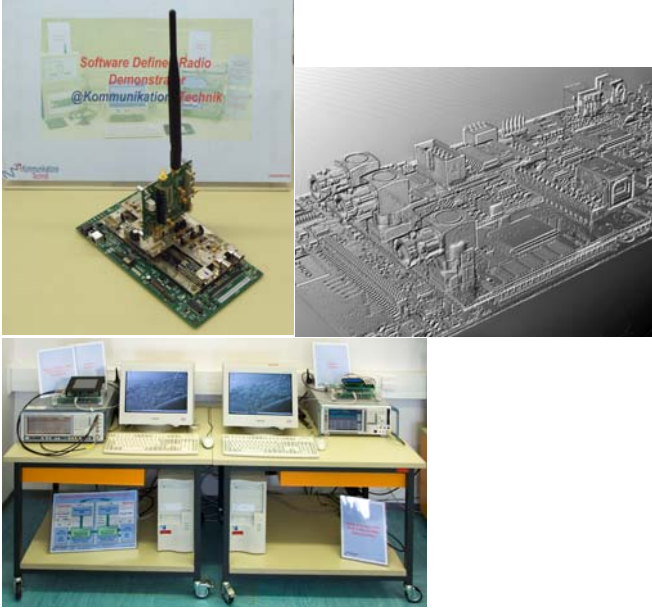




# R&D@KT



Univ.-Prof. Dr.-Ing. habil. Peter Jung



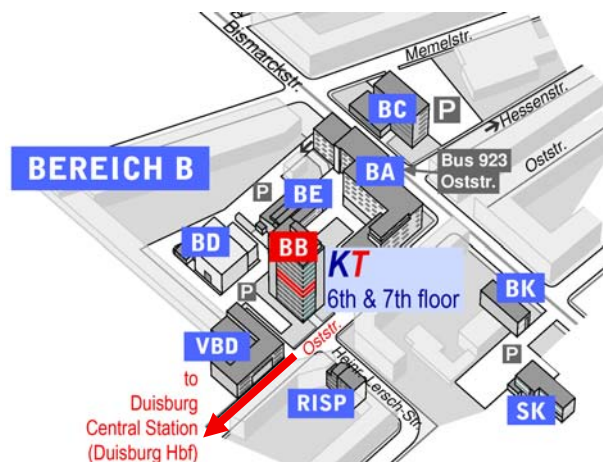
Dr.-Ing. Guido H. Bruck



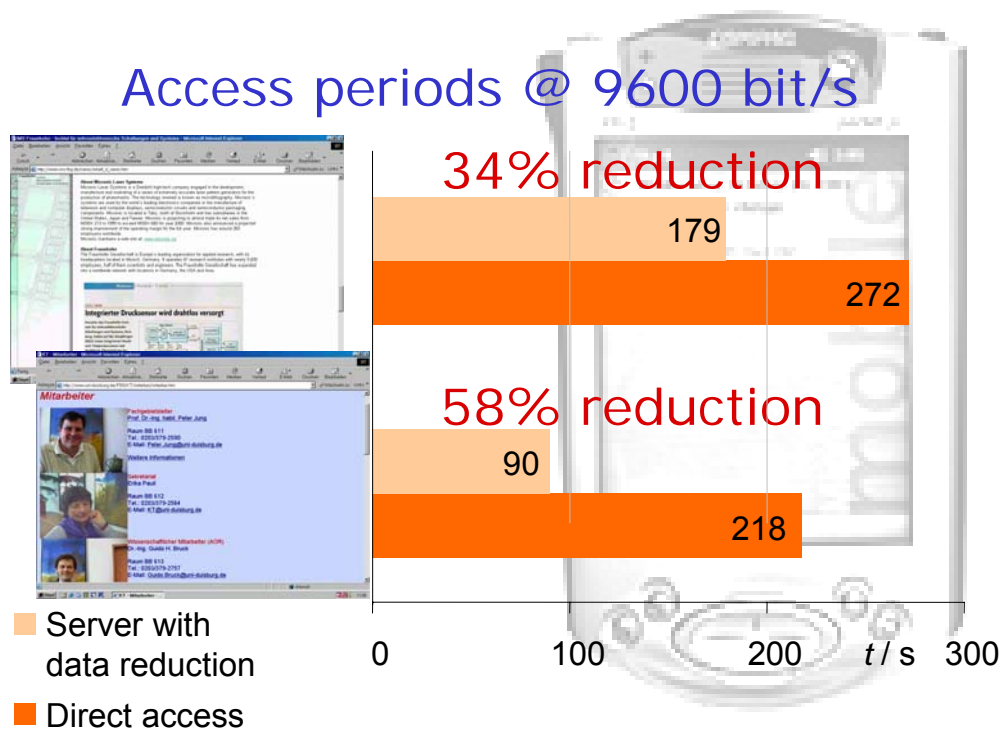
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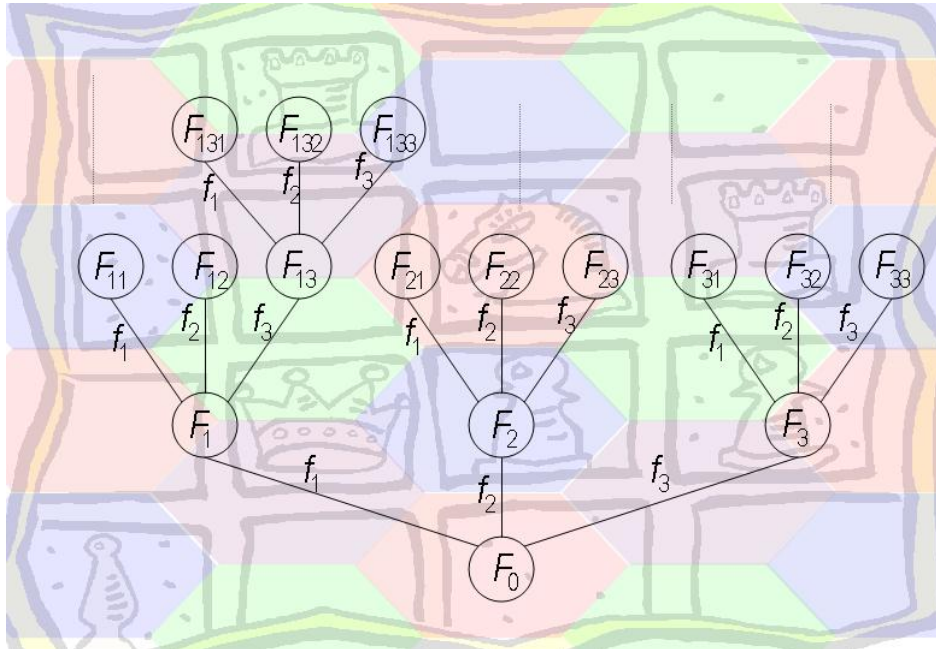


① **Integration of Wireless Multimedia Applications**



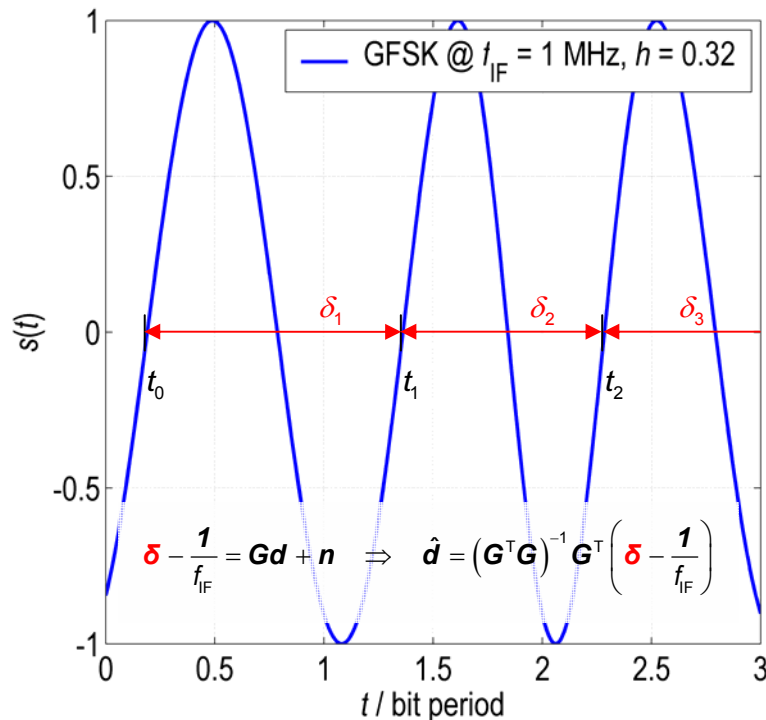
- Parameter optimization of source coding algorithms for **Data Reduction** tailored for the application in **Internet (Internet Protocol, IP) based Wireless Multimedia Applications**.
- **Cross-Layer Optimization** techniques, e.g. **Joint Source and Channel Coding and Decoding** techniques.
- **Middleware and Application Software** development, e.g. of integrated audio/video (AV) applications, like
  - web site and still image transmission,
  - video streaming tailored to mobile handsets,
  - biometrical parameter transmission (e.g. handwriting transmission),
  - evaluation of the colour reproducibility of displays for mobile terminals.
- Present **Subprojects** are
  - Mobile Data Compressor,
  - Joint Source and Channel Decoding (JSCD),
  - Wireless MediCare,
  - Java Based Secure „Mobile Web Terminal“ (MWT),
  - CarIT.

## ② Infrastructure Aspects of Wireless Communication Systems



- Development and analysis of **Quality of Service (QoS)** based adaptive Radio **Resource Management (RRM)** strategies in cellular systems, in particular
  - **Dynamic Resource Allocation**, i.e. dynamic channel allocation (DCA), and **Hybrid Resource Allocation**, i.e. hybrid channel allocation (HCA) techniques based on **Game Theory**;
  - **Load Control** for multimedia applications.
- Control strategies, in particular **Power Control** and **Handover/Handoff**, respectively (hard, soft, softer).
- **Performance Evaluation**, e.g. of outage probabilities w.r.t. the fulfilment of quality of service (QoS) criteria.
- Present **Subprojects** are
  - Radio Resource Management in Wireless Systems,
  - Quality of Service (QoS) for Mobile Packet Services.

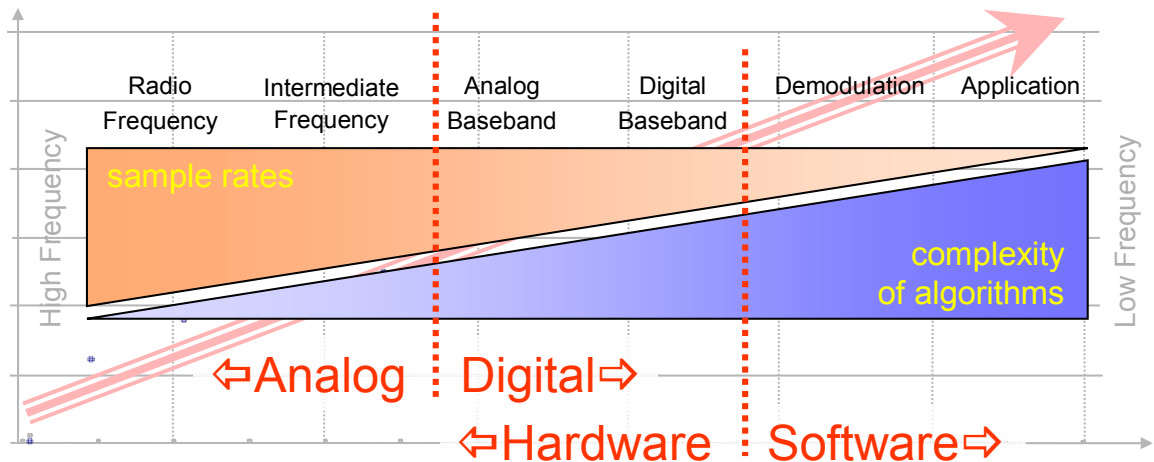
③ **New Technologies of Signal Demodulation (sifirX, JoinTrans)**



- Development and theoretical analysis of system and signal models with **Non-Equidistant Sampling**, in particular
  - analytical description of noise and intersymbol interference at the output of **Zero Crossing Detectors**;
  - derivation of appropriate linear system equations by using matrix-vector calculus.
- Derivation of novel receiver structures with zero crossing demodulation for wireless systems (e.g. **Bluetooth, DECT, GSM, EDGE, UMTS, IEEE 802.11g,n, UWB**), in particular
  - design and theoretical as well as simulative analysis of optimum and suboptimum receiver algorithms;
  - evaluation of channel and source coding combined with zero crossing demodulation.
- **Joint Transmission** and **Predistortion Techniques** with equidistant and non-equidistant sampling.
- Present **Subprojects** are
  - Theory of Irregular Sampling,
  - Bluetooth/GSM/DECT Transceiver w/ Irregular Sampling,
  - Joint Transmission and Predistortion Techniques.

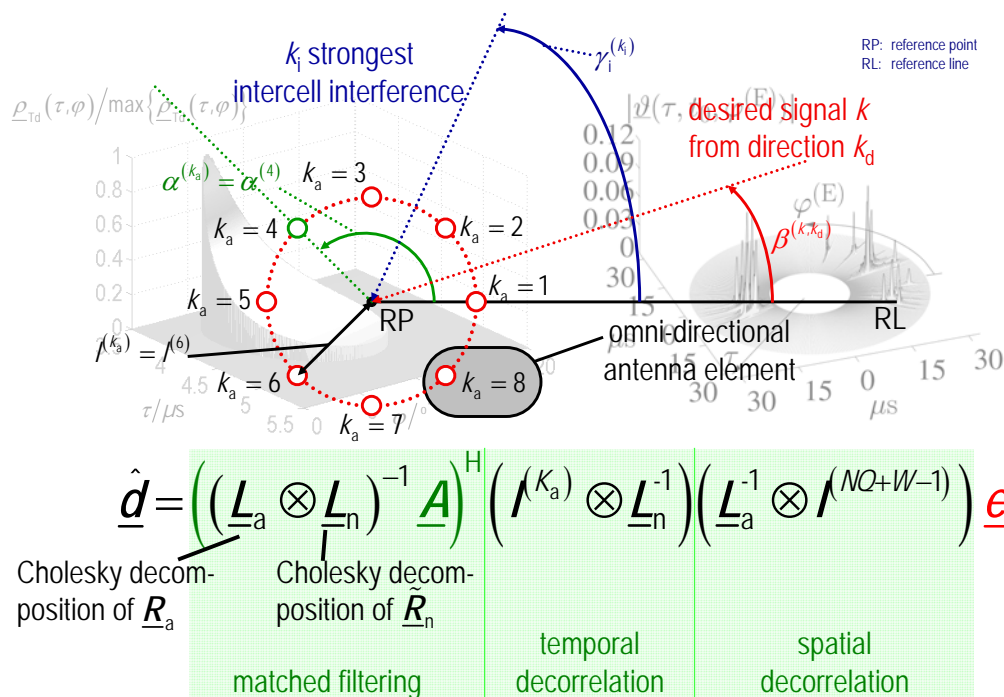


#### ④ Reconfigurable Radio (Software Defined Radio, SDR)



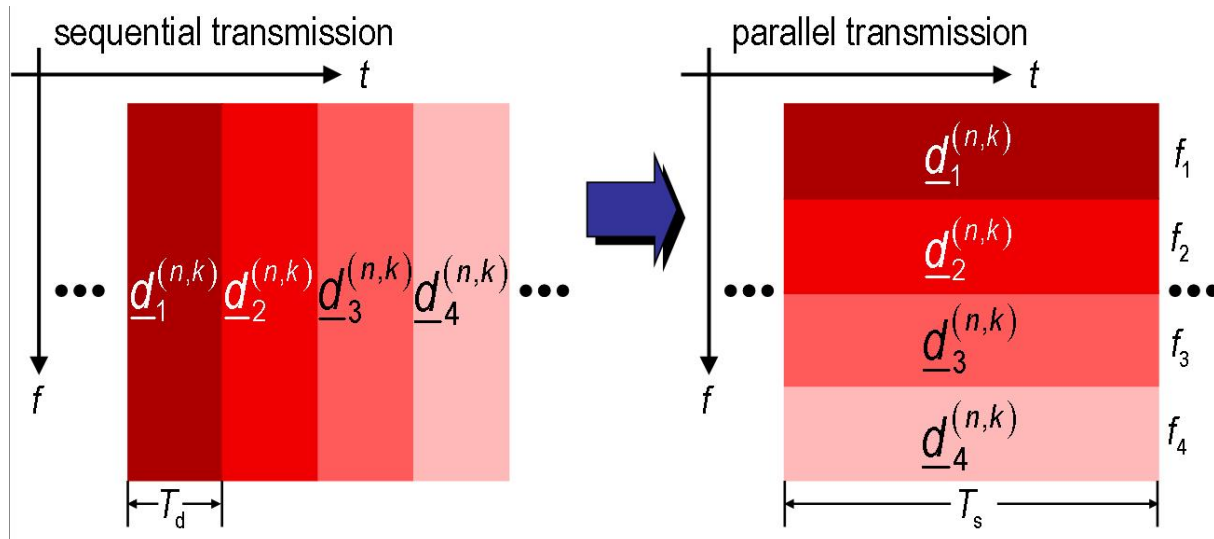
- Establishment of **Design Paradigms** and **Partitioning Strategies** for mobile terminals taking technological restrictions into account, in particular
  - design and analysis of transceiver front ends (unstabilized oscillators, low IF and zero IF concepts);
  - hardware/software split in transceiver data paths (turbo principle), based on the expected signal processing effort, the power consumption and the required chip area;
  - implementation of **Real-Time Signal Processing** on e.g. the C6000 DSP platform by Texas Instruments and measurements of the signal processing behaviour.
- Concept engineering for **Multi-Standard Single Chip Transceivers** for **GSM**, **UMTS**, **Bluetooth**, WLAN (i.e. IEEE **802.11g,n**) and **UWB**.
- Realization of **Demonstrators** based on a multi DSP solution with e.g. C6000 DSPs by Texas Instruments.
- Present **Subprojects** are
  - Software Defined Radio Demonstrator,
  - UMTS/WCDMA PHY Performance Aspects,
  - Turbo-Codes for Impulsive Noise Environments,
  - Turbo-Codes Analysis Using EXIT Charts.

⑤ **Smart Antennas for Future Wireless Communications**



- **Design and Analysis of 3G and "beyond 3G" (B3G/4G) Wireless Communication Systems** with smart antennas, e.g.
  - mathematical description of multiple input multiple output (MIMO) systems with array antennas,
  - modelling of the transmission channel with angular anisotropy.
- Development of **Diversity**, **Beamforming** and **MIMO** techniques for performance and **Capacity Enhancements**, in particular
  - channel estimation techniques for e.g. direction of arrival estimation (DOAE),
  - optimum and suboptimum combining and detection techniques ;
  - evaluation of the system performance of e.g. **3G** systems and **UTRA LTE** (UMTS Terrestrial Radio Access Long Term Evolution), e.g. by determining the bit error ratio, the throughput, and the spectral efficiency, in particular for UTRA/LCR-TDD, UTRA/HSDPA and UTRA/HSUPA evolutions.
- Development of **Demonstrators**.
- Present **Subprojects** are
  - Spatial and Non-Spatial Channel Modeling,
  - Principles of Beamforming,
  - Diversity and MIMO Schemes.

## ⑥ Transceiver Techniques for Mobile Communication Systems Beyond 3G (B3G)



- Design and analysis of transceiver concepts for mobile communication systems with code division multiple access (CDMA) and **Multicarrier Techniques**, such as
  - orthogonal frequency division multiple access (**OFDM**) and
  - combinations thereof (e.g. **Multicarrier-CDMA**).
- Implementation-friendly design of optimum and suboptimum **Signal Processing Algorithms** for receivers.
- Introduction of the **Turbo Principle** to receivers by using **Soft Input/Soft Output** receiver components based on likelihood, or equivalently, on log-likelihood processing.
- Present **Subprojects** are
  - PHY Aspects of UTRA Evolution,
  - Multicarrier Techniques for Mobile Communications “Beyond 3G”.