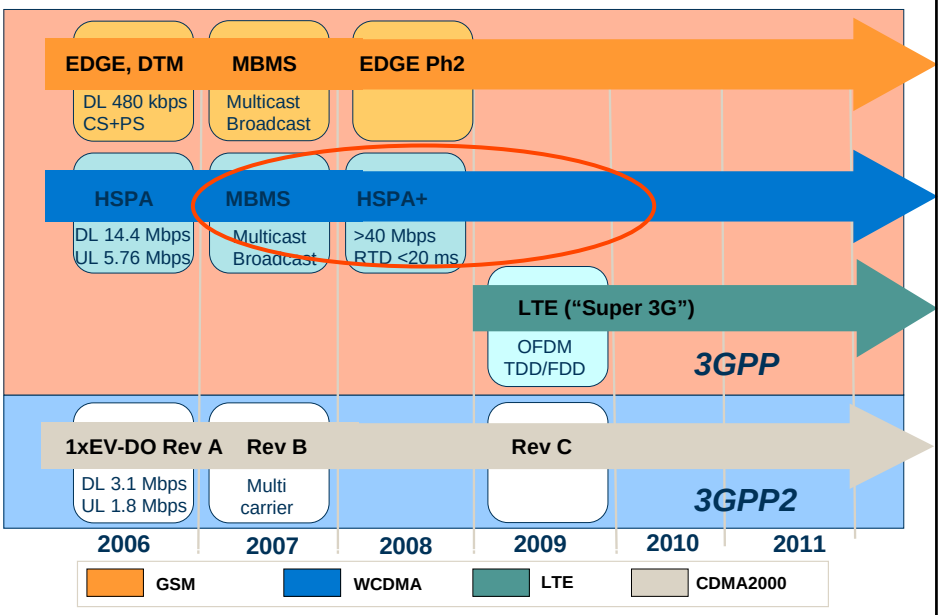
Agenda

- Overview of cellular standards
- Evolution of HSPA and commercial deployments
- LTE (”Super 3G”)
- Status on test beds, etc.

Evolution of cellular standards



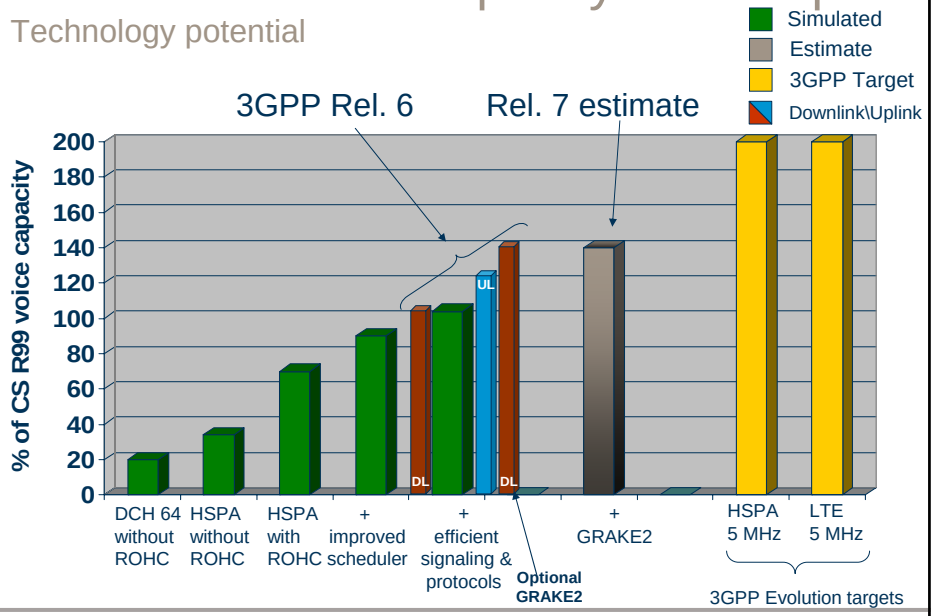
HSPA+

Improving the HSPA track

SPEED		Higher bit rates: Up to 40 Mbps downlink Higher bit rates: Up to 10 Mbps uplink
CAPACITY		1.5 - 2 times improved system capacity DL/UL 1.5 - 2 times more VoIP users 2 times improved broadcast/multicast capacity
REDUCED DELAY		Quicker response time with interactive services
STANDARDIZED		Integral part of WCDMA (3GPP Rel 7)
Network Coverage		Short time to market with existing sites

VoIP over HSPA capacity roadmap

Technology potential



HSDPA is live and commercial

Commonly provides users with 1 Mbps download speeds

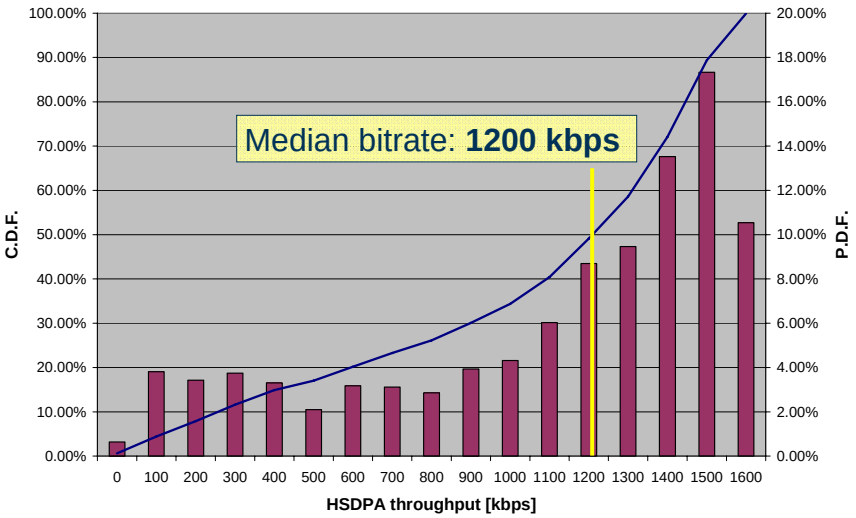
HSDPA devices available today

Terminal availability (HSDPA)

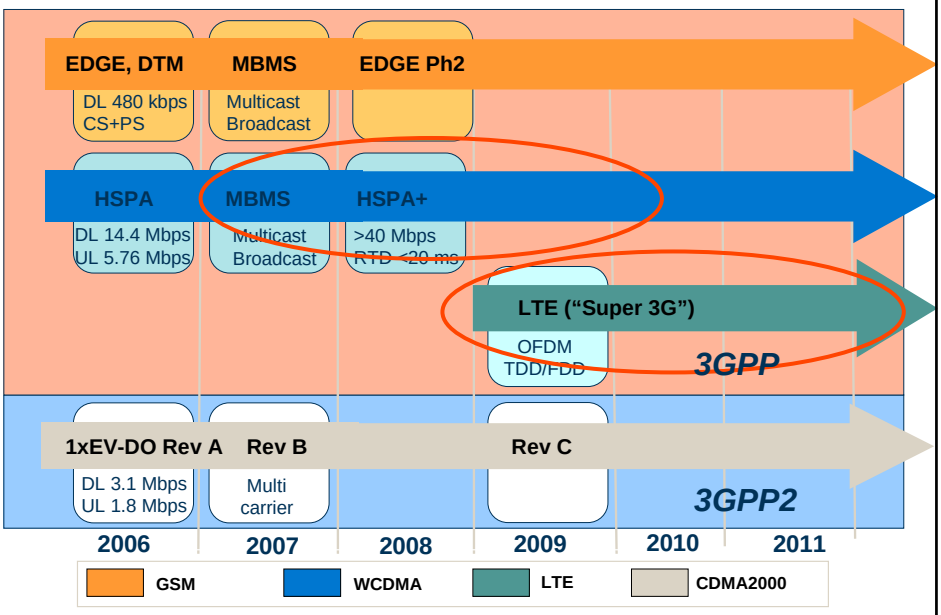
- Available today:
  - Volume PC cards, 1.8 Mbps
    - Suppliers: Novatel, Sierra Wireless, Option, Huawei
  - ”Proof-of-Concept” Ericsson Fixed Wireless Terminal
- 2Q06:
  - First handsets, 1.8 Mbps
    - Suppliers: Samsung, BenQ/Siemens
  - First PC cards, 3.6 Mbps
- 2H06:
  - Volume handsets, 3.6 Mbps
  - 2nd generation FWT (from Ericsson) for commercial use
- 1H07:
  - PC cards and handsets, 7.2 Mbps DL
  - Enhanced Uplink support, 1.46 Mbps
    - Handsets and PC cards

HSDPA bit rate

Live network, March 2006, mobile drive route – 1.8 Mbps



Evolution of cellular standards



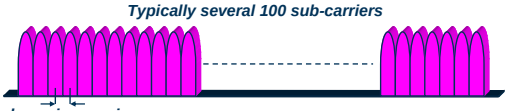
What is OFDM?

- OFDM = ***O**rthogonal **F**requency **D**ivision **M**ultiplex*
- Fundamentally just a modulation/multiplexing method

Single-carrier transmission
(e.g. WCDMA, cdma2000)

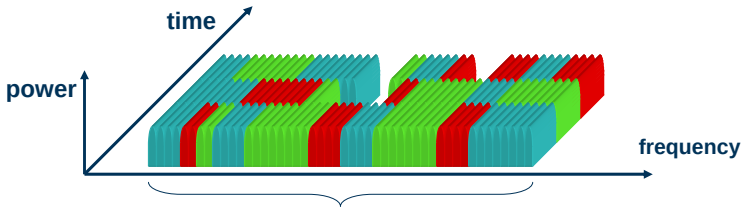
Typically several 100 sub-carriers

OFDM *("multi-carrier" transmission)*



Sub-carrier spacing
(a few kHz to a few 10 kHz)

Frequency hopping and OFDM



One OFDM carrier

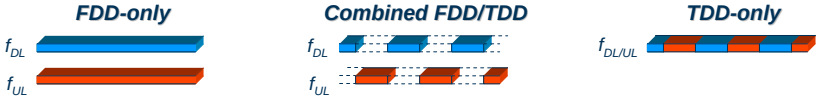
3G LTE

What does 3G LTE bring compared to HSPA?

- **Higher end-user bitrates by wider carrier bandwidth**
  - Over 100 Mbps in a 20 MHz carrier bandwidth.
- **Spectrum flexibility and smooth migration into legacy bands**

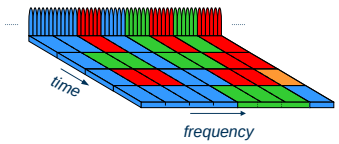
- Flexible bandwidth

- **Spectrum availability**
  - Support for operation in both FDD and TDD dedicated spectrum

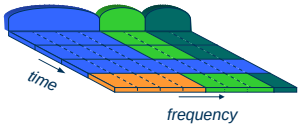


LTE physical layer, 3GPP

- **Downlink: *Adaptive OFDM***
  - ***Channel-dependent scheduling and link adaptation in time and frequency domain***

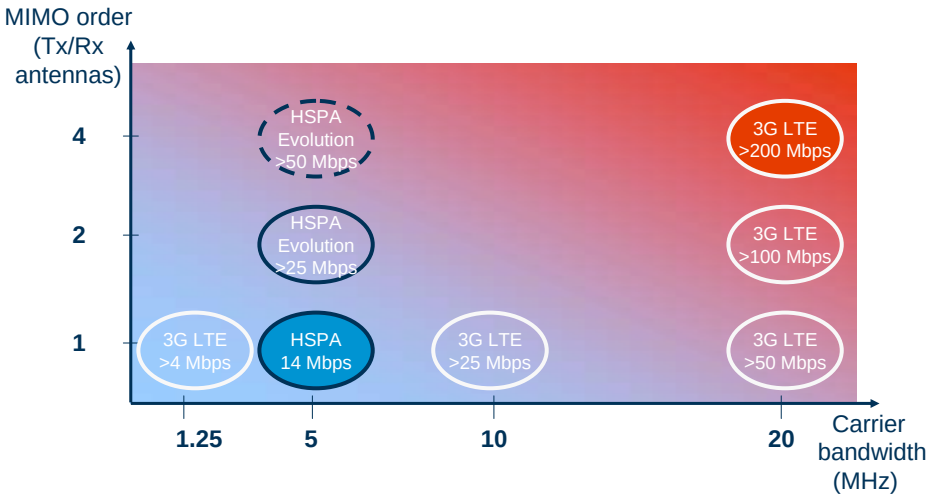


- **Uplink: SC-FDMA with dynamic band width (Pre-coded OFDM*)***
  - ***Low PAPR ➡ Higher power efficiency***
  - ***Reduced uplink interference (enables intra-cell orthogonality)***



HSPA evolution and 3G LTE

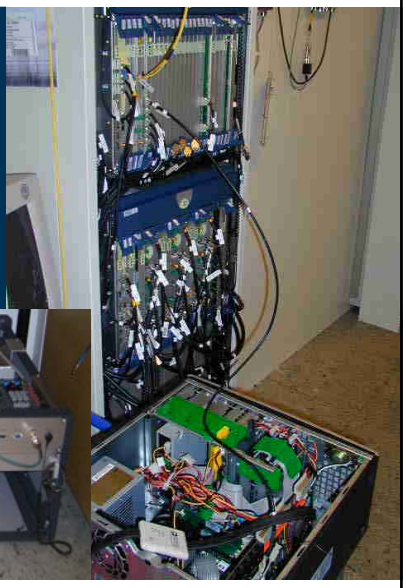
Downlink peak datarates



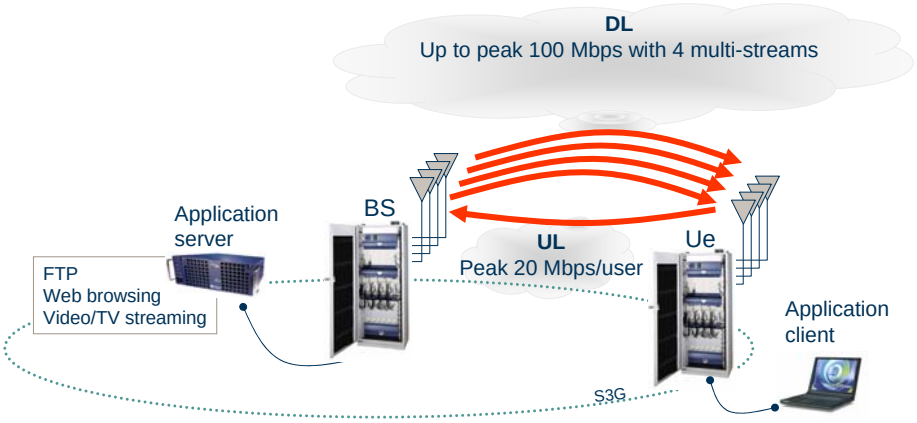
MIMO for HSPA

Testbed for HSPA evolution

- HSPA MIMO with 2 antennae
  - 20 Mbit/s over air now working in lab!
- Demo made at CTIA in April



Status 3G LTE testbed



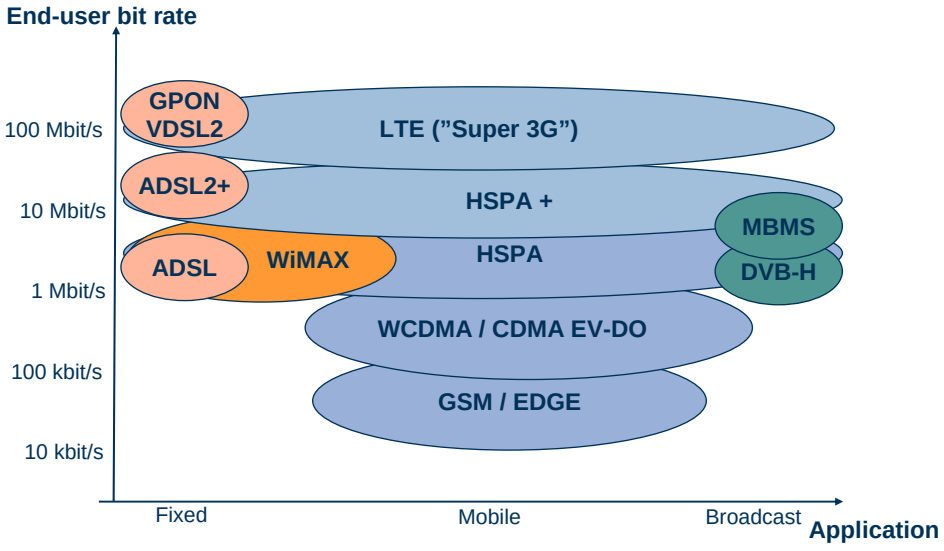
3G LTE testbed

- 46 Mbit/s transmitted over air in December 2005 over one 20 MHz channel; full 60 Mbps will be reached after DSP processor upgrade
- Applications running in downlink in March
- Implementation of new uplink channel ongoing, peak rate 20 Mbps

The new RBS transciever board for 3G LTE

- 20 Mhz carrier bandwidth
- 3G LTE modulation (OFDM)
- Variable bandwidth from 600 kHz up to 20 MHz

Access technology overview

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