The Cellular Concept

Unit 3

3.2 Frequency Reuse

- Each cellular base station is allocated a group of radio channels within a small geographic area called a *cell*.
- Neighboring cells are assigned different channel groups.
- By limiting the coverage area to within the boundary of the cell, the channel groups may be reused to cover different cells.

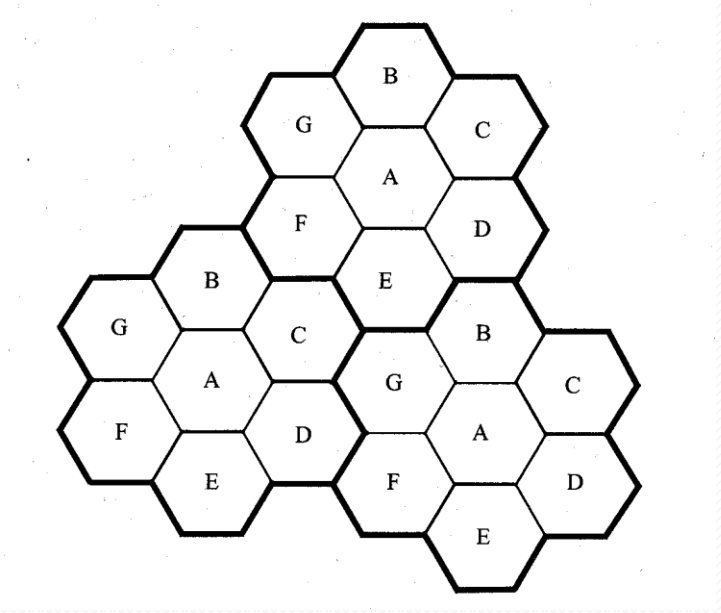
3.2 Frequency Reuse

- Keep interference levels within tolerable limits.
- Frequency reuse or frequency planning

•seven groups of channel from A to G

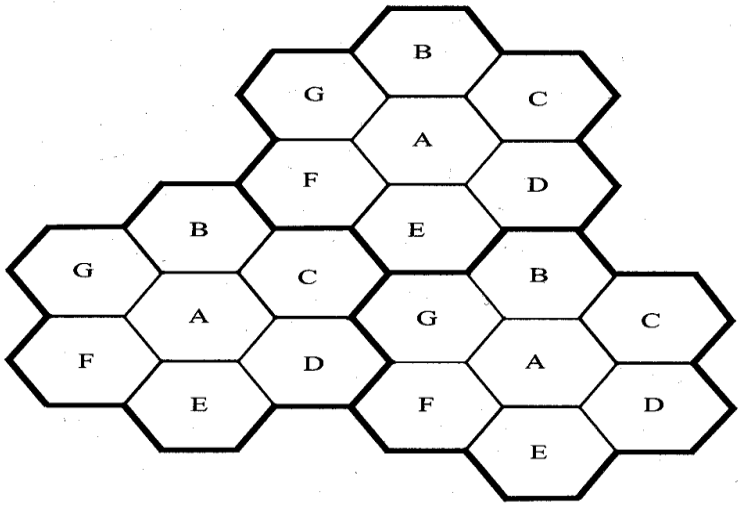
•footprint of a cell - actual radio coverage

•omni-directional antenna v.s. directional antenna



•In mobile-telephone nets these cells are usually hexagonal.

•Adjacent cells use different frequencies. However in cells that are separated further away, frequencies can be reused.



- Consider a cellular system which has a total of *S* duplex channels.
- Each cell is allocated a group of *k* channels, .
- The *S* channels are divided among *N* cells.
- The total number of available radio channels

$$S = kN$$

- The *N* cells which use the complete set of channels is called *cluster*.

- The cluster can be repeated M times within the system. The total number of channels, C, is used as a measure of capacity

$$C = MkN = MS$$

- The capacity is directly proportional to the number of replication M.
- The cluster size, N, is typically equal to 4, 7, or 12.
- Small N is desirable to maximize capacity.
- The frequency reuse factor is given by

$$k < S$$

$$1/N$$

- Hexagonal geometry has
  - exactly six equidistance neighbors
  - the lines joining the centers of any cell and each of its neighbors are separated by multiples of 60 degrees.
- Only certain cluster sizes and cell layout are possible.

- The number of cells per cluster, *N*, can only have values which satisfy

- Co-channel neighbors of a particular cell, ex, *i=3* and *j=2*.

$$N = i^2 + ij + j^2$$