Wireless LAN MAC Protocol: Data Compression as a MAC Option to improve Effective Throughput

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ABSTRACT

In this short contribution we address the use of compression techniques to increase the throughput provided by the MAC layer.

This contribution addresses the Issue 9.1 related to MAC throughput (see [1]).

DISCUSSION

Among the various requirements which are commonly considered for a wireless LAN, the performance and more specifically the throughput is often explicitly or implicitly mentioned. For instance the IEEE 802.11 documents [2] and [3] address this performance aspect.

Different approaches and alternatives can be followed to improve the throughput. The focus can be placed on the PHY layer: in this case the objective is to optimize the use of the transmission channel. For instance the question to be answered is: "Given a 1 MHz wide channel, which encoding / modulation / signal processing technique will provide the most efficient transmission channel?". The purpose of this contribution is not to answer this type of question. Rather than that, the focus can be placed at the MAC layer level. In this case, the question to be answered is: "Given a 1 Mbps physical layer, which technique can be used to provide the most efficient MAC channel?". Several aspects can be addressed while answering this question. The one which is the most often addressed corresponds to the "intrinsic" channel efficiency achieved by the MAC protocol. Basically it specifies the ratio of information data exchanged during a given time interval. For instance the paper [4] indicates a 87.2% maximal throughput in its third section. In other words this figure shows that during a time interval of say 1 ms, 872 μs are used for data transmission. The effective throughput is then obtained by taking into account the overhead due to headers / trailers generated by the MAC layer. If one assumes this MAC overhead in the range of 10%, then the effective throughput will correspond to 785 μs used for effective data transmission (data that originates from upper layers).

Another aspect can be addressed when dealing with MAC layer throughput: it deals with the data compression. This technique allows to significantly increase the overall throughput of the media, without inducing excessive complexity in the MAC layer. The underlying principle is quite straightforward: each piece of information received by the MAC layer from the upper layer is compressed before being further treated by the MAC layer; and each piece of information to be sent by the MAC layer to the upper layer is expanded before sending. Thanks to this compression / expansion approach, the throughput, as seen by the upper layers, is improved by a ratio equal to the compression ratio. If one

assume a compression ratio equal to 3:1, then the global efficiency of the MAC protocol becomes 235.5% instead of the previous figure 78.5%.

We believe that the specification of a compression algorithm is outside the scope of the 802.11 committee. Nevertheless we **strongly** recommend that the 802.11 MAC standard has provision for optional data compression. It means that some parameters should be identified to specify if a piece of data exchanged between two instances of the 802.11 MAC protocol has been or not compressed. Obviously all the "control" information flowing at MAC level must not be compressed (that is: must remain in clear): only the "payload" originating from layers above the MAC layer is candidate for optional compression.

The following figure allows to position the optional compression functions within the global 802.11 reference Model.

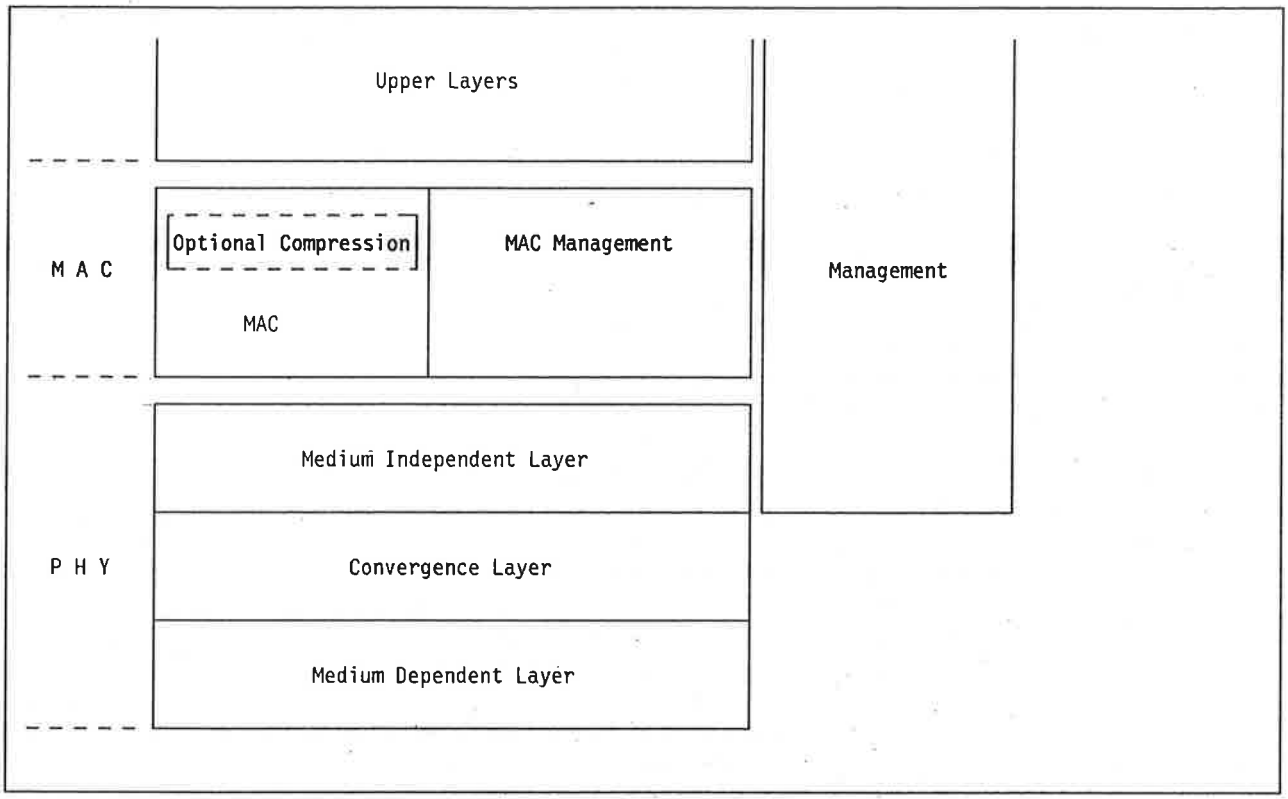

Figure 1. Optional Compression placement in the Reference Model

BIBLIOGRAPHY

[1] IEEE P802.11 Issues Document, IEEE 802.11-92/64.

[2] IEEE P802.11 WLAN Requirements, IEEE 802.11-91/108.

[3] C.A.Rypinski, *MAC Evaluation Criteria*, IEEE 802.11 Working Group paper, IEEE 802.11/92-25

[4] K.S.Natarajan, C.C.Huang and D.Bantz, *Medium Access Control Protocol for Wireless LANs (an Update)*, IEEE 802.11 Working Group paper, IEEE 802.11/92-39