ABSTRACT

Nowadays there are many works which analyze and seek to improve the performance of Wireless Local Area Networks (WLANs) from different perspectives. A great deal of them is focused on design aspects, such as frequency distribution or channel assignment. Therefore, as these features have already been widely studied, my efforts have been directed to study other conditions that also could affect their performance and that have not been analyzed in depth yet. The main goal of this Ph.D. dissertation has been to perform a detailed study that researches the weather's impact on the performance of WLANs IEEE 802.11b/g. Two different WLAN scenarios have been analyzed to validate the results and to find precise relations. From conclusions of these previous analysis, the second objective has been to design a cognitive protocol that based on weather conditions and network performance parameters, allows networks to adjust their transmission features in order to overcome such impact.

In order to conduct this study, firstly it was necessary to study which statistical methods could be used to extract the level of correlation between performance parameters of networks and weather conditions running at the same time. Secondly, I had to know which performance parameters the outdoor WLAN of Universitat Politècnica de València (UPV) could provide, and select them according to my objective. Then, I defined the period of time in which these parameters were gathered periodically. The next step was to select and collect the weather conditions from a close weather station during the same period of time. Finally, I had to perform a detailed pre-processing to put all of the volume of data in order and data were statistically analyzed. Results were successful; however there were several problems due to the variability derived from a real WLAN scenario. Therefore, an experimental setup was required in order to check the obtained results. It entailed to design and to develop an outdoor point-to-multipoint IEEE 802.11b/g link and to analyze again the weather's impact. Multiple points were considered in order to take into account different distances in the performed evaluation and to examine the behavior of different modulation schemes working under the same weather conditions. From these results, a cognitive algorithm was designed in order to reduce the weather's impact on IEEE 802.11b/g networks. One key aspect was to ensure it was energy efficient. This protocol was simulated and the obtained results were satisfactory in terms of both energy efficiency and network performance.

To conclude, other external factor to WLANs studied in this Ph.D thesis has been the specific absorption rate. It deals with a current public health worry because it is used to measure the body tissue exposure to electromagnetic fields. Obviously, signal absorption by human bodies affects to the performance of WLANs and so, this parameter should be also taken into account when deploying efficient networks. For this reason, this study has been also included in this thesis.