

Moving Cells/Networks

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I. EXTENDED ABSTRACT

The traffic explosion in mobile internet puts new challenges on future mobile access networks. Forecasts predict more than 50 billion connected devices and a required thousand-fold increase in network capacity. Such future wireless access networks will enable the intelligent society in which humans and devices can be connected anywhere at any time and with anything.

To make this massive connectivity feasible there is a need to reduce the environmental impact of mobile communication systems by intelligently deploying new wireless nodes where users are, in order to optimally use energy and equipment.

In future wireless networks, a significant number of users accessing wireless broadband will be vehicular (i.e., in public transportation vehicles like buses, trams, or trains and in personal cars). Thus, one promising solution is to deploy one or several moving relay node(s) (MRNs) on vehicles that forms their own cell(s) inside the vehicle to serve vehicular users, since such environments constitute natural hot spots. By proper antenna placement, an MRN can reduce or even eliminate the vehicular penetration loss that severely affects the communication. Moreover, MRNs can exploit various smart antenna techniques and advanced signal processing schemes, as they are less limited by size and power than regular user equipment connected directly to a macro base station.

With smart backhauling for the moving cell, it can potentially be fully integrated in the resource allocation and interference coordination in the mobile communications system. Integrating moving cells/networks in wireless access networks can thus enable full control of the Quality of Service (QoS), and at the same time improve the capacity and energy efficiency of the wireless access networks.

The MRNs can potentially also be used to serve users outside of the vehicles, thus acting as moving small cell base stations within the macro network. Thus, future vehicles and transportation systems may play an integral role in wireless networks by providing additional communications capabilities and becoming part of the communications infrastructure to improve capacity and coverage of the mobile communications system.

However, there are also challenges in using MRNs, such as efficient backhauling, design of efficient resource allocation and interference management techniques, as well as proper mobility management schemes to exploit the benefit of group handovers for vehicular UE devices served by the same MRN.

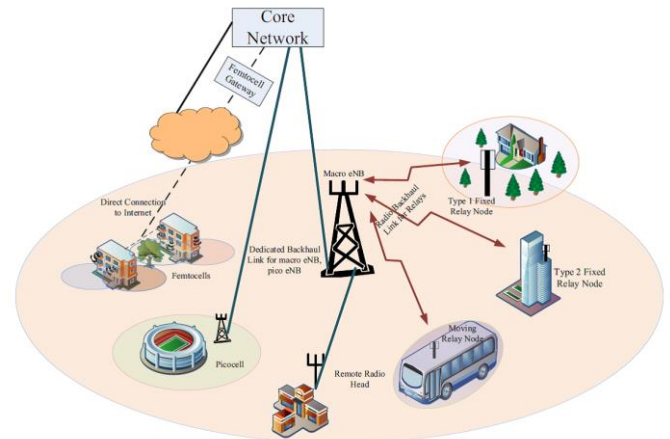


Figure 1: Illustration of a heterogeneous and small cell networks augmented with a moving cell.

This talk will give an overview of our research at Chalmers on moving cells/networks and elaborate on the visions within the EU FP7 METIS project related to moving networks. The talk will be based on our work published in the references below. The speaker would like to acknowledge the contributions of the co-authors.

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