Title: Separate Physical Layer Preamble and PLCP Headers

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Abstract

This submission reviews the concept of having a common PLCP PHY header for the 802.11 PHY layers. This paper focuses on the PLCP header from a DS PHY prospective, comparing the DS PHY fields in the header against the FH PHY and IR PHY PLCP header fields as described in the P802.11D1.1 working draft. The intention of this submission is to present some observations between the respective PHY PLCP headers and possible practical implications for having a common header, in products which will support the standard.

Introduction

In 802.11 meetings past, the issue of having a common PLCP header shared between the DS PHY and the FH PHY was raised. Having a common PLCP header for ALL of the PHYs is the "ideal" solution from a MAC layer and overall WLAN network prospective. However, the problem with adopting this concept, is that the PLCP headers are optimized for the respective PHYs. The PLCP headers are typically detected by the PHY layer because of signal detection algorithms, critical timing and signal acquisition issues associated with them. If we observe the current PLCP header formats and consider the operation of the PHYs, a common header may indeed make the individual PHY PLCP detection state machines much more complex.

Header Formats

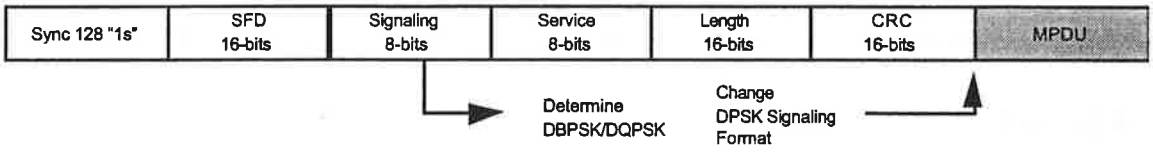
After reviewing the PLCP headers in the draft, it is apparent some of the differences between the headers are the bit widths of the header fields and their position. Each of the PHY sub-groups carefully selected bit lengths and fields, in the respective PLCP headers to guarantee an optimum solution. The only field "position" common to both the DS PHY and the FH PHY is the Unique Word (Start of Frame Delimiter) and the CRC. If the headers were consolidated, It is not clear how to combine the PLCP headers and whether or not if an additional field is needed to differentiate between the PHYs. The PHYs are so different in architectures that this would only confuse the process.

For example if we observe and examine the DS PHY architecture, the Sync preamble field bit length is longer than the other PLCP PHYs because it was optimized to preserve the signal acquisition performance if antenna diversity is selected. There is no reason to penalize the other PHYs to comply with longer Sync preamble, and besides, the other PHYs have the same criteria in mind. Another observation, is the addition of the Service field. The Service

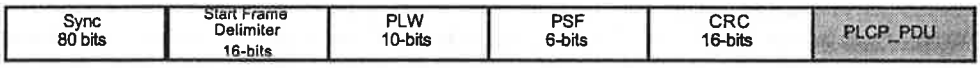
field was added a place holder for future enhancements in the standard which are applicable to DS PHY networks. The bit length in the Signaling field, was defined to provide flexibility in the standard for supporting other data rates in the future. The DS PHY uses this field to determine the modulation type and data rate for the MPDU packet. When this field is detected by the PHY, the modem switches between DBPSK and DQPSK, to time align and properly demodulate the data in the MPDU packet. If we consider the operation of the other PHYs, we believe that the similar arguments hold true.

The bottom line is that the modulations of the (3) PHYs are distinctly different and any attempt to achieve a common PLCP will result into inefficiencies for ALL PHYs. The diagram below illustrates from a top level these differences. These differences apply to the actual fields as well as the number of bits required for each of the PHYs. Any attempt for commonality will introduce less than optimum PHYs.

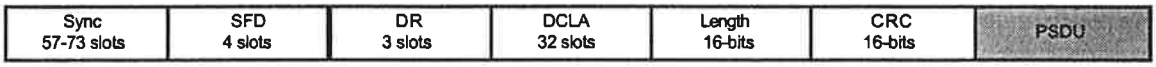
DS PHY Preamble-PLCP Header from section 11.2.2 of P802.11D1.1



FH PHY Preamble-PLCP Header from section 10.3.2 of P802.11D1.1



IR PHY Preamble-PLCP Header from section 12.2.2 P802.11D1.1



Conclusions

The assumption is that products supporting the standard will be introduced for one PHY or the other. It is also clear that respective specific 802.11 PHY types will not communicate with each other because of the fundamental differences between the spreading architectures and modulation signaling types. If we consider the scenario of having one common header, WLAN products designed to the standard would be burdened with the penalty of processing additional PLCP header field bits, which are PHY specific. Lastly, if we consider the semiconductor industry, semiconductor manufacturers are likely to introduce products which supports the PHYs individually, and products that support the MAC protocol. The likelihood of combining all of the MAC and PHY functions universally, into a highly integrated RF-to-bits silicon solution is small, because of process technology limitations, cost and system testing issues. Therefore we recommend that the PLCP headers remain separate as currently proposed, in P802.11D1.1 to minimize overhead burdening of PHY products which will support the standard.