Interactive Services and Technologies for Mixed Broadcasting, Navigation and Communication in the Mobile Society (BROCOM)

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Persons Participated in the Project

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Efficient use of radio resources is vital in the design of future wireless communication networks as the new services impose many different constraints such as:

- large bandwidth
- high reliability
- high flexibility

Radio resource management (RRM) methods must be used to maximize the network capacity within these constraints.
Background - II

RRM

Functions
- Rate control
- Power control
- Handover control

Intelligence
- Self-tuning
- Fuzzy logic

Measurements
- Location information
- Link quality measurements
Background - III

Analytical approach to study the performance of different RRM algorithms is extremely difficult if not impossible. One must resort to simulations.

Simulations need very much computational power to finish in reasonable time. Thus it will be studied whether an FPGA-based hardware accelerator card or a network of them can be used for accelerating the simulations.
BROCOM: Project Goal

to develop and study really new technologies and methods for enabling a comprehensive radio frequency communications, navigation and broadcasting solution.

to develop simulation models and analysis for broadband radio systems

upon these models a combined simulator / demonstrator environment for services and applications.
BROCOM: Project Goal

SIG-laboratory:
- WCDMA is the selected radio access method for 3rd generation networks, thus role of the power control is strongly emphasized.
- New intelligent algorithms are developed and these (RRM) algorithms are then simulated and analysed.
- For simulations, parallel computing architectures and hardware solutions will be evaluated.
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Planned Publications

Licenciate Thesis

- Rintamäki, M.
  Adaptive Power Control in CDMA Cellular Communications Systems

2 Master’s Thesis

- Martikainen, J.
  Feasibility Study of a Link Level UMTS System Simulator Using Parallel Computing

- Korpela, E.
  Design of a Generic Reconfigurable Computing Platform
Planned Publications - II

Conference Papers

M. Elmusrati, M. Rintamäki, I. Hartimo, H. Koivo,

M. Rintamäki, H. Koivo,
Contents

Future Radio Resource Management
- Power control in WCDMA

Cellular Network System Simulator Using Parallel Computing Methods
- Feasibility Study

Hardware acceleration card development
Power control in WCDMA

Minimize power
- reduces interference
- increases capacity

Guarantee QoS
- acceptable service

Practical problems:
- loop delay
- signaling bandwidth

ADAPTIVE POWER CONTROL ALGORITHMS:
significant gains can be achieved with the proposed adaptive algorithms with zero increase in power control signaling information

ESTIMATED STEP POWER CONTROL:
very attractive for low mobile speeds, but performance degrades very much at high speeds
easy to implement
Cellular Network System Simulator Using Parallel Computing Methods

**Methods:**
Computational requirements evaluated based on COSSAP model
Estimates are used in evaluating different partitioning schemes (2G partitioning methods are not suitable)

**Results:**
Channel calculations present a bottleneck
Simulation takes years in single PC
Base station and region-based partitionings are useful
Acceleration cards can be used to speed the simulator up

Partitioning based on base stations  Partitioning based on network elements  Partitioning based on regions  Single processor partitioning
Hardware acceleration card development

Hardware accelerator card by SIG-lab:

- Computing engine consists of large Altera PLDs
- Network interface: Ethernet
- A single PCB