

# Planning Report – 5G Radio Access

Magnus Thalén  
magth371@student.liu.se

## Problem formulation

The upcoming next generation of mobile telecommunication (5G) is as of yet not specified. This means that companies are still able to influence what 5G should consist of in terms of changes compared to the current fourth generation (4G). It is also believed that the amount of traffic and connected devices will greatly increase in the coming years [1]. Thus there is a need to identify areas that when changed could improve the system as a whole, and to see how changes done for other reasons impact the systems properties. Properties such as data rate, spectral efficiency, energy consumption and forward compatibility are of interest.

It has been shown that the energy consumption in today's systems is dominated by the static part of the communication [2], which is the information that must be communicated even when no users are actively receiving or transmitting any data. This is opposed to the dynamic part which is the data intentionally sent and requested by the users and not used for system services such as initial access. The static part includes, but is not limited to, system information blocks, paging signals and random access signals [3]. A proposed solution to this problem is the defining of a new system control plane (SCP) that would take care of these basic system access related functions [1][2][4]. It is also believed that this change would enable the system to further utilize techniques such as MIMO.

Some of the potential benefits of such a change are related to the random access channel, the channel used by a mobile unit when it needs to gain initial access to the system. In today's systems the user camps on a single cell while inactive. If one were to leave this model, which the new SCP would enable, one could further improve the capabilities by using techniques that require the cooperation of several cells simultaneously. This would for example make it possible to make use of macro diversity and beamforming.

It is thus clear that these changes could be beneficial. There has not however been much in the way of studies to bring clarity to the topic, which is where this thesis fits in. The idea for this project is to explore and evaluate if the introduction of a new SCP would be an improvement to the random access functionality in the upcoming 5G.

## Approach

Initially the student will read up on relevant literature to gain more insight into the topic. The student will then in cooperation with his supervisors at the company decide in more detail what changes that are to be studied. Everything will not be specified immediately considering that what is interesting to study is dependent on what results are found along the way.

The student will familiarize himself with an already existing simulator that will be used in order to evaluate the considered changes. Proper test cases will be constructed and run, thus generating data that will then be processed. The post processing will primarily occur in MATLAB with the aim of showing what effects the proposed changes will have upon the system in terms of relevant measures such as energy consumption, delay etc.

In parallel with this the student will write the report. The major part of this task will be done during the latter part of the project.

## **Time plan**

See separate file.

## **Literature**

- [1] M. Olsson, C. Cavdar, P. Frenger, S. Tombaz, D. Sabella, R. Jantti. "Towards Green 5G Mobile Networks" *GReen Optimized Wireless Networks (GROWN) workshop in association with IEEE International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob)*, Lyon, France, Oct. 2013.
- [2] P. Frenger, M. Olsson, E. Eriksson, "A Clean Slate Radio Network Designed for Maximum Energy Performance" in Proc. *IEEE PIMRC 2014*, Washington, DC, USA, Sept. 2014.
- [3] Dahlman, E. Parkvall, S. and Sköld, J. "4G: LTE/LTE-Advanced for Mobile Broadband" Academic Press, 2011.
- [4] *EARTH deliverable D3.1*, "Most promising tracks of green network technologies," pp. 80-83, Dec. 2010, Available:  
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