Self-Optimization of Antenna Tilt and Pilot Power

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Mobicom

- Established in 2009
- 9 Professors and 30 Doctoral Students
- Communication for disaster scenario
- Areas of Interest
  - Self-organization in communication
  - Distributed MIMO
  - Cognitive Radio
  - Information Management
Motivation

- Normal load
- Overloaded
Outline

• Tilt and Pilot Adaptation
• Optimization framework
• Simulation assumptions
• Results
• Conclusion
Antenna Tilt and Pilot Power

**Antenna Tilt:**
Elevation angle of the main beam of the antenna relative to the azimuth plane

**Pilot:**
DL reference signal
Joint Adaptation

- Overload
- Inter-cell Interference
- Pilot Pollution

Initial

Pilot Reduction

Downtilt Increase

Tilt and Pilot Adaptation
Optimization Framework

Network

NodeB 1
- Performance Monitor
- Optimization Process
- Parameter Adaptation

NodeB 2
- Performance Monitor
- Optimization Process
- Parameter Adaptation

NodeB n
- Performance Monitor
- Optimization Process
- Parameter Adaptation

Coupling Matrix

\[ C(i,j) = \text{Pathloss}_{i,j} \times \text{Gain}_{i,j} \times \text{Gain}_{j,i} \times \text{CPICH}_j \]
Optimization Process

1. Load Default Configuration
2. Wait
   - [time >= 15min]
3. Check User-BS Connections
4. [performance below threshold]
5. Optimize and Adapt
   - Identify the Cluster
   - Calculate Optimal Parameters for the Cluster
   - Communicate Parameters in the Cluster

<table>
<thead>
<tr>
<th>Sector 1</th>
<th>Sector 1</th>
<th>Sector 2</th>
<th>Sector 2</th>
<th>...</th>
<th>Sector n</th>
<th>Sector n</th>
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<tbody>
<tr>
<td>Tilt 1</td>
<td>Pilot 1</td>
<td>Tilt 2</td>
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<td>...</td>
<td>Tilt n</td>
<td>Pilot n</td>
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Simulation Assumptions

- Snapshot analysis
- Moving hotspot model
- Three traffic intensities
Results

• Optimal cluster size
Results cont.

- Performance improvement

**Average Satisfied Users: 1300-1800 Hrs**

- Un-optimized: 74.2%
- 4 Sector Cluster: 93.86%
- Globally optimized: 96.93%
Results cont.

• Costs involved

![Graph showing Number of Optimizations Performed in 24 Hrs](image1)

![Graph showing Average No. Of Sectors Below Threshold per Optimized Snapshot](image2)
Conclusions

• Conclusion
  – Presented a distributed mechanism for antenna tilt and pilot power optimization
  – Achieved performance close to global optimization
  – Performance varies with the cluster size

• Future work
  – Focus on LTE
  – Model free optimization
Thank you!

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