IEEE P802.11
Wireless LANs

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| Annex N.2.2 Deriving Medium TimeProposed Edits |
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Abstract

This document contains proposed changes to Annex N.2.2 of 802.11mc V2.0.

**Reason for required Edits**

In my enthusiasm to capture the hard work of Mark Rison who painstakingly produced the pseudo code for deriving Medium Time for all conceivable cases, I inadvertently missed that he had included mentioning of “Burst Size Definition” and “Nominal MSDU Aggregation” which were under consideration at the time but were then dropped. Hence, there is no reference in 11mc 2.0 to these terms and they need to be removed.

Also it needs to be stated that the Nominal MSDU size is also the A-MSDU size.

Also the text was not updated for 11ad, and some ambiguity remains regarding the exact meaning of Nominal MSDU Size and the Data Rates.

The edits are relatively straightforward and remove references to those features.

**PROPOSED EDITS**

***Make changes to 8.4.2.29 as shown below.***

The Nominal MSDU Size field is 2 octets long and contains an unsigned integer that specifies the nominal size, in octets, of MSDUs or (where A-MSDU aggregation is employed) A-MSDUs belonging to the TS under this TSPEC, and is defined in Figure 8-228 (Nominal MSDU Size field). If the Fixed subfield is equal to 1, then the size of the MSDU or A-MSDU is fixed and is indicated by the Size subfield. If the Fixed subfield is equal to 0, then the size of the MSDU or A-MSDU might not be fixed and the Size subfield indicates the nominal MSDU size. If both the Fixed and Size subfields are equal to 0, then the nominal MSDU or A-MSDU size is unspecified.

The Minimum, Mean and Peak Data Rates do not include the MAC and PHY overheads incurred in transporting the MSDUs or A-MSDUs, with the exception of the MAC overheads specific to A-MSDUs (A-MSDU subframe header and padding).

***Make changes to N.2.2 as shown below.***

**N.2.2 Deriving medium time**

It is recommended that the AP use the following procedure to derive Medium Time in its ADDTS Response frame.

There are two requirements to consider: 1) the traffic requirements of the application, and 2) the expected error performance of the medium.

The application requirements are captured by the following TSPEC parameters: Nominal MSDU Size and Mean Data Rate. Note that the Nominal MSDU Size is the nominal A-MSDU size, where A-MSDU aggregation is employed.

The medium requirements are captured by the following TSPEC parameters: Surplus Bandwidth Allowance and Minimum PHY Rate.

The following formula describes how Medium Time, in units of 32 µs periods per second, can be calculated:

Medium Time =
 ceiling (Surplus Bandwidth Allowance
 / 0x2000
 × Packets Per Second
 × Frame Exchange Time
 / 32)

where:

1) if A-MPDU aggregation is not employed (i.e. TS Info Ack Policy = 00 (Normal acknowledgement)):

Packets Per Second =
 ceiling (Mean Data Rate
 / 8
 / Nominal MSDU Size)

***Note to the editor: in D2.0 there are a number of “ceiling”s which need to be changed to the symbol. They are at 1269.24, 1277.49 (once the exact implication of the definition at 1278.10 is understood!), 1283.52, 1978.36, here and just below, 3114.20. Similarly there are “round”s, “floor”s and “int”s at 1104.15, 1284.15, 1979.33, 2214.1 (twice), 3007.39, 3008.2.***

Frame Exchange Time =
 duration (Nominal MPDU Size, Minimum PHY Rate)
 + SIFS Time
 + duration (ACK Size, ACK Rate)

Nominal MPDU Size =
 MAC Header Size
 + Nominal MSDU Size
 + Security Encapsulation Size
 + FCS Size

2) if A-MPDU aggregation is employed (i.e. TS Info Ack Policy = 11 (Block Ack)):

Packets Per Second =
 ceiling (Mean Data Rate
 / 8
 / Nominal MSDU Size
 / Nominal MPDU Aggregation)

Frame Exchange Time =
 duration (Nominal A-MPDU Size, Minimum PHY Rate)
 + SIFS Time
 + duration (BlockAck Size, BlockAck Rate)

Nominal A-MPDU Size =
 Nominal MPDU Aggregation
 × Nominal A-MPDU Subframe Size
 – Pad Size

Nominal A-MPDU Subframe Size =
 MPDU Delimiter Size
 + MAC Header Size
 + Nominal MSDU Size
 + Security Encapsulation Size
 + FCS Size
 + Pad Size

Pad Size =
 3
 – (MAC Header Size
 + Nominal MSDU Size
 + Security Encapsulation Size
 + 3)
 mod 4

and where:

Sizes are in octets; Rates are in bps; durations and Times are in µs; Surplus Bandwidth Allowance is the unsigned integer value passed

MAC Header Size = 26

MPDU Delimiter Size = 4

Security Encapsulation Size = 16 (CCMP), 20 (GCMP and TKIP), 8 (WEP) or 0 (open system)

ACK Size = 14

BlockAck Size = 32

FCS Size = 4

SIFS Time = 10 when operating in the 2.4 GHz band, 16 when operating in the 5 GHz band, 3 when operating in the 60 GHz band

ACK/BlockAck Rate is the rate used for the ACK/BlockAck frame, given the Minimum PHY Rate, subject to the corresponding multirate rules

duration () is the PLME-TXTIME primitive defined in clauses 10.4.6 and 7 that returns the duration of a PPDU based on the PSDU size and the PHY data rate and PHY employed, e.g. clauses 17.3.4, 18.4.3, 19.5.3.2, 20.4.3 and 21.12.3

Notes:

* + Division does not truncate.
	+ Any signal extension is included, even for the acknowledgement frame which ends the frame exchange.
	+ If protection frames are used, then they are included in the Frame Exchange Time too. Each frame contributes an additional term:

Frame Exchange Time +=
 duration (Protection Frame Size, Protection Frame Rate)
 + SIFS Time

where:

RTS Protection Frame Size = 20

CTS Protection Frame Size = 14

Protection Frame Rate is the rate used for the protection frame, given the Minimum PHY Rate, subject to the corresponding multirate and protection rules

An AP assumes that a STA will use CTS-to-self protection if an ERP Information element directs use of protection.

* + The assumption is made that HT Control headers and beamforming frames are not normally used and so their contribution to Medium Time is negligible.
	+ The Nominal A-MPDU Subframe Size can be increased by the AP where necessary to account for the Minimum MPDU Start Spacing. For example, if the Minimum PHY Rate is 65 Mbps and the Minimum MPDU Start Spacing is 16 µs then the minimum Nominal A-MPDU Subframe Size is 132 octets (including 2 octets of pad).
	+ A STA might request TSPEC parameters that would result in violation of other applicable constraints such as the receiver's maximum A-MSDU or A-MPDU size, any maximum PPDU duration, or, for uplink or bidirectional TSPECs, any non-zero TXOP Limit. An AP receiving such a request is likely to reject it. An AP might also reject requests that cannot be satisfied for reasons that the STA is not always aware of, such as, for uplink or bidirectional TSPECs, the AP’s maximum Block Ack Buffer Size..
	+ Where A-MPDU aggregation is employed, HT-immediate Block Ack is assumed.