



Celtic-Plus⁺

Smart Connected World



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INTERFEROFF: efficient inter-cell INTERFerence coordination, cELL planning and tRaffic OFFloading in next-generation mobile hetnets

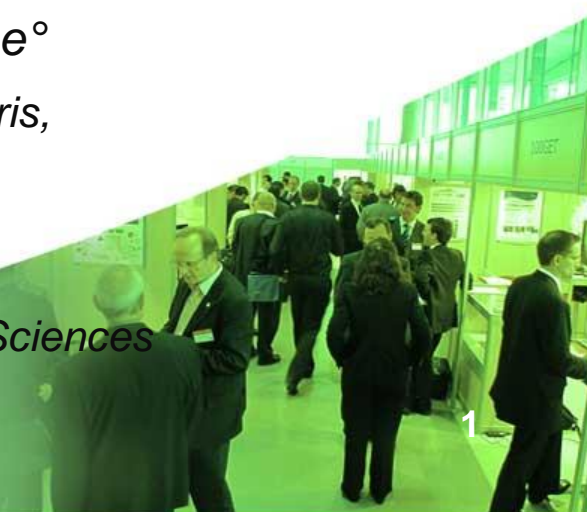


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Institut Télécom, Télécom Sud Paris, France

Institut Mines Telecom/Telecom Sud Paris is a French High Engineering school since 1979. The main research activities are mobile communication networks, autonomous and spontaneous networks, pervasive computing, middleware, distributed systems, web and information systems, multimedia, information society, IT applications and uses, Urban life and mobility, others. At present there are more than 100 permanent research members, very active in different research initiatives in France and abroad, very strong collaboration with the industry and lot of support for industrial innovation.

University of Siena, Italy

The University of Siena – Department of Information Engineering and Mathematical Sciences (UNISI) was established in 1996. The main research activities encompass the areas of Automatic Control, Mobile Communications, Computer Science, Electrical Engineering, Electromagnetism, Electronics, Mathematical Analysis, and Operation Research. At present, there are more than 130 members in our Department: 74 professors (19 full professors, 33 associate professors, and 18 assistant professors), 7 members of the administrative staff, 14 post doctoral students, and more than 40 PhD students.

Proposal Introduction

Short info what the proposal is about

- The large adoption of next-generation mobile terminals (smart phones and other mobile Internet devices) offering enhanced user experience with **high-bandwidth-consuming applications** (video streaming, mobile cloud) has caused an **exponential growth of data traffic**, reaching the theoretical limits of network capacity and spectral efficiency of current cellular systems.
- Since 2011, mobile Internet access has exceeded the broadband wired one and this trend is expected to continue in the future.
- To address this exponential growth of mobile data traffic, **this proposal is about self-organizing interference coordination schemes and efficient traffic offloading** to be applied to 4G (LTE-A) and 5G systems to improve the overall network capacity and user experience.

Proposal Description (1)

Short info on expected outcome and impacts

- Heterogeneous networks (HetNets) comprising of conventional high-power macro cell base stations overlaid with low power nodes (e.g., micro cells, pico cells) represent an efficient solution **to improve resource reuse**, while offloading users traffic from macro cells towards small ones.
- Inter-cell Cell Interference Coordination (ICIC) mechanisms become of major interest in this scenario where high power and low power nodes are overlaid and share the same spectrum.
- We propose to investigate different ICIC/planning techniques adopting a **cognitive approach**, which takes interference into account not only between neighboring cells of the same neighborhood layer (macro to macro or micro to micro), but also across different neighborhood layers (macro to micro cells and vice versa).

Proposal Description (2)

Short info on expected outcome and impacts

- We propose the allocation of different frequency segments to cell center and cell edge and between macro and micro cells in a way that is **self organizing**.
- We also propose to investigate and set-up **efficient schemes for traffic offloading** between different cells (small cells, macro cells) of same or different technologies in HetNets in order to improve the **energy efficiency and power consumption**.
- Connected objects and M2M may benefit from our new planning scheme with offloading, taking power constraints into account.
- The target is to increase the overall cell capacity of **at least 20%-30%** with no cost increase with respect to other HetNet state-of-the-art schemes in the literature.

Proposal Description (3)

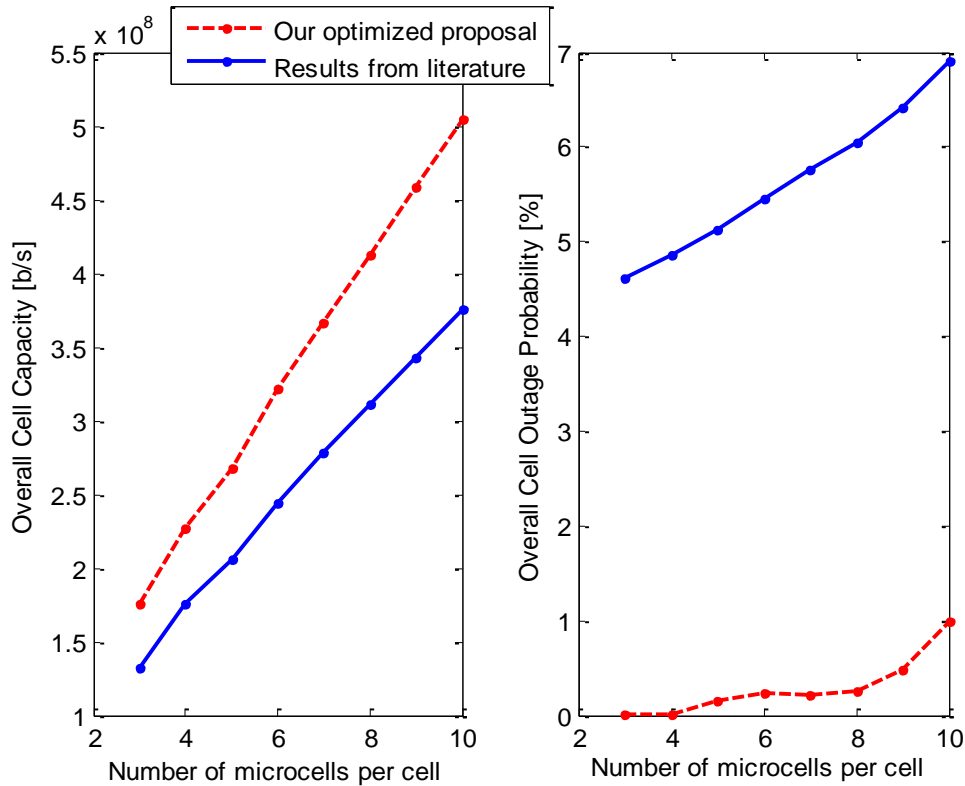
Technical details of the cognitive HetNet scheme

- There are three BW segments {F1,F2,F3}. This scheme is to select the BW segment for edge and central parts (FRP) of each micro cell assuming that the reuse scheme of macro eNBs is given.
- **Centralized scheme:**
 - The channel quality at micro cells is measured (ESINR) and regularly reported to the corresponding macro eNB (X2 interface). On the basis of these measures received, the macro eNB decides the order in which the micro cells select their FRPs.
- **Decentralized scheme:**
 - Each micro cell randomizes the instant it selects FRP. Based on interference on different BW segments, it chooses FRP to improve the quality on its edge part.

G. Giambene, V. A. Le, T. Bourgeau, H. Chaouchi, "Soft Frequency Reuse Schemes for Heterogeneous LTE Systems", *accepted to be presented at the IEEE ICC 2015 - Mobile and Wireless Networking Symposium* (38% acceptance rate), 8-12 June 2015, London, UK.

Expected Results / Partners Search

- Results from an LTE-A HetNet scenario with macro and micro cells:



Interests received so far from partners

- Possible partners:
 - Institut Télécom, Télécom Sud Paris, France
 - Fraunhofer - Scai, Germany
 - Innovalia, Spain
 - University of Oulu, Finland
 - University of Siena, Italy
 - Promptinc, Canada ?
 - Netas, Turkey ?
 - Beia Consult International SRL, Romania ?
- Some detailed interests we received:
 - Innovalia: Peer-to-Peer communications, traffic offloading security, communication simulations.
 - University of Oulu: 5G, interference management in multidimensional HetNets across tiers, RATs, backhaul, offloading, LTE-U, LAA, C-RAN among others.
 - **We are looking for inputs from other interested partners.**

Contact Info

Project proposal: INTERFEROFF
“Efficient inter-cell INTERFERENCE coordination, cELL planning and tRaffic OFFloading in next-generation mobile hetnets”

For more information and for interest to participate please contact:



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