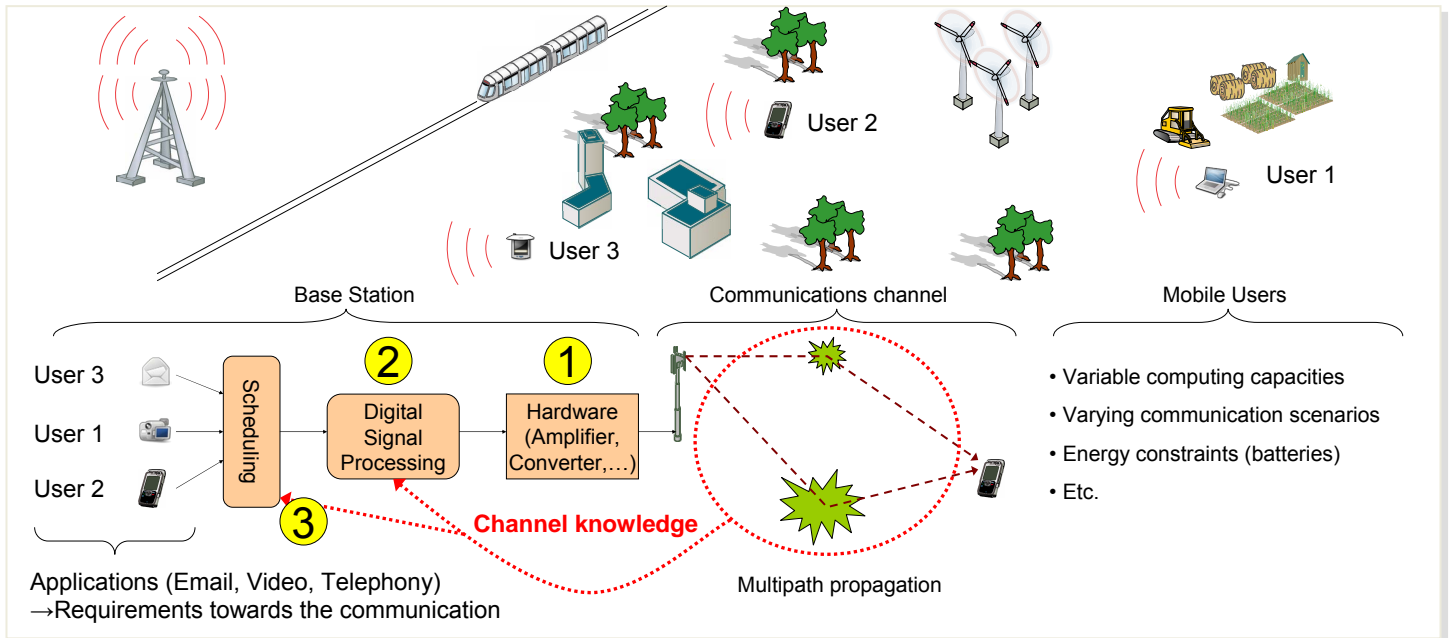


Adaptivity In Modern Mobile Communications

M. Petermann, R. Böhnke, C. Bockelmann, D. Wübben and K.-D. Kammeyer
 {petermann, boehnke, bockelmann, wuebben, kammeyer}@ant.uni-bremen.de



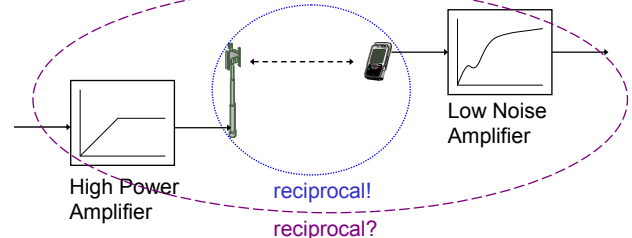
Motivation

- Growing demands on mobile equipment by a variety of applications, communication scenarios and constraints like battery power and hardware cost
- Solution: Adaptive methods
 - ◆ Signal preprocessing at the base station (e.g. preequalization)
 - Channel knowledge at the transmitter
 - + Lower hardware requirements at the mobile
 - ◆ Adaptive resource allocation (e.g. power allocation)
 - Usually channel knowledge at the transmitter
 - May be unfair (far-off users, bad communication conditions)
 - + Optimized performance (e.g. throughput, error rates)
 - ◆ Cross-Layer optimization
 - Channel knowledge, Application requirements and Queue length needed
 - + Optimized performance regarding the situation
- General Problem: How to get channel knowledge?

1

Hardware Influences

- Channel knowledge through feedback from the mobile
- Or: Channel knowledge through knowledge of the reverse channel from mobile to base station
 - ◆ Assumption: Channel is reciprocal between antennas
 - ◆ But: different hardware
- Example: Amplifier

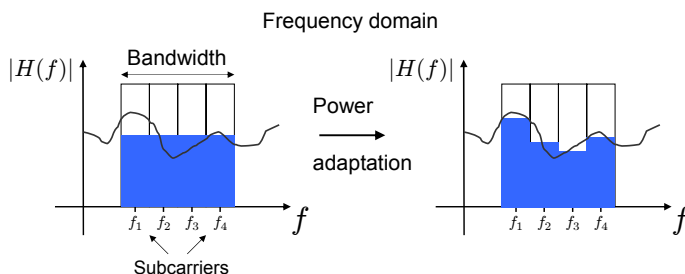


- Compensation of hardware influences is necessary!

2

Adaptive Signal Processing

- Using channel knowledge signal preprocessing at the transmitter can be applied
- Example: Signal power adaptation for multi carrier systems (e.g. OFDM, applied in WLAN 802.11a, WiMAX, DVB, DSL)



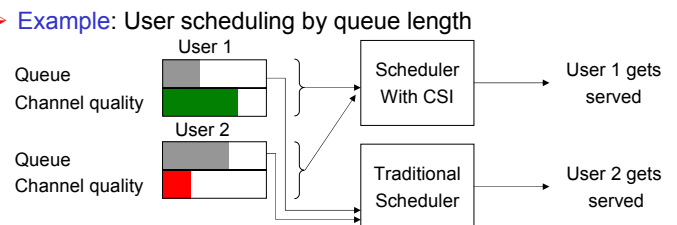
- „Good“ subcarriers get more power, „bad“ ones less power
 - ◆ Higher data rates / lower error rates can be achieved

3

Cross-Layer Optimization

ComNets
 Communication Networks

- Usually only the application requirements (delay, rate, ...), queue lengths or waiting times are used to schedule users nowadays
- But: The actual channel state information (CSI) is crucial to the choice of the served user
- Example: User scheduling by queue length



- ◆ Pure queue length scheduling disregards the channel quality
- Depending on other requirements the overall communication performance can be drastically enhanced