Cellular Concept

Frequency Reuse

Cellular Concept

Frequency Reuse

- In the cellular concept, frequencies allocated to the service are re-used in a regular pattern of areas, called 'cells',
- each cell is covered by one base station
- In mobile-telephone nets these cells are usually hexagonal
- In radio broadcasting, a similar concept has been developed based on rhombic cells

Cellular Concept
Frequency Reuse

- To ensure that the mutual interference between users remains below a harmful level, adjacent cells use different frequencies
- In fact, a set of *C* different frequencies

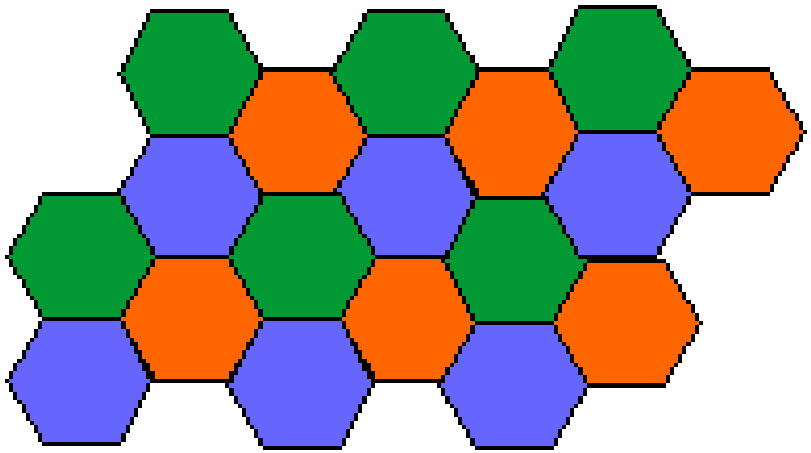
$$\{f_1, \ldots, f_C\}$$

- are used for each cluster of *C* adjacent cells
- Cluster patterns and the corresponding frequencies are re-used in a regular pattern over the entire service area

Cellular Concept

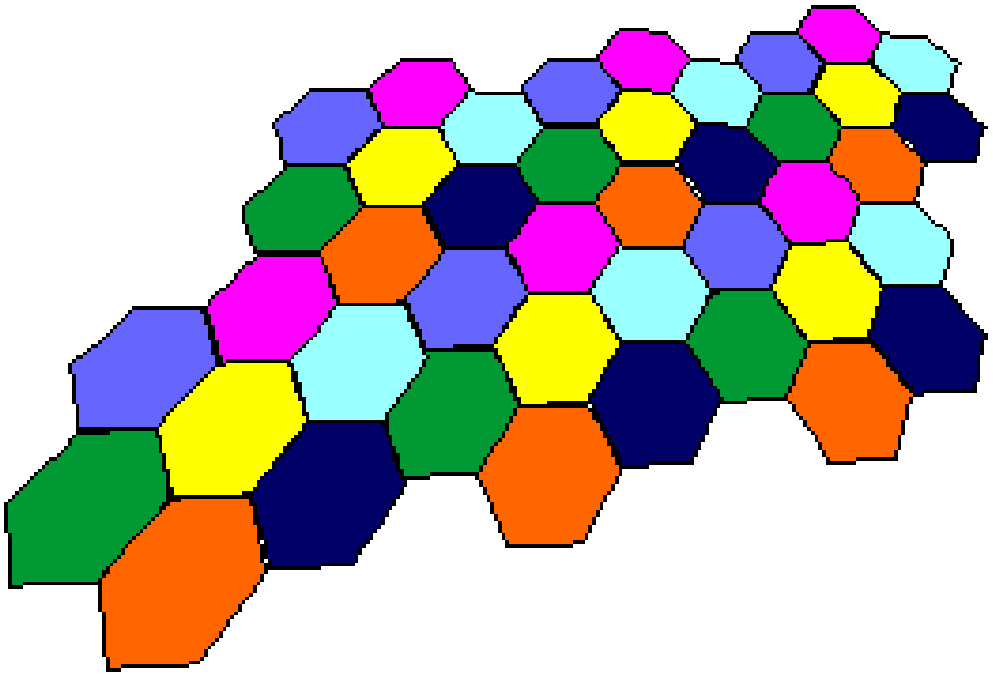
Frequency Reuse

- Frequency reuse plan for $C = 3$, with hexagonal cells. (i=1, j =1)



Cellular Concept
Frequency Reuse

- Frequency reuse plan for $C = 7$ ($i=2$, $j=1$)
- The total bandwidth for the system is C times the bandwidth occupied by a single cell



Reuse Distance

- The closest distance between the centres of two cells using the same frequency (in different clusters) is determined by the choice of the cluster size *C* and the lay-out of the cell cluster
- This distance is called the frequency 're-use' distance
- It can be shown that the reuse distance r_u, normalised to the size of each hexagon, is

$$r_u = \text{SQRT}\{3\ C\}$$

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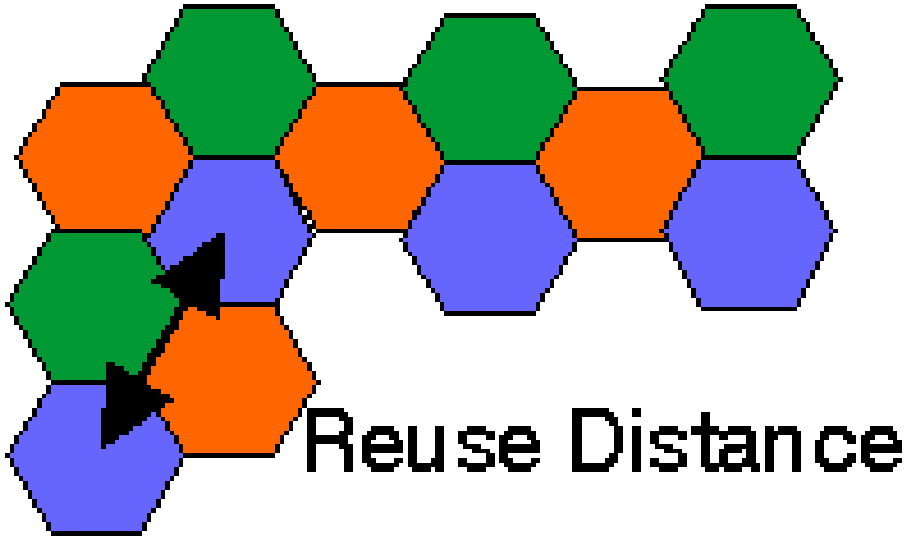


Reuse Distance

- For hexagonal cells, possible cluster sizes are

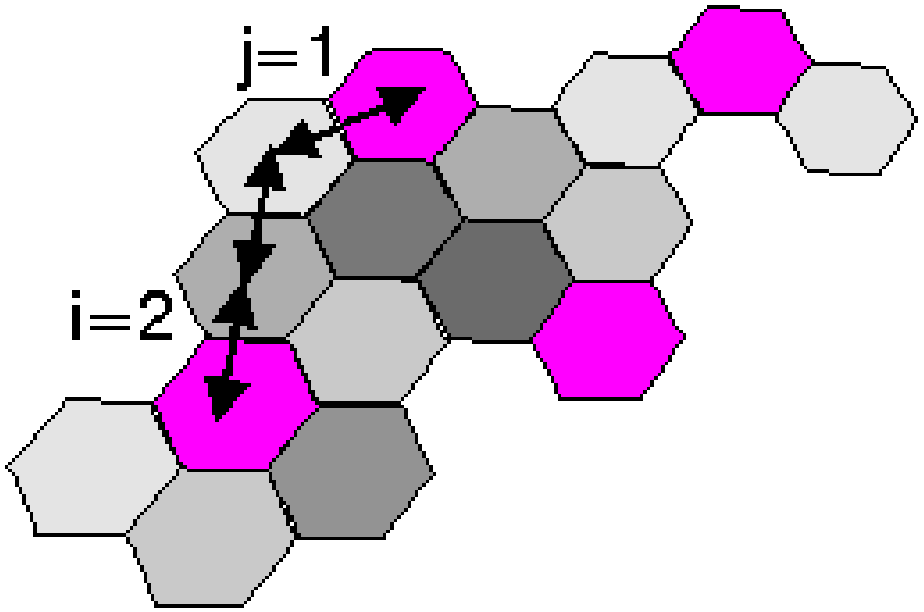
$$C = i^2 + ij + j^2,$$

- with integer i and j (C = 1, 3, 4, 7, 9, ...)
- Integers i and j determine the relative location of co-channel cells

Reuse Distance

- **Derivation of the Frequency Reuse Formula**

[http://www.wirelesscommunication.nl/reference/chaptr04/cellplan/reuse.htm]



- In GSM the 7 clusters per cell ($C = 3$) is used