Chapter 20
IEEE 802.11E Block Acknowledgement Policies

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Abstract Optimization of IEEE 802.11e MAC protocol performance is addressed by modifying several parameters left open in the standard, like block size and acknowledgement policies in order to improve the channel efficiency. The use of small block sizes leads to a high overhead caused by the negotiation on the other hand, the use of large block sizes causes long delays, which can affect negatively real-time applications (or delay sensitive applications). An event driven simulator was developed, and results with a single service and several services running simultaneously were extracted. By using the Block Acknowledgement (BA) procedure, for video and background traffics in a single service situation, the capacity was improved in the case when the number of stations is equal or higher than 16 and 12, respectively. However, for lower values of the number of stations, the use of BA leads to a slightly worst system performance. In a scenario with mixture of services the most advised block size is 12 (less delay in a highly loaded scenario). The number of supported user (total) increases from 30 to 35.

Keywords IEEE 802.11e · simulator · block acknowledgement · quality of service

20.1 Introduction

Recent years have seen an immense growth in the popularity of wireless applications that require high throughput. To support such growth, standardization bodies such as the IEEE 802.11 have formed task groups to investigate and standardize features providing increased quality of service (QoS) and higher throughputs. One of these extensions is the acknowledgement (ACK) policy feature included in the ratified IEEE 802.11e amendment for QoS support [3], which is the focus of this work. In
particular, we investigate the policy regarding the block size for a video application. The Block Acknowledgement (BA) procedure improves system throughput results by reducing the amount of overhead required by a station to acknowledge a burst of received traffic [1,2]. It acknowledges a block of packets by a single ACK, instead of using several ACKs, one for each packet, saving the Arbitration Inter-frame Spacing (AIFS) period, the backoff counter time, and the acknowledgement time. The number of frames that can be transmitted within a block is called block size. It is limited and is not specified in the standard. In this chapter, to find the most suitable block size we have tried several block sizes and several loaded scenarios with and without mixture of services. This chapter is organised as follows. In Section 20.2, a brief introduction to the IEEE 802.11e standard is presented along with the main directive lines of the BA procedure. Section 20.3, gives the description of the state of the art. Section 20.4 defines the problem and the scenario, including details on traffic parameters. Section 20.5 gives the simulation results obtained for several scenarios with and without the use of the BA procedure, with and without mixtures of traffic. Conclusions are given in Section 20.6, as well as suggestions for further work.

20.2 IEEE 802.11e and Block Acknowledgement Description

20.2.1 IEEE 802.11e User Priorities and Access Categories

The so-called enhanced distributed channel access (EDCA) provides differentiated, distributed access to the medium for Quality Stations (terminals that support IEEE 802.11e) using four access categories (ACs) voice (VO), video (VI), best effort (BE), and background (BK). This differentiation is achieved by mapping the traffic to four queues that correspond to the four AC. The traffic prioritisation is performed by varying the amount of time a station queue senses the channel to be idle before backoff or transmission, or the length of the contention window to be used for the backoff, or the duration a station queue may transmit after it acquires the channel. Each AC contends to access the medium with a single CSMA instance, [3] [1]. Each queue has an Arbitration Inter-frame Spacing (AIFS) period preceding the next backoff contention window (see Fig. 20.1).

20.2.2 Block Acknowledgement

The BA mechanism (see Fig. 20.2) improves channel efficiency by aggregating several acknowledgements into one frame [4,5]. There are two types of BA mechanisms: immediate and delayed. Immediate BA is suitable for high-bandwidth, low-latency traffic while the delayed BA is suitable for applications that tolerate moderate latency. The QSTA with data to send using the BA mechanism is referred