IEEE P802.11

Wireless Access Method and Physical Layer Specification

Section 5.2.6.2 thru 5.2.6.5 Response
to Draft D1 Letter Ballot
Processed at March 1995 Meeting

Richard E. White
Motorola Inc.
50 E. Commerce Dr
Schaumburg IL 60173 USA
Phone: +1 708 576 7878
Fax: +1 708 576 7907
E-Mail: rick_white@wes.mot.com

Abstract: This paper presents the Section 5.2.6.2 thru 5.2.6.5 Response to Draft D1 Letter Ballot processed at March 1995 meeting.

Action: Adopt the changes in this paper to replace the relevent portions of Section 5 of P802.11/D1,
as shown in the companion document P802.11-95/59.

SECT	AUTH	TYP	REQUIRED CHANGE	COMMENTS	RESPONSE
5.2.6.1 . & 5.2.6.2 .	Fische rma:Ba sic Acces s & Backof f Proced ure	T	Backoff mechanism must be changed to state that "stations in backoff should count backoff time whenever the medium is sensed free," as opposed to only after DIFS. Alternative solution: transmitters must backoff on initial attempts.	Network capture Is more likely with the D1 proposal than it ever has been with 802.3 because of the procedure described in D1 sections 5.2.6.1. and 5.2.6.2. For example, if four stations are involved in two higher-level conversations, then the first winner of a contention period will then keep the medium for as long as he has traffic to transmit. This is because he will never find the medium busy (since whenever he has completed a transmission, the medium should be free again) unless he must by default backoff for each new transmission - but I do not find such wording anywhere in the document. (See section 10.3.3.2. Carrier Sense/Clear Channel Assessment Procedure) The winner of the first backoff will transmit an uninterrupted stream of traffic, since the loser is not allowed to count down his backoff until the winner has no more traffic to transmit. This is because the loser is not allowed to count down his backoff unless the medium has passed DIFS with no traffic, but at the end of each DIFS, just when the loser would start his backoff counter, there will be a new frame from the winner. Effectively, the winner will have captured the network - the loser of the contention will have chosen a non-zero backoff value, and he may only count down when the medium is NOT busy following a DIFS. But the medium will always be busy following DIFS as long as the winner has traffic to transmit! At least in the 802.3 case, the loser was allowed to count down his backoff even if the network was busy. He then had a chance, after some later IFS time, to attempt to come back in and win the contention back from the original winner. I vaguely remember in a proposal that all intial TX attempts must use an initial backoff, but I do not see that anywhere in the D1 document.	REJECTED because5.2.6.2 para 3 addresses concern. Commentator is confused. ad-hoc vote 4-0-1
5.2.6.2	Bob O'Hara	E	Replace "selecting" with "computing."		
5.2.6.2	Bob O'Hara	E	replace "A station that has just transmitted a frame" with "A station that has just completed transmission of a frame", delete the comma and move "to the medium" after "access" in the paragraph after the figure.	Better usage, clarity.	
5.2.6.2	David Bagby	E	A station that has just transmitted a frame and has another frame ready to transmit (queued), shall perform the backoff procedure. This requirement is intended to produce a level of fairness of access amongst STAs to the medium.	See imbeded comments and annotations	

SECT	AUTH	TYP	REQUIRED CHANGE	COMMENTS	RESPONSE
5.2.6.2	A. Bolea	T		Clearly state that the backoff timer is only decremented after the medium is idle for a slot time and not continuously.	ACCEPTED text needs to be crafted. vote 6-0-0
5.2.6.2	Bob O'Hara	T	add "and placing that value into the Backoff Timer" to the end of the first sentence of the second paragraph.	A method for initializing the Backoff Timer must be described.	REJECTED Proposed text change doesn't make sense as written. Intent unclear. vote 5-1-0
5.2.6.2	Geiger	T	~~The advantage of this approach is that stations that lost contention will defer again until the next DIFS period, and will then likely have a shorter backoff delay than new stations entering the backoff procedure for the first time.~~	This statement is not true unless the Random() function uses some inverse weighting of the CW value. Stations entering the contention period for the first time will have a better chance of winning access than the units which have already backed off because their CW is smaller than backed off units and they have a higher probability of picking a smaller number than the stations that have already contented once. What this algorithm really does is provide a means for reducing collisions in a congested state where lots of stations are trying to access the medium. This algorithm helps reduce the number of units picking the same slot time. It does not tend toward fair access on a first come, first serve basis.	REJECTED Commentator misunderstands statement, which refers to losing contention in a single transmission attempt, not to retransmission attempts. vote 6-0-0
5.2.6.2	Greg Ennis	T	remove final paragraph	explanations are not necessary within the standard text	REJECT paragraph increases clarity and unambiguity of standard. vote 4-0-2
5.2.6.2	P. Brenner	T	It should be specified that for the purpose of Backoff Procedure, the Contention Free Period is to be considered as "busy" medium, i.e. Backoff Timer does not decrement, even when the medium is sensed free.	This will reduce the probability of collisions immediately after the Contention Free Period.	REJECT unnecessary clarification, because NAV provides this insurance. vote 6-0-0
5.2.6.2	Renfro	T		State that backoff timer is decremented in steps of slot time. Need to ensure that stations which lose contention during random backoff will begin transmission on integer slot time next time around.	ACCEPT same as bob o'hara's comment.
5.2.6.2	Rick White	T	Assuming that the backoff timer is integer multiples of the slot times, the backoff timer should be decrement after each slot time in the contention window when the medium is not busy. When the backoff timer reaches zero, the STA should access the medium.		ACCEPT same as bob o'hara and renfro's comment

SECT	AUTH	TYP	REQUIRED CHANGE	COMMENTS	RESPONSE
5.2.6.2	Rick White	T	The statement: "A station that has just transmitted a frame and has another frame ready to transmit (queued), shall perform the backoff procedure." is not true.	A station does not have to perform the backoff procedure when it has received an ACK for a fragment of a fragmented MSDU and has an additional fragment for the same MSDU to send. This must be corrected.	ACCEPT WITH CHANGE tenative text - still needs work: "... has just transmitted a frame and has antoher frame ready ..." is changed to "... has completed the transmiission of an MSDU and has another MSDU ready ..." vote 6-0-0
5.2.6.3	A. Bolea	E		"CW will be greater than one.." should be reworded to reflect correct CW as defined insection 5.2.5.	
5.2.6.3	Greg Smith	E	ACK_RE-TRANSMIT_counter and ACK_RE-TRANSMIT_limit should be : DATA_RE-TRANSMIT_counter and Limit	If this is not an editorial error, then much more explanation is required.	
5.2.6.3	McKown	E	If after ... > If, after ...	phrase needs commas at both ends	
5.2.6.3	Rick White	E	This section should come after Section 5.2.6.4 which describes the use of RTS/CTS.		
5.2.6.3	Wim Diepstraten	E	Add a paragraph as follows: Stations that receive an RTS frame, but do not sense a busy medium (Data frame) after a CTS-Timeout period can reset their NAV to the previous value. Last paragraph, middle sentence: Change "CW will be greater then one" into: "CW will be greater then Cwmin"	The last paragraph does again suggest that Cwmin is one rather then a much bigger value (for instance 16 or 32).	
5.2.6.3	bdobyns	T	RTS_RE-TRANSMIT_LIMIT and ACK_RE-TRANSMIT_LIMIT are not defined elsewhere. Either put them in the MAC MIB or use MAC MIB parameters.	maybe these should be aRTS_Retry_Max and aDATA_Retry_Max?	ACCEPT use aRTS_Retry_Max and aDATA_Retry_Max vote 6-0-0
5.2.6.3	Bob O'Hara	T	Replace the two retransmit limits with a single limit.	It is not clear why the MAC should try harder to deliver a frame in one case than another. No mechanism is described to initialize the two limit counters and how to handle interaction between them. Two limits are unnecessarily complex.	REJECT there are more than one rationale for different paramerts, 1) May want to to have data same probability of non-collision as rts 2) may want to retry rts more because it's cheaper 3) may want to rely on rts-cts as deferral mechanism if phy as crummy CCA and they will all be explained in the informative annex. vote 6-0-0
5.2.6.3	David Bagby	T	Many circumstances may cause an error to occur in a RTS/CTS exchange. For instance, CTS may not be returned after the RTS transmission. This can happen due to a collision with another RTS or a DATA frame, or due to interference during the RTS or CTS frame. It can however also be	See imbeded comments and annotations	REJECT same as bob o'hara's comment.

SECT	AUTH	TYP	REQUIRED CHANGE	COMMENTS	RESPONSE
			that CTS fails to be returned because the remote station has an active carrier sense condition, indicating a busy medium time period. this section appears to crate a different retry limit for RTS than non-RTS cases. I don't agree with nor see the usefulness of this. RTS frames should be retried the same as other frames. If after an RTS is transmitted, the CTS fails in any manner within a predetermined CTS_Timeout (T1), then a new RTS shall be generated while following the basic access rules for backoff. Since this pending transmission is a retransmission attempt, the CW shall be doubled as per the backoff rules. ~~This process shall continue until the RTS_RE-TRANSMIT_Counter reaches an RTS_RE-TRANSMIT_Limit.~~ ~~The same backoff mechanism shall be used when no ACK frame is received within a predetermined ACK_Window (T3) after a directed DATA frame has been transmitted. Since this pending transmission is a retransmission attempt the CW will be greater than one as per the backoff rules. This process shall continue until the ACK_RE-TRANSMIT_Counter reaches an ACK_RE-TRANSMIT_Limit.~~		
5.2.6.3	David Bagby continu ation	T			
5.2.6.3	Geiger	T	RTS_RE-TRANSMIT_Limit RTS_RE-TRANSMIT_Counter ACK_Window (T3) CTS_RE-TRANSMIT_Limit CTS_RE-TRANSMIT_Counter CTS_Timeout(T1)	I assume that these values need to be defined somewhere, maybe the MIB, can't find them there.	ACCEPT WITH CHANGE Limits are already in the mib, counters are not. Vote 5-0-0
5.2.6.3	Greg Ennis	T	remove first two paragraphs	explanations are not necessary within the standard text	REJECTED text increases the clarity and and lucidity of the standard. vote 5-0-1

SECT	AUTH	TYP	REQUIRED CHANGE	COMMENTS	RESPONSE
5.2.6.3	Rick White	T	Must resolve editor's comments relating to CTS_Timeout (T1), RTS_RE-TRANSMIT_Limit, ACK_RE-TRANSMIT_Limit and ACK_Window (T3) and any requirement for interaction between RTS and ACK retransmission.		REJECTED already resolved - all already in MIB.
5.2.6.3	Okada	T Approve	No T1 and T3 are defined	They are defined by each PHY	REJECTED t1, t3 are informative tags, "real names" already in MIB
5.2.6.3 ,4	Geiger	T	Okay, now I know how RTS and CTS are exchanged, when do you send the data frame which generated the RTS/CTS exchange, during the SIFS slot or the first DIFS slot or what? I suspect that a station should send the data frame involved in a RTS/CTS exchange in the SIFS slot as well as the ACK, CTS, and Data Fragments.	Guys, we have got to think of all these things and then document them. - I found it... its in figure 5-9. Good job hiding this one. I just finished playing Myst and this clue was tougher than any Myst clue to find. Section 5.2.4.1 should be re-written to include RTS/CTS data frame and data fragments!	REJECTED This section is concerned with NAV. Besides the picture in 5-9 and the text in 5.2.7 makes it clear.
5.2.6.4	C. Heide	e	2nd paragraph, second sentence, strike the first word "a".		
5.2.6.4	C. Heide	e	figure 5-9, explain T1 and T3.		
5.2.6.4	Tim Phipps	E	*Remove:* "In the absence of a PCF ... reset the NAV".	This is not true. Data and ACK frames also carry duration information and update the NAV.	
5.2.6.4	A. Bolea	T		In second paragraph, need to clarify that destination station of RTS does not update its NAV.	ACCEPTED text needs to be crafted and inserted in this section.
5.2.6.4	A. Bolea	T		Accuracy of NAV should be in units of milliseconds.	REJECT milliseconds is too big.
5.2.6.4	Bob O'Hara	T	Replace "X ns" with "one bit time."	Simpifies timing requirements. (See comment on 4.1.2.2)	REJECT with multiple rates this is unworkable proposal
5.2.6.4	C. Thomas Baumgartner	t	state NAV internal state accuracy as - 0 + 1 microsecond.	A longer NAV will not cause protocol errors but a shorter NAV counter will.	ACCEPT NAV is in units of 1 microseconds.
5.2.6.4	Dean Kawaguchi	T	Setting the NAV Through Use of RTS/CTS Frames (3rd paragraph) Maintenance of the NAV shall consist of an internal state accurate to ~~X nS~~ 1 microsecond of the busy/free condition of the medium...	Standard should not have a TBD. The uncertainty of other timing factors such as propagation delay is on the order of 1 microsec. The allowed error in the NAV should not be any more stringent.	ACCEPT specified as 1 microsecond
5.2.6.4	Fischer, Mike.	T	The X nanoseconds in the 3rd paragraph needs to be quantified. My recommendation is a value of 1000ns (1 microsecond, the same resolution as the TSF timer).	Many things in this MAC are done to microsecond resolution, so there is no simplification to using a NAV resolution coarser than 1 microsecond. Given the response times in the existing PHY specifications, there appears to be no benefit to a finer NAV resolution than 1 microsecond.	ACCEPT specified as 1 microsecond

SECT	AUTH	TYP	REQUIRED CHANGE	COMMENTS	RESPONSE
5.2.6.4	Geiger	T	Duration Field value determination is not defined. See section 4 for RTS and CTS frame structure says to see section 5.xx for duration field explanation. (I believe programmers call this an infinite loop).	Don't worry about this, just throw RTS/CTS out!	REJECT we like RTS CTS/
5.2.6.4	Joe Kubler	T	X nS should be defined.		ACCEPT specified as 1 us
5.2.6.4	Joe Kubler	T	strike "are the only events that"	NAV should be set to protect ack on directed data MPDU	ACCEPT text to be crafted later
5.2.6.4	Joe Kubler	T	dwell should be "dwell or superframe"	in presence of PCF AP, should fragment based on superframe time (not just FH hop dwell time).	REJECT Comment is on 5.2.6.5: superframe is stretched to permit remainder of fragments.
5.2.6.4	John Hayes	T	TBD	Accuracy of X ns needs to be defined.	ACCEPT 1 microsecond
5.2.6.4	Mahany	T	Required Accuracy of NAV timer must be inserted. 1usec +/- 25 ppm is appropriate.	Required for Interoperability	ACCEPT WITH CHANGE 1 microsecond. - no accuracy measure needed for interop.
5.2.6.4	McKown	T	para 3: NAV precision specified as "X nS"	typo	ACCEPT 1 microsecond
5.2.6.4	Miceli	T	NAV accuracy needs definition	not defined	ACCEPT 1 microsecond
5.2.6.4	Paul Pirillo	T	Insert: The NAV has a value in the range {XX..YY} that is an integer multiple of the slot time	I am unclear as to the upper limit for NAV and whether NAV is a multiple of some other time period (such as slot time) or whether NAV can take on any value in the valid range. The text I suggest is just an example of how to resolve my concerns. I will accept any text that defines these properties of NAV.	ACCEPT 1 microsecond accuracy for NAV, Range is 0 ... 65535 microseconds - which is implied by the size of the duration field - (16 bits) as specified in section 4.1.2.2 therefore no range specification is necessary here.
5.2.6.4	Paul Pirillo	T	Insert: The NAV has a value in the range {XX..YY} that is an integer multiple of the slot time	I am unclear as to the upper limit for NAV and whether NAV is a multiple of some other time period (such as slot time) or whether NAV can take on any value in the valid range. The text I suggest is just an example of how to resolve my concerns. I will accept any text that defines these properties of NAV.	ACCEPT 1 microsecond accuracy for NAV, Range is 0 ... 65535 microseconds - which is implied by the size of the duration field - (16 bits) as specified in section 4.1.2.2 therefore no range specification is necessary here.
5.2.6.4	Renfro	T		Accuracy of NAV counter of X ns must be better defined. Nanosecond timing is not necessary in this network. If allowable inaccuracy grows to several usec, must be included in slot time since it will result in error in starting DIFS timer.	ACCEPT 1 microsecond

SECT	AUTH	TYP	REQUIRED CHANGE	COMMENTS	RESPONSE
5.2.6.4	Rick White	T	The reception of Data and ACK frames can also set the NAV to a non-zero duration.		ACCEPT WITH CHANGES DATA may set non-zero NAV. ACK may set zero NAV. text will be created when we have nothing better to do.
5.2.6.4	Rick White	T	Data and ACK frames also contain a duration field.		ACCEPT DATA and ACK should set NAV. text will be created later.
5.2.6.4	Rick White	T	Must define the internal state accuracy for the NAV.	Not defined.	ACCEPT 1 microsecond
5.2.6.4	Stuart Kerry	T	Setting the NAV Through Use of RTS/CTS Frames (3rd paragraph) Maintenance of the NAV shall consist of an internal state accurate to X nS 1 microsecond of the busy/free condition of the medium...	Standard should not have a TBD	ACCEPT 1 microsecond
5.2.6.4	Tom T.	T	Change 'X nS' value to 1 µsec. Remove word 'a' from third line second paragraph 'All STA receiving a these...'	Need a real number here. 1 µsec seems reasonable considering the size of the DIFS.	ACCEPT 1 microsecond
5.2.6.4	Wim Diepstraten	T	Stations should set the NAV to the received "Duration" field only when the "Duration" value is greater then the current NAV value.	Stations could have already received other RTS and CTS information (from a neighbouring BSS) that has already set the NAV to a larger value then the new "Duration" value.	ACCEPT Text to explain will be crafted later
5.2.6.4	Wim Diepstraten	T	The "Duration" field in Data and Ack frames should also be interpreted by all stations, and they should update their NAV accordingly. Also section 5.2.10 should be updated to reflect this procedure.	The text in these sections does not reflect the changes that occured by the fragmentation. The "Duration" field in the Data frame should be specified similarly as the RTS function, while the Duration field in the Ack should be specified similarly as the CTS function.	ACCEPT Text to explain will be crafted later
5.2.6.4	Greg Smith	T/E	X nS	The value of X is fundamental to the operation of the system	ACCEPT 1 microsecond
5.2.6.4	Fischerma:Setting NAV through use of RTS/CTS frames	T	In the absence of a PCF, reception of RTS, CTS, DATA and ACK frames may all set the NAV to a non-zero duration in certain circumstances.	Note that D1 text fails to include DATA and ACK frames that are part of a fragmented MSDU exchange as being capable of setting NAV to non-zero value.	ACCEPT text to explain will be crafter later

SECT	AUTH	TYP	REQUIRED CHANGE	COMMENTS	RESPONSE
5.2.6.4	Fischerma:Setting NAV through use of RTS/CTS frames	T	Maintenance of the NAV shall consist of an internal state accurate to 16 microseconds of the busy/free condition of the medium.	Xns resolution of NAV is not specified. 16 microseconds would satisfy the update rate of the CCA information delivered by PHYs.	REJECT 1 microsecond.
5.2.6.4	P. Brenner	T	The Duration field of the CTS should be copied from the RTS (without any need for further calculation), so its definition should be: On the RTS it is the time from the end of the corresponding CTS to the end of the ACK, and on the CTS it is the time from the end of this message to the end of the ACK.	The CTS (and ACK) response is the more time-critical portion of the whole MAC implementation, so the amount of calculations in this portion should be reduced. Outsider stations (calculating the NAV) are idle, so the calculations overhead should be there.	REJECT generator CTS must subtract off the CTS time from the duration received from the RTS.
5.2.6.4	P. Brenner	T	The accuracy of the NAV timer should be on the range of 1 microsecond	The PHY specifications are in microseconds, so there is no point of having a NAV more accurate than that.	ACCEPT 1 microsecond
5.2.6.5	Bob O'Hara	E	Replace "IFS" with "SIFS"	typo?	
5.2.6.5	Bob O'Hara	E	Replace "will" with "shall" in second paragraph	Proper standard language	
5.2.6.5	Bob O'Hara	E	Replace "IFS" with "SIFS" in caption to figure 5-10		
5.2.6.5	Bob O'Hara	E	Replace "will" with "shall" in tenth paragraph	Proper standard language	
5.2.6.5	C. Heide	e	second paragraph, first sentence remove the word "either".		
5.2.6.5	C. Thomas Baumgartner	e	in first sentence change from (IFS) to (SIFS) In 3rd paragraph change from IFS to SIFS Change In title of Figure 5-10 from IFS to SIFS	typo	
5.2.6.5	Geiger	E	The Short Inter-Frame Space (SIFS) (beginning of the section the IFS abbreviation is wrong)	Clarity	
5.2.6.5	Iwen Yao	E Approve		Dwell Time is used in this section but it is not defined. Please define.	
5.2.6.5	Mahany	E	Define Dwell Time Prior to this discussion.	Readibility. Concept of a dwell time has not been introduced at this point. Superframe boundary may provide same limitation. as dwell time (5.3.1) See 5.5 for dwell time definition.	
5.2.6.5	Geiger	T	When a station has transmitted a frame other than a fragment, it does not have priority to transmit on the channel following the ACK for that frame	What the hell does not have priority mean? Can't use the SIFS frame or must use the backoff algorithm, or start with a CW of 2 or what? Why not say the station must wait for the normal contention period before it can again access the channel.	ACCEPT (EDITORIAL) change "does not have priority" to "may not" in both para 14, 15

SECT	AUTH	TYP	REQUIRED CHANGE	COMMENTS	RESPONSE
5.2.6.5	Greg Ennis	T	replace "until ... MSDU" with "until it has sent all fragments of an MSDU and received their corresponding ACKS, or until it failed to receive an ACK for a specific fragment".	Station must contend if it fails to receive an ACK for a fragment	ACCEPT apply change to paragraph 1 (not paragraph 2)
5.2.6.5	McKo wn	T	para 3: guidlines > rules	not optional	ACCEPT (EDITORIAL) paragraph 13, not 3
5.2.6.5	McKo wn	T	para 13 et seq.: a limit on the number of fragment retransmission attempts in the absence of acknowledgement, without the use of RTS & CTS, should be established (analogous to RTS_Retransmit_Limit, which applies with RTS & CTS).	oversight?	ACCEPT (with change) Already have such a limit aDATA_Retry_Max mib parameter is the limit.
5.2.6.5	Renfro	T		In paragraph 7, if source station receives ack but does not have time to transmit next fragment and receive ack before hop, it must not only contend for channel after hop settling time, it must use random backoff procedure.	DEFER iinteresting conversation piece.
5.2.6.5	Renfro	T		Last paragraph. Frames not requiring ack (e.g., broadcast/multicast from AP) should not be fragmented. Probability of success will be higher if they are transmitted in entirety since no ack to indicate failure.	DEFER CON: This permits broadcast to not be clobbered by a dwell boundary. OPTION: let the implementation decide.
5.2.6.5	Rick White	T	¶ 8, Fragment retransmission: Change "If the source station does not receive an acknowledgment frame, it will attempt to retransmit the fragment at a later time (according to the backoff algorithm). When the time arrives to retransmit the fragment, the source station will contend for access in the contention window." to "If the source station does not receive an acknowledgment frame, it will attempt to retransmit the fragment according to the backoff procedure. The CW shall increase exponentially after every retransmission attempt for any fragment for a given MSDU, up to a maximum value CWmax.		DEFER if accepted needs to change 5.2.5 as well.
5.2.6.5	Tom T.	T	Add to the last paragraph: The spacing between fragments of a broadcast/multicast frame shall be equal to the SIFS period.	The case of a broadcast fragment burst is unique and must be fully specified. From the implementation point of view it would be easier to make this a PIFS time, however this should be so only if it is not possible for a STA to send a fragmented broadcast during the contention free period of a superframe.	ACCEPT WITH CHANGES Add new paragraph after paragraph 12 (the source station has...) "The source station has transmitted a framgent of a broadcast/multicast frame and has more fragments for the same MSDU to transmit, and there is enough time left in the dwell time to send the next fragment."

SECT	AUTH	TYP	REQUIRED CHANGE	COMMENTS	RESPONSE
5.2.6.5	Okada	T Approve	If the source station does not receive an acknowledgement frame, it will attempt to retransmit the fragment at a later time (according to the back-off algorithm). How long does the source station have to wait, T3 or SIFS?	T3	ACCEPT WITH CHANGES change "at a later time (according to the back-off algorithm)" to "according to the back-off algorithm
5.2.6.5	P. Brenner	T	It should be specified whether contiguous Fragments of MSDUs that do not require acknowledgment are sent with SIFS between them or not.	Is not clear from the draft.	ACCEPT Response to tom t.'s comment clarify