Projects RE56 – Radio Networks

<Proposed by Mr. Hakim Mabed, hmabed@gmail.com | hakim.mabed@univ-fcomte.fr>

Context: The application « Radio Mobile Network Tool » is a Javascript application used for testing and educational purpose. The application uses the Leaflet API that provides some tools to manage geographical data.

The objective is then to develop some extensions of this application in order to familiarize themselves with radio engineering notions.

Project6 : Radio propagation model - Wallfisch Nakamura

Several propagation models were proposed in scientific literature. Rather than looking for an accuracy of the measurement, the objective is to rapidly obtain a good estimation of the radio propagation.

One of the more sophisticated and documented model is the Wallfisch Nakamura's model. The objective of the project is to implement this model. The students should select some good papers describing the model that implement the model.

Two other models are already implemented in the application: Single Knife Edge and Cost231-Hata. The students should take a leaf out of what is being done there.

Project 7: Radio propagation model - Deygout

Several propagation models were proposed in scientific literature. Rather than looking for an accuracy of the measurement, the objective is to rapidly obtain a good estimation of the radio propagation.

One of the more sophisticated and documented model is the Deygout's model (or Multiple Knife Edge). The objective of the project is to implement this model. The students should select some good papers describing the model that implement the model.

Two other models are already implemented in the application: Single Knife Edge and Cost231-Hata. The students should take a leaf out of what is being done there.

Project 8: Frequency assignment algorithm

In GSM network, one of the main optimization tasks is to define the frequency channel that should be allocated to every station in order to reduce the interference. According to radio coverage of stations, potential interferences between every pair of station is estimated (see project of radio constraints cartography).

The objective of the project is to implement a channel allocation algorithm (heuristic, iterative, …) that reduces the amount of potential interferences. Every station is defined by the number of required channels (depends on the traffic density on the station).

Project 9: Location Zones optimization

Mobile networks use VLR data bases that store the data of users recently located on its area. This area corresponds to a set of cells (stations) that belongs to the same location area (LA). When a client leaves the location area and enter into another LA, its data are then updated in the system. To reduce the number of updating procedures, the LA should be optimized according to the users' mobility.

In this project, students should implement the tools that allow the application user, to define the mobility axis of the clients (from, to, direction, intensity), and conceive the optimization algorithm that regroups cells within Las and reduces updating procedures.

Project 10: Radio quality cartography

To assess the quality of a cellular network, the decision maker needs for a graphical representations of the radio measurement. The "Mobile Network Optimization Tool" application already provides some indispensable cartographies such as: cellular cartography, power cartography and interference cartography.

In this project, the student should implement two new cartographies. The first one, called handover cartography, should represents the handover area where the handover could be performed in good conditions. The second cartography, should represent the radio constraints between stations, i.e. when the amount of interference between two station is high (see interference computation), the two stations should be linked by a line which the color represents the intensity of the radio constraint.