IEEE P802.11
Wireless LANs

Mechanism to Allow Correct Calculation of Frame Durations

Date: January 13, 1999

Author: Michael Fischer
CHOICE Microsystems, Inc.
4242-3 Medical Drive
Phone: +1-210-614-4096
Fax: +1-210-614-8192
e-Mail: mfischer@child.com

Abstract

The aMPDUDurationFactor PHY characteristic defined in IEEE 802.11-1997 was developed to yield correct frame duration calculations in the presence of the MPDU expansion due to operation of the FHSS data whitener. This mechanism is insufficient to handle the MPDU expansion in the high-rate PHYs. TGa has coding rates that vary with data rate, and requires length- and rate-dependent padding of the MPDU to fill an integral number of symbols. TGb with PBCC adds a single octet to the end of the MPDU, independent of MPDU length and has preamble and PLCP header lengths which vary independent of MPDU length. This submission proposes a new PLME service primitive that fully solves these problems, and is likely to be sufficient for any future PHY-dependent differences between PSDU length and PPDU length. This allows resolution of comments 48, 58, and 74 on 802.11b and a comment by AS on 802.11a.

In Clause 1.3 of 802.11B/D2.0:

Remove the entry for aMPDUDurationFactor from Table 7 in clause 1.3.3.

Add a subclause 1.3.4 after subclause 1.3.3:

1.3.4 HR/DSSS TXTIME calculation

The value of the TXTIME parameter returned by the PLME-TXTIME.confirm primitive shall be calculated according to the following equation:

TXTIME = aPreambleLength + PLCPHeaderTime + Ceiling(((LENGTH+PBCC) x 8) / DATARATE)

Where LENGTH and DATARATE are values from the TXVECTOR parameter of the corresponding PLME-TXTIME.request primitive. PBCC has a value of 1 if the SIGNAL value from the TXVECTOR parameter specifies PBCC and has a value of 0 otherwise. The value of aPreambleLength is 144 microseconds if the TXPREAMBLE_TYPE value from the TXVECTOR parameter indicates “LongPLCP” or 72 microseconds if the TXPREAMBLE_TYPE value from the TXVECTOR parameter indicates “ShortPLCP”. The value of PLCPHeaderTime is 48 microseconds if the TXPREAMBLE_TYPE value from the TXVECTOR parameter indicates “LongPLCP” or 24 microseconds if the TXPREAMBLE_TYPE value from the TXVECTOR parameter indicates “ShortPLCP”. LENGTH is in units of octets. DATARATE is in units of Mbit/s. Ceiling is a function which returns the smallest integer value greater than or equal to its argument value.

In Clause 1.5 of 802.11B/D2.0, replace the sections beginning “Existing Paragraph No.: 9.6 ...” and ending just before “Appendix A” with the following:

CHANGES to Clause 9.6:

Replace the existing clause with the following:

Some PHYs have multiple data transfer rate capabilities that allow implementations to perform dynamic rate switching with the objective of improving performance. The algorithm for performing rate switching is beyond the scope of this standard, but in order to ensure coexistence and interoperability on multirate-capable PHYs, this standard defines a set of rules that shall be followed by all STAs.

All Control frames shall be transmitted at one of the rates in the BSS basic rate set so that they will be understood by all STAs in the BSS.

All frames with multicast and broadcast RA shall be transmitted at one of the rates included in the BSS basic rate set, regardless of their type or subtype

Data and/or management MPDUs with a unicast immediate address shall be sent on any supported data rate selected by the rate switching mechanism (whose output is an internal MAC variable called MACCurrentRate, which is used for calculating the Duration/ID field of each frame). A STA shall not transmit at a rate that is known not to be supported by the destination STA, as reported in the supported rates element in the management frames. For frames of type Data+CF-ACK, Data+CF-Poll+CF-ACK and CF-Poll+CF-ACK, the rate chosen to transmit the frame must be supported by both the addressed recipient STA and the STA to which the ACK is intended.

To allow the transmitting STA to calculate the contents of the Duration/ID field, the responding STA shall transmit its Control Response frame (either CTS or ACK) at the highest rate in the BSS basic rate set that is less than or equal to the rate of the immediately previous frame in the frame exchange sequence (as defined in 9.7). In addition the Control Response frame shall be sent using the same PHY options as the received frame.

The time required to transmit a frame, for use in the Duration/ID field, is determined using the PLME-TXTIME.request primitive, defined in 10.4.6, and the PLME-TXTIME.confirm primitive, defined in 10.4.7.

CHANGES to Clause 10.4:

Remove the references to aMPDUDurationFactor from 10.4.3.1.

Insert the following subclauses at the end of 10.4:

10.4.6 PLME-TXTIME.request

10.4.6.1 Function

This primitive is a request for the PHY to calculate the time that will be required to transmit onto the wireless medium a PPDU containing a specified length MPDU and using a specified format, data rate, and signalling.

10.4.6.2 Semantics of the service primitive

The primitive provides the following parameters:

PLME-TXTIME.request(TXVECTOR)

The TXVECTOR represents a list of parameters that the MAC sublayer provides the local PHY entity in order to transmit an MPDU, as further described in 12.3.4.4 and the clause defining the local PHY entity.

10.4.6.3 When generated

This primitive is issued by the MAC sublayer to the PHY entity whenever the MAC sublayer needs to determine the time required to transmit a particular MPDU.

10.4.6.4 Effect of receipt

The effect of receipt of this primitive by the PHY entity shall be to generate a PHY-TXTIME.confirm primitive which conveys the required transmission time.

10.4.7 PLME-TXTIME.confirm

10.4.7.1 Function

This primitive provides the time that will be required to transmit the PPDU described in the corresponding PLME-TXTIME.request.

10.4.7.2 Semantics of the service primitive

The primitive provides the following parameters:

PLME-TXTIME.confirm(TXTIME)

The TXTIME represents the time in microseconds required to transmit the PPDU described in the corresponding PLME-TXTIME.request. If the calculated time includes a fractional microsecond, the TXTIME value is rounded up to the next higher integer.

10.4.7.3 When generated

This primitive is issued by the local PHY entity in response to a PLME-TXTIME.request.

10.4.6.4 Effect of receipt

The receipt of this primitive provides the MAC sublayer with the PPDU transmission time.

CHANGES to Clause 14:

Remove the entry for aMPDUDurationFactor from Table 57a in clause 14.9.

Add a subclause 14.10 at the end of clause 14:

14.10 FH TXTIME calculation

The value of the TXTIME parameter returned by the PLME-TXTIME.confirm primitive shall be calculated according to the following equation:

TXTIME = aPreambleLength + aPLCPHeaderLength + Ceiling((LENGTH x 8 x 1.03125) / DATARATE)

Where LENGTH (in octets) and DATARATE (in Mbit/s) are values from the TXVECTOR parameter of the corresponding PLME-TXTIME.request primitive and Ceiling is a function which returns the smallest integer value greater than or equal to its argument value.

CHANGES to Clause 15:

Remove the entry for aMPDUDurationFactor from Table 58a in clause 15.3.3.

Add a subclause 15.3.4 after subclause 15.3.3:

15.3.4 DS TXTIME calculation

The value of the TXTIME parameter returned by the PLME-TXTIME.confirm primitive shall be calculated according to the following equation:

TXTIME = aPreambleLength + aPLCPHeaderLength + ((LENGTH x 8) / DATARATE)

Where LENGTH (in octets) and DATARATE (in Mbit/s) are values from the TXVECTOR parameter of the corresponding PLME-TXTIME.request primitive.

CHANGES to Clause 16:

Remove the entry for aMPDUDurationFactor from Table 75 in clause 16.4.

Add the following paragraphs at the end of clause 16.4:

The value of the TXTIME parameter returned by the PLME-TXTIME.confirm primitive shall be calculated according to the following equation:

TXTIME = aPreambleLength + aPLCPHeaderLength + ((LENGTH x 8) / DATARATE)

Where LENGTH (in octets) and DATARATE (in Mbit/s) are values from the TXVECTOR parameter of the corresponding PLME-TXTIME.request primitive.

CHANGES to Annex C:

Remove the definition of aMPDUDurationFactor and replace the use of aMPDUDurationFactor, aPreambleLength, and aPLCPHeaderLength with use of PLME-TXTIME.request and PLME-TXTIME.confirm primitives in the formal description, updating the following diagrams:

Remove the MPDU Duration Factor support sort on diagram 3125_d\RateAndDurationSorts on page 319.
Remove aMPDUDUrationFactor definition from the structure on diagram 3127_d\PHY_Params on page 321.
Remove aMPDUDurationFactor synonym from diagram 3204_d\PhyOperation on page 325.
Add definitions of PlmeTxtime.request and PlmeTxtime.confirm signals on diagram Sta_signals_2c on page 329 and on diagram AP_signals_2c on page 404.
Add PlmeTxtime.request to the PlmeRequestSignals signallist on diagram Sta_signallists_3b on page 330 and on diagram AP_signallists_3a on page 405.
Add PlmeTxtime.confirm to the PlmeConfirmSignals signallist diagram Sta_signallists_3b on page 330 and on diagram AP_signallists_3a on page 405.
Add signals to use PLME-TXTIME.request and PLME-TXTIME.confirm primitives in replacement of the uses of aMPDUDurationFactor, aPreambleLength, and aPLCPHeaderLength on diagrams sta_tx_idle_2d on page 348, sta_tx_dcf_3.1d on page 350, sta_tx_atim_5d on page 352, validate_rx_2b on page 393, pre_filter_1b on page 394, ap_tx_idle_2d on page 426, ap_tx_dcf_3d on page 427, ap_tx_dcf_3.1d on page 428, validate_rx_2b on page 462, and pre_filter_1b on page 463.