Courses

Mobile Commun. (4230)
Radio & Mobility (4700)
Mobile Services (4710)
Sensor Networks (47xx)
PhD Mobile Services (9710)
All Ifi/UNIK courses
Master Reporting

Master Thesis Research

Ongoing thesis
Completed thesis
Open Thesis

Research

Research@UNIK
About UniK

ICT research

ICT@UNIK
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Projects

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Courses/UNIK4700topics

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adjcri1[?] — **06 September 2012, 00:42**

ltcc0831sm

adjrve7[?] — **31 August 2012, 18:13**

lt0831sm

juliawaq[?] — **02 April 2010, 08:43**

hello julia here i like this site

what about studying at University of Oslo. Be welcome

Josef Noll — **27 November 2009, 16:50**

Mobilitet: Introduksjon - etterpå en time med spørsmål.

Josef Noll — **13 November 2009, 09:29**

diskuter karaktærsetting, hva er fokus i bedømmelsen

målsetning

- literatur

- methode
- egen vurdering

ikke bedømt
- spørsmål i timene

Alternativer
- evtl "mini-eksamen" i slutten av hver time, spørsmål om spesielle områder

Josef Noll — 04 September 2009, 09:40

spørsmal: hva er GSM? - dette er "Groupe Special Mobile" -

UNIK 4700 - Radio and Mobility

- first lecture
- Goal of the course,
  - what to achieve
  - how to achieve it
- detailed TOC,
- list of references for radio,
- modelling approach

Goals Radio

- Understand that "radio is not just another IP connection"
- Set-up a good course
- Involve you in giving the course

Radio
- get a basic understanding of radio communication
- can explain the characteristics of radio propagation
- get a feeling for wave propagation and the attenuation

Goals Mobility

- identify the factors for mobility management
- know the characteristics of current mobility schemes
- address topics in current research

Mandatory
- knowledge of presentation material
- presentation and analysis of 3-4 papers
- simulation

Evaluation (draft)

- presentation of topics (own work)
- simulation results
- optional: (final exam)

Detailed TOC - General

- History of wireless communications
- History of wireless terminals
- Future trends on wireless communications
- Wireless standardisation forums
- Current wireless technologies
- Technologies and user
- Wireless network types

TOC - Basics of communication

- Electromagnetic signals
- Nyquist Theorem
- Signal/noise ratio
- Shannon Theorem
- Signal strength

TOC - Signal propagation

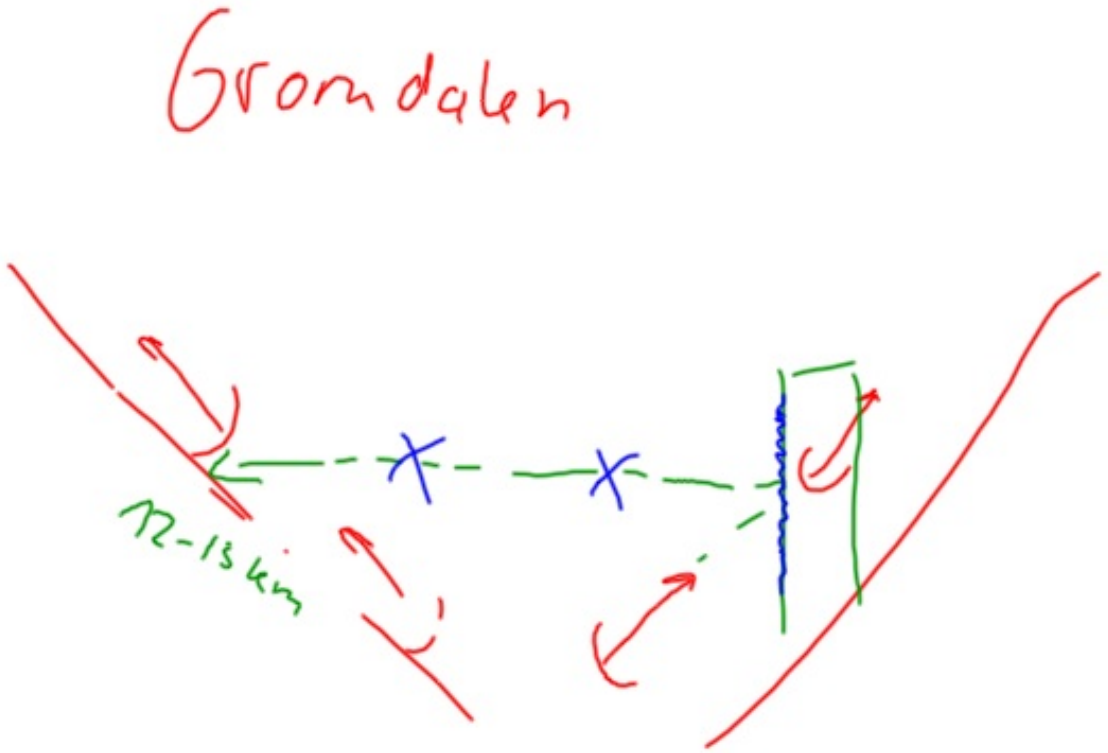
- Antenna types
- Radiation patterns
- Antenna gain
- basic propagation models (ground wave, sky wave and line of sight (LoS) propagation)
- optical vs radio LoS
- attenuation (free space)
- Noise (thermal, intermodulation, crosstaal, impulse noise)
- Atmospheric absorption
- Multipath propagation
- refraction, reflection, diffraktion and scattering
- fading (fast, slow, flat, selective, rayleigh, rician,

TOC - Propagation models

- Environments (indoor, outdoor to indoor, vehicular)
- outside (Lee, Okumura, Hata, COST231-Hata, COST231-Walfish-Ikegami)
- inside (One-slope, multiwall, linear attenuation)

TOC - Radio interference (see Magne's course)

- Co-channel, adjacent-channel, intermodulation, near-end-to-far-end, inter-symbol, simulcast
- Local scatterers
- Frequency planning



Interference through scattering from Buildings, Groruddalen, Oslo

Propagation in Cities, Limitations of radio propagation

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TOC Comparison of access technologies

- proximity: RFID and NFC
- short range: ZigBee, Bluetooth and Wibree
- local: Wireless LAN,...
- mobile: GSM, UMTS, IMT-A (WiMAX, LTE)

TOC - Mobility

- still has to come

- ....

Second half of course will deal with mobility

The five myths of wireless (1.-4)

1. Wi-Fi is faster than Ethernet. While the raw data rate of Wi-Fi (11 Mbps) may be faster than the original Ethernet (10 Mbps), Wi-Fi's throughput efficiency is always less. Why?
2. The longer the transmission range, the better. That may be true for some wireless communications, but for wireless LANs, a greater transmission range often results in more users per cell and lower per-user throughput. Why?
3. Wireless networks can be dangerous to your health. Almost all wireless LANs have radio output levels of less than 100 milliwatts (20 dBm). Is output power the real measure?
4. 802.11g will make 802.11a obsolete. Lots of people think that 802.11g will kill 802.11a because it offers the same data rate as 802.11a (54 Mbps) plus backward compatibility with 802.11b. Other factors?

The five myths of wireless

5. Wireless LANs are inherently insecure. Yes, there are security issues with the original 802.11b specification, but there are plenty of ways, including the use of VPNs and security gateways, to make wireless as secure as wired. True?

Note: 802.11 is sending with different speeds for header and payload. Header is always transmitted at lowest speed, why?

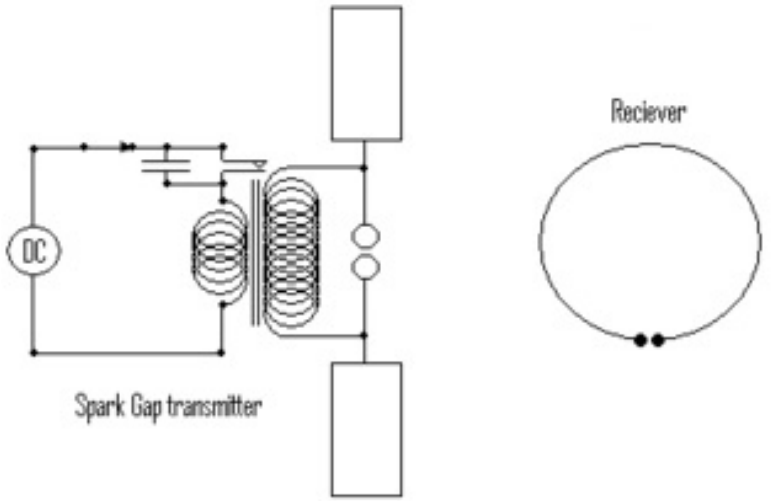
Wireless Communication

- electromagnetic wave
- wave propagation
- attenuation, scattering
-

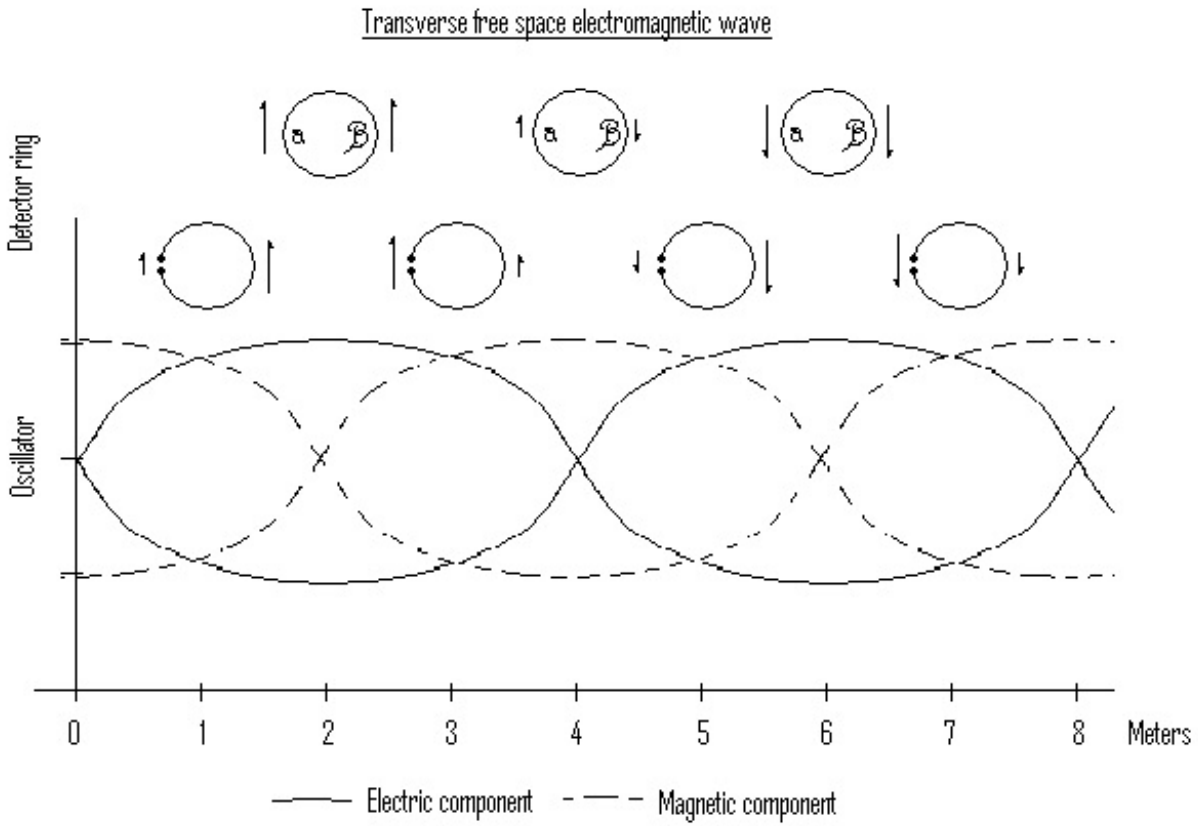
The real researchers

Michael Faraday (1791 – 1867), James Clerk Maxwell (1831 – 1879) and Heinrich Rudolf Hertz (1857 – 1894) established the theory for the understanding of electromagnetic waves

[Source:Magne Pettersen, Wikipedia]



Heinrich Hertz - The electromagnectic wave



Hertz did not realise the practical importance of his experiments. He stated that,
"It's of no use whatsoever[...] this is just an experiment that proves Maestro Maxwell was right - we just have these mysterious electromagnetic waves that we cannot see with the naked eye. But they are there." [3]

Asked about the ramifications of his discoveries, Hertz replied, "Nothing, I guess." [3]

The real researchers

Guglielmo Marconi (1874 – 1937) experimented with Hertz waves in 1894/1895

- used 50000 UK pound on a transatlantic experiment in 1901
- brought electromagnetics to life

[Source:Magne Pettersen, Wikipedia]

Marconi watching associates raise kite antenna at St. John's, December, 1901

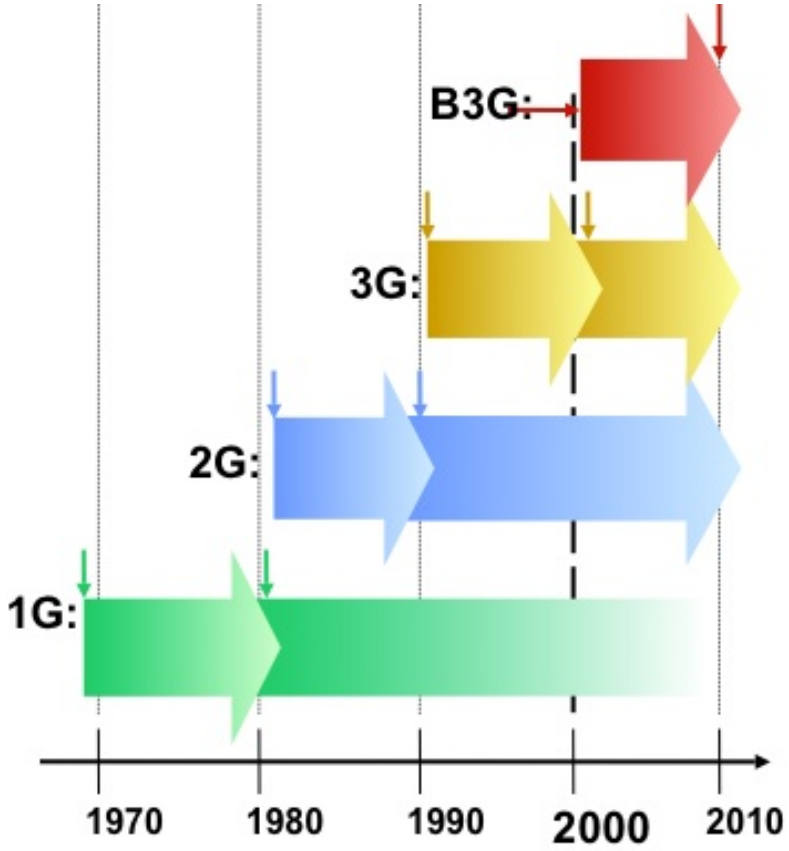
The real researchers

- Graham Bell (1874 – 1922) invented the phone,...
- but who invented also the mobile phone back in 1924?

Bell considered his most famous invention an intrusion on his real work as a scientist and refused to have a telephone in his study

[Source:Magne Pettersen, Wikipedia]

History of wireless communications



Personalised broadband wireless services

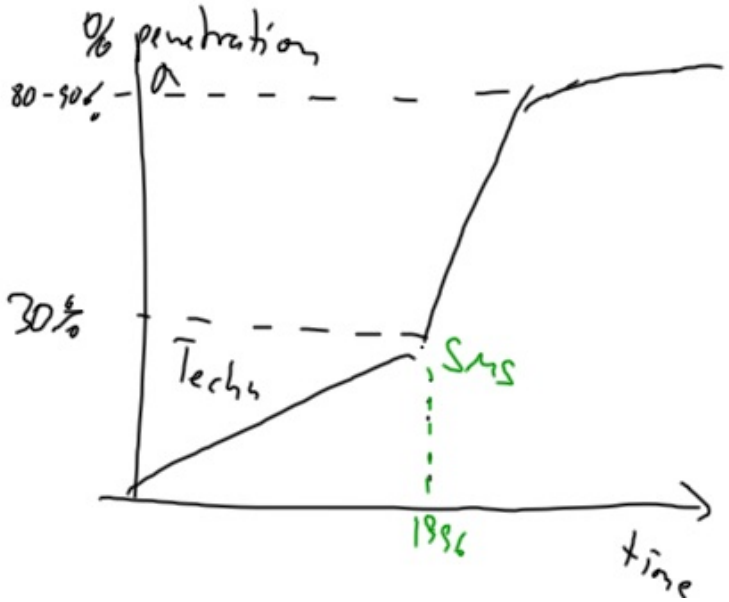
Multimedia communication

Mobile telephony, SMS, FAX, Data

Mobile telephony

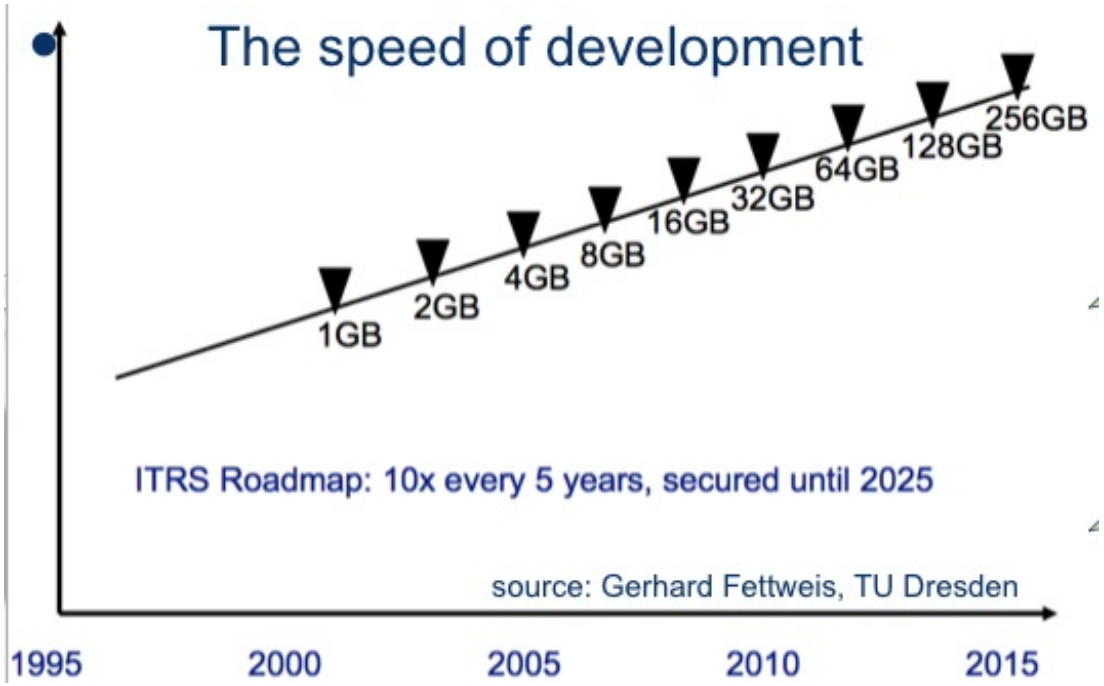
while 1G and 2G were all about radio interfaces, 3G and Beyond 3G (B3G) are all about services

Comments



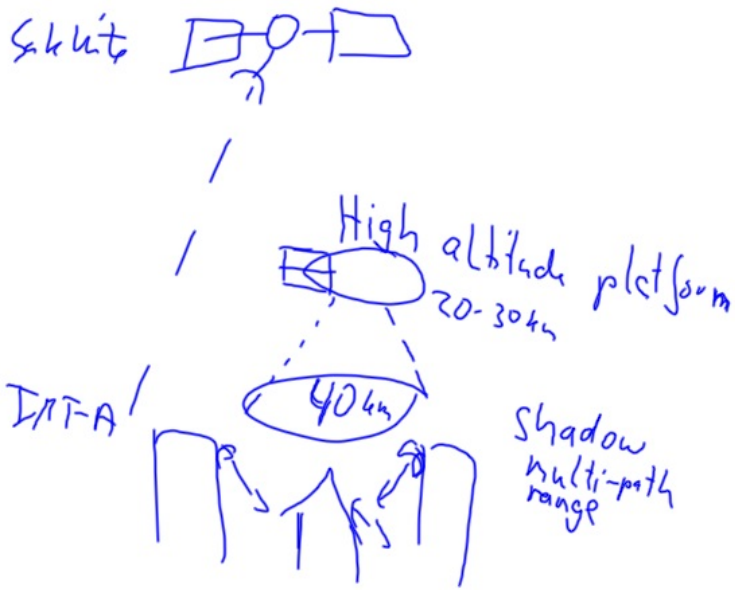
Technology acceptance curve

Speed of technology



- “There might be a need for 5 computers” (1943 Watson(?), 1951 Hartree)
- Mobile: NMT, GSM, GPRS, EDGE, UMTS, 3G, HSDPA, SMS, EMS, MMS,... DVB-H,...

Comments



Future communication systems, composed of IMT-A (ground), High altitude platform (HAP) and satellite

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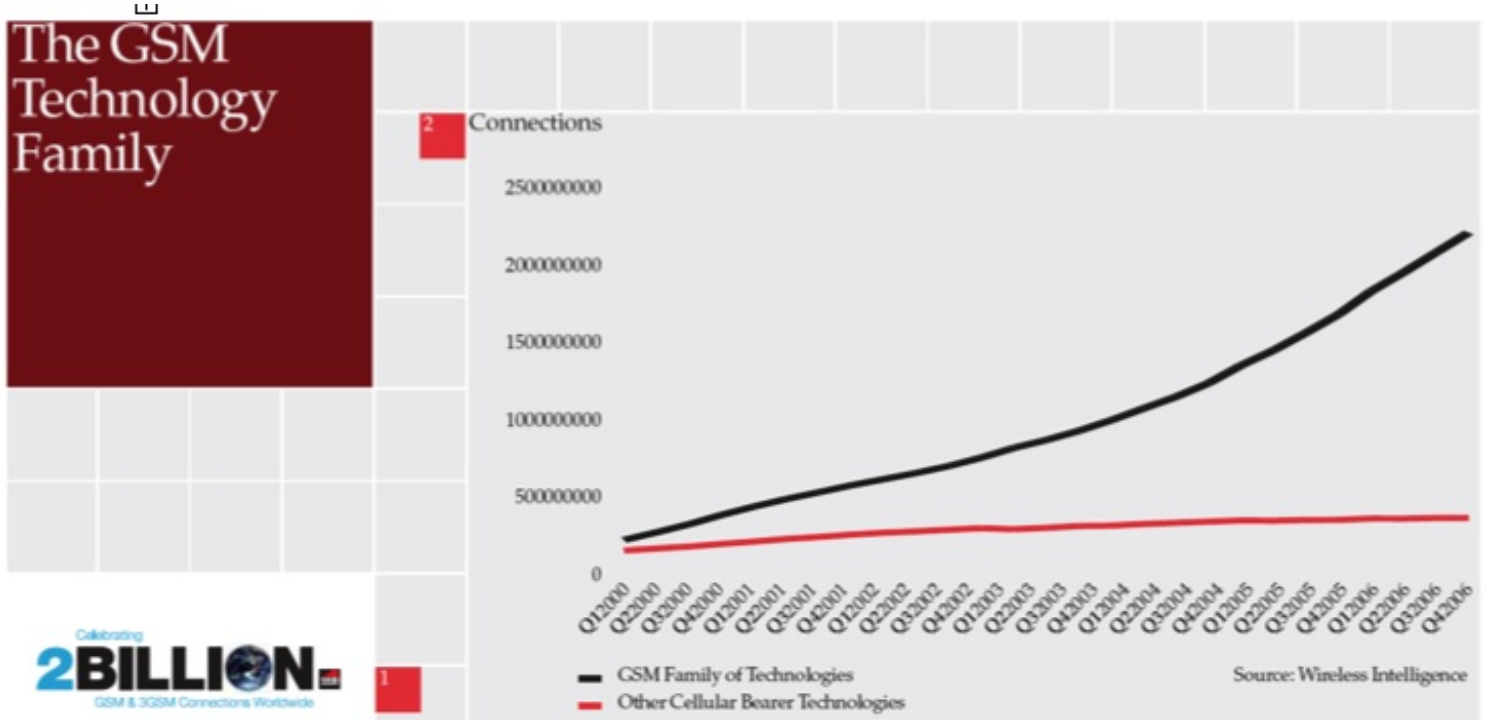
Josef Noll, UniK[?] — 21 September 2008, 01:38

Enhancements towards higher bitrates might be fulfilled through HAP (high altitude platforms), as they can provide (almost) LOS conditions in most cities.

History of wireless terminals



- 3.3 Bio Mobile Terminals in Q2.2008

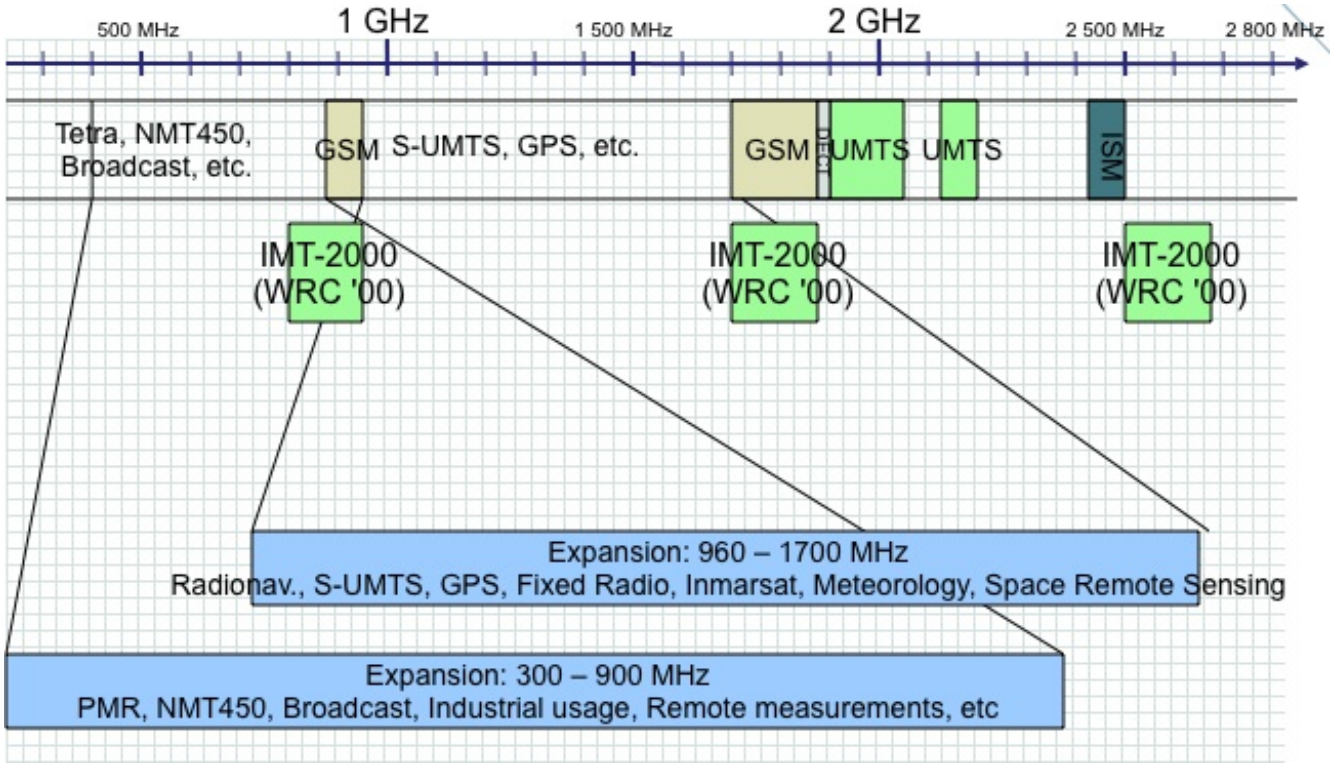
Wireless standardisation forums

- ITU-T
- ETSI
- IEEE
- 3GPP (3G Partnership Project) and 3GPP2
- Bluetooth SIG, zigbee alliance

and a lot of others adressing interworking

- OMA (open mobile alliance)
- UMTS forum
- ...

Frequency spectrum



Current wireless technologies

Ultra short range
- RFID, NFC

Vicinity
- Bluetooth, Wibree, Zigbee, WiMedia,

Local area
- Wireless LAN, 802.11 familien
- Wireless telephoni: DECT (Digital Enhanced Cordless Telecommunications)

Mobile Communications:
- NMT
- GSM
- 3G: UMTS
- IMT-A

- Mobile satellite communication: Geostationary (Inmarsat A, C, M) or low orbit (e.g. Iridium)

Class	Maximum Permitted Power	Range(Approximation)
Class 1	100 mW (20 dBm)	~100 meters
Class 2	2.5 mW (4 dBm)	~10 meters
Class 3	1 mW (0 dBm)	~1 meter

Version	Data Rate
Version 1.2	1 Mbits/sec
Version 2.0+EDR	3 Mbits/sec
WiMedia Alliance (proposed)	53 - 480 Mbit/s

Trend: Personal Networks

Interconnectivity

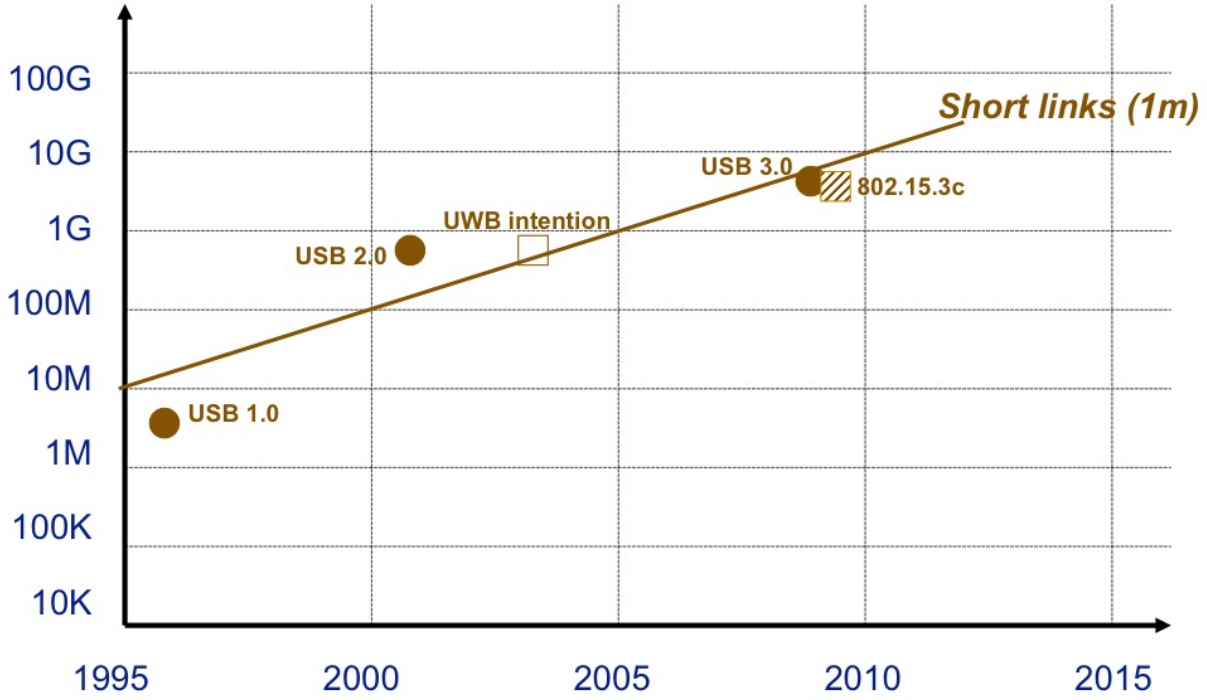
- Between devices
- To your neighbour
- create spontaneous networks (and your personal sphere)
- access **everyware**
- access from all devices

Future trends on wireless communications

IMT-Advanced (IMT-A)

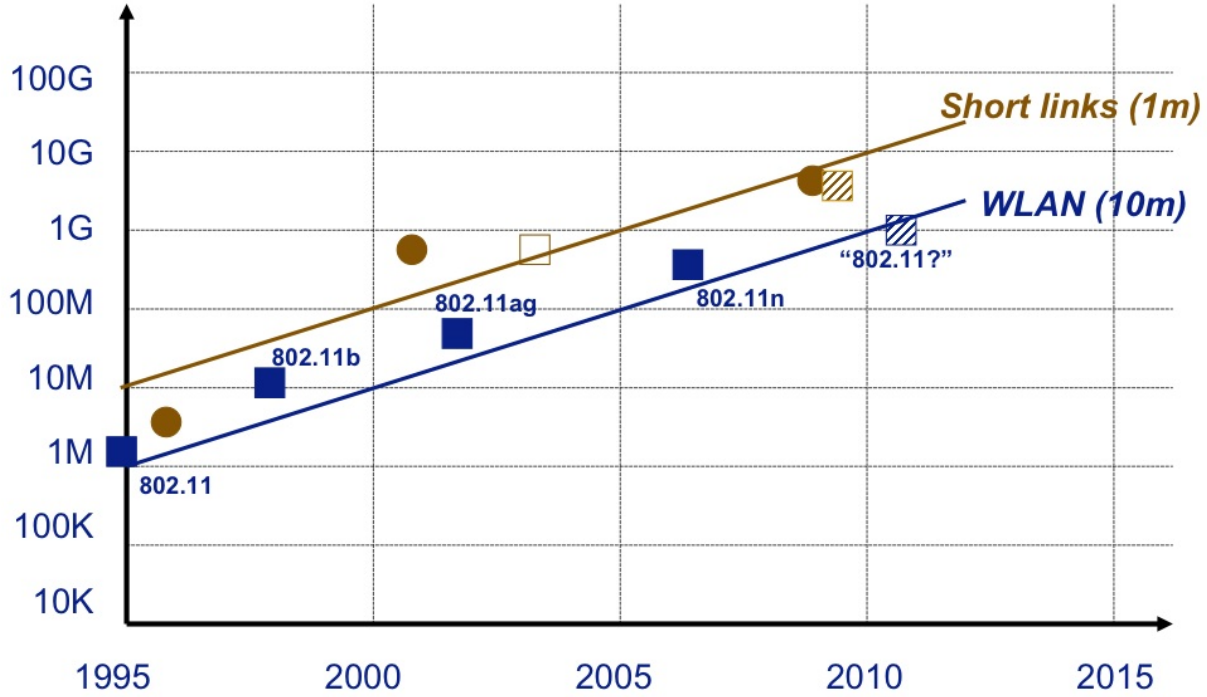
- WiMAX presentation?
- LTE presentation?

Short range communication



[Presentation G. Fettweis, IEEE VTC forum Baltimore], http://www.ieeevtc.org/plenaries/vtc2007fall/28.pdf

"WLAN communication"



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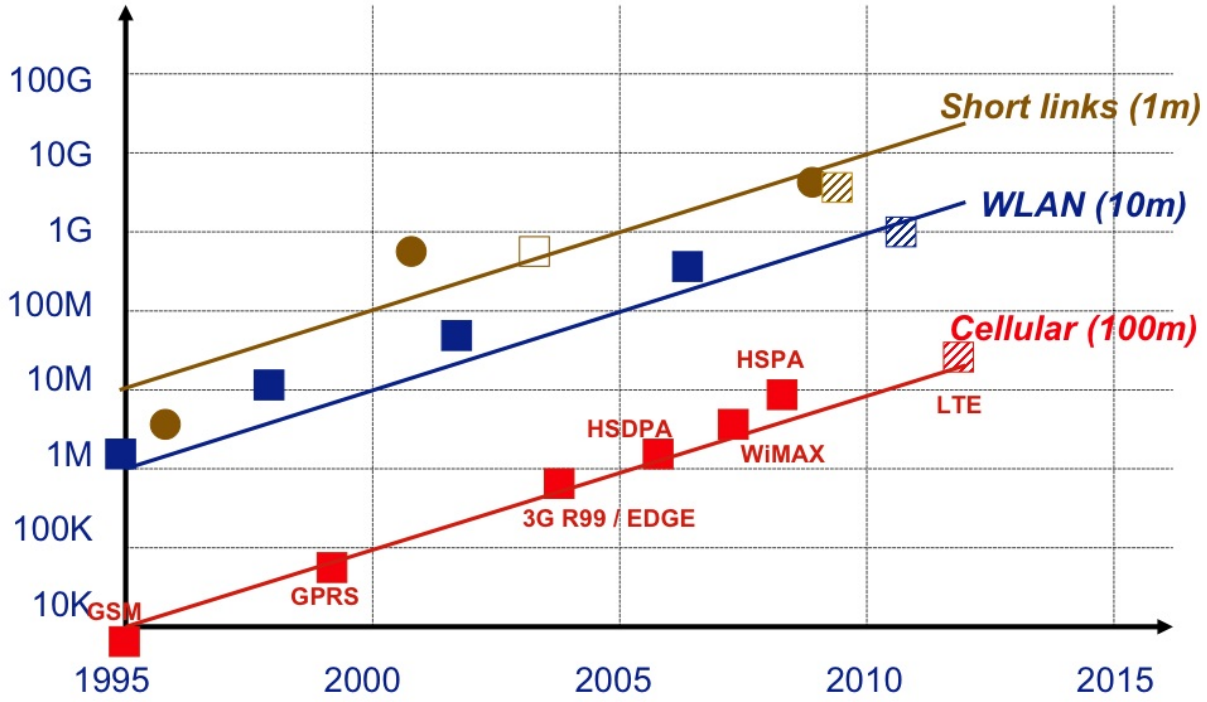
Mobile Communication



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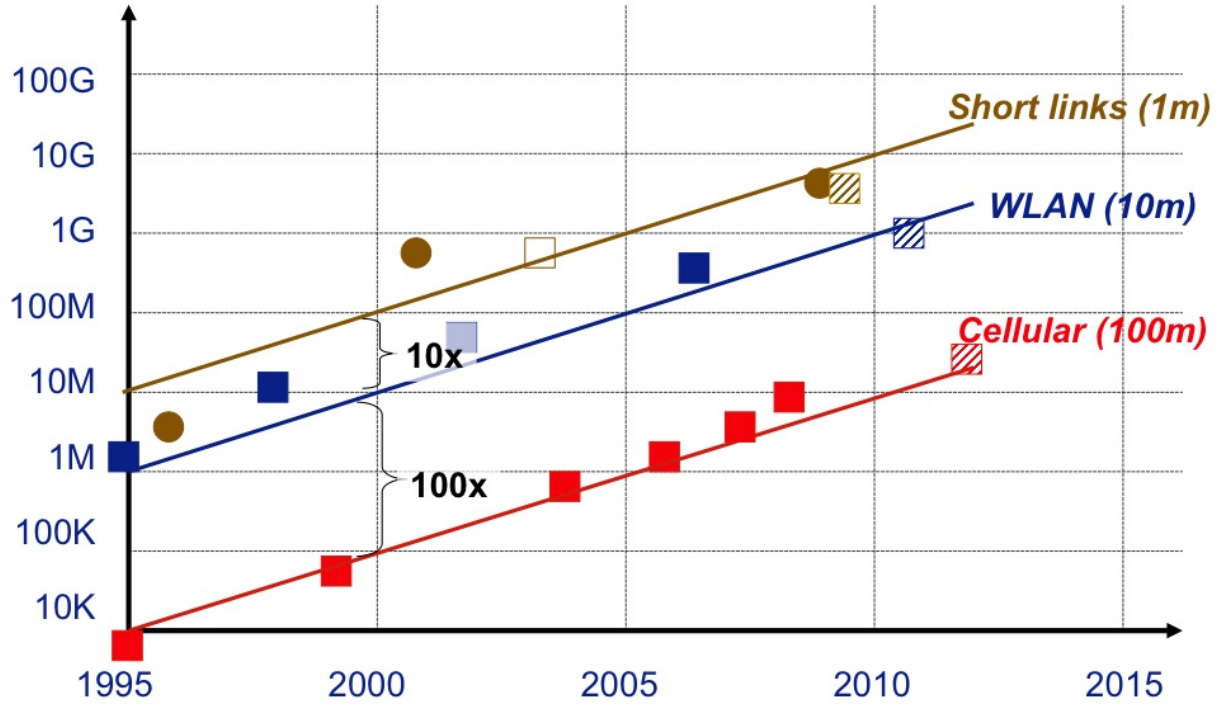
Comparison of communication technologies



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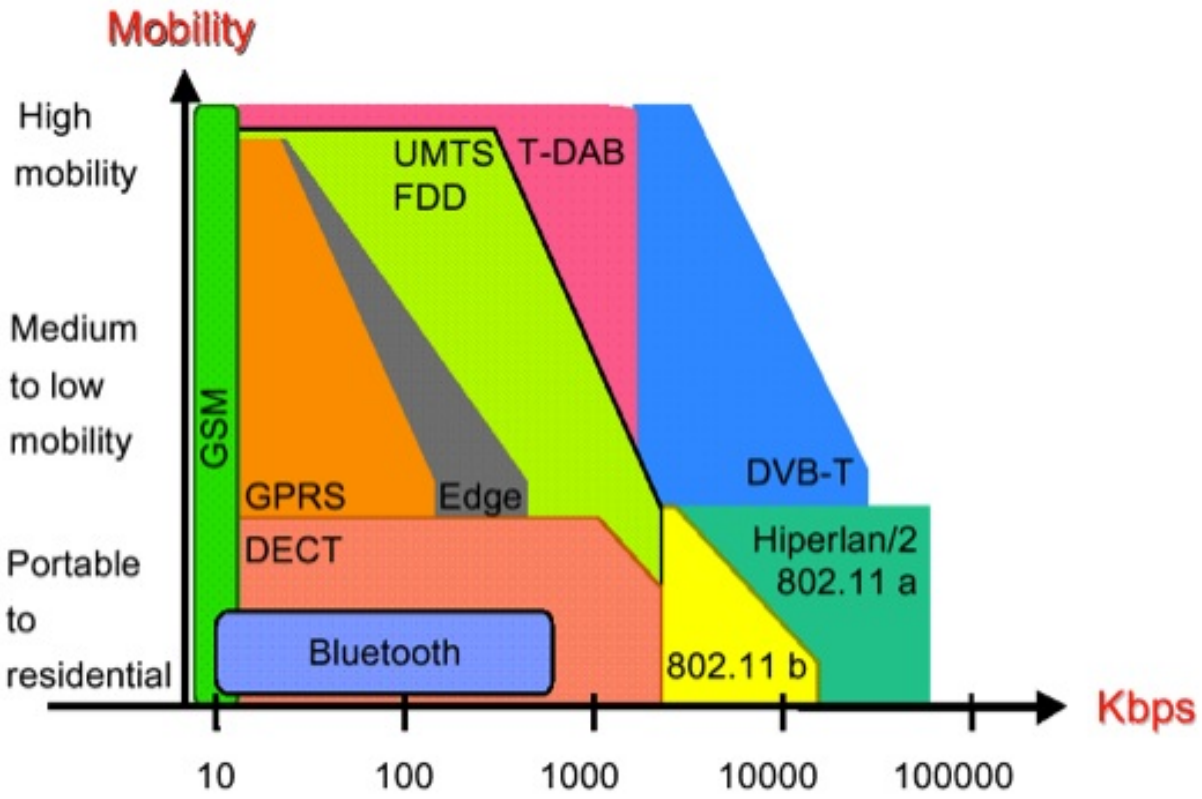
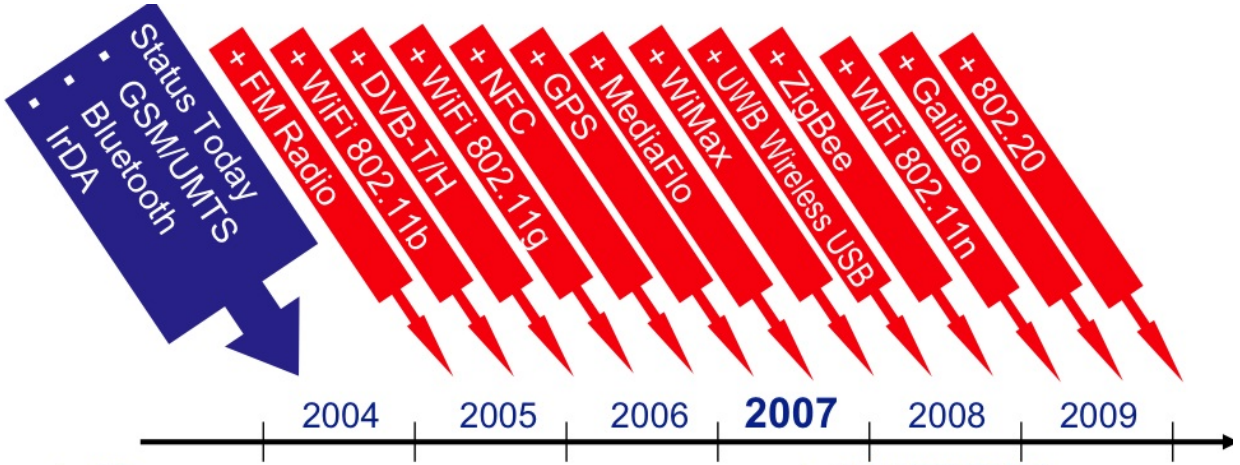
Wireless network types



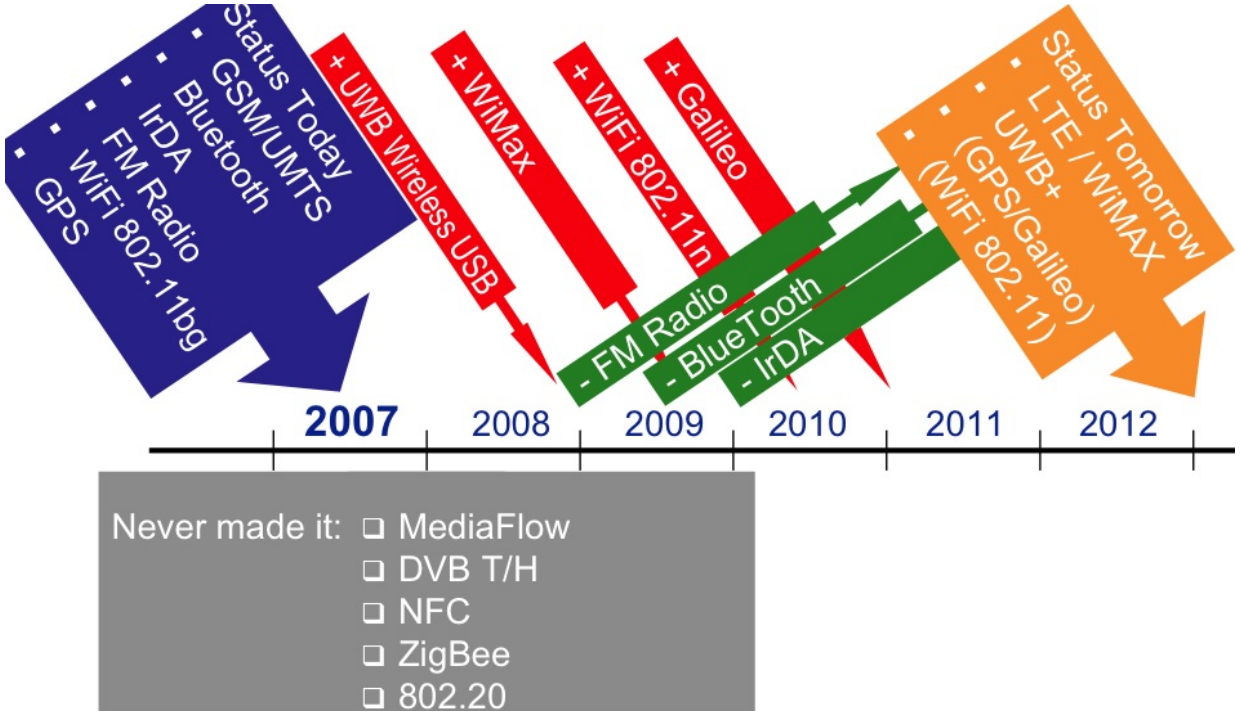
Handset challenges - today



- WiFi
  - IEEE 802.11b: 11Mb/s wireless LAN @ 2.4GHz (up to 100m)
  - IEEE 802.11a/g: 54Mb/s wireless LAN @ 2.4/5GHz (up to 100m)
  - IEEE 802.11n: 250Mb/s wireless LAN @ 5GHz (up to 30m)
- UWB (IEEE 802.15.3a): 480Mb/s wireless USB2.0 (typ. 1m)
- WiMax (IEEE 802.16d/e): ~10Mb/s broadband wireless access
- NFC: Near Field Communications (RF-ID, wireless payment,...)
- ZigBee: (IEEE 802.15.4)
  - Sensor networks, remote control
- Bluetooth
  - Version 2: TBD?

[Presentation G. Fettweis, IEEE VTC forum Baltimore], http://www.ieeevtc.org/plenaries/vtc2007fall/28.pdf

Handset challenges - tomorrow



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Josef Noll, UniK? — 21 September 2008, 01:36

G. Fettweis has focus on radio technology, not on applications and "costs" for usage. In the application area, NFC is a replacement of contactless cards for payment, using the same security mechanisms. With respect to "sensor networks" and low energy consumption, the limitations to UWB+ will not fulfill those needs.

Summary

Focus on three communication areas

- ultra short range, e.g. NFC
- vicinity, e.g. Bluetooth
- local area, e.g. WLAN
- mobile communications, e.g. LTE

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