IEEE P802.11

Wireless Access Method and Physical Layer Specification

Proposed Text for Sections 5.5 and 5.6, Based on responses to Draft D1 Letter Ballot processed at March 1995 Meeting

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Abstract: This paper presents the changes to section 5.5 thru 5.6 in the Draft Standard P802.11/D1 as a result of the Response to Draft D1 Letter Ballot processed at the March 1995 Meeting as shown in the companion Document P802.11-95/70.
Not all Letter Ballot comments were processed at the March 1995 Meeting.

Action: Adopt the changes in this paper to replace the relevent portions of Section 5 of P802.11/D1.

5.5 Fragmentation

The MAC *may*~~will~~ fragment and reassemble MSDUs, *directed and multicast/broadcast. The primary reason for fragmenting an MSDU is that it is larger than the PHY is capable of sending in one MPDU.* The fragmentation and reassembly mechanisms allows for fragments to be retransmitted.

All stations shall support the simultaneous reception of a minimum of 6 MSDUs.

The fragmentation design also allows for the characteristics of FH PHYs. For the purposes of this description a 'dwell time' will refer to the duration of time spent on a single frequency in a FH system. Therefore in a FH PHY the PHY will hop to the next frequency in the hop sequence at the end of the current dwell time. ~~For other systems a 'dwell time' will refer to the period of time spanning from the start of transmission of a TIM until just before the start of transmission of the next TIM.~~

~~Whenever possible, t~~*T*he ~~size of the~~ payload of a fragment shall be ~~some fixed number of octets~~*an even number of octets for all fragments except the last.* ~~This is denoted by aFragment_Payload. aFragment_Payload equals aFragmentation_Threshold minus MAC Header minus CRC.~~ The payload of a fragment shall never be larger than aFragment_Payload. However, the ~~size of the payload~~ *it* may be less than aFragment_Payload.

When data *is* ~~needs~~ to be transmitted, the number of octets in the payload of the fragment shall be determined based on the time at which the fragment is to be transmitted for the first time. Once a fragment is transmitted for the first time, its contents shall be fixed until it is successfully delivered to the *immediate receiving*~~destination~~ station.

The number of data octets in the payload of a fragment shall depend on the values of the following *three*~~two~~ variables at the instant the fragment is *assembled* to be transmitted for the first time:

a) *aFragment_Payload*
b)~~a)~~ The time remaining in the current dwell time.
c)~~b)~~ The number of octets in the MSDU that have not yet been transmitted for the first time.

Since the control of the channel will be lost at a dwell time boundary and the station will have to contend for the channel after the dwell boundary, it is required that the acknowledgment of a fragment be transmitted before the stations cross the dwell time boundary. Hence, if there is not enough time remaining in the dwell time to transmit a fragment with an aFragment_Payload payload, the number of octets in the payload may be reduced to the maximum number of octets that will allow the fragment plus the MAC acknowledgment to fit within the time remaining in the dwell time. This is shown in Figure 5-24, *for an MSDU of 1500 octets.*

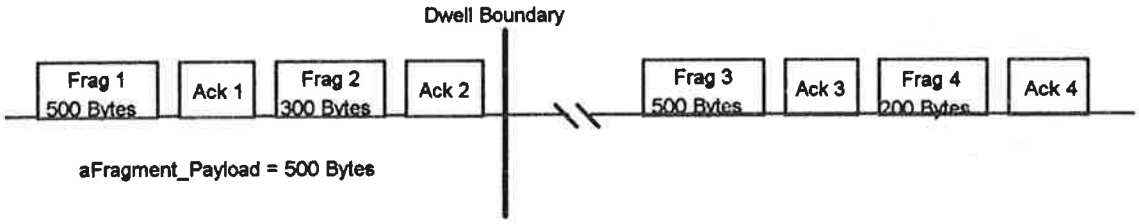

Figure 5-24: Fragmentation Near a Dwell Boundary

Referring to Figure 5-24, a 1500 octet MSDU is fragmented into four fragments with aFragment_Payload set at 500 octets. There is enough time left in the dwell to send two fragments, one of 500 octets and a

second of 300 octets. After the dwell boundary, the rest of the MSDU is sent, one 500 octet fragment and one 200 octet fragment.

A station may elect not to adjust the size of the payload when approaching a dwell boundary. In this case, the station *must*~~shall~~ wait until *after the next dwell boundary* ~~the next dwell time~~ to create and transmit a fragment with a aFragment_Payload octet payload (provided there are at least aFragment_Payload more octets remaining in the MSDU). A station must be capable of receiving fragments of varying size for a single MSDU.

If a fragment requires retransmission, its contents and length shall remain fixed for the lifetime of the MSDU at that station. In other words, after a fragment is transmitted once, contents or length of that fragment are not allowed to fluctuate to accommodate the dwell time boundaries. Let the fragmentation set refer to the contents and length of each of the fragments that make up the MSDU. The fragmentation set is created at a station as soon as the fragments are attempted for the first time. The fragmentation set remains fixed for the lifetime of the packet at the transmitting station. This is shown in Figure 5-25.

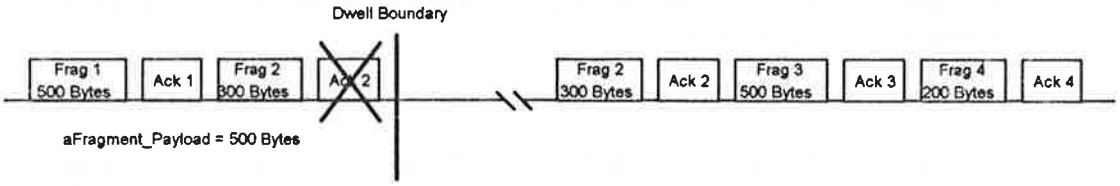

Figure 5-25: Fragmented MSDU with missed ACK Near a Dwell Boundary

In the example shown in Figure 5-25, the same 1500 octet MSDU is fragmented at the same point in the dwell time as in Figure 5-24 but the ACK for the second fragment is missed. After the dwell boundary, the fragment is retransmitted and the fragment size remains 300 octets.

Each fragment will contain a *Sequence Control Field, which is comprised of a Sequence Number and Fragment Number*~~MSDU ID and fragment ID~~. When a station is transmitting a MSDU, the *Sequence Number*~~MSDU ID~~ will remain the same for *all fragments of that* ~~a given~~ MSDU. ~~and the~~ *The* fragments will be *sent* in order of lowest *Fragment Number*~~ID~~ to highest *Fragment Number*~~ID~~, *where the fragment number increases by one for each fragment.* The *Frame Control Field*~~fragment ID also~~ contains a bit, *the Last Fragment bit,* that indicates the last *(or only)* fragment of the MSDU.

If, when retransmitting a fragment, there is not enough time remaining in the dwell time to allow transmission of the fragment plus the acknowledgment, the station shall wait until *after the next dwell boundary*~~the start of the next dwell time~~ before retransmitting that fragment.

The source station will maintain a aTransmit_MSDU_Timer attribute for each MSDU being transmitted. There is also an attribute, aMax_Transmit_MSDU_Lifetime, that specifies the maximum amount of time allowed to transmit a MSDU. The aTransmit_MSDU_Timer starts on the attempt to transmit the first fragment of the MSDU. If aTransmit_MSDU_Timer exceeds aMax_Transmit_MSDU_Lifetime *then*~~than~~ all remaining fragments are discarded by the source station and no attempt is made to complete transmission of the MSDU.

5.6 Reassembly

Each data fragment contains information to allow the complete MSDU to be reassembled from its constituent fragments. The header of each fragment contains the following information that is used by the destination station to reassemble the MSDU:

Frame Type (data, acknowledgment, etc.).

Source Address

Destination Address

Sequence Control Field~~MSDU ID~~: This field allows the destination station to check that all incoming fragments belong to the same MSDU, *and the sequence in which the fragments should be reassembled. The Sequence Number within the Sequence Control Field remains the same for all fragments of an MSDU, while the Fragment Number within the Sequence Control Field increments for each fragment.*

~~Fragment Number: Fragments of an MSDU are numbered sequentially, 1, 2, 3, etc.~~

Last Fragment Indicator: Indicates to the destination station that ~~the fragment ID of the fragment corresponds to~~*this is* the last fragment of the MSDU. Only the last fragment of the MSDU will have this bit set to one. All other fragments of the MSDU will have this bit set to zero.

The destination station can reconstruct the MSDU by combining the fragments in order of *Fragment Number portion of the Sequence Control Field*~~increasing fragment number~~. If the fragment with the last fragment bit set to one has not yet been received, then the destination station knows that the *MSDU*~~data packet~~ is not yet complete. As soon as the station receives the fragment with the last fragment bit set to one, the station knows that no more fragments will be received for the MSDU.

The destination station will maintain a aReceive_MSDU_Timer attribute for each MSDU being received. There is also an attribute, aMax_Receive_MSDU_Lifetime, that specifies the maximum amount of time allowed to receive a MSDU. The aReceive_MSDU_Timer starts on the reception of the first fragment of the MSDU. If aReceive_MSDU_Timer exceeds aMax_Receive_MSDU_Lifetime than all received fragments are discarded by the destination station.

To properly reassemble packets, a destination station must discard any duplicated fragments received. If a station receives a fragment with the same Source, Destination, ~~MSDU ID~~, and *Sequence Control Field*~~Fragment Number~~ as a previous fragment, then the station must discard the duplicate fragment. *However an acknowledge must be sent in response to a duplicate fragment of a directed MSDU.*