

Abstract

Capability to provide wireless access to subscribers ranging from individual to small business groups is one of the important objectives of the present and next generation networks. There are different types of access networks in use while some of them are stand-alone systems, and others are in a hybrid form between different technologies. In this thesis, we considered broadband wireless access provided by WiFi networks which are wirelessly connected to the wired networks through the IEEE 802.16x WMAN as a viable access solution. With increasing demand for multimedia services, medium access control (MAC) protocols of wireless networks are required to give importance and satisfy a variety of quality of service (QoS) requirements. MAC protocols play a vital role also in the efficient and fair sharing of bandwidth amongst the different users and services. In view of the importance of networks depend on them, the objective of the work is placed as the study of MAC protocols of a hybrid wireless access network is studied with enhanced MAC protocols and suitable enhancements are proposed to MAC protocols of the IEEE 802.11x, 802.16x standards and their performances are studied.

In the first part of thesis work, the dependence of IEEE 802.11x MAC layer protocol performance on the protocol parameters for varying network load conditions is investigated to establish the relationship between the performance and protocol parameters. The performance of IEEE 802.11x is found to be sensitive to DIFS. A modified backoff algorithm is proposed to investigate the impact of the DIFS overhead on the performance of IEEE 802.11x. This thesis also proposes certain performance enhancement schemes to the standard IEEE 802.16x WMAN. Due to the scarcity of the uplink bandwidth and scheduling complexity which in turn is due to the distributed need, it has become important to obtain the minislot allocation algorithm such that it uses the bandwidth efficiently. A QoS architecture, and a hierarchical uplink scheduling algorithm are proposed to carry out the study and optimize the uplink performance of the IEEE 802.16 MAC protocol for VoIP, Video, FTP, HTTP traffic models. We also presented a mathematical model to obtain the uplink performance for best-effort (BE) traffic and the analytical results are compared with simulation results. An extension of the analysis by accounting for the impact of transmission channel effects in a Rayleigh fading environments is also provided.

Since the aggregate traffic at the subscriber station (SS) arriving from individual access networks like WLAN/Ethernet or any other access network exhibits the property of self-similarity and long-range-dependence (LRD), the impact of aggregate traffic on the uplink performance of IEEE 802.16 WMAN is also investigated to study the behaviour at the hybrid access network. Furthermore, the hybrid access network along with the proposed enhancements is fully implemented and the performance is studied. The performance is found to be in agreement with the WMAN performance where in the traffic of SS's is represented by the models of aggregated traffic. It also demonstrated that the hybrid access network is an excellent access solution.

Key Words - MAC, Hybrid access network, WLAN, WMAN, self-similarity, DIFS