**Cellular concept**

The use of licensed radio frequency bands with **‘spatial multiplexing’**

Split the city up into cells, and allocate an operating frequency to each.

Frequencies can be re-used when far enough away. Must not transmit too loud, so the signal doesn’t propagate to a cell of the same frequency.

To add more users, we should reduce the size of the cell, and reduce power. However, this introduces bit-errors, and requires FEC

**Multiplexing**

FDMA - Frequency division multiplexed access

TDMA - Time division multiplexed access

CDMA - Code Division multiplexed access - Each transmitter uses same band, but with a unique code

OFDMA - Orthogonal frequency division multiplexed access - instead of transmitting on one frequency band, transmit on lots of frequencies at the same time. Very important development, lots of things are now processed in the frequency domain. Uses MIMO transmission

In mobile systems, all of the above methods **also** use spatial multiplexing.

Buffers are very necessary in speech transmission (2G)

**B-FSK Modulation (you get this)**

Encode bits in the frequency of the sine wave.

1 = low frequency, 0 = high frequency

Constant amplitude. This is important, because as amplitude degrades over distance, constant amplitude makes it easy to re-amplify, without any worry.

The secret to the success of 2G-GSM

**CDMA - Code Division Multiplexed Access**

Each bit from the coded signal is ‘spread’, and each bit becomes a pseudo-random sequence of ‘chips’

Requires huge bandwidth (50x)

Receiver knows transmitter’s code in advance

It is possible to recover the original signal, if the sequence is known, otherwise heard as noise.

CDMA also sort of provides free encryption, assuming you do not distribute your code.

**Cocktail party analogy for CDMA**

Lots of people talking in a bar all in different languages. Can only understand your partner if you speak the language, all else is noise. As more people join the bar, the noise gets louder, so you have to get closer to your partner to hear them (Think of cells)

**MIMO - Multiple input Multiple output**

Use more than one antenna for send/receive to increase capacity of the link