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Title : DESIGN AND DEVELOPMENT OF THE NETWORK INTERFACE, PACKETS SCHEDULING AND INTERFERENCE MITIGATION SCHEMES FOR LTE-BASED FEMTOCELL NETWORKS

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Cellular networks face numerous challenges in providing services for indoor users.Therefore, femtocells are suggested as a solution to indoor coverage issues that macro cells have failed to address to date in cellular networks such as Global System for Mobile Communication (GSM), Universal Mobile Telecommunications System (UMTS), and Long Term Evolution (LTE). Although femtocells can provide various benefits for both operators and users, many technical challenges must be resolved for effective femtocell deployment in real environments. In this thesis, the network interface, the packet scheduling and the interference management challenges are investigated in order to address these issues with proper solutions. The network interface challenge is related to the integration of the femtocell in a cellular network such as LTE. The proposed solution is to deploy an IP Multimedia Subsystem (IMS) as an integration platform between the femtocell and the LTE cellular network. Thus, an IMS module has been implemented for signalling in a LTE-based femtocell network that contains both registration and invitation procedures. Based on this study, it has been observed that the integration of an IMS in a LTE based femtocell network can improve the network performance since the Packet Loss Ratio (PLR) can be minimised. For the packet scheduling challenge, the authors propose a resource block preserver (RBP) scheduling algorithm in the downlink of the LTE based femtocell network. The RBP algorithm has two layers, upper and lower. The upper layer of the RBP exploits the LTE frame concept that contains a number of sub-frames, whereas the lower layer of the RBP algorithm adopts the concept of a Proportional Fair (PF) algorithm to schedule the non-real time (NRT) flows, while an Exponential/Earliest Deadline (Exp/ED) algorithm is applied for the real time (RT) flows. The proposed RBP scheduling algorithm outperforms the well-known scheduling algorithms in terms of a lower PLR among users in the LTE based femtocell network. Finally, a self-organising power control mechanism is proposed as an interference mitigation scheme for the LTE femtocell network. The notion is based on adjusting the transmission power of the femtocell based on the interference power received at the femtocell downlink in order to reduce the interference between adjacent femtocells. The power adjustment is controlled centred on relevant factors such as the number of femtocells and the distance between the femtocells and the subscribers. Through this study, it has been found that by utilising the proposed interference mitigation scheme, the interference between neighbouring femtocells can be reduced and a desirable QoS for subscribers can be provided when performing RT services.