

Energy and spectral efficiency balancing algorithm for energy saving in LTE downlinks

ABSTRACT

In wireless network communication environments, Spectral Efficiency (SE) and Energy Efficiency (EE) are among the major indicators used for evaluating network performance. However, given the high demand for data rate services and the exponential growth of energy consumption, SE and EE continue to elicit increasing attention in academia and industries. Consequently, a study of the trade-off between these metrics is imperative. In contrast with existing works, this study proposes an efficient SE and EE trade-off algorithm for saving energy in downlink Long Term Evolution (LTE) networks to concurrently optimize SE and EE while considering battery life at the Base Station (BS). The scheme is formulated as a Multi-objective Optimization Problem (MOP) and its Pareto optimal solution is examined. In contrast with other algorithms that prolong battery life by considering the idle state of a BS, thereby increasing average delay and energy consumption, the proposed algorithm prolongs battery life by adjusting the initial and final states of a BS to minimize the average delay and the energy consumption. Similarly, the use of an omni-directional antenna to spread radio signals to the user equipment in all directions causes high interference and low spatial reuse. We propose using a directional antenna instead of an omni-directional antenna by transmitting signals in one direction which results in no or low interference and high spatial reuse. The proposed scheme has been extensively evaluated through simulation, where simulation results prove that the proposed scheme is efficiently able to decrease the average response delay, improve SE, and minimize energy consumption.

Keyword: Battery life; Delay; Energy-efficient; Power saving; Downlink; LTE