HACETTEPE UNIVERSITY
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
ELE 401-402 GRADUATION PROJECT

FAIR RESOURCE ALLOCATION FOR ULTRA-DENSE COMMUNICATION NETWORKS

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INTRODUCTION

The main purpose of this project is to derive fair and enterprise-aware resource allocation problems for next generation ultra dense heterogeneous wireless networks and to reach the best or near best solutions of these problems. The project outputs will enable new projects to be created in the subdomains of ultra dense heterogeneous networks such as vehicle communication, drone communication and object communication, which will be realized in the future.

DEFINITION

Data rate for the i'th user in a multiple access channel:

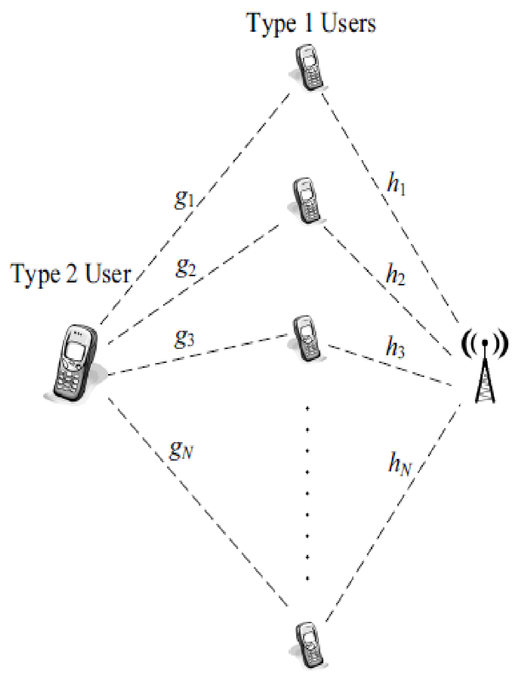
$$R_i(\mathbf{h},\mathbf{p},\pi) = B\log_2\left(1+\frac{|h_i|^2 P_i}{BN_0+\sum_{j\in S(i)}|h_j|^2 P_j}\right)$$

Here, the set S(i) indicates the set of users whose signals have not yet been decoded while the i'th user is decoded. B is the communication bandwidth, N_o is noise variance, h_i valued channel coefficient between the user and the base station and P_i is the transmission power of the i'th user. The vectors h and p are vectors that contain the channel coefficients and transmission powers of the users, respectively.

Maximize $R_i, \quad \forall i,$ (1)
Constraints: $0 \le P_i \le P_{azami}, \quad \forall i,$
$|g_i|^2 P_i \le Q_i, \quad \forall i.$

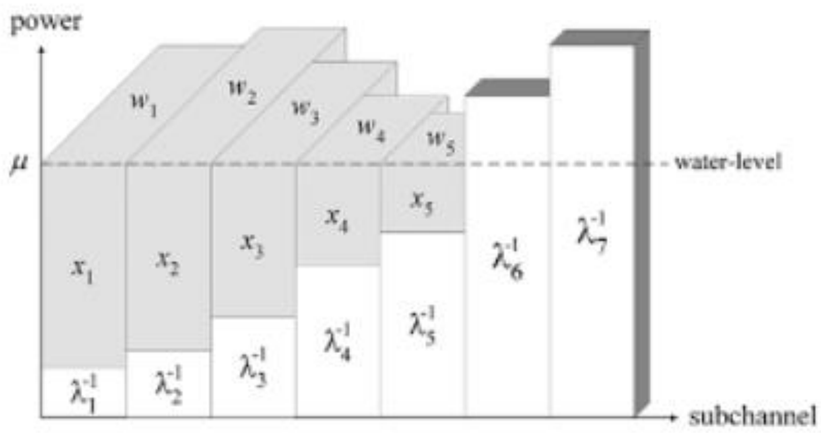
Maximize $\min(R_i),$ (2)
Constraints: $0 \le P_i \le P_{azami}, \quad \forall i,$
$\sum_{i=1}^{N}|g_i|^2 P_i \le Q,$

The gi is the complex value interference channel coefficient between the user and the second cell, and Qi is the interference power threshold value that the i'th user can apply. P_{azami} is maximum power and Q is the total interference power threshold.



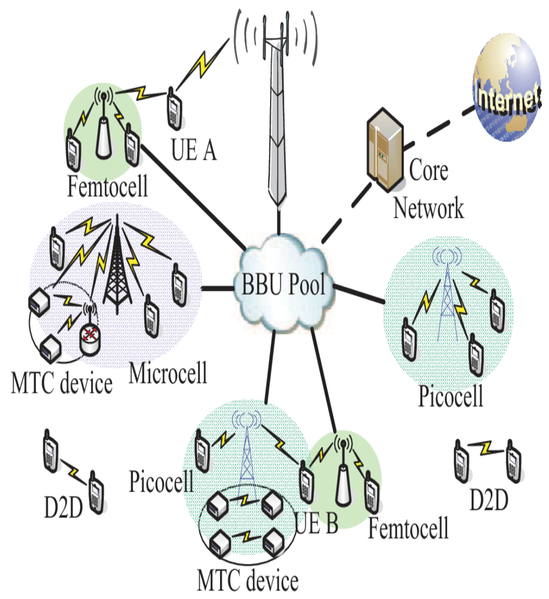
METHODOLOGY

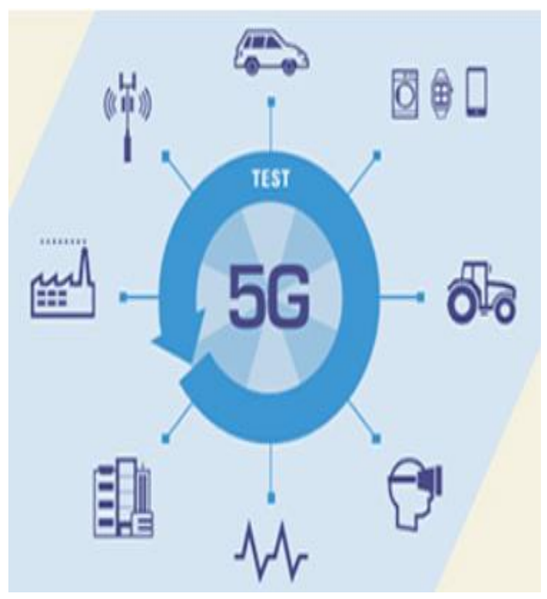
- Method of Lagrange Multipliers
- Water-Filling Algorithm in Optimization Problems
- Sorting Algorithms
  1. Bubble Sorting
  2. Quick Sort
  3. Merge Sort
- Convex Problem Solving



APPLICATION AREAS

This project provides an important oppurtunity for 5G communication.Ultra dense HetNets are foreseen to be used in many applications in the future.





CONCLUSION

Within the scope of this project, the best or near best solution proposals were made for the first (1) and second problem (2) structures. Although dual resource allocation solutions maximize data speed, they can do this for certain users, requiring other users to be off and not able to access resources. In these structures, it is clear that the solution will not be a dual allocation and that all users will be given access to the system fairly.The first problem structure (1) is solved using the water filling algorithm. The second problem structure (2) is tried to be developed by using the first problem structure (1).The studies to be carried out will be pioneers in heterogeneous network structures such as ultra dense small networks, intensive V2V-V2I communication, multi-drone communication, multi-machine communication and internet of things which are important parts of 5G and beyond communication systems.