



Dimensioning, configuration and deployment of Radio Access Networks.

part 3: 3G voice

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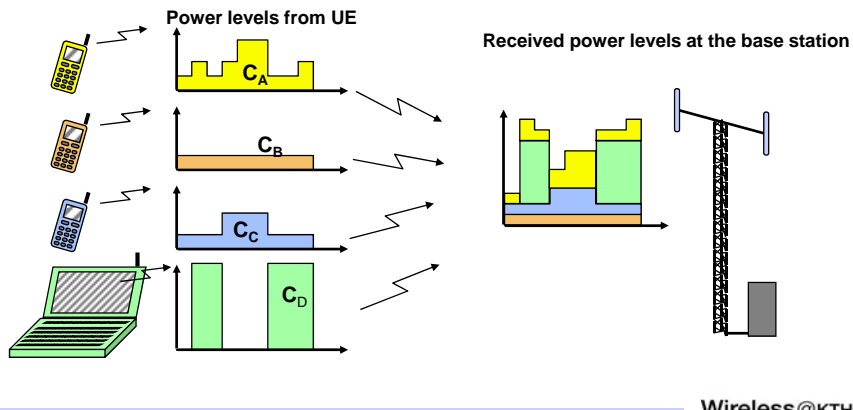
WCDMA

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

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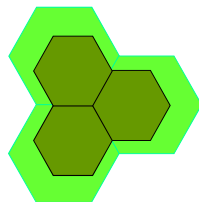
Power is the common shared resource



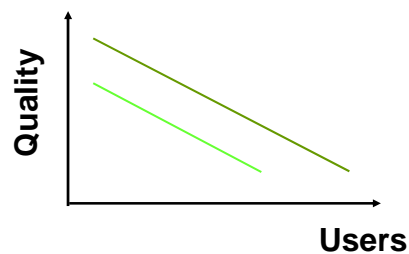
Capacity and Coverage

Coverage, Capacity and Service Flexibility

- Soft capacity gives flexibility between coverage, capacity and quality

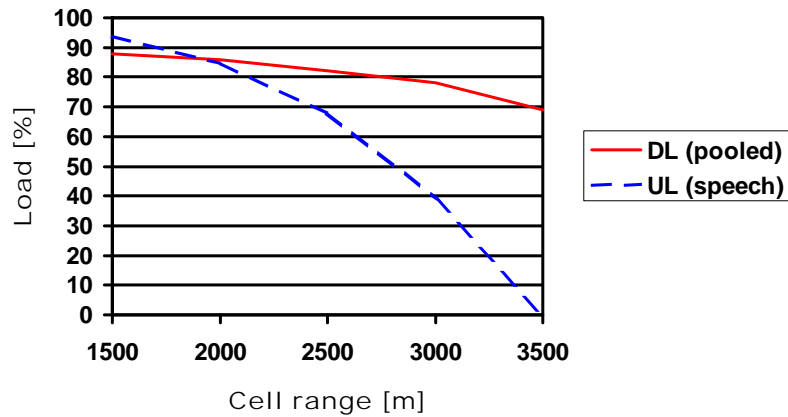


Coverage vs. capacity





Uplink - downlink comparison



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WCDMA SUMMARY

Maximum number of (voice) channels on 2x5MHz: ~196
(spreading factor 256 UL, AMR 7.95kbps) / ~98 (spreading factor 128 UL, AMR 12.2kbps)

Voice coding: AMR codecs (4.75 kHz - 12.2 kHz)

Duplexer (190MHz separation),

Receiver sensitivity: Node B: -121dBm, Mobile -117dBm

Data type: Packet and circuit switch

Modulation: QPSK

Chip rate: 3.84 Mcps

Channel raster: 200 kHz

Maximum user data rate (Physical channel): ~ 2.3Mbps
(spreading factor 4, parallel codes (3 DL / 6 UL), 1/2 rate coding),

Channel bit rate: 5.76Mbps

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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

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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 using AMR, Frequency hopping and 1/1 re-use, is possible
- 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 price than GSM or any other standard.
- The secret behind this is the Trunking efficiency that the wideband 5MHz radio channel offers!

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Excercise 2

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.

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