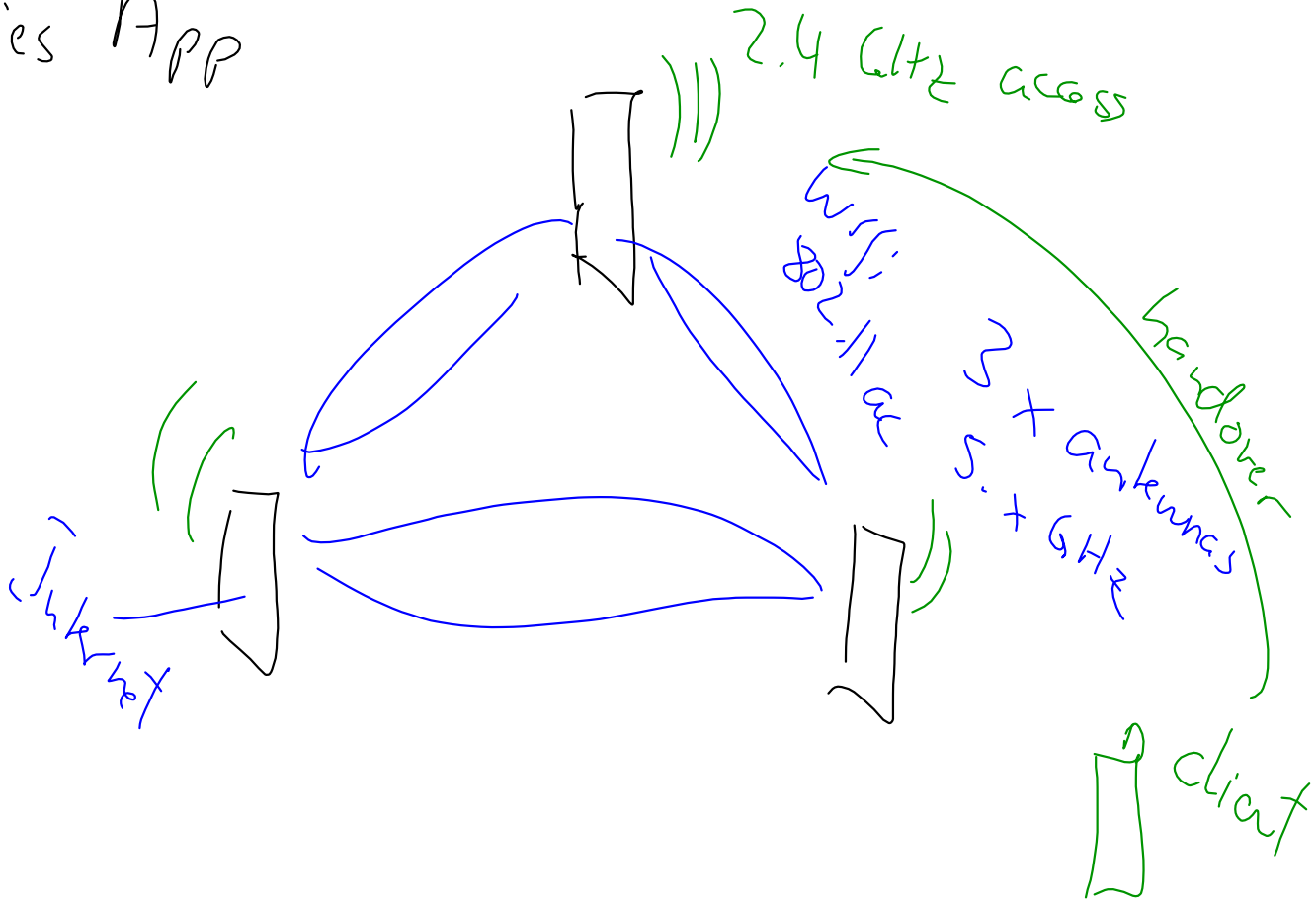
Managed Wifi

Shahzad

Air 4920

AirTies App



Today

Building ... Networks

History, Now and Future
- History
- Pioneers: Maxwell, Hertz,...
- 1G, 2G,... 5G networks
- Frequencies and Standards
- Future Challenges

A-Basics of Communication
- Electromagnetic Signals
- Radio Communication Principles
- Digital communication: Signal/Noise Ratio
- Signal strength and Capacity, Shannon

B-Antennas and Propagation
- Free Space Propagation
- Antennas, Gain, Radiation Pattern
- Multipath Propagation, Reflection, Diffraction
- Attenuation, Scattering
- Interference and Fading (Rayleigh, Rician, ...)
- Mobile Communication dependencies

C-Propagation models
- Environments (indoor, outdoor to indoor, vehicular)
- Outdoor (Lee, Okumura, Hata, COST231 models)
- Indoor (One-slope, multiwall, linear attenuation)

D-System Comparison
- Proximity: RFID, NFC
- Short Range: ZigBee, Bluetooth, ANT+,...
- WLAN/Wifi/802.11...
- Mobile: GSM, UMTS, IMT-A (WiMAX, LTE)

E-Mobility
- Mobile Network mobility
- IP mobility

F-Network Building
- Future Networks
  - 5G Heterogeneous Networks
  - Basic Internet
  - Video Distribution Networks
- Coverage simulations
- Coverage simulations
- Traffic simulations
- Network Capacity simulations

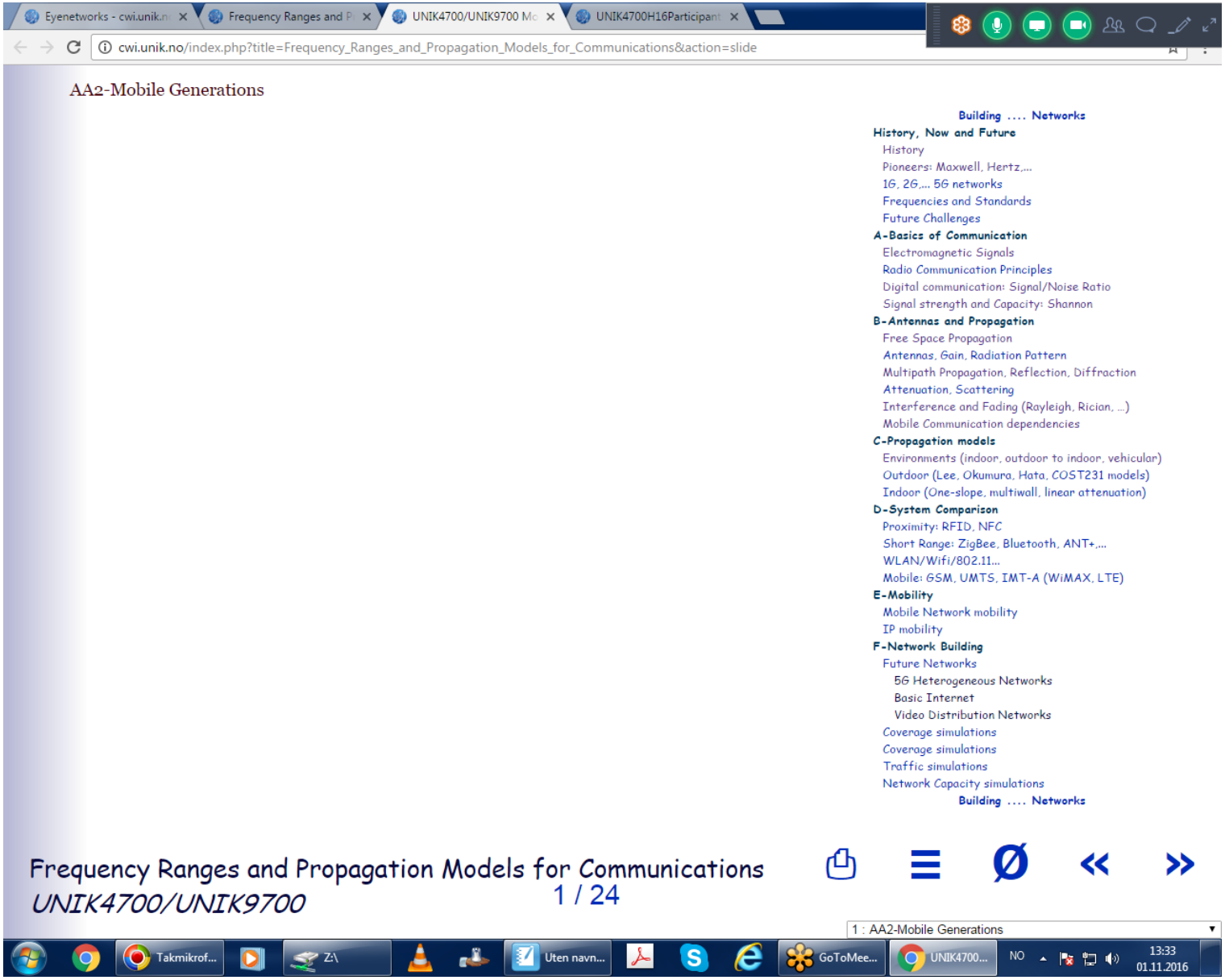
Building .... Networks

To day

repeat

→ Fading Margin

Wifi → Behzad


Eyenetworks - cwi.unik.no
Frequency Ranges and P
UNIK4700/UNIK9700 Mo
UNIK4700H16Participant
cwi.unik.no/index.php?title=Frequency_Ranges_and_Propagation_Models_for_Communications&action=slide
AA2-Mobile Generations
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Frequency Ranges and Propagation Models for Communications
UNIK4700/UNIK9700
1 / 24
1 : AA2-Mobile Generations
Takmikrof...
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Uten navn...
GoToMee...
UNIK4700...
NO
13:33
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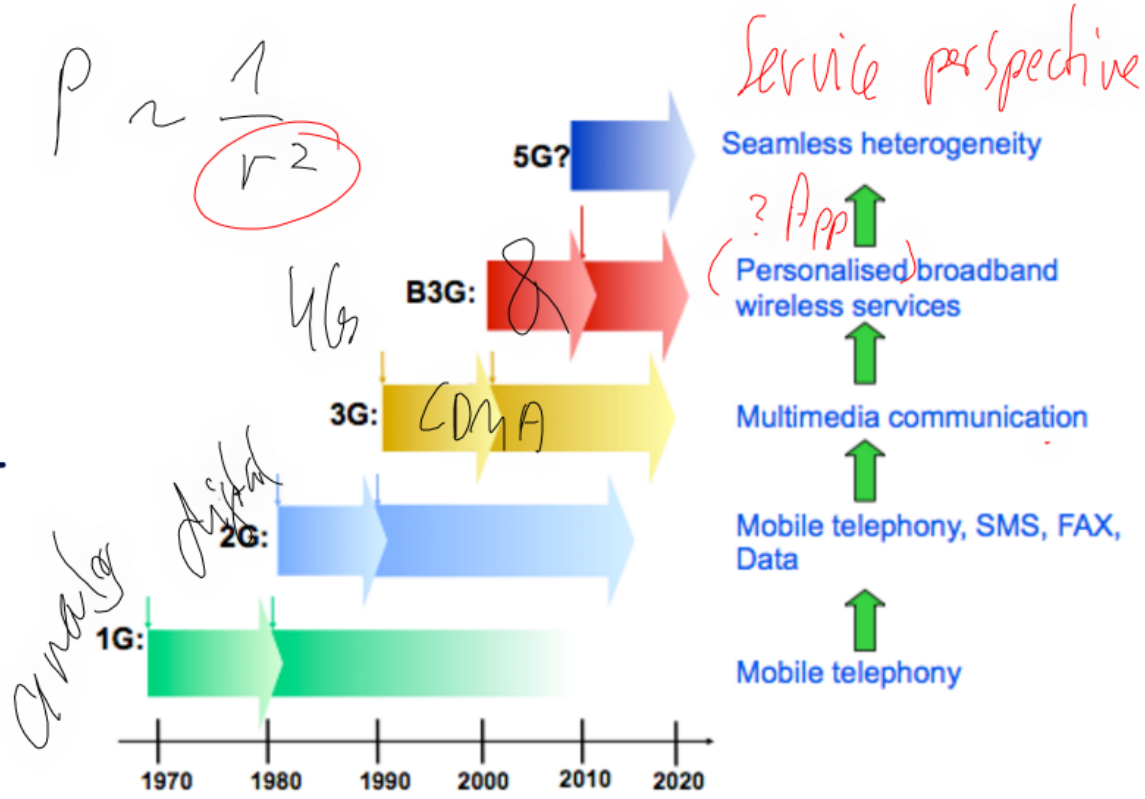
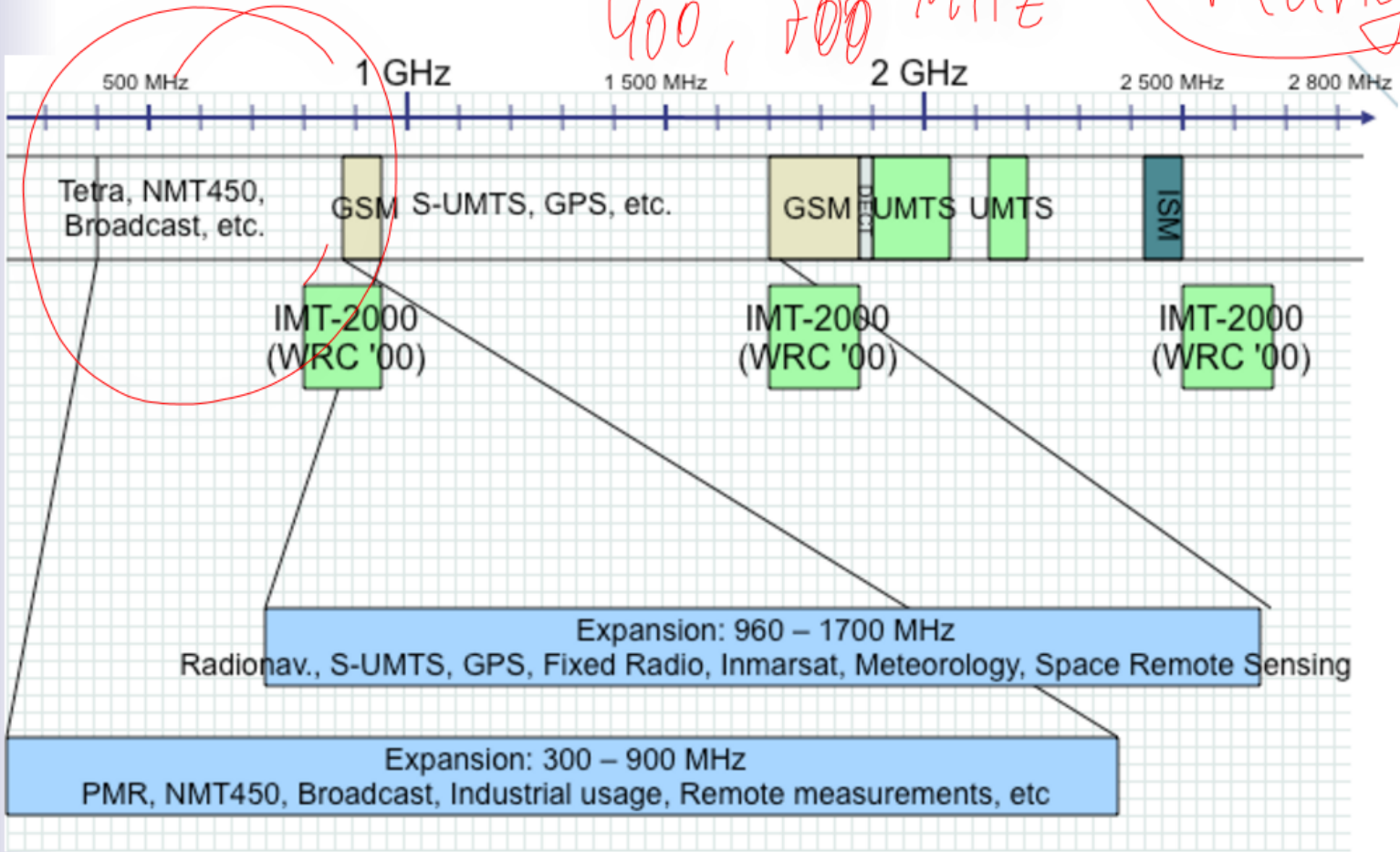
History Of Wireless Communications

while 1G and 2G were all about radio interfaces,

- 3G and Beyond 3G (B3G) are all about services
- 4G is using mobile broadband everywhere
- 5G will be truly heterogeneous network



Frequency Spectrum



Current Wireless Technologies

Ultra short range

- RFID, NFC

Vicinity

- Bluetooth, Wibree, Zigbee, WiMedia,
- ANT+, Bluetooth Smart (Low Energy)

Local area

- Wireless LAN, 802.11 family
- Wireless telephony: DECT (Digital Enhanced Cordless Telecommunications)

Mobile Communications:

- NMT
- GSM
- 3G: UMTS
- 4G:LTE - IMT-A
- 5G
- Mobile satellite communication: Geostationary (Inmarsat A, C, M) or low orbit (e.g. Iridium)

802.15 Wireless Hart, IN50100

36.000km delay

many satellites

directive antenna

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

Expectations Towards Global Coverage

Affordability?

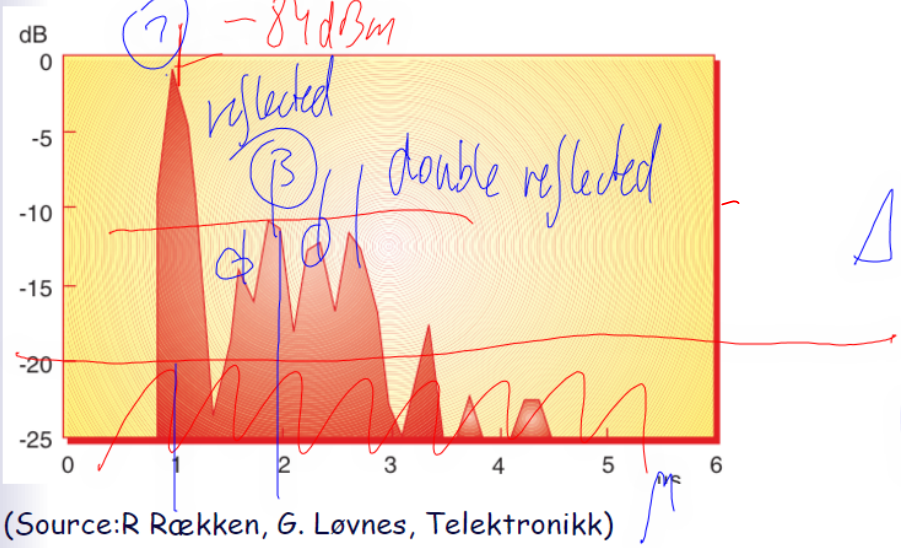
- According to Ericsson, Mobile Technologies are available for 50% of the world's population (2013), and the coverage will increase to 75% by 2017.
- According to Internet.org (Facebook, Opera Software, ...), only 1/3 of the world's population has access to the Internet (2013).
- An extrapolation by the Basic Internet Foundation points out that even in 2017 about 45% of the population will not have access to Internet, mainly due to affordability. Thus they promote the free access to basic information of the Internet, being text and pictures.

Impuls response

fixed antenna, received power from a pulse

Measurements In Rural Farmland

- Typical IR from Farm_1, 1718 Unik/MHz. Total received power was -84 dBm, 20 dB above GSM sensitivity level



(Source:R Rækken, G. Løvnes, Telektronikk)

$P_{Sen} = -104dBm$

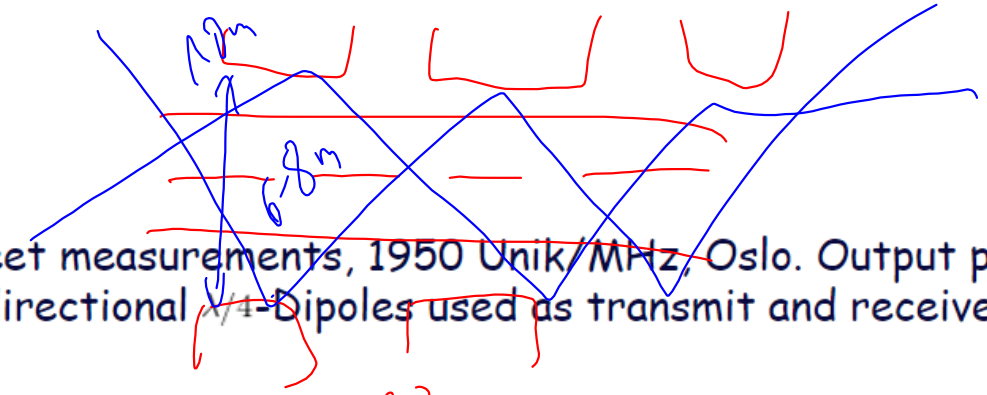
$\Delta 1\text{-}3 \sim 2\mu s \sim 600m$

$V = \frac{s}{t} \rightsquigarrow s = v \cdot t$

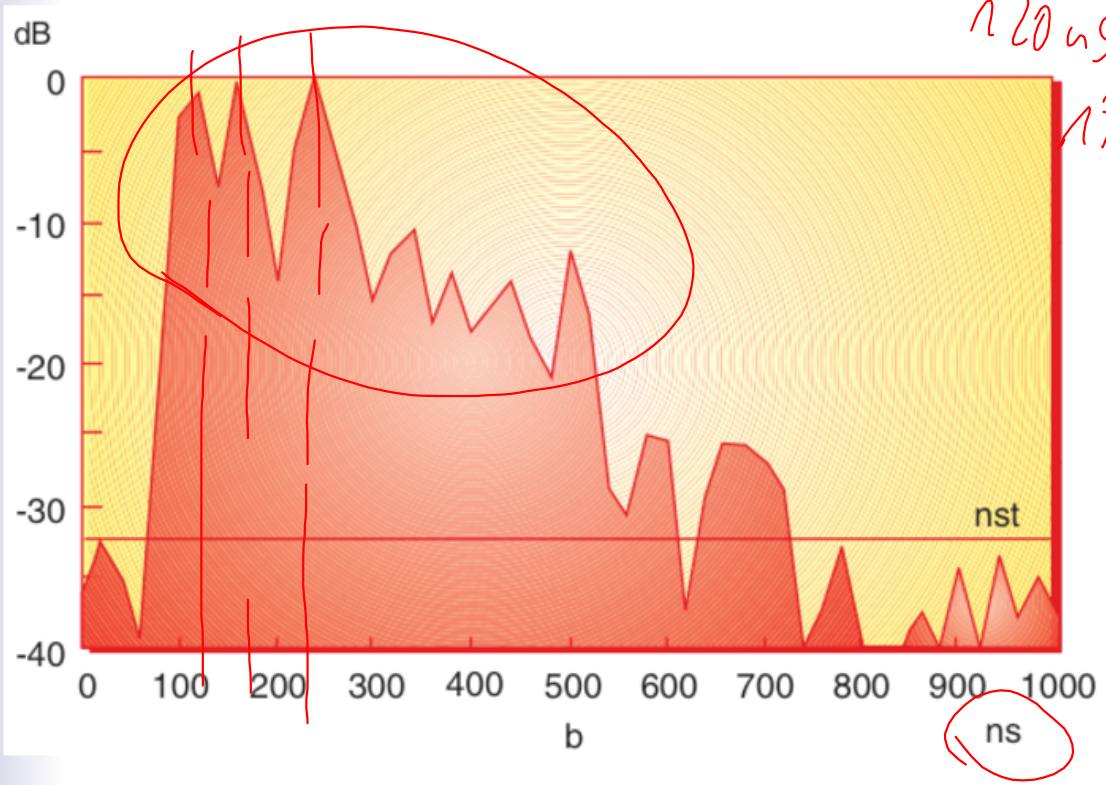
$3E8\,m/s \cdot 2E\text{-}6s$

These questions are valid for all of the following impulse responses

- from delay, calculate reflection factor and free space attenuation
- describe characteristics of reflection



- Typical IR from City street measurements, 1950 Unik/MHz, Oslo. Output power 25 dBm (in mW?). Omnidirectional λ/4-Dipoles used as transmit and receive antennas.



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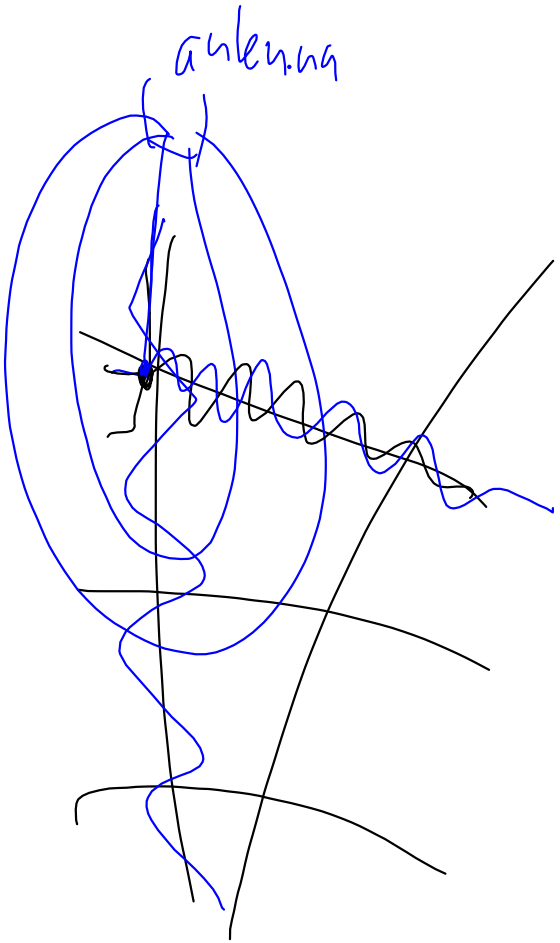
why almost equal distribution? What effect?

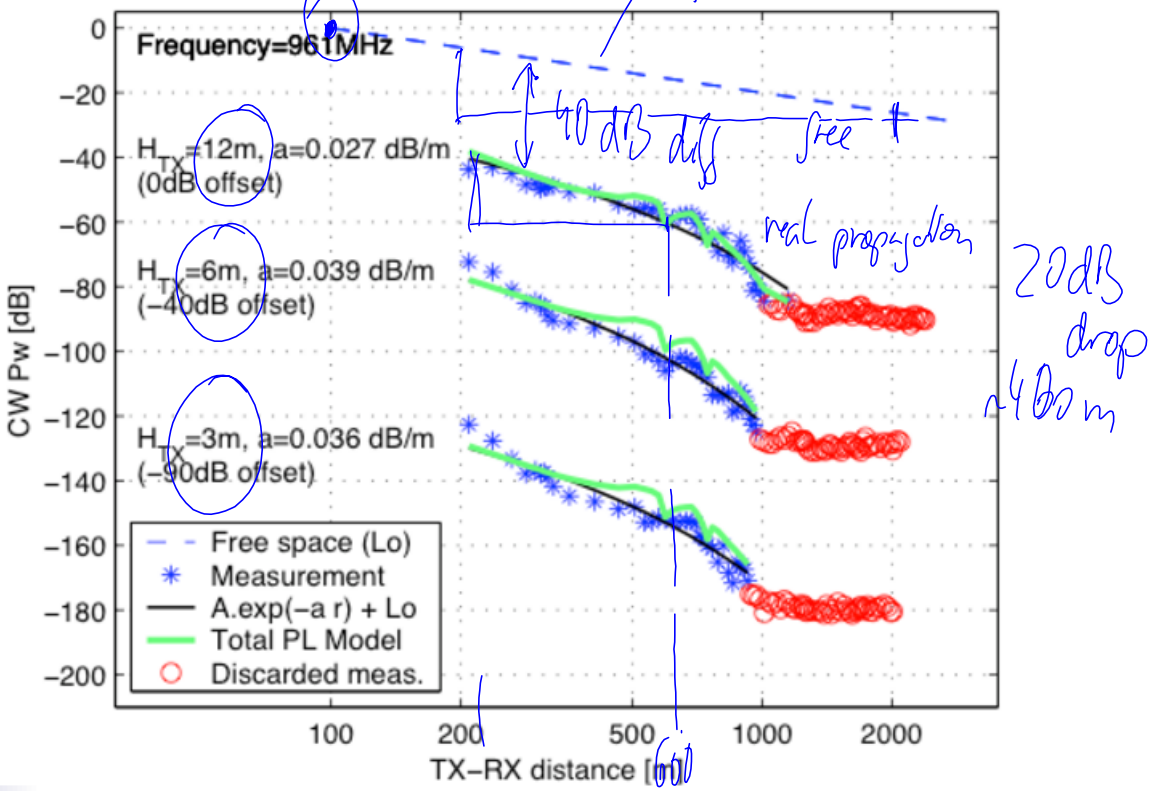


City propagation

Multipath reflection

Forest, 961 MHz Measurements

- slightly hilly terrain



(Source:István Z.Kovács,Ph.D.Lecture,CPK, Septembe

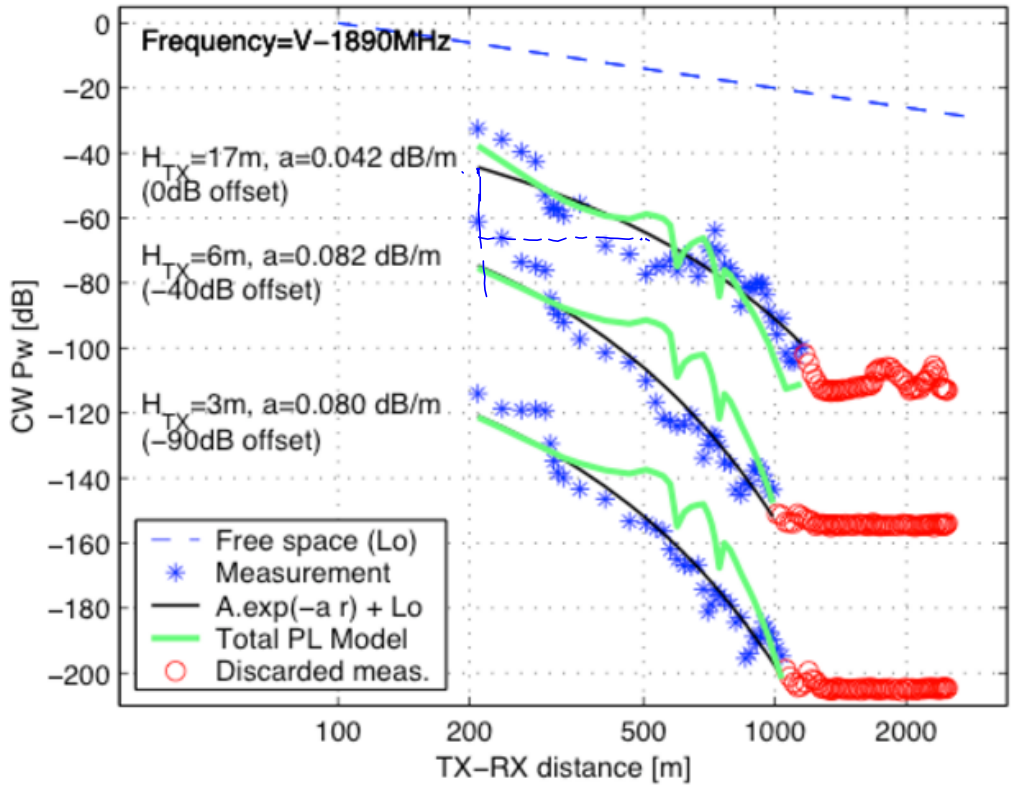
ETSI Indoor Office Test Environme

- derived from COST 231
- r is transmitter-receiver distance in m; n is number of floors in the path
- path loss L should always be more than free space loss. Log-normal shadow fading standard deviation of 12 dB
- Path loss model: $L_{indoor} = 37 \log r + 18.3\ n^{((n+2)/(n+1)-0.46}$ [dB]

+ no of rooms ; number floors

Forest, 1890 MHz Measurements

- slightly hilly terrain



L=32.4 +20log f[MHz] +10log R[km]

(Source:István Z.Kovács,Ph.D.Lecture,CPK, September6,

2 freq ~ prop. model

~ measurements

Shezad

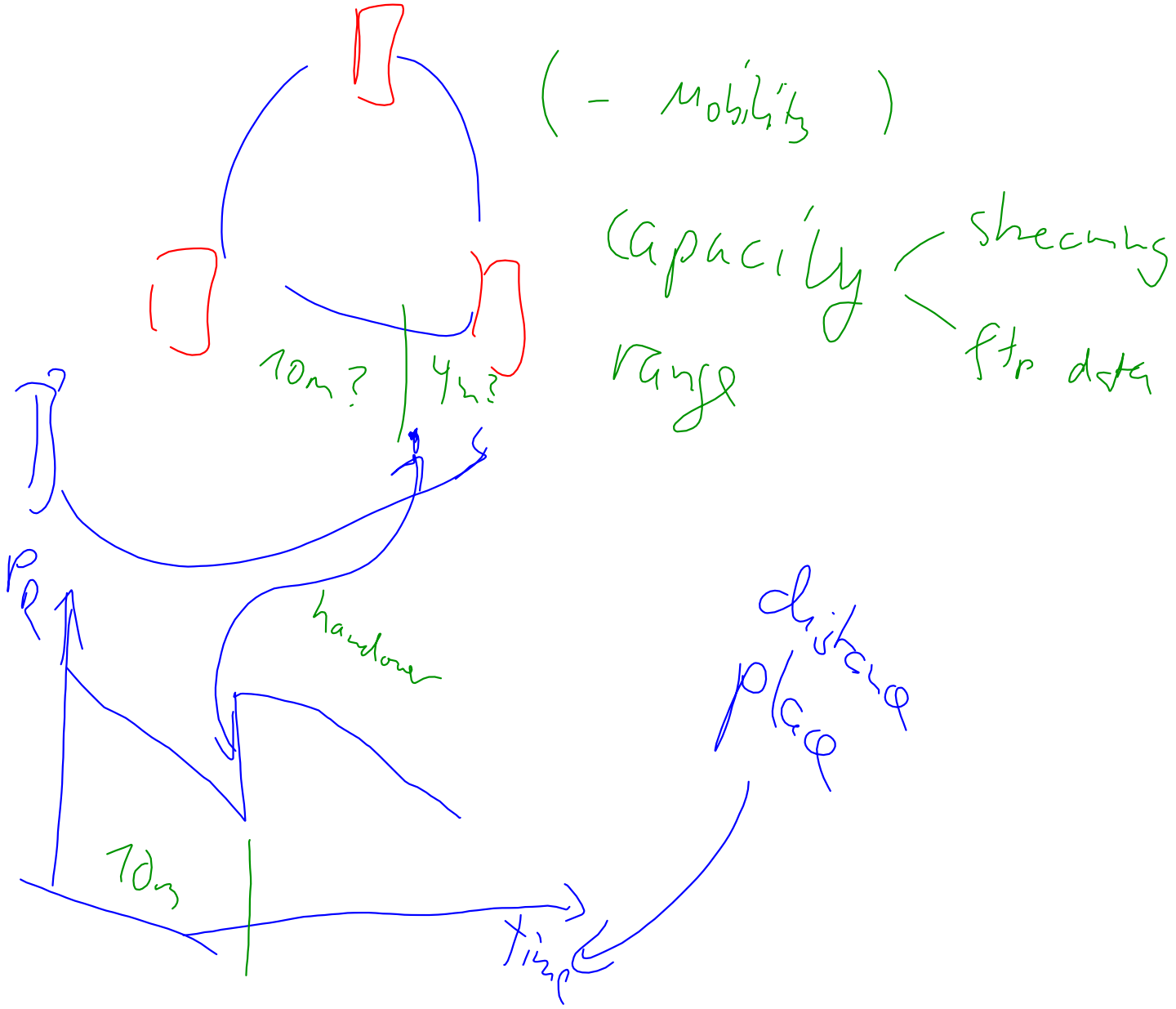
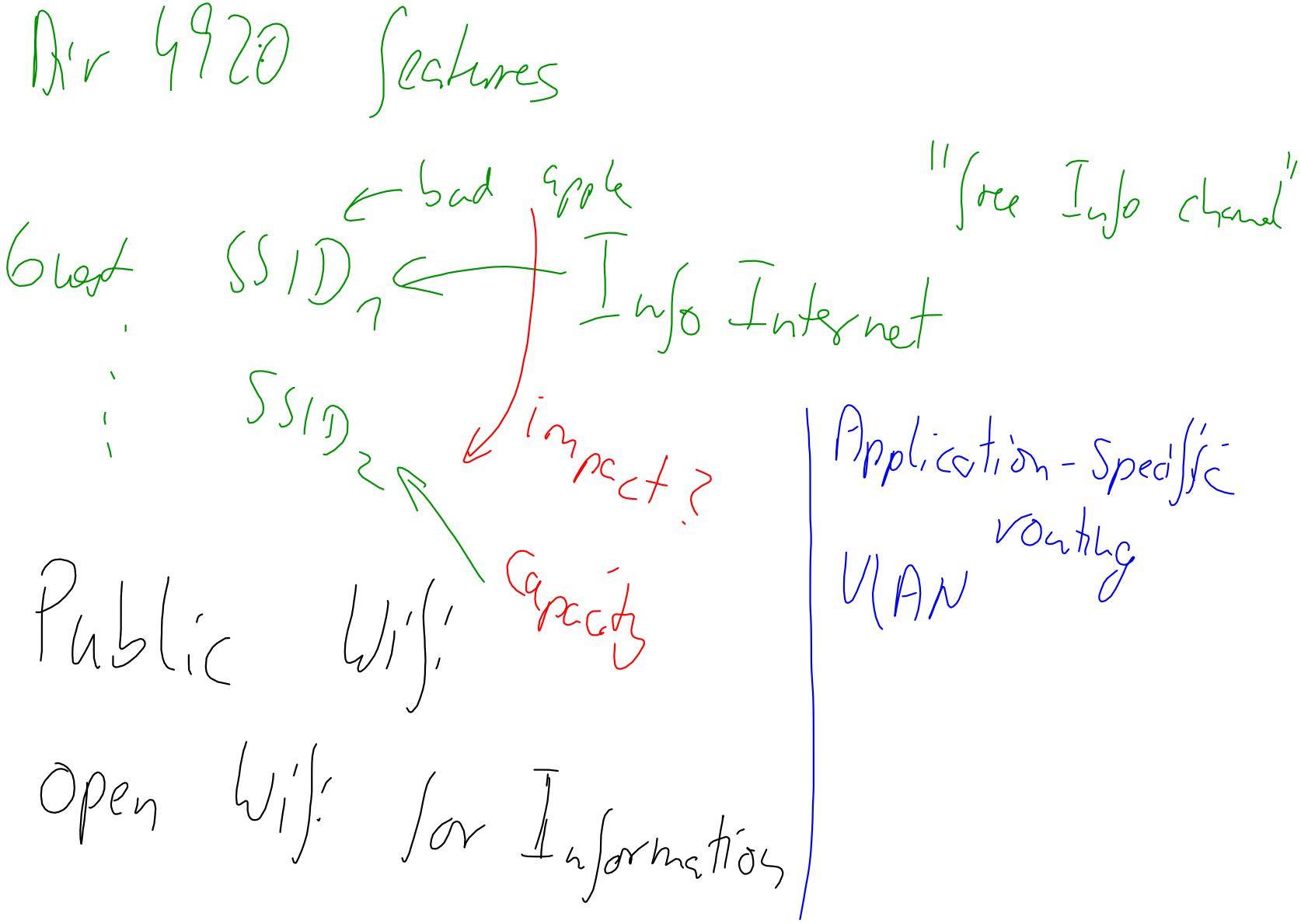
pick freq

other parameters

- range
- handover
- packet rate
- ....

} quality of a network

"bad apple" switch off 2x


(- mobility)
capacity
streaming
ftp data
range
10m ?
4m ?
handover
P_R
10m
time
distance
place

Air 4920 features