NOVEL ALGORITHMS FOR IMPROVING RESOURCE ALLOCATION PROCEDURE IN REUSE ONE LTE NETWORKS

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Abstract

Long Term Evolution (LTE) is the next generation mobile broad-band network and its standardization has been finalized by 3rd Generation Partnership Project (3GPP) in Release 8 (Rel'8). LTE technology is designed to increase the capacity and speed of mobile networks to meet rapid growth in demanded mobile applications. The main challenge of LTE networks is to use unitary frequency reuse factor to achieve highest possible user's data throughput, however this leads to a severe interference affecting all active users and specially cell edge users.

This study explores novel algorithms that can be implemented in Resource Allocation (RA) procedure to mitigate the effect of Inter-Cell Interference (ICI), thus improves peak data rate in LTE to achieve global targets. In the earlier literature, most of the studies were focused on Bandwidth partitioning techniques to mitigate Inter-Cell Interference (ICI), however such techniques cannot achieve target peak data rate due to the usage of portions of available data rate. By exploiting proposed resource allocation techniques, the impact of inter-cell interference can be limited, and the overall network performances can be further enhanced.

My dissertation is dedicated to address both challenges, aiming at providing practical, effective, and efficient methods to monitor and to reduce the effect of the ICI in LTE networks implementing reuse one schemes. These targets are met through improving all the stages of resource allocation procedure which can be listed as cell selection as a preliminary stage followed by scheduling then power assignment.

Cell selection algorithms are considered another crucial feature in LTE-heterogeneous networks (HetNet) to improve peak data rate. Due to different downlink transmit power levels in HetNet and randomness deployment of distinct nodes with different maximum transmitting power levels, great challenge for achieving better user throughput requires appropriate algorithms for selecting optimum serving cell and also reduces the necessity of dynamic load balancing and handover algorithms. In this work, new Hybrid and Standalone Cell Selection Algorithms (HCSA) and (SCSA) are proposed that enable new user to select best serving cell through selecting the cell achieving maximum effective achievable Data rate by

considering several factors other than highest instantaneous SNR or maximum RSRP. We also designed a new prediction algorithm based on Proportional Fair (PF) scheduling algorithm to predict the pattern of served users within a certain Time Transient Interval (TTI). A novel Resource Allocation Algorithm (RAA) with reduced complexity is then developed to schedule users in a pattern where the ICI is reduced, and accordingly user's signal-to-noise Ratio (SNR) is improved.
Finally, new standalone Power Allocation Algorithm (PAA) is presented to assign optimal downlink power levels to scheduled users to minimize ICI without any need to coordination between adjacent cells, such sub-optimal power values leads to a significant reduction in the ICI and consequently an improvement occurs in achievable data rate.

A comprehensive system level simulation has been presented in this dissertation to evaluate the performance of these algorithms, whereas the results have shown that proposed algorithms lead to an improvement in system performance compared to standard reuse one scheme and various bandwidth partitioning schemes.