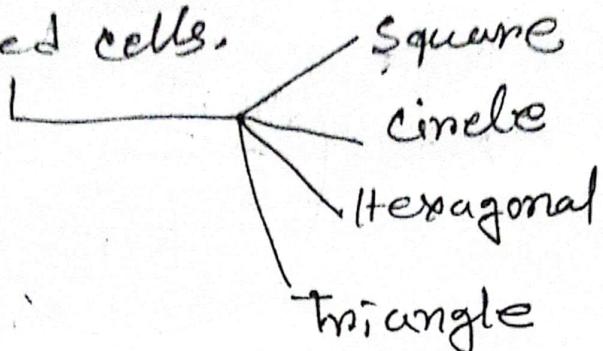


Lecture - 10

* Why cell is Hexagonal in shape?

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



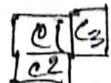
* Criteria of cell shape:-

① Geometric Shape

② Area without overlap.

③ Area of cell should be maximum.

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

① Square → 

② Hexagonal → 

③ Triangle → 

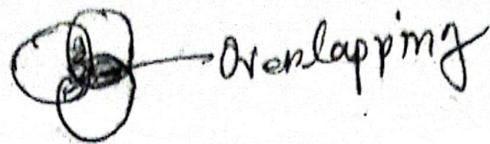
if circle →  gap

* 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 $\rightarrow 17.77\%$

u " Square $\rightarrow 63.7\%$

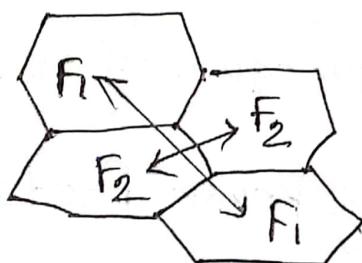
u " Hexagonal $\rightarrow 83\%$

→ No overlapping, gap

→ Proper geometric shape

Frequency Reuse

- * It is a concept of reusing a set of frequencies.
- * It enables to expand total system capacity without the need to employ higher antenna.



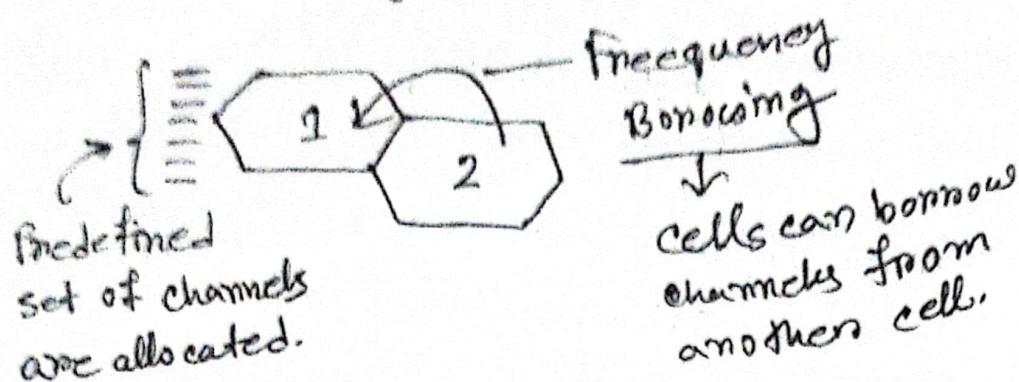
Adjacent cells

Concept

Fixed frequency reuse

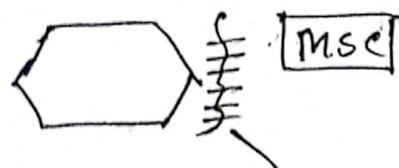
Dynamic frequency reuse.

* Fixed Frequency Reuse :-



If all channels are used others service or call can't place.

* Dynamic Frequency Reuse :-



frequency Bands are requested
as per demand (frequency)
cell demand.

* Calculating the frequency reuse factors :-

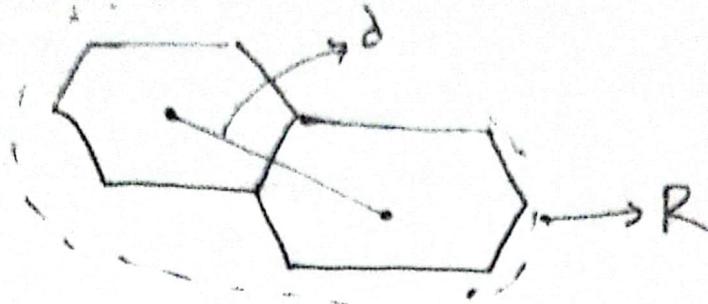
N = Frequency Reuse Factor.

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:

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

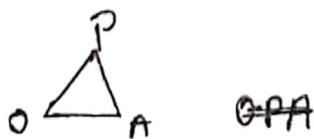
$$D_{\min} = \sqrt{3} N \times R \quad \leftarrow \text{Important}$$

$$OQ = ? = d = ?$$

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

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

$$OB = OA + AB$$



$$\begin{aligned} &= R + R/2 \\ &= \boxed{\frac{3R}{2}} \end{aligned}$$

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

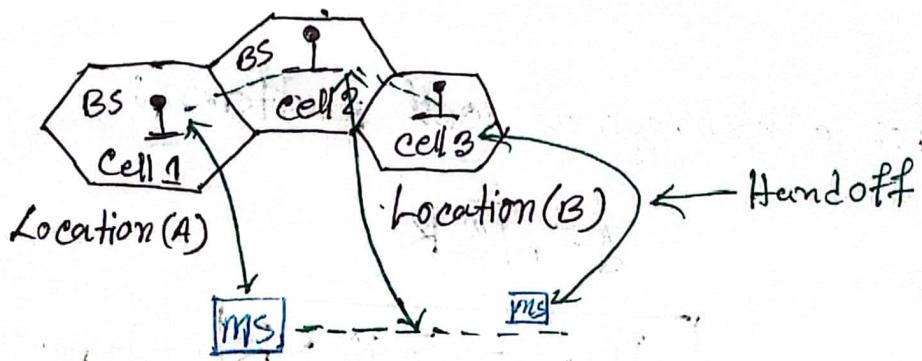
$$OP = \frac{R\sqrt{3}}{2}$$

$$OQ \neq OP + PQ$$

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

Hand off

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



- * Reasons for Handoff:-

- ① Mobile device moves one cell to another cell (main reasons)
- ② When capacity of a cell is
- ③ In non-CDMA, when channel used is interfered by other phone using same channel in different cell.
- ④ In CDMA, when there is interference from small neighbouring cells.

Types

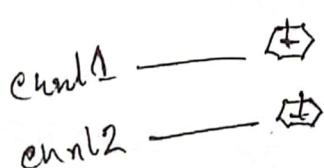
Inter Cell	Intra-cell	Hard Handoff	Soft Handoff
Source & Target are different cell.	Source & target are in same cell.	(Break before make) ↳ channel in source cell is released as only when channel in target cell is engaged.	(Make before break) ↳ channel in source cell is retained as used for while in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

IMP			
Inter cell	Intra cell	Hand Handoff	Soft Handoff
<p>Source (Handoff Originale) Target (Handoff receive)</p>	<p>Only used channel changed.</p>	<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

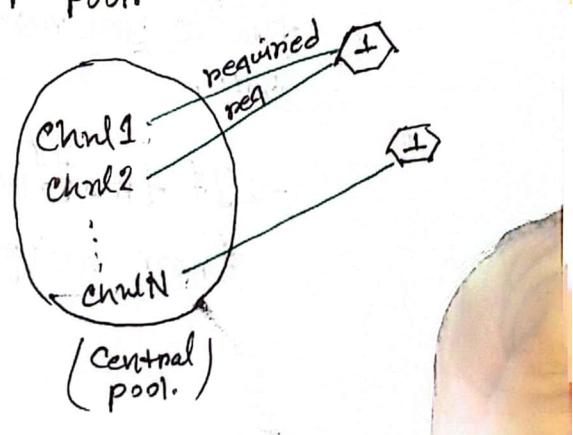
Static

→ Fixed Number of channels are allocated to each cells.



Dynamic

→ Channels are allocated dynamically from central pool.



* Used to assign channels to cells in cellular networks.

① Fixed Channel Allocation (FCA)

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

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

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

→ Disadvantages:

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

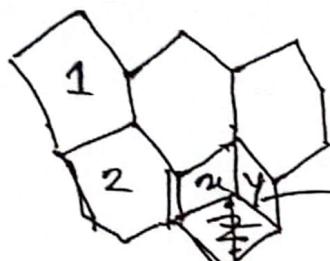
*Borrowing? → (2-Schemes)

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.

- D = Frequency reuse distance.
- R = Radius
- N = Number of channels required to service the coverage area

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



→ 'Y' can borrow free unused cells from 1 or 2.

- * Frequency Reuse distance should be maintained.
- * 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.

