LTE Planning and Responsibility Project Web Forum Development

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http://observatory-rri.info/

Activities

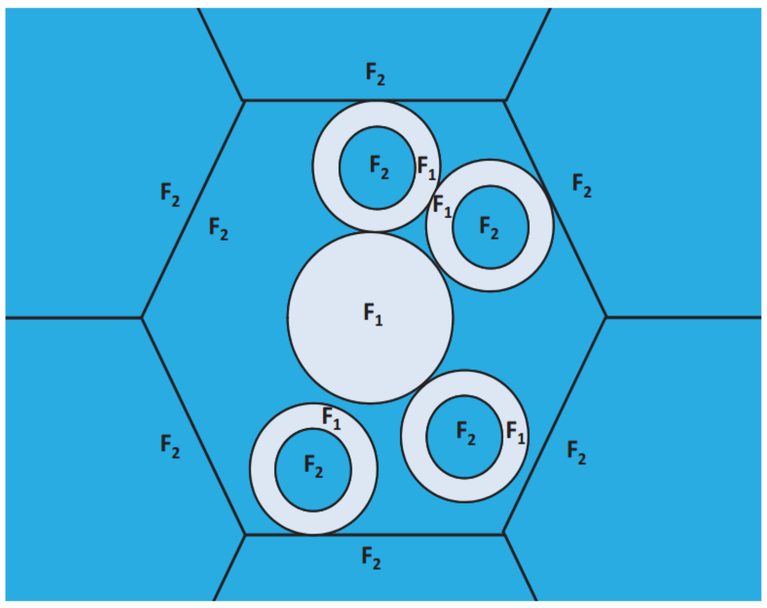
Optimization of LTE planning:

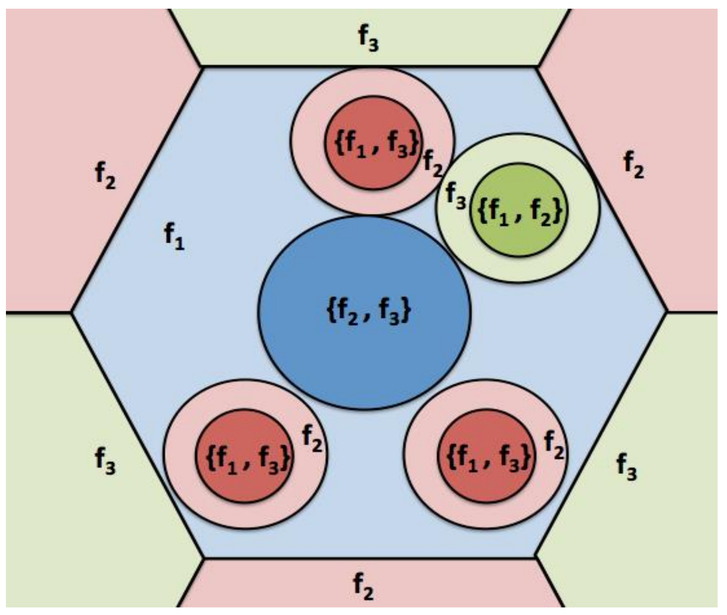
- The emerge of small cells to cope with exponential growth of mobile traffic demand is drastically changing the neighborhood concept in cellular network, posing new challenges of addressing both co-tier and cross-tier interference. In order to improve the planning of LTE systems with heterogeneous cells, a novel Three-Band Improved Soft Frequency Reuse (3B-ISFR) scheme based on three frequency segments is proposed along with a technique to determine frequency allocation plan for pico/micro cells, and an algorithm to control the association of user terminals to the cell center area or the cell-edge area.

ICT tool for Responsibility project Web Forum:

- In order to fine-tune the result of a discussion on a Responsible Research and Innovation (RRI) issue, a new module called Citizen Jury has been developed to enable Responsibility project members to give their opinions and consult the experts based on the final decision of the discussion.

LTE Scenarios



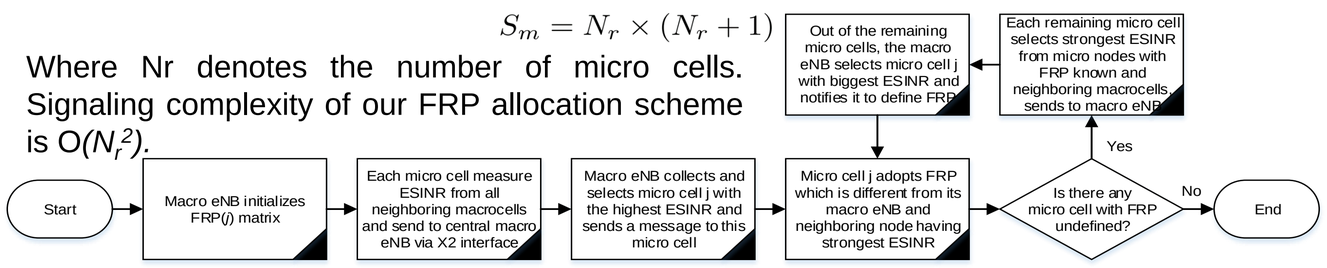


Frequency Reuse Pattern Algorithm

- One of the most critical problem with 3B-SFR and 3B-ISFR is to define Frequency Reuse Pattern (FRP) of each cell to avoid strong interference at cell-edge area.
- The FRP of each macro node is easily defined according to SFR with a 3-color reuse scheme as shown in [1].
- The FRP of each micro cell is selected based on a centralized algorithm with ESINR measurement involved.
- The number of messages exchanged to have that all micro cells have their FRP defined is as follows:

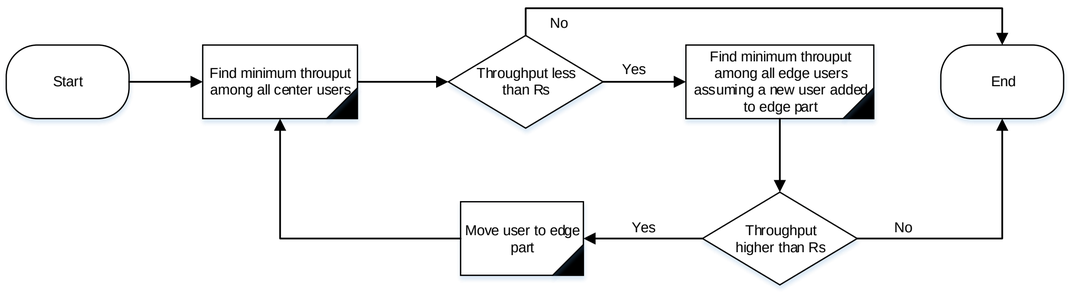
$$S_m = N_r \times (N_r + 1)$$

Where Nr denotes the number of micro cells. Signaling complexity of our FRP allocation scheme is $O(N_r^2)$.



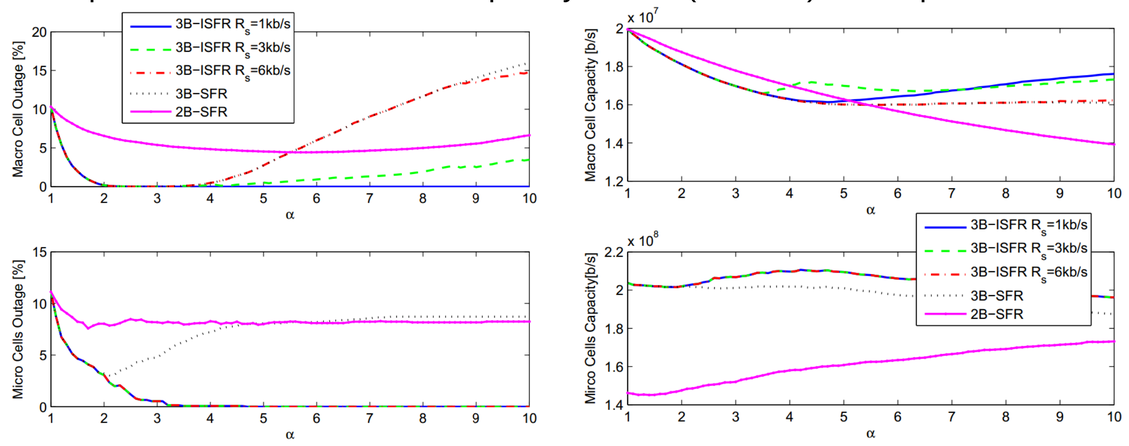
User-BW Association Algorithm

- With Three-Band Soft Frequency Reuse (3B-SFR) technique, some cell-center UEs, which are very close to cell-edge UEs, may suffer from very low signal quality which leads to very low throughput or even outage.
- In order to avoid jeopardizing cell center UEs, an user-BW association algorithm has been designed which protects cell-center UEs on the basis of a bit-rate threshold criterion Rs.



Simulation Results

- We vary different parameters which are power factor between edge and center part of a cell (α), center user ratio (μ) and Nr to compare the performance of our techniques with Two-Band Soft Frequency Reuse (2B-SFR) technique in literature.



Conclusions and Future Work

- Simulation results show that the proposed scheme (3B-ISFR) outperforms other schemes in literature in terms of capacity and outage.
- A further work has been carried out to optimize the association of users to micro cells according to a load balancing scheme that takes capacity into account, while guaranteeing fairness between users (log-capacity function).
- The effects of shadowing and QoS requirement will also be addressed.

Publications

[1] G. Giambene, T. A. Yahiya, V. A. Le, K. Grochla, K. Polys, "Resource Management and Cell Planning in LTE Systems", chapter of the WiNeMO COST Action book: A. Kassler, I. Ganchev, M. Curado, Wireless Networking for Moving Objects, Spinger LNCS Series, 2014.

[2] G.Giambene, V.A.Le, "Performance Evaluation of Different Fractional Frequency Reuse Schemes for LTE", in Proc. of the FITCE International Conference, 53rd, Naples, 12-15 Novermber 2014.

[3] G.Giambene, V.A.Le, T.Bourgeau, H.Chaouchi, "Soft Frequency Reuse Schemes for Heterogeneous LTE Systems", IEEE ICC, London, 2015.

[4] G. Giambene, D. K. Luong, V. A. Le, T. De Cola, " Smart Gateway Diversity Techniques and Transport-Layer Issues for Future Satellite Networks", International Journal of Satellite Communications and Networking, July 2014.

Responsibility Project Forum Development

The goal of the RESPONSIBILITY EU FP7 project (2013-2016) is to develop a virtual observatory for enhancing the interaction among research outcomes and policy making, making use of the full potential of scientific achievements to be incorporated in the policy development and implementation. The RESPONSIBILITY Forum is an ICT tool with two main aims; the first is to provide a space for discussion and determination of RRI issues. The second main aim of the Forum is to feed the Observatory. The Observatory is a repository of material on RRI that is dynamically feed and updated via the Forum.

Description of Citizen Jury Tool

- The purpose of Citizen Jury module is to allow member of RRI website to vote on decisions of an experts' discussion.
- For each decision, there will be a group of selected members (jurors), who are allowed to vote.

Implementation

- This module is implemented by using Rates, Views and Rules modules on Drupal 7 platform.
- Only moderator of a discussion can create new poll.
- After new poll is created, each selected participant will receive an email notifying about the selection, including a link to the poll.
- Participant can read discussion materials by going to related discussion dossier.
- The "Vote" section is only visible to the selected participants.
- The participant can refuse to join the citizen jury and deny giving vote.
- http://observatory-rri.info/#