

INTERFERENCE AWARE RESOURCE ALLOCATION FOR UNDERLAY D2D-BASED DATA OFFLOADING IN 5G CELLULAR NETWORK

Meriam Hmila, Supervised by Dr. Manuel Fernández Veiga

Affiliation: Network lab. Of AtlantTIC Research Center, Department of Telematics Engineering (University of Vigo)

Motivation

- Underlay Device to Device (D2D) in 5G cellular network is a new paradigm used to alleviate traffic growth. It allows users in close proximity to communicate directly without the intervention of the base station using resource blocks already allocated to cellular user. It increases network capacity, spectral and energy efficiency but it causes harmful interference to cellular users. Moreover, these devices have limited life battery [1].
- Our main interest is underlay device to multi device (D2MD), here devices form a cluster/group with one device as head cluster for data offloading. This model inherits single transmitter to single receiver (unicast) challenges and poses more as: weakest receiver, head cluster selection, and users grouping. These points are poorly addressed in the literature compared to unicast cases and need more investigation [2,4].

Objectives

Our main objective is the application of underlay multicast D2D communication for data offloading in 5G cellular networks. Therefore, we focus on providing low complexity algorithms for relay selection, resource allocation, and devices clustering. We intend to use optimization techniques and game theory to model and solve these problems considering energy consumption reducing and interference mitigation. Moreover, we will apply an experimental methodology that combines theoretical analysis with extensive simulations.

Activities

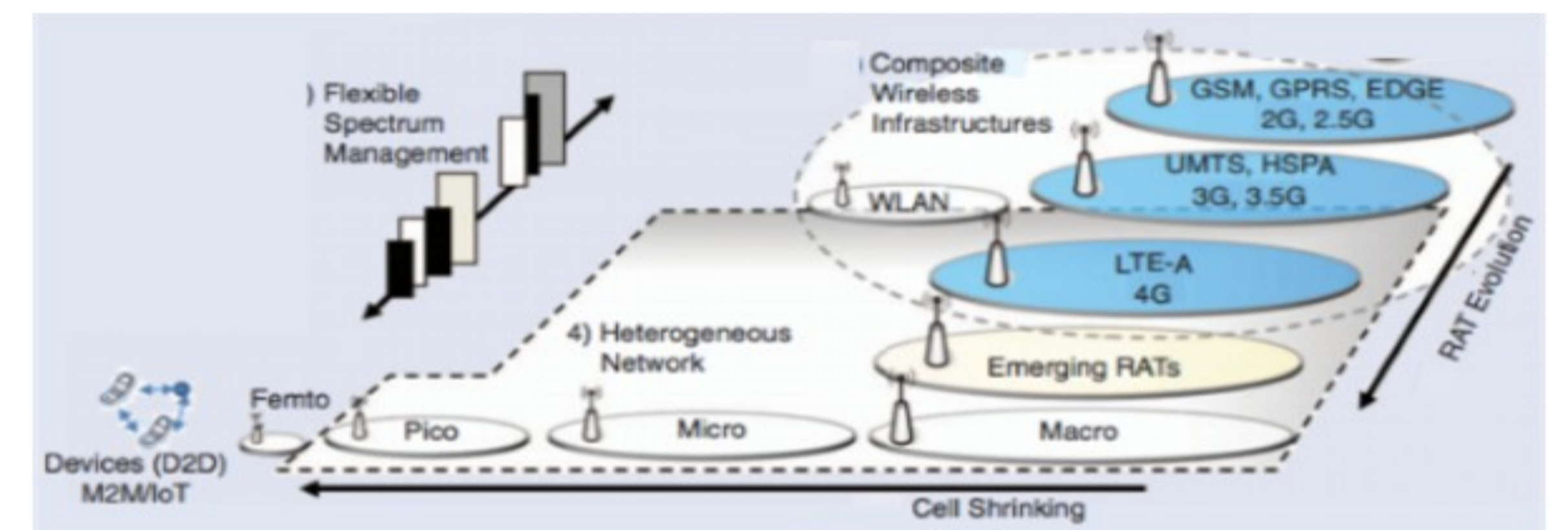
- Define the mathematical model for D2D energy efficient (EE) trade-offs.
 - The Problem is a joint optimization (integer -continuous).
 - Specify EE metrics: global EE vs. min max EE.
 - Solution approach: fractional programming and sequential convex approximations.
- Numerical experiments on:
 - Group size.
 - Number of groups per channel.
 - Minimum rate and maximum transmission power.
- Adding a stochastic geometry model to the simulation tool and density tests.
- Attend online Matlab course to learn more about optimization problems implementation.
- Learn more about GAMS framework for optimization problem solving.
- Conference paper in preparation.

Next Year Plan

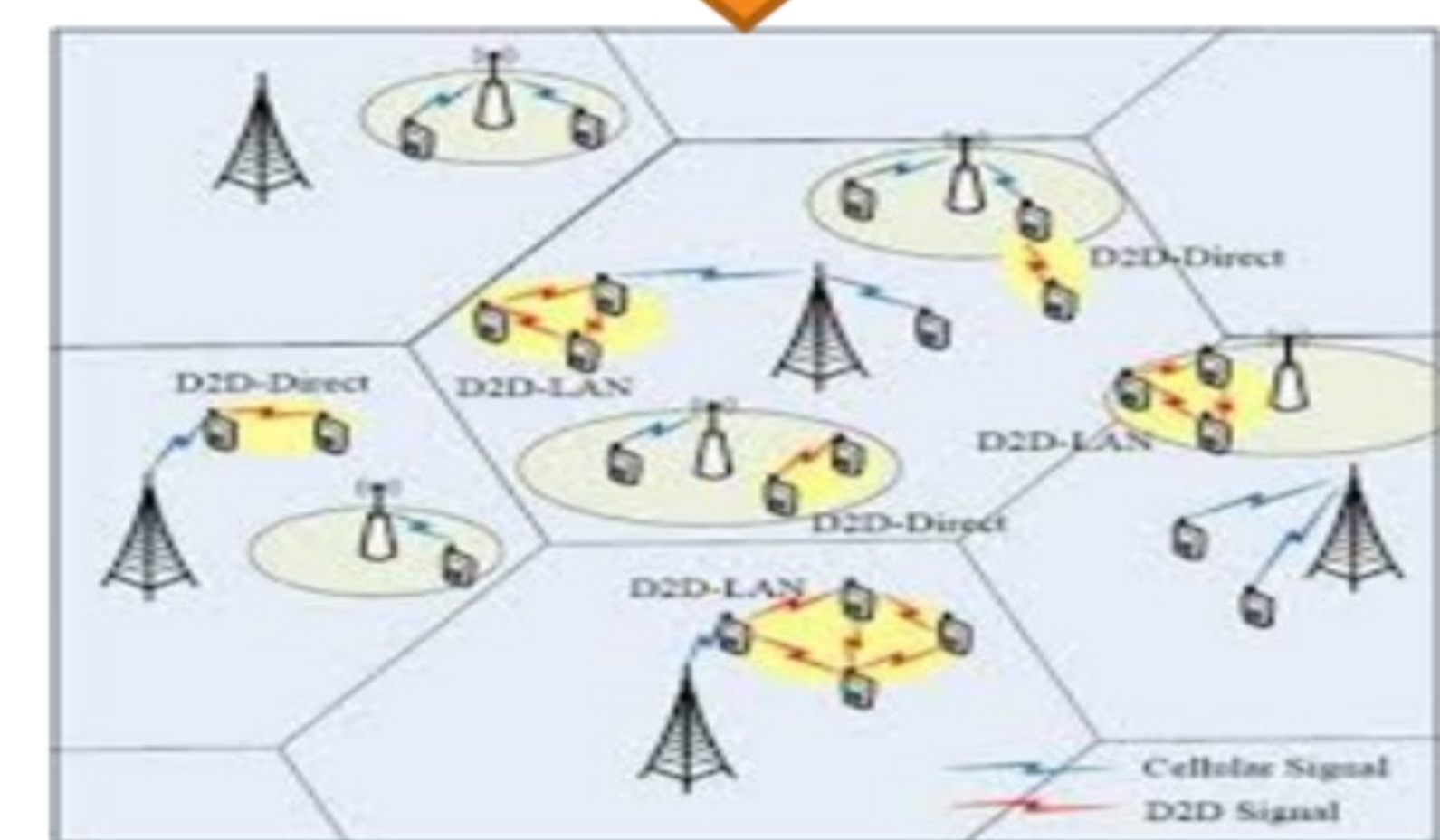
- Enhance users grouping using game theory.
- Evaluate the models experimentally (via simulation).
- Publish results in conferences and journals.
- Write and defend the thesis.

References

- [1] Song, L., Niyato, D., Han, Z., & Hossain, E. (2015). *Wireless Device-to-Device Communications and Networks*. Cambridge University Press.
- [2] Bhardwaj, Ajay, and Samar Agnihotri. "A resource allocation scheme for device-to-device multicast in cellular networks." *Personal, Indoor, and Mobile Radio Communication (PIMRC)*, 2015. IEEE 26th Annual International Symposium on. IEEE, 2015.
- [3] Rodriguez-Perez, Miguel, et al. "Optimum Traffic Allocation in Bundled Energy-Efficient Ethernet Links." *IEEE* (2015).
- [4] Militano, Leonardo, et al. "When D2D communication improves group oriented services in beyond 4G networks." *Wireless Networks* 21.4 (2015): 1363-1377.



UNDERLAY D2D-BASED DATA OFFLOADING IN 5G



Research Plan

