

Interference Management in OFDMA Femto-Cells

Agrim Gupta, Varunesh Goyal, Ramanpreet Singh
Department of Electrical Engineering, IIT-Bombay

Objectives

To study femtocells, their advantages and disadvantages:

- Why femtocells are a good solution to current cellular network problems
- what are the hurdles in deploying femtocells
- Schemes to solve those problems
- Simulate those schemes to see the resulting benifits

Introduction

Cellular networks have nearly met to the bandwidth and data rate requirements of the population. However, seamless indoor coverage and call drops/mutes are still a challenging problem to look at. Femto-cells are small scale base stations with lower transmit power than a full fledged macro cell. Deployment of femtocell near a selected indoor area can potentially solve the coverage issue in the *indoor area*. Apart from improving the coverage in an indoor area, femto-cells also help **lengthen thebattery life** of the UEs (User Equipment) in it's coverage area, since those UE no longer needs to communicate to a far off macro cell. Femtocells also *reduce the back-haul burden* of the macro cell, since femtocell traffic is carried over residential broadband connections and can also help *reduce the traffic intensity* at macro cell.

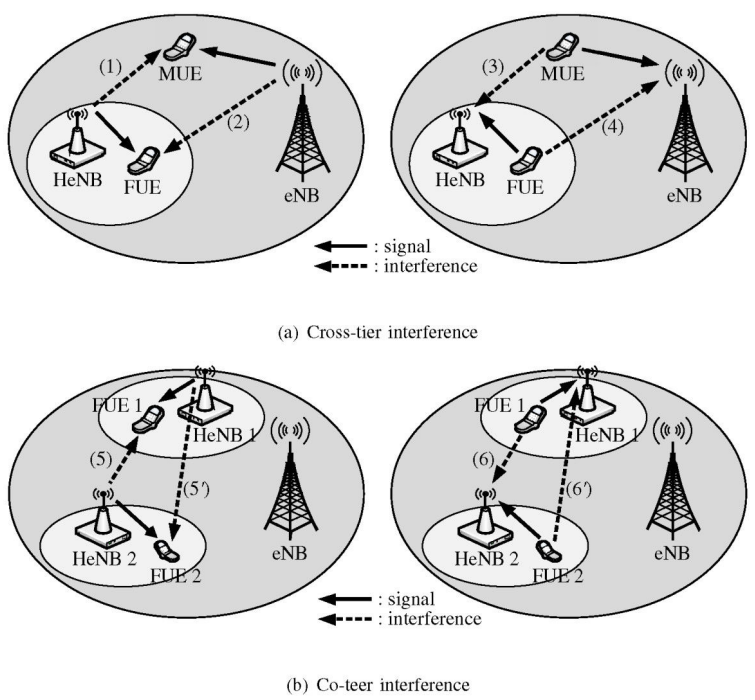


Figure 1: Co-tier and cross-tier interference [1]

Problem of femtocells

Problems in femtocell system:

- Co-tier interference
- Cross-tier interference
- Timing synchronisation
- mobility management
- uplink deadzone

Interference Management

- Femto-Aware Spectrum Arrangement
- Femtocell Clustering
- Beamforming Approaches
- Collaborative Frequency Scheduling
- Power Control Approach
- Fractional Frequency Reuse

Important Result

The Femto-aware scheme is a good solution towards dealing with cross-tier interference, and it solves the uplink deadzone problem as well.

Simulation Setup

Results

To understand about the cross-tier interference problem, simulated he Femto-Aware arrangement scheme proposed by Wu et al.

System Model

- Spectrum is demarcated into 2 parts, the macro dedicated part and the femto-macro sharing part
- Femto-Interference Pool formed
- Macro UEs not belonging to the femto-interference pool given the full spectrum

Simulation Procedure undertake:

- Generation of Random Points in the scenario
- Path Loss Models and Fading Models
- SINR calculations
- CQI and throughput calculations

Conclusion

- Femto-aware scheme is good solution towards dealing with cross-tier interference and solves the uplink deadzone problem as well
- Scheme not fair towards the UEs lying outside the femto-cell near the edge
- The efficiency of those UEs hampered since they are not able to use the macro-femto sharing part of spectrum

Future Work

- Hybridize the scheme with Collaborative Frequency Scheduling
- Can also merge with the sectorization based FFR schemes to reduce complexity
- Integration with clustering of adjacent femto cells method
- Performance of proposed scheme when there is a neighboring femto cell should also be characterized

References

[1] S. J. Bae, Y. M. Kwon, M.-Y. Lee, B. T. Koo, and M. Y. Chung, "Femtocell interference analysis based on the development of system-level lte simulator," *EURASIP Journal on Wireless Communications and Networking*, vol. 2012, no. 1, p. 287, Sep 2012. [Online]. Available: <https://doi.org/10.1186/1687-1499-2012-287>