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Downlink Base Station Cooperative Transmission Under Limited-Capacity Backhaul

- Qian Zhang, Chenyang Yang (Beihang University, Beijing, China)
- A.F. Molisch (USC, LA)

Index Terms-Coordinated multi-point transmission, transmission mode switching, limited-capacity backhaul.

- Downlink Coordinated Multi-Point transmission (CoMP) strategies with limited-capacity backhaul
- Switch between CoMP-CB and CoMP-JP transmission modes.
- Proposed soft mode switching and hard mode switching

System Model

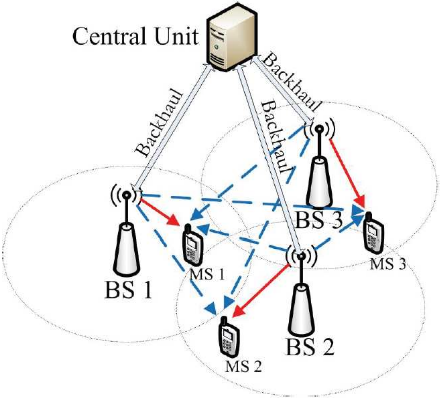

Figure: System model

System Model

- Cluster consisting of B BSs, each equipped with N_t antennas.
- In the CoMP-CB mode, each BS serves M active single antenna mobile stations (MSs).
- In the CoMP-JP mode, the cooperating BSs jointly serve BM active single-antenna MSs

Soft Mode Switching

- Rate splitting into a common data and private data
- Common data by CoMP-JP mode and private data by CoMP-CB
- ZFBF is employed
- Optimization problem not convex.
- Constraints satisfy Mangasarian-Fromovitz constraint qualification (MFCQ)

Hard Mode Switching

- All users are divided into either CoMP-CB or CoMP-JP
- Realized by comparing the achievable rates under the two modes
  - Joint Hard Mode Switching
  - Distributed Hard Mode switching
  - Semi-Dynamic Mode Switching

Downlink Coordinated Multi-Point with Overhead Modeling in Heterogeneous Cellular Networks

- Ping Xia (Qualcomm Inc.,)
- Chun-Hung Liu (National Cheng Kung University, Tainan, Taiwan)
- Jeffrey G. Andrews (UT Austin)

IndexTerms-Heterogeneous cellular networks, downlink coordinated multi-point transmission, interference management, stochastic geometry

Problems with previous approach

- They usually ignore the inter-cell overhead messaging delay, although it results in an irreducible performance bound
- Considers the grid or Wyner model for base station locations

Contributions

- Develops a novel framework, which considers overhead delay for CoMP evaluation in HCNs
- As an eg., application to downlink CoMP ZFBF explained

System Model

- K-tier HCN (i.e., K types of BSs)
- All tiers distributed independently on $\mathbb{R}^2$
- BSs in the kth tier distributed according to homogeneous PPP
- The end-user will listen to the downlink pilot signals from different BSs, and measure their long-term average powers
- The end user is associated with the BS from whom it receives the strongest average power
- i.i.d channel assumed

System Model

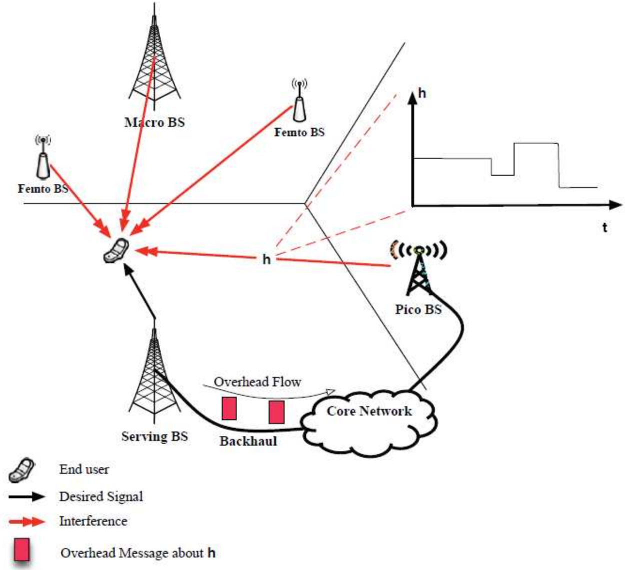

Figure:

- Impact of Overhead Delay
  - Two major imperfections : Delay and Quantization inaccuracy
  - Delays due to propagation time delay and imperfections of overhead channel
  - Time window divided into overhead messaging phase and cooperation phase
- Effects of delay on CoMP ZFBF
  - Throughput is not increased when the overhead channel delay is larger than 60% the channel coherence time
  - In most cases, coordinating with only one other cell is nearly optimum for downlink

On Optimizing Green Energy Utilization for Cellular Networks with Hybrid Energy Supplies

- Tao Han and Nirwan Ansari (New Jersey Institute of Technology, Newark, NJ)

IndexTerms-Green communications, energy efficient networking, renewable energy, cellular networks

- Optimizes the energy utilization in such networks by maximizing the utilization of green energy, and thus saving on-grid energy
- GEO decomposed into Multi-stage Energy Allocation (MEA) and Multi-BSs Energy Balancing (MEB)
- MEA : Optimize the green energy allocation at individual BSs to accommodate the temporal dynamics of both energy generation and the mobile traffic
- MEB : To balance the green energy consumption among BSs to reduce on-grid consumption
- Energy consumption of BS adjusted by adapting the cell size

System Model

- At a time slot, if a BS's stored green energy > energy demand, the BS is powered by green energy; otherwise, by on-grid energy
- Cellular network experience high traffic volumes (i.e., no sleep mode of BS)
- Solar panel generate power during day-time
- Energy consumption directly related to the traffic load on BS
- Considers temporal and spatial variations in traffic

MEA

- Based on energy drain ratio (EDR)

$$\min_{(E^A_{1,j},\ldots,E^A_{i,j},\ldots,E^A_{L,j})} (\delta_{1,j}, \delta_{2,j}, \ldots, \delta_{L,j})$$

$$\begin{aligned} \textit{subject to} : E^S_{i,j} &= E^S_{i-1,j} + \alpha_{i-1}\tau - E^A_{i-1,j}, \\ E^A_{i,j} &\leq E^S_{i,j} + \alpha_i \tau \end{aligned}$$

- Probability of consuming on-grid energy is reduced

MEB

- Adaptation of cell sizes
- BS with more green energy enforced to have larger cell size
- MEB problem is NP-Hard

Coping with a Smart Jammer in Wireless Networks: A Stackelberg Game Approach

- Dejun Yang, Guoliang Xue, Jin Zhang, Andrea Richa, and Xi Fang (Arizona State Univ)

IndexTerms-Jamming, Stackelberg Game

- Smart jammer: Can quickly learn the transmission pattern of the user and adaptively adjust its jamming strategy to maximize the damaging effect.
- Actions taken not simultaneous
- Hence Nash Equilibrium is not the best solution
- Stackelberg game (A leader and a follower) serves the purpose
- SINR as the reward of the user

Rendezvous Enhancement in Arbitrary-Duty-Cycled Wireless Sensor Networks

- Chih-Min Chao, Lin-Fei Lien, and Chien-Yu Hsu (National Taiwan Ocean Univ)

IndexTerms-Wireless sensor networks, low duty cycle networks, rendezvous problem

- If active periods not properly scheduled, sensor nodes may not be able to communicate with another node
- Proposes a Staggered Scheduling protocol which
  - Ensures rendezvous between each pair of nodes
  - Produce lower rendezvous variance
  - Nodes can independently choose their target duty cycles
- Uses Chinese Remainder Theorem (CRT) to design awake/sleep mechanism

Other papers

- A Markov Decision Theoretic Approach to Pilot Allocation and Receive Antenna Selection
- An Analytical Approach to the Design of Energy Harvesting Wireless Sensor Nodes
- Reduced-Complexity Robust MIMO Decoders
- Structured and Sparse Limited Feedback Codebooks for Multiuser MIMO
- Towards a Simple Relationship to Estimate the Capacity of Static and Mobile Wireless Networks