Multiple Access Techniques for Wireless Communication

FDMA
TDMA
SDMA
PDMA

A Presentation by Schäffner Harald

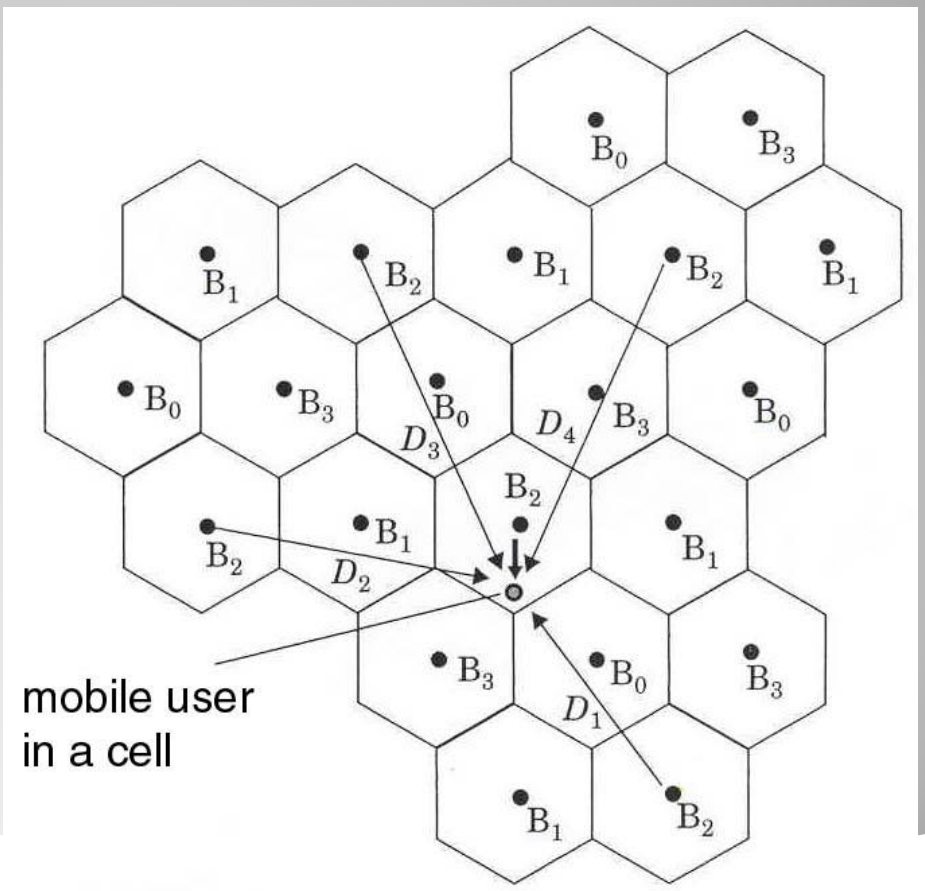
Co-Channel Reuse Ratio Q

$$Q=D/R$$

- Q … co-channel reuse ratio
- D … distance between two co-channel cells
- R … cell radius

Forward channel interference

- cluster size of 4
- D0 … distance serving station to user
- DK … distance co-channel base station to user



Carrier-to-interference ratio C/I

- M closest co-channels cells cause first order interference

$$\frac{C}{I} = \frac{D_0^{-n_0}}{\sum_{k=1}^{M} D_K^{-n_k}}$$

- n_0 … path loss exponent in the desired cell
- n_k … path loss exponent to the interfering base station

Carrier-to-interference ratio C/I

- Assumption:
- just the 6 closest stations interfere
- all these stations have the same distance D
- all have similar path loss exponents to n_0

$$\frac{C}{I} = \frac{D_0^{-n}}{6 * D^{-n}}$$

Worst Case Performance

- maximum interference at $D_0 = R$
- $(C/I)_{min}$ for acceptable signal quality
- following equation must hold:

$$1/6 * (R/D)^{-n} \geqq (C/I)_{min}$$

Co-Channel reuse ratio Q

$$Q = D/R = (6*(C/I)_{min})^{1/n}$$

- D … distance of the 6 closest interfering base stations
- R … cell radius
- $(C/I)_{min}$ … minimum carrier-to-interference ratio
- n … path loss exponent

Radio Capacity m

$$m = \frac{B_t}{B_c * N} \text{ radio channels/cell}$$

- Bt … total allocated spectrum for the system
- Bc … channel bandwidth
- N … number of cells in a complete frequency reuse cluster

Radio Capacity m

- N is related to the co-channel factor Q by:

$$Q = (3*N)^{1/2}$$

$$m = \frac{B_t}{B_c * (Q^2/3)} = \frac{B_t}{B_c * \left(\frac{6}{3^{n/2}} * \left(\frac{C}{I}\right)_{min}\right)^{2/n}}$$

Radio Capacity m for n = 4

$$m = \frac{B_t}{B_c * \sqrt{2/3 * (C/I)_{min}}}$$

- m … number of radio channels per cell
- $(C/I)_{min}$ lower in digital systems compared to analog systems
- lower $(C/I)_{min}$ imply more capacity
- exact values in real world conditions measured

Compare different Systems

- each digital wireless standard has different $(C/I)_{min}$
- to compare them an equivalent (C/I) needed
- keep total spectrum allocation B_t and number of rario channels per cell m constant to get $(C/I)_{eq}$: