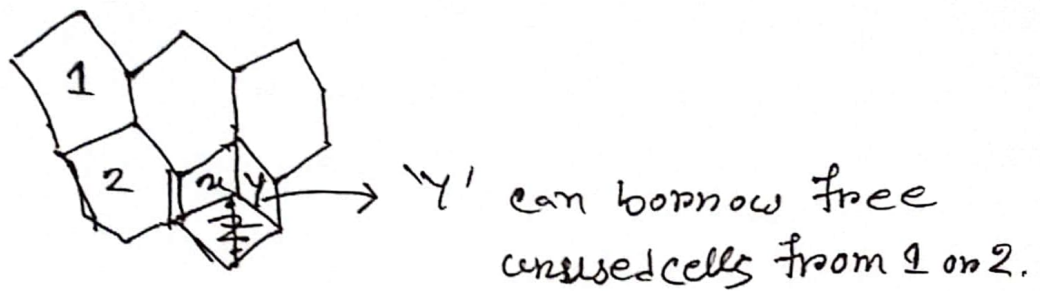
Wastage of channel bandwidth & congestion can occur if traffic is not uniform.

* Borrowing: (2-schemes)

Now, suppose you (particular cellular) to provide some channels but the traffic increase. So, then handling the traffic you need to borrowed free channel from neighbour cells.

→ If traffic increase, free channels are borrowed from neighbouring cells.

- 1) Simple: Simply free unused channels are borrowed.
- Select donor cell with largest free channel
 - Select first free channel.



- * Frequency Reuse distance should be maintain.
- * No interference.

- 2) Complex: Traffic channel is partitioned into two groups:-

- One group is assigned to each cell permanently
- Second group kept reserved as donors.

