Cooperation strategies for energy-aware wireless heterogeneous networks

Recently, triggered by the increase of energy price, and the will to participate in the global environmental protection, the energy efficiency issue has become a top objective for the telecommunications industry. Recent statistics have shown that 70% of the operators' energy is consumed by the radio access. Further studies [1] have revealed that 90% of data traffic is carried in only 40% of network cells.

These facts show that efficient strategies for energy conservation can be applied in the context of wireless heterogeneous networks using offloading and traffic concentration techniques.
Energy reduction has been a widely explored topic in especially in wireless sensor networks since constrained energy resources of sensor nodes is one of the most critical limitations in this kind of networks. Many works have concerned the development of energy aware applications and protocols (PHY, MAC, routing, data aggregation, mobile sinks, etc.) [2, 3]. Energy-aware routing algorithms discuss reducing the consumption of battery-power at each node. Other advanced studies have focused on data compression and aggregation to overcome the resource constraints [4]. Many research works have lately been developed, in the context of wired networks and service infrastructures, to achieve a better ratio between performance and energy consumption. Some works have concerned the network devices (LAN switches, Ethernet interfaces,...) in order to exploit low/sleep power states [5, 6, 7]. Other solutions focused on the design of next generation devices where energy enhancements are feasible [8, 9].

In this work, we propose to tackle the problem of energy optimisation in wireless heterogeneous networks where users access the network using multihomed and high performance mobile devices (smartphones, tablets, PDA, etc.). The aim of the PhD is to study cooperation and relay strategies which can be employed between users and bases stations to achieve a global network utility in terms of energy consumption. Some directions will be explored such as offloading, traffic concentration, traffic re-routing, forced-Handover, and turning off some parts of the network. The PhD student will have to realize the design, the modelling and the performance evaluation of different cooperation strategies. More specifically, he/she will realize:
- An extensive analysis on energy reduction strategies in different networking areas
- Study cooperation and relay strategies for global utility achievements
- Design and modelling of the cooperation and relay strategies (some theoretical tools like game theory could be applied)
- Performance evaluation of the designed techniques

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