Optimization of Cloud-RAN deployment using Integer Programming

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INTRODUCTION

The mobile data traffic is increasing with a very high rate due to the rise of smartphones and tables. The only way to overcome such a large traffic volume is to increase the capacity in the network by deploying more base stations. This means, that the mobile operators are facing a challenging future as the cost to build, operate and upgrade the Radio Access Network (RAN) is becoming more expensive. Due to a very competitive marked, the Average Revenue Per User (ARPU) is constant or even decreasing. It is therefore in the mobile operators' interest to find new solutions on how to reduce cost in order to maintain a profitably business.

It is estimated that Information and Communication Technologies (ICT) accounts for 2-4% of the worldwide carbon emissions and is expected to double in 2020. The mobile network has a big part in this and is therefore relevant when talking Green Energy. In the mobile network, base stations accounts for 58% of the power consumption. This means that the increasing number of base stations in the network will be a major problem when trying to lower carbon emission in the future.

THEORY AND METHOD

A promising solution to the above challenges is C-RAN (Cloud-Radio Access Network), which is a novel mobile network architecture. C-RAN is using distributed Remote Radio Head (RRH) and centralized Baseband Unit (BBU) architecture. C-RAN has the potential to support extremely dense mobile network deployments enhancing the network capacity while offering cost savings and lower power consumption on baseband resources.

This project will look into solutions on how the operators can optimize new green field deployments in terms of Total Cost of Ownership (TCO). In order to minimize the TCO, an Integer Programming (ILP) model is made. The model is optimizing the allocation of RRHs to the BBU pools, when looking at different mobile network deployment scenarios. The model takes into account that all cells are having different traffic profiles and that different types of base stations can be used.
By using this model, the power consumption in the mobile network will greatly decrease, as fewer base stations will be needed compared to a traditional mobile network deployment.

RESULTS AND CONCLUSION

The results show that C-RAN may be a possible solution to the future challenges in the mobile network. It is offering cost savings when deploying new networks and lowering the power consumption in the network by aggregating baseband resources. However, the findings also show that C-RAN is mostly beneficial for urban deployments with densely placed cells.