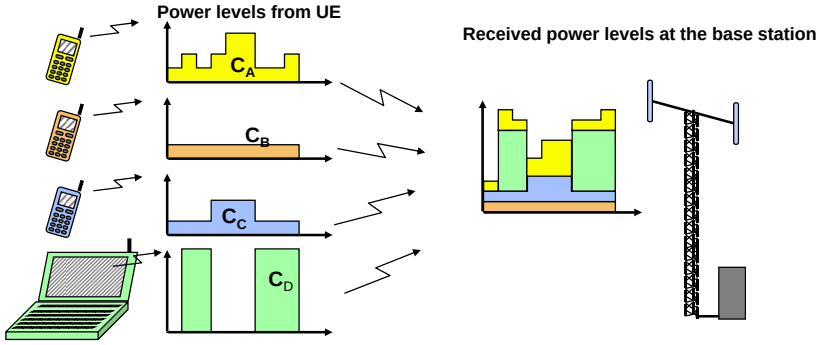
Dimensioning, configuration and deployment of Radio Access Networks.

part 3: 3G voice

WCDMA

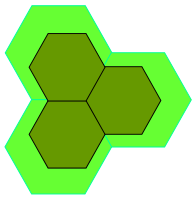
- Specified by 3GPP
- Frequency Division Duplex
- CDMA system
- Originally at 2000MHz, 1900 in North America, but soon also at 900MHz in Europe

Power is the common shared resource

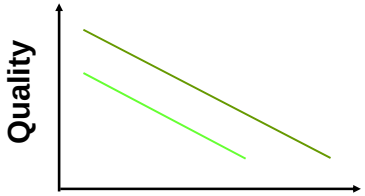


Coverage, Capacity and Service Flexibility

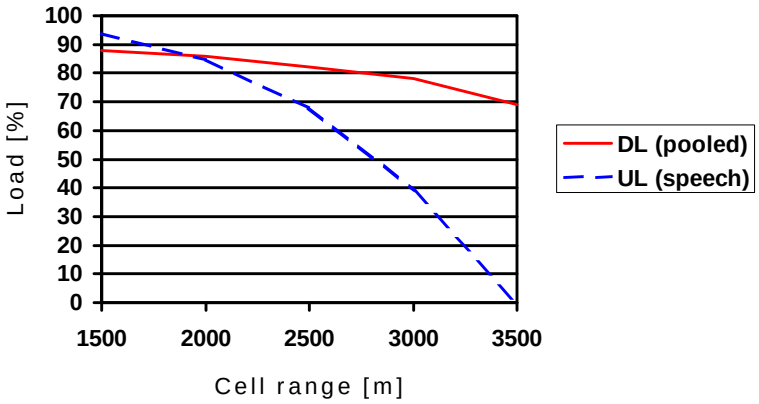
- Soft capacity gives flexibility between coverage, capacity and quality



Coverage vs. capacity



Uplink - downlink comparison



Excercise

WCDMA (UMTS) and GSM1800 are almost at the same frequency band so a comparison is pretty relevant. For speech the two link budgets don't differ much. From a coverage perspective the maximum cell radius is about 3-5km for both systems. Using the example above, If an operator has 5MHz,

a. How much more voice capacity does he get with WCDMA compared to GSM in a suburban cell that has a radius of about 3km.

b. In a urban cell with a radius of a few hundred meters.

WCDMA Capacity

If we look at a very simple WCDMA network with 5MHz of spectrum we find that:

- Reaching an area with a radius of about 3km we get around 32 voice channels per sector
- 32 voice channels and 2% blocking is 24Erlang

High Capacity Issues

- In a small WCDMA cell we may have up to 86 voice channels per sector and around 75Erlang.
- This is still just by using 1Trx!
- Getting the same capacity out of a GSM base station in a 5MHz spectrum is definitely possible using modern techniques such AMR, Frequency hopping and 1/1 re-use.
- However, it would require ~11 Trx per sector!

Conclusions

- Voice networks are dimensioned for Peak hour capacity needs whereas the revenues are determined by minutes of use
- If we assume 30mErl/user at peak hour we will typically need 1 base station for every 1000 subscriber in GSM
- In a high capacity scenario WCDMA offers higher capacity to a much lower prize than GSM or any other standard.
- The secret behind this is the Trunking efficiency that the wideband 5MHz radio channel offers!