Collected comments on Section 5 of draft standard D1 (Part 1)

	Rick White	T	The definition of busy medium needs to be more specific.	Is a medium considered busy if either Physical and Virtual Carrier sense indicate a busy, can I send a frame if neither indicate busy? I'm assuming that I will always wait a DIFS and select a Contention Slot. The only time that I can send a frame immediately is after the media has not been busy form a period of time longer than DIFS plus CWmax. It this is true, the draft must reflect this. Figure 5-7 does indicate immediate access when medium is free >= DIFS.
5	C. Heide	e	"frame type" is used to refer to things that are not frame types according to table 4-1. For instance, ACK is not a frame type, and Request and Response are constantly referred to as frame types which they are certainly not according to table 4-1. An "ACK" is a Control frame, subtype ACK. Some consistent jargon should be used throughout the section (and the entire document). How about ACK becomes frame type Control:ACK.	frame types inconstant with table 4-1
5	C. Heide	t	remove the DCF and use of CSMA from the PCF.	CSMA based operation relies on the ability of all STAs to "hear" each other to function properly. This inability to do this is exactly what differentiates the wireless network from the wired network. A CSMA based coordination function does not support mobility, portability or hidden stations.
5, ch 4, 6, 7	MLT	T	specific timings or time ranges should be defined for all intervals referenced in this chapter	
5.	David Bagby	T	The document would appear to read better is sec 5 immediately followed section 3, and sec 4 followed section 5. Sec 4 assumes a lot of info and terminology that is introduced in section 5.[DB1] In the following sections, the MAC functional description is presented. Section 5.1 introduces the architecture of the MAC sublayer, including the distributed coordination function, the point coordination function and their coexistence in an 802.11 LAN. Sections 5.2 and 5.3 expand on this introduction and provide a complete functional description of each. Section 5.4 describes the security mechanisms within the MAC layer. Section 5.5 and 5.6 cover fragmentation and reassembly~~. Multirate support is addressed in Section 5.7.~~ Section 5.8 reiterates the functional descriptions in the form of state machines.	See imbeded comments and annotations
5.1	Belanger	E	Move section 5.1 after section 5.7.	Section 5.1 is difficult to read. It may be easier to understand after sections 5.2 to 5.7.
5.1	Jim Panian	E	Put "Mac" in all capital letters.	MAC is written as "Mac".
5.1	Jim Panian	E	Change "may" to "must".	In referring to the MAC state machine the sentence reads "It may also provide the sequencing required to provide the point coordination function and the associated time-bounded and contention-free communications services."
5.1	Bob O'Hara	T	revise figure 5-1 to match updated architecture figure (figure 2-11)	The current figure does not match the current state of the standard.

5.1	David Bagby	T	The MAC State Machine shall provide the sequencing required to provide the distributed coordination function. The Mac State Machine shall provide the protocol sequencing necessary to provide asynchronous communication service. The MAC State Machine shall ~~It may~~ also provide the sequencing required to provide the point coordination function and the associated time-bounded and contention-free communication services. The implementation of the PCF portions of the MAC State Machine (and the associated Time-bounded and contention-free services) are optional. The MAC State Machine shall not interfere with time-bounded nor contention-free communications even if the optional point coordination function is not implemented. The MAC Management State Machine shall provide the protocol sequencing required to provide the following services: a) Association and re-association b) Access to the MAC MIB c) Timing synchronization d) Power management e) Authentication & Deauthentication	See imbeded comments and annotations
5.1	Fischer, Mike.	T	change Òasynchronous, time bounded, and . . .Ó to Òcontention based and . . .Ó at end of 2nd to last sencence of first paragraph add Òand is able to support both asynchronous and timeÐbounded service classes.Ó 3rd paragraph, add Òand pointÓ between ÒdistributedÓ and ÒcoordinationÓ in 1st sentence and replace the last sentence with ÒA defined subset of the MAC state machine shall provide the DCF and shall not interfere with timeÐbounded nor conentionÐfree communications.Ó (based on the adoption of the updated state machines in document 95/14 and my comment regarding these state machines and section 5.8)	There are 2 access control techinques, contention-based and contention-free. These access control techniques are independent of the type of data or service (async, time bounded, etc.) that might be delivered using the access control technique. Some facilities, such as the access priority needed to meet certain bounds of time bounded service, may not be available from both access control techniques.
5.1	Rick White	T	¶ 2: Only a high level view of the service request and indication is given in Section 3.2. A detailed description of each service and request indication must be given	
5.1	Rick White	T	¶ 2: There is no Management State Machine defined in Section 5.8. The Management State Machine must be defined.	
5.1	Rick White	T	¶ 3: None of the state machines in Section 5.8 cover any point coordination, time bounded, or contention-free communications.	
5.1	Rick White	T	¶ 4: A complete list of management services must be defined. Control of a FH PHY should be one of the services.	Not defined.
5.1	Rick White	T	¶ 4: Define management services required for time bounded and contention-free data services.	Not defined.
5.1	Rick White	T	Figure 5-2 must also should how Point Coordinated time bounded service fits into the picture.	
5.1.1	Belanger	E	"If the medium is sensed busy the station shall defer..."	Strike "(a collision)". The situation described is not a collision.
5.1.1	Bob O'Hara	E	delete "and access points" in the next to last sentence of first paragraph.	Redundant.

5.1.1	Bob O'Hara	E	replace "transmitting" with "using the medium" in the first sentence of the second paragraph.	Better usage, clarity.
5.1.1	C. Thomas Baumgartner	e	In 2nd paragraph delete "(a collision)"	Sensing the medium busy before beginning to transmit is NOT a collision. That is how a collision is avoided.
5.1.1	David Bagby	E	The fundamental access method of the 802.11 MAC is a distributed coordination function derived from~~known as~~ carrier sense multiple access with collision avoidance, or CSMA/CA. The distributed coordination function shall be implemented in all stations and access points. It is used within both ad hoc and infrastructure configurations.	See imbeded comments and annotations
5.1.1	Geiger	E	RTS and CTS meaning has not defined yet or listed in the abbreviation table.	useful
5.1.1	Jeff Rackowitz	E	Second paragraph. "... If the medium is sensed busy (a collision) the station shall defer until..." medium being busy does not mean there is a collision.	
5.1.1	Mark Demange	e	Paragraph 2, sentence 4 - ".. sensed busy (a collision).." implies a collision is synonymous with a busy channel. This clearly is not true.	
5.1.1	Mark Demange	e	Paragraph 2 sentence 5 - reword or delete this sentence - it doesn't make sense as stated.	
5.1.1	C. Heide	t	second paragraph, 5th line, remove "(a collision)".	sensing the medium busy is not a collision
5.1.1	C. Thomas Baumgartner	t	in 2nd paragraph cahnge sentence to "After deferral, the stations shall select a random backoff interval and shall decrement the interval counter while the medium in idle."	This is supposed to be a short summary but it was simplified so much that sentence is incorrect.
5.1.1	Rick White	T	The second paragraph is confusing when it talks about interframe space. The reference to DIFS should be removed or there should be more detail about exactly when a station should use DIFS period.	The way the paragraph is written, it appears there should be a DIFS between all frames but this is not true. A reference should also be made to the NAV when discussing RTS/CTS.
5.1.1, 2nd paragraph	Fischer, Mike.	T	recomment that Ò. . . (a collision) . . .Ó be removed. A channel busy indication is not a collision in the sense that ÒcollisionÓ is used on contentionÐarbitrated (CSMA/CD) networks such as 802.3.	Understandability by the sort of nonÐ802.11 participant who might be in the sponsor ballot group for a subsequent revision of the standard.
5.1.2	C. Thomas Baumgartner	t	Need to make provisions in the protocol to "handle" the limitation in last sentence of 1st paragraph regarding not supporting overlapping point-coordinated BSS's (BSA's?) on same channel. This requires discussion to decide best method. The method could be as simple as a having any STA which can hear two PCF polls to tell the one that it is associated with that a channel change is required because of overlapping.	Only IR PHY can live with this limitation in such situations as multi-tenant building because the IR BSA is contained within walls. Therefore the fact that IR is only single channel is not a problem. Need to add mechanism for unrelated point coordinators in overlapping BSA's on same channel to go to different channels in multi-channel PHY's.

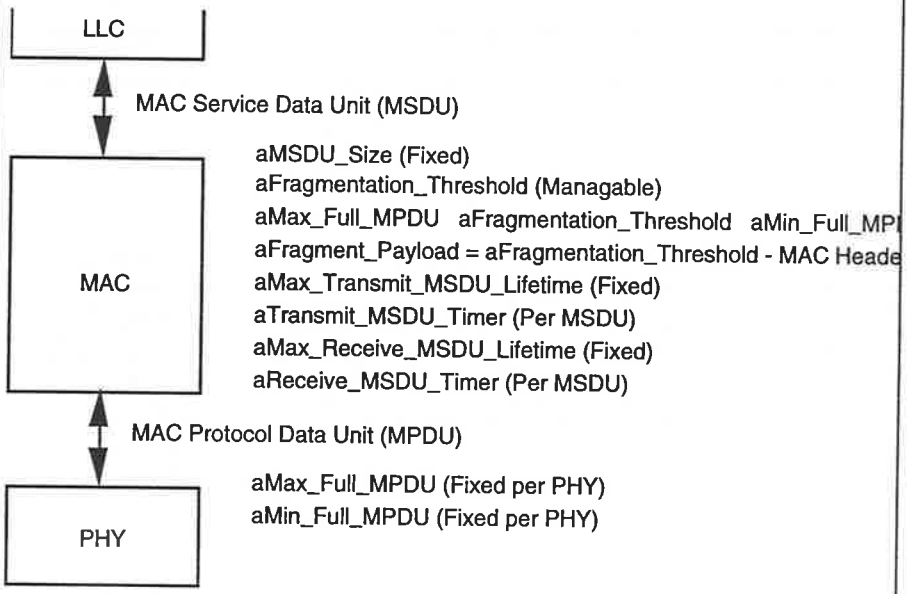
5.1.2	David Bagby	T	The 802.11 MAC may also incorporate an optional~~alternative~~ access method described as a point coordination function. This alternative access method shall be implemented on top of the distributed coordination function. This access method uses a point coordinator to determine which station currently has the right to transmit. The operation is essentially that of polling with the point coordinator playing the role of the polling master. The support of the point coordination function requires that the network configuration involves no overlapping point-coordinated BSS's on the same channel. the preceding sentence identifies the limitation of the PCF - BSSs can not overlap on a single channel. However, section 3.1.1.2 says: "Time bounded service shall not be interrupted when a station reassociates with a new access point in its current ESS." - thus I conclude that this is a conflict and that the PCF can not support mobility as defined in section 2.4.2.1. Until the PCF can support mobility, we have not met the par requirement for a "voice service". I note that a voice service can be accomplished over the async service we have defined (many existence proofs on asnyc channel wired LANs). Because the async service could do a voice service, I conclude that we have technically met the PAR requirement and that the optional PCF TB service is a supplement only. I have concerns over the technical merits of PCF operation, but will stop short of making the PCF one of my reasons for voting No at this time. Should the PCF or any service dependent on the PCF become in any way non-optional, that would be a reason for a NO vote on the draft. Adoption of 94/252 made the PCF explicitly optional.	See imbeded comments and annotations
5.1.2	Geiger	T	Support of the point coordination function requires that the network configuration involves no overlapping point-coordinated BSS's on the same channel. Many PHY Layer implementations may not be able to guarantee this non overlapping requirement. In addition, all stations participating in a point coordinated network must be able to receive all PCF transmissions. Restrict PCF usage to only PHYs which can support the	The PCF function will not work with both of the RF based PHYs but might with the IR PHY. It is important to indicate in the standard that the implementation of this function will be limited by PHY constraints.
5.1.2	Wim Diepstraten	T	Delete the last sentence of this section. There is no mechanism in which the PCF signals that a CF-Burst is occuring.	There is nothing that signals the start of a Super Frame. The target starting point is however specified by an element SF_Length in conjuntion with the TSF timer. It TSF mod SF_Length = 0 then the NAV should be set to a value CF_Boundary, as need to be further specified in section 5.3.1.

5.1.2, 1st paragraph	Fischer, Mike.	T	The last sentence should be removed, or at least replaced with something to the effect that ÒThe operation of the point coordination function may require additional coordination, not specified in this standard, to permit efficient operation in cases where multiple, pointÐcoordinated BSSes are operating on the same channel in overlapping physical space.Ó	It is completely possible to operate overlapping pointÐcoordinated BSSes with a singleÐchannel PHY if the point coordinators follow appropriate rules (and/or coordinate their activities using communication over the DSM if these BSSes are part of a common ESS). I know this from direct experience Ñ several of my employerÕs current products operate in this manner using PCFs with similar characteristics to the PCF described in recent drafts of this standard, over a DSSS physical layer with considerable behavioral similarity to the DSSS PHY in the current draft (except operating in a different frequency band). I see little benefit to adding mandatory complexity to handle these general cases, but I see no reason to continue to propagate and/or reinforce the myth that PCFs cannot overlap when using a singleÐchannel PHY.
5.1.2, 2nd paragraph	Fischer, Mike.	T	after Ò(DIFS)Ó replace the remainder of the paragraph with Òto gain control of the medium. Frames transmitted by the PCF and in response to polls from the PCF are separated by the SIFS, except in cases where a transmission is unacknowledged, in which case the PCF resumes transmissions after a PIFS duration to retain control of the medium. Since both the SIFS and the PIFS are smaller than the DIFS, pointÐcoordinated traffic shall have piroirty access to the medium. The use of the SIFS once control of the medium has been obtained by the PCF maximizes the portion of the contentionÐfree period used for frame transmission and minimizes the portion used for spaces. Another improvement in the efficiency of PCFÐcontrolled transfers is the piggybacking, whenever possible, of CFÐpolls and CFÐacknowledgements using encodings of the frame subtype field of data frames, thereby avoiding the need to send any RTS and CTS frames, as well as most acknowledgement frames, during the contentionÐfree period.	clarification, correctness
5.1.3	C. Heide	e	remove "Both", first word of first paragraph.	bad sentence - they coexist with each other. If you say both you must specify what it is with which they both coexist.
5.1.3	Rick White	T	Figure 5.3 should be modified to should the contention-free period and the contention period. The bursts should be remove. They are only confusing. The contention burst should not overrun the beginning of the superframe.	
5.1.4	Bob O'Hara	E	Change figure 5-4 into a list.	Better usage, clarity.
5.1.4	C. Thomas Baumgartner	e	Change "than" to "then" in Transmit_MSDU_Timer description	Typo
5.1.4	Joe Kubler	E	aMax_Full_MPDU aFragmentation_Threshold aMin_Full_MPDU should read aMax_Full_MPDU>=aFragmentation_Threshold>=aMin_Full_MPDU	
5.1.4	Mahany	E	Revise Figure 5-5.	This figure may be misleading due to proportioning of in the four fragments. Also suggest that fragments be spaced equally to avoid any assumptions of DIFS in this figure.
5.1.4	Mark Demange	e	Paragraph 1 sentence 2 should read "... is a function..."	
5.1.4	Mark Demange	e	Paragraph 4 and 5. Define a maximum "full size" MPDU. How does this differ from a maximum MPDU. If it isn't different then delete "full" if it is different then define.	
5.1.4	Renfro	E	Under aReceive_MSDU_Timer, replace 'replicted' with 'replicated'.	
5.1.4	Greg Smith	E/T	aMax_Transmit_MSDU_Lifetime = The time by which the MSDU must reach its destination MAC service interface.	The current definition is poorly worded and ambiguous

5.1.4	John Hayes	E/T	Reassembly is accomplished at each AP and the destination STA.	The current wording describes reassembly as a function of the recieving station. Because it is possible that different APs along the way will have different values for aFragmentation_Threshold that a single fragment will not be able to pass through without additional fragmentation. The current fragmentation scheme does not allow for recursive fragmentation. Therefore, this requires that reassemble be accomplished at each intermediate AP.
5.1.4	Wim Diepstraten	E/T	The aMin_Full_MPDU MIB variable definition is not correct. The intend of this definition is to specify the minimum fragment size that a MAC may be configured for, and is PHY independent. Also figure 5-4 needs to be updated accordingly, by listing this parameter as a MAC fixed value.	This parameter is to specify the minimum value that the aFragmentation_Threshold can be set to.
5.1.4	Bob O'Hara	T	first paragraph: add "for the purpose of utilizing a PHY with a current transport size less than the MPSU size" after "(MPDUs)"	Clarity.
5.1.4	Bob O'Hara	T	Define the attributes listed by placing the correct definitions in the MIB in section 7.	Standard is incomplete without complete definitions.
5.1.4	C. Heide	t	rename aMin_Full_MPDU to aMin_MPDU, and aMax_Full_MPDU to aMax_MPDU	an MPDU has a minimum and maximum allowable size. The introduction of the word "full" into these values is redundant and confusing.
5.1.4	C. Thomas Baumgartner	t	change attribute names to "MPDU_Maximum" and "MPDU_Minimum". Delete "full" from the description of MPDU_Minimum. Change to proper attribute names in Figure 5-4.	These seem to be the names that the PHY sections have agreed to use. What does "minimum full size" mean?
5.1.4	C. Thomas Baumgartner	t	delete Fragmentation_Threshold attribute. Rewrite Fragment_Payload description in light of this change	Unnecessary complication in an already too complex protocol. The only use I know would be for PHY to know that its error rate is high so a smaller packet could get through better. But the MAC has responsibility for making this decision and MAC doesn't have to tell PHY it just sends smaller MPDU. Otherwise this number is always MPDU_Maximum.

5.1.4	David Bagby	T	**1. Fragmentation/Reassembly Overview** Why do both 5.1.4 and 5.5 cover fragmentation? these two sections should be collapsed into a single section.[DB8] The process of partitioning a MAC Service Data Unit (MSDU) into smaller MAC level frames, MAC Protocol Data Units (MPDUs), is defined as fragmentation. Fragmentation is function of the source station. The process of recombining MPDUs into a single MSDU is defined as reassembly. Reassembly is a function of the destination station. The following are the Management Information Base (MIB) attributes used by fragmentation. the MIB variables specified in this section are not in the MIB chapter. Update the MIB chapter to be consistent before draft can be forwarded.[DB9] aMSDU_Size: This attribute specifies the maximum size of a MSDU, in octets, supported the 802.11 MAC. This is a fixed value. a reference to the value specified must be provided. aMax_Full_MPDU: This attribute specifies the maximum full size MPDU, in octets, that the attached PHY can transmit and is PHY dependent. This is a fixed value. the referenced fixed value must be specified[DB11] aMin_Full_MPDU: This attribute specifies the minimum full size MPDU, in octets, that the attached PHY can transmit and is PHY dependent. This is a fixed value which is specified for each PHY and can never be less than 512 (check minutes was the floor value 256?) for any 802.11 PHY..	See imbeded comments and annotations

5.1.4	David Bagby continuation	T	the referenced fixed value must be specified aFragmentation_Threshold: This attribute specifies the current maximum size of a MPDU, in octets, that can be delivered to the PHY. An MSDU will be broken into fragments if its size exceeds the value of this attribute after adding MAC headers and trailers. The value of aFragmentation_Threshold must be less than or equal to aMax_Full_MPDU and greater than or equal to aMin_Full_MPDU. The default value for this attribute shall be equal to aMax_Full_MPDU. ~~aFragment_Payload: This attribute specifies current maximum size of a MPDU fragment, in octets. The value of this attribute equals aFragmentation_Threshold minus MAC headers and trailers. The payload of a fragment shall never exceed this attribute. However, the size of the payload may be less than this attribute.~~ This variable is unneeded and confusing. At a minimum it must specify that this is a calculated read only value and not a set-able mib variable. If it were set-able, it would then be possible to set both Min_Full_MPDU and Fragment_Payload, resulting in an inconstant state. As I believe that MIB variables should be simply storage slots that are read and written, but that we should avoid trying to make a MIB calculate values to be read, the best this to do is to simply delete this variable from the spec as it is not needed. aMax_Transmit_MSDU_Lifetime: This attribute specifies the maximum amount of time allowed to transmit a MSDU. aTransmit_MSDU_Timer: This attribute is replicated for each MSDU being transmitted. It is a timer that starts on the attempt to transmit the first fragment of the MSDU. If it exceeds aMax_Transmit_MSDU_Lifetime than all remaining fragments are discarded by the source station and no attempt is made to complete transmission of the MSDU. aMax_Receive_MSDU_Lifetime: This attribute specifies the maximum amount of time allowed to receive a MSDU.	

5.1.4	David Bagby continuation	T	insufficient description - measured starting when? potentially all frames would fail this timer as speced... clarify or remove from draft. aReceive_MSDU_Timer: This attribute is replicted for each MSDU being received. It is a timer that starts on the reception of the first fragment of the MSDU. If it exceeds aMax_Receive_MSDU_Lifetime than all received fragments are discarded by the destination station. The attributes are illustrated in Figure 5-4.  	

5.1.4	David Bagby continuation	T	the text in the above diagram does not seem to make any sense. I think that some inequality operators and possibly some "if" statements are missing? Needs to be corrected before sponsor letter ballot.	

Figure 5-4: MPDU and MSDU Definitions

When a frame is received from the LLC with a MSDU size greater than aFragment_Threshold~~Payload~~, the frame must be fragmented. The MSDU is divided into MPDUs. Each MPDU is a fragment ~~with a frame body~~ no larger than aFragment_Threshold~~Payload~~. It is possible than any fragment may contain a frame ~~body~~ smaller than aFragment_Threshold~~Payload~~. An illustration of fragmentation is shown in Figure 5-5.

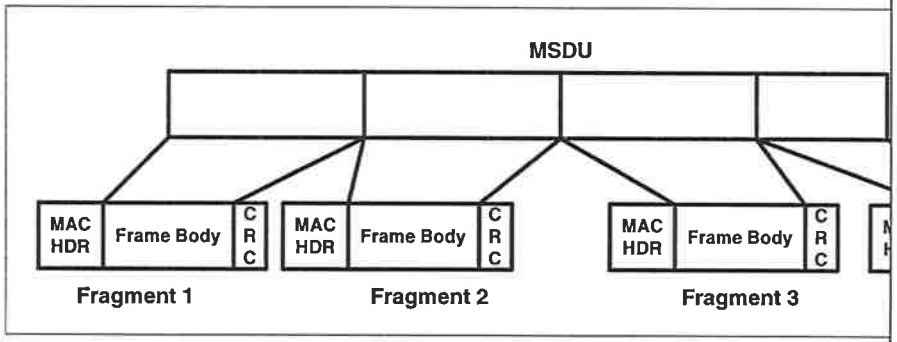


Figure 5-5: Fragmentation

5.1.4	Geiger	T	aMin_Full_MPDU	With all the overhead associated with sending any packet, I think this attribute is kind of silly. I also can not think of a single reason why this number can't be zero for all the PHYs unless some PHYs allow this number to be negative which might actually increase throughput.
5.1.4	Mark Demange	t	Paragraph referencing Max_Transmit_MSDU_lifetime should read "... remaining fragments **of that MSDU** are ..."	Omission of this addition will cause the MAC to discard all fragments of all MSDUs.
5.1.4	Mark Demange	t	Paragraph referencing Max_Receive_MSDU_lifetime should read "... remaining fragments **of that MSDU** are ..."	Omission of this addition will cause the MAC to discard all fragments of all MSDUs.
5.1.4	McKown	T	para 3 et. seq.: supported > supported by. Also, when is the value fixed --- manufacturing time? spec writing time? association time?	clarity
5.1.4	P. Brenner	T	Add value ranges for the aMax_Receive_MSDU_Lifetime and MaxTransmit_MSDU_Lifetime	A total mismatching of those values between different vendors may result with a large amount of retransmissions.

5.1.4	Rick White	T	Define the values or ranges for all the MIB attributes or reference the MIB Section where all of the values and ranges must be defined.	Not defined.
5.1.4	Rick White	T	Figure 5-4 is missing some math symbols. The third line for the MAC should be corrected to "aMax_full_MPDU _ aFragmentation_Threshold _ aMin_Full_MPDU"	
5.1.4	Wim Diepstraten	T	The aFragmentation_Threshold needs to be redifined according to the current definition of Fragment_Payload. The range of this threshold should be defined to be between aMin_Full_MPDU and aMAX_Full_MPDU - maximum size MAC header and trailers.	The two MIB attributes aFragmentation_Threshold and aFragment_Payload are closely related, and are not bith needed.
5.1.4, figure 5Ð5	Fischer, Mike.	E	suggest adding the IV at the left end of the MSDU and start of frame body of fragment 1, and adding ICV at the right end of the MSDU and end of frame body of fragment 4	clearly illustrate how WEP applies over the whole MSDU, not to each fragment thereof
5.1.4, 1st paragraph	Fischer, Mike.	T	change Òsource station Ó to Òtransmitting stationÓ and Òdestination stationÓ to Òreceiving stationÓ	The frame may require reÐfragmentation at intermediate points along a distribution path from source station to destination station. The unit of distribution is the MSDU, not the MPDU, so the assumption is that each AP will reassemble ToDS frames prior to invoking distribution service and (re)fragment (if necessary) FromDS frames after receiving such frames from distribution service. Therefore, the relevant addresses are the TA and RA, and the relevant stations are the transmitter and receiver over each instance of the WM.
5.1.4, under aFragment_ Payload	Fischer, Mike.	T	Add sentences ÒThe value of aFragment_Payload shall be an even integer. The payload of each fragment, other than the final fragment, shall contain an even number of octets.Ó	consistency with a motion passed at the November, 1994 Plenary meeting
5.1.5	Geiger	E	In section 3.2, the service primitives are defined as MA-UNIT_DATA.request and MA-UNIT_DATA.indication. In section 5.1.5 these primitives are described as MA_DATA.request and MA_DATA.indication.	Consistency
5.1.5	Jim Panian	E	Correct primitive name.	The primitive is MA-UNIT-DATA, not MA_DATA.
5.1.5	Joe Kubler	E	Type and Control values should be defined.	
5.1.5	Mark Demange	e	M_SDU should be MSDU	
5.1.5	Wim Diepstraten	E	Resolve inconsistencies between sections 3.2.1.2 & 3.2.2.2 and section 5.1.5.	
5.1.5	Bob O'Hara	T	Correct psuedo-code and eliminate "???"	Correct translations from service requests at the SAP into signals driving the state machine and reporting its status are required.

5.1.5	David Bagby	T	The MAC Data Service shall translate MAC service requests from LLC into inputs~~signals~~ utilized by the MAC State Machines. It shall also translate outputs~~signals~~ from the MAC State Machines into service indications and confirmations to LLC. The translations are given below. The MA_DATA.request from LLC shall initiate one of the transmit cycles in the MAC State Machine. The psuedo-code below shall be used to translate this request into particular signal indications to the MAC State Machine. Tx_data_req = { requested_service_class = async & length(MSDU) > RTS_threshold & destination_address <> (broadcast | multicast) } Tx_broadcast_req = { requested_service_class = async & destination_address = broadcast } Tx_multicast_req = { requested_service_class = async & destination_address = multicast } Tx_unitdata_req = { requested_service_class = async & length(M_SDU) < RTS_threshold} DA = { destination_address } Length = { Rate_factor * (length(MSDU) + Overhead) } Type = { ??? } Control = { ??? } what do the "???" signify here - clarify please.[DB20]	See imbeded comments and annotations
5.1.5	Geiger	T	you can't use the parameter value length(MSDU) - where did it come from. What is a length(M_SDU)??? Type = ??? Control = ??? MA_DATA.confirmation should be MA_DATA.confirm per section 2.10 not confirmation. Whats an M_SDU?	The Length of the MSDU is not passed in the MA_UNIT-DATA.indicate. There is no other way currently defined to calculate the length unless I missed something. Also resolve ???
5.1.5	Geiger	T	In section 3.2, the only service primitives defined at the LLC-MAC SAP are MA_DATA.request and MA_DATA.indicate. In this section it is implied that a MA_DATA.confirm also exists. This service primitive is missing form section 3.2 or should be deleted from this section.	Consistency
5.1.5	Mark Demange	t	Delete different types of TX_XXX_req are undefined in the MAC state machine.	Undefined cycles in the MAC state machine is inappropriate for a standard.
5.1.5	Mark Demange	t	Tx_broadcast_req and Tx_multicast req are redundant. The TX MAC state machine should not differentiate these since a broadcast is in fact a special case of a multicast in which all destinations are members of the multicast group.	
5.1.5	Rick White	T	Resolve editor's comment.	
5.1.5	Rick White	T	Type and Control need to be defined	Not defined.
5.1.5	Tim Phipps	T	*Remove:* "Note a value of zero is reserved... requests".	This section is incomplete. A service_class parameter is required to distinguish different qualities of service (e.g. time-bounded, connection-oriented), rather than using an artificial value of connection-id.

5.1.5-7	Simon Black	T	Delete these sections (or at least move them to section 5.8).	The pseudo code here would seem to go with the incomplete and incorrect state machines. The MAC Data Service is actually defined by the primitives in 3.2.
5.1.6	Geiger	T	Connection Control Service Delete this section	This section looks like notes to the editor or MAC committee concerning some work which hasn't been done yet. There are no service primitives defined in section 3.2 for this service nor is there any pseudo-code for the operation of the service. To provide connection services, i.e.., services that use the contention free period, there
5.1.6	Greg Ennis	T	Merge section into subsequent section	Connection Control is one aspect of the MAC Management Service
5.1.6	Rick White	T	How is the Connection Control Service used? Is it a Management service? This must be defined.	Not defined.
5.1.7	Bob O'Hara	E	Move to section 7	incorrect location
5.1.7	Geiger	E	Where is the SM_MA_DATA.request service primitive definition? Same comments regarding M_SDU and length(M_SDU) as in section 5.1.5 Type = ??? Control = ???	I can't find a service primitive definition for the primitive being discussed here
5.1.7	Greg Ennis	E	Throughout sections, change "psuedo" to "pseudo"	correct spelling
5.1.7	Joe Kubler	E	Type and Control values should be defined.	
5.1.7	Mark Demange	e	Paragraph referencing Receive_MSDU_Timer should read " .. is **replicated**.."	
5.1.7	Mark Demange	e	M_SDU should be MSDU	

5.1.7	David Bagby	T	The MAC Management Service shall translate a SM_MA_DATA.request from an external management entity as defined in the following psuedo-code. Tx_data_req = { requested_service_class = async & length(M_SDU) < RTS_threshold & destination_address <> (broadcast | multicast) } Tx_broadcast_req = { requested_service_class = async & destination_address = broadcast } Tx_multicast_req = { requested_service_class = async & destination_address = multicast } Tx_unitdata_req = { requested_service_class = async & length(M_SDU) > RTS_threshold} DA = { destination_address } Length = { Rate_factor * (length(M_SDU) + Overhead) } Type = { ??? } Control = { ??? } what do the "???" mean - clarify or remove[DB21] The MAC Management Service shall translate signals from the MAC State Machine to SM_MA_DATA.confirmation as shown in the psuedo-code below. transmission_status = { !Tx_failed } The MAC Management Service shall translate signals from the MAC State Machine to SM_MA_DATA.indication as shown in the following psuedo-code. control = { type,control } destination_address = { DA } source_address = { SA } M_SDU = { info_field } reception_status = { !(CRC_error | Format_error) }	See imbeded comments and annotations
5.1.7	Mark Demange	t	Paragraph referencing Max_Receive_MSDU_lifetime should read "... remaining fragments **of that MSDU** are ..."	Omission of this addition will cause the MAC to discard all fragments of all MSDUs including those MSDU's which may be in a queue for transmission.
5.1.7	Mark Demange	t	Tx_broadcast_req and Tx_multicast req are redundant. The TX MAC state machine should not differentiate these since a broadcast is in fact a special case of a multicast in which all destinations are members of the multicast group.	
5.1.7	Rick White	T	Resolve the two editor's comments.	

5.1.7	Tim Phipps	T	*Remove this section.*	This section does not work with the rest of the spec. There is no support within the frame formats for this. If this request and indication are required, then additional QoS parameters will be required within data frames.
5.2	Sarosh Vesuna		Add the following sentence after the words " transmit the actual data frame". " For stations & for all AP's that do not initiate an RTS/CTS sequence, the duration informatio is also available in all data frames."	This will clarify that the Virtual Carrier Sense can be acheived even without a RTS/CTS.
5.2	Sarosh Vesuna		Change text as follows in the 4th para of this section. "***and*** also to stations that are possibly "hidden" from"	Editorial. Reads better.
5.2	Sarosh Vesuna		"destinations" at the end of the fourth para is spelt incorrectly.	Editorial.
5.2	Sarosh Vesuna		"sent" spelt incorrectly in 7th para.	
5.2	Sarosh Vesuna		replace "this" with "these" in para 10 in the sentence " ... are always transmitted at one of these mandatory rates."	
5.2	A. Bolea	E	Last sentence of 4th paragraph, **"destiniations"** is spelled Incorrectly.	
5.2	Bob O'Hara	E	delete "where" from last sentence and begin new sentence at "Retransmission".	Better usage, clarity.
5.2	Bob O'Hara	E	replace "destiniations" with "destinations".	correct spelling
5.2	Bob O'Hara	E	delete "especially" and last sentence in sixth paragraph.	Too colloquial.
5.2	Bob O'Hara	E	paragraph 10: replace "this" with "these", "will assure" with "ensures" and "on" with "in"	Better usage, clarity.
5.2	C. Heide	e	fourth paragraph second sentence should read "The RTS and CTS frames contain a duration field which is the period of time ...".	bad grammar
5.2	C. Heide	e	fourth paragraph, last sentence, replace "destiniations" with "destinations"	spelling
5.2	C. Heide	e	10th paragraph, second sentence replace "this" with "these".	grammar
5.2	Geiger	E	This parameter is a manageable object... change to parameter is a managed object	Goofy wording
5.2	Joe Kubler	E	10 paragraph, 2nd to last line "this mandatory" should be "these mandatory"	
5.2	Mahany	E	Last paragraph: substitute "PHY rates" for "rates". An additional advantage for RF PHY's is improved link margin at the low rates for these frame types. This may improve probability of reception	Readability
5.2	Renfro	E	Modify first sentence to remove the reference to dissimilar PHYs. Change 'send' in 7th paragraph to 'sent' Change 'this' in next to last sentence of 10th paragraph to 'these'.	Simply not true. FH PHY CCA requirements do not require any courtesy to DS PHY.
5.2	Rick White	E	¶ 7: Correct "RTS_Threshold" to "a RTS_Threshold"	
5.2	Tom T.	E	In Seventh paragraph replace 'should be send' with 'should be sent'. In last paragraph replace 'one of this mandatory rates' with 'on of the mandatory rates'.	
5.2	C. Heide	t	10th paragraph, support of multiple rates should be removed.	multiple rate support breaks (1) the virtual carrier sense mechanism when data transactions do not use RTS/CTS, which is optional; (2) the power management mechanism (section 7.2); and (3) the synchronization (section 7.1) mechanisms. All of these mechanisms are based on STAs interpreting information they hear in other STA's frames, which cannot be accomplished if STAs are communicating at multiple rates.

5.2	C. Thomas Baumgartner	t	Add paragraph discussing the effect of the RTS/CTS mechanism as regards to overlapping BSA's on same channel.	Presently it sounds as if there are many times that RTS/CTS mechanism isn't needed. If the overlapping situation is discussed it will become clear that RTS/CTS is much more useful. This is perfect example of a situation that MUST be simulated to determine the effect. We can't approve standard without knowing what happens. Might find that RST/CTS is mandatory for adequate performance.
5.2	David Bagby	T	The basic medium access protocol is a Distributed Coordination Function (DCF) that allows for automatic medium sharing between compatible~~similar and dissimilar~~ PHYs through the use of CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance) and a random backoff time following a busy medium condition. In addition, all directed traffic uses immediate positive acknowledgements (ACK frame) where retransmission is scheduled by the sender if no ACK is received. The CSMA/CA protocol is designed to reduce the collision probability between multiple stations accessing a medium, at the point where they would most likely occur. Just after the medium becomes free following a busy medium (as indicated by the CS function) is when the highest probability of a collision occurs. This is because multiple stations could have been waiting for the medium to become available again. This is the situation where a random backoff arrangement is needed to resolve medium contention conflicts. Carrier Sense shall be performed both through physical and virtual mechanisms. The virtual Carrier Sense mechanism is achieved by distributing medium busy reservation information through an exchange of special ~~small~~ (RTS and CTS, (medium reservation) frames prior to the actual data frame. The RTS and CTS frames contain a duration field for the period of time that the medium is to be reserved to transmit the actual data frame. This information is distributed to all stations within detection range of both the transmitter and the receiver, so also to stations that are possibly "hidden" from the transmitter but not from the receiver. This scheme can only be used for directed frames. When multiple destiniations are addressed by broadcast/multicast frames, then this mechanism is not used.	See imbeded comments and annotations

5.2	David Bagby continuation	T	It can also be viewed as a Collision Detection mechanism., Bbecause the actual data frame is only transmitted when a proper CTS frame is received in response to the RTS frame, this resultsing in a fast detection of a collision if it occurs on the RTS. However the addition of these frames will result in extra overhead, which is especially impactsconsiderable for short data frames. Also since all stations will likely be able to hear traffic from the AP but may not hear the traffic from all stations within a BSA, its use may be benificial for inbound traffic only. Therefore the use of the RTS/CTS mechanism is under control of RTS_Threshold attribute, which indicates the payload length under which the data frames should be sentd without any RTS/CTS prefix. This parameter is a manageable object and can be set on a per station basis. This mechanism allows stations to be configured to use RTS/CTS either always, never or only on frames longer then a specified payload length. Although a station can be configured not to initiate RTS/CTS to transmit its frames, every station shall respond to the duration information in the RTS/CTS frames to update its virtual Carrier Sense mechanism, and respond with a proper CTS frame in response to an addressed RTS frame. ~~The basic medium access protocol allows for stations supporting different set of rates to coexist, this is achieved by the fact that all stations are required to be able to receive any frame transmitted on a given set of rates, and must be able to transmit at (at least) one of these rates. All Multicast, Broadcast and Control frames (RTS, CTS and ACK) are always transmitted at one of this mandatory rates. This set of restrictions will assure that the Virtual Carrier Sense Mechanism described above will still work on multiple rate environments.~~	
5.2	Geiger	T	Remove the usage of RTS/CTS in the standard	Apple Computer supplied the committee with a statement which indicated that the RTS/CTS reservation mechanism may infringe upon a specific patent. Apple has never submitted any licensing statement regarding the use of any of their patented technology which might appear in the Standard.
5.2	Geiger	T	all stations are required to be able to receive any frame transmitted on a given set of rates. This is not true!	No station is required to receive data at higher bit rates than the basic rate of the BSS except in the IR PHY. The wording of this paragraph needs to be changed to not mislead implementors in to thinking that all PHYs require all rates to be supported

5.2	Mahany	T	Sixth paragraph: Delete Statement that RTS CTS may be beneficial for inbound traffic only.	Reflects a bias that does not belong in the text. This mechanism is of value when multiple access points are within range of one another in IR systems, or in some cases in DS or FH systems. Let individual implementers make this judgment.
5.2	Rick White	T	¶ 4: Change to "The RTS and CTS frames contain a duration field that defines ~~for~~ the period of time that the medium is to be reserved ton transmit the actual Data frame and ACK."	
5.2	Tim Phipps	T	*Replace:* "Therefore the use of the RTS/CTS mechanism ... prefix" *with:* "The use of the RTS/CTS mechanism is under control of the RTS_Threshold attribute. If the payload length of an **MPDU** is not less than this threshold, the MPDU will be sent following an RTS/CTS exchange."	The threshold applies to MPDUs, i.e. to the individual fragments following fragmentation. This is consistent with the use of the duration field within the RTS/CTS which apply to the first fragment only. Subsequent DATA/ACK frames carry updated NAV information and act as the reservation mechansm for following frames.
5.2, 5.2.2	Fischer, Mike.	T	The NAV is updated by Duration fields in all frames, not just RTS and CTS frames. This needs to be updated wherever references solely to RTS/CTS appear. Among such places are the 4th paragraph of 5.2 and the sole paragraph of 5.2.2.	correctness, consistency
5.2.1 8.x	Belanger	E	"Physical Carrier Sense Mechanism see section 8..." should be deleted or Section 8 should describe more explicitly how CCA information is passed to the MAC. Section 8 should explicitly state that the START OF ACTIVITY indication and END-OF-ACTIVITY indications are used for CCA	Section 8 does not define how Carrier Sense information is conveyed to the MAC.
5.2.1	Bob O'Hara	T	replace fourth paragraph with "A destination STA shall reject a frame which has the Retry bit set in the Frame Control field as a duplicate if the received Dialog Token matches the most recently received Dialog Token from the source STA, which is kept in a local cache. The size of the cache may be limited."	Current language is difficult to understand and ambiguous.
5.2.1	Rick White	T	There is no information in Section 8 that address how physical carrier sense in conveyed to the MAC. This must be corrected.	
5.2.10	Bob O'Hara	E	delete boxes around text and make into a list	
5.2.10	C. Heide	e	second line of the first 3 boxes should say "than" instead of "then"	
5.2.10	C. Heide	e	the third box defines "free" to be "no NAC or no CS" - this definition applies to the first two boxes too.	
5.2.10	Geiger	E	I think that medium free should be describe first before launching into the pseudo code	Clarity
5.2.10	Jim Panian	E	Specify with T1 and T3 are started relative to the start/end of RTS, CTS.	The standard does not specify when the timers T1 & T3 are started.
5.2.10	Tom T.	E	In the first three blocks change word 'then' to 'than' in sentence 'If medium is free longer then DIFS....' Either remove '(No NAV and no CS)' from third block or add to the first two as well. Replace last line of fourth block with: Return a CTS frame one SIFS period after the end of the RTS.	
5.2.10	A. Bolea	T		In first block, setting a timer T1 in response to a RTS is incorrect. This should be removed from the true part of the IF statement. In addition, the second block also needs to be removed. In first block false part of IF statement, the CTS should be returned after a SIFS period regardless of the NAV or CS.

5.2.10	C. Thomas Baumgartner	t	In rules for receiving station If RTS frame detected after ELSE change to "Return a CTS frame after SIFS"	CTS is returned without regard to medium state
5.2.10	David Bagby	T	The following rules need to be applied when transmitters use the DCF Asynchronous Services. When transmitting a unicast MPDU using RTS/CTS exchange: If medium is free longer then DIFS, then transmit RTS. Else defer until DIFS gap is detected, and go into backoff. If CTS is received within T1 after RTS, then transmit the DATA after SIFS. Else go into Retransmit_Backoff. If Ack not received within T3 then go into Retransmit_Backoff. When transmitting a unicast MPDU without the RTS/CTS exchange: If medium is free longer then DIFS, then transmit DATA. Else defer until DIFS gap is detected, and go into backoff. If Ack not received within T3 then go into Retransmit_Backoff. When transmitting a Broadcast/Multicast MPDU: If medium free (No NAV and no CS) longer then DIFS, then transmit DATA. Else defer until DIFS gap is detected, and go into backoff. The following rules need to be applied by receiving stations: If RTS frame is detected but station is not the destination, Then: Update the NAV with the Duration information and start a T1 timer. Else Return a CTS frame when medium free (no NAV and no CS) after SIFS. If T1 timer expires, and CS is not active at that time, then clear the NAV. If CTS frame is detected Then: Update the NAV with the Duration information. If station is the destination of a unicast DATA frame, Then: Transmit Ack after SIFS when CRC was correct.	See imbeded comments and annotations

5.2.10	Geiger	T	If CTS is received within T1 after RTS, then transmit the DATA	According to figure 5-9, T1 is the time from the end of a RTS to the start of DATA. Isn't it really T1-G1 as with the ACK description and T3. In addition, it looks to me that the NAV is calculated from the end of CTS, not the start of where data
5.2.10	Joe Kubler	T	algorithm should illustrate how ack is protected in transmit case 2 by setting duration to protect the ack and in receive case 1, T1 should be set to duration to protect ack before station senses DIFS	in a busy network, the number of missed acks could get quite large without this. it really adds no cost to bandwidth since (as fig 5-13 shows) other stations should defer until after a DIFS following the ack. This would still allow the use of short directed frames even in BSAs that are using RTS/CTS in an efficient manner
5.2.10	Renfro	T		For receiving stations, if RTS is detected but receiver is not destination station, NAV should be updated but T1 timer should not be set. If receiver is destination station, it should return CTS after SIFS even if medium is not free. Second receive block which states 'If T1 timer expires, and CS is not active at that time, then clear NAV' is wrong. This defeats the purpose of having a NAV. If all stations always hear CTS after RTS then NAV is a waste of effort.
5.2.10	Rick White	T	What is the purpose of the DCF Pseudo code when there are state machines later in the draft.	
5.2.10	Rick White	T	The Pseudo code is not complete. It does not reflect anything dealing with fragmentation. Must be resolved.	
5.2.10 or 5.5	Iwen Yao	E Approve		It will be helpful to clarify the fragmentation process by including it in the Pseudo Code presented here.
5.2.11	bdobyns	E	Eliminate references to a hash function.	
5.2.11	Bob O'Hara	E	replace "MPDUID" with "Dialog Token"	
5.2.11	Bob O'Hara	E	replace "ID" with "Dialog Token"	
5.2.11	Bob O'Hara	E	delete the third paragraph	no longer correct, definition is in section 4
5.2.11	Jeff Rackowitz	E	What is the definition of the hashing algorithm defined in the 3rd paragraph?	
5.2.11	McKown	E	this language refers to frames; it should refer to fragments	oversight
5.2.11	Tom T.	E T E	Replace MPU ID throughout this section with 'Dialog Token'. Replace third paragraph with: The Dialog Token is a 12 bit sequence number maintained by the source STA. This number is incremented before sending the next new MPDU. Replace last three words of paragraph five with: a max retry event.	 Now that we voted to use full 6 byte addresses in all frames there is no need to hash this value as it is always tied to the source address of the sending STA which is unique. An FCS erronot the same as this would cause a retry from the source. Mistaking a frame as a duplicate causes a discard of an acknowledged frame.
5.2.11	Wim Diepstraten	E	This section need to be updated to reflect the current frameformat situation.	This section still describes the MPDUID consept.
5.2.11	A. Bolea	T		All references to MPDU ID should be replaced with Sequence Control. Second Paragraph and Third paragraphs should be deleted. Question: Do we need to specify the depth of the Cache of previous messages?
5.2.11	bdobyns	T	MPDU ID is no longer a field. This section should refer to *sequence number*, as defined in section 4.1.2.4	

5.2.11	bdobyns	T	"MPDU_ID_CACHE shall keep the last X MPUD ID's on a FIFO ..." Need to specify X.	
5.2.11	bdobyns	T	Should specify upper and lower bounds on permissible "MPDU_ID_CACHE" depth, rather than a single value.	
5.2.11	C. Heide	t	How does the duplicate detection method work in light of the fact that there is no such thing as a MPDU ID.	there is no such thing as an MPDU ID according to section 4.
5.2.11	C. Thomas Baumgartner	t	change to "...shall keep the last 100 MPDU IDs..."	Need a number and 100 seems likely to be adequate compromise between accuracy and memory needs. But open to other opinions.
5.2.11	C. Thomas Baumgartner	t	get together with frame format authors and have them include MPDU ID field	MPDU ID field not in frame now according to Section 4. Because this feature is meant to be duplicate detection by the receiving STA why not just have the receiving STA calculate this hash instead of sending it over the precious bandwidth. Needs some more work since the source address is not in some frames.
5.2.11	C. Thomas Baumgartner	t	Correct the description of the 16 bit hash. What is the 2 octet Network ID field? The Sequence Field is 2 octets; assume that they want first 12 bits of this field.	Not clear how to implement from current description

5.2.11	David Bagby	T	**2. Duplicate Detection and Recovery** Since MAC-level acknowledgments and retransmissions are incorporated into the protocol, there is the possibility that a frame may be received more than once. Such duplicate frames shall be filtered out within the destination MAC. Duplicate frame filtering is facilitated through the inclusion of a Sequence Control~~an MPDU ID~~ field within the individual frames of an MPDU~~, including the DATA and ACK frames. Frames which are part of the same MPDU shall have the same ID, and~~ Ddifferent MPDUs will (with a very high probability) have a different sequence control Ids. The sequence control field is defined in section 4. ~~The MPDU ID is a 16 bit hash of the 2 octet Network ID field, 6 octet source address and a 1 octet sequence number maintained by the source STA. The hashing of this information into a smaller field reduces overhead, particularly within ACK frames.~~ ~~A destination STA shall reject a frame which has the RETRY bit set in the CONTROL field as a duplicate if it receives one which matches a value of recent MPDU IDs kept in the MPDU_ID_CACHE. The MPDU_ID_CACHE shall keep the last X MPUD IDs on a FIFO basis for the purpose of comparison with the most recent MPDU ID.~~ There is the small possibility that a frame will be improperly rejected due to ~~such~~ a sequence control match; however, this occurrence would be rare and would simply result in a lost frame similar to an FCS error. Destination STAs shall perform the ACK procedure even if the frame is subsequently rejected due to duplicate filtering.	See imbeded comments and annotations
5.2.11	Fischer, Mike.	T	This paragraph is totally out of data with the current MAC. The duplicate detection using MPDU ID was eliminated by decision at the July, 1994 Plenary meeting, the current scheme was adopted at the November, 1994 plenary meeting, but this paragraph seems to have been overlooked. I recommend that material from document 94/290 (or 94/254A, which has a clearer description, but must be adapted for the November 1994 compromise reflected in 94/290) be used to replace this sectionÕs text.	correctness, consistency with motions passed since March, 1994
5.2.11	Geiger	T	MPDU_ID is not a defined field in section 4. I suspect this field is now the Sequence Number field.	Either delete the MPDU_ID for the sequence Number field or the Sequence Number field for the MPDU_ID field.
5.2.11	Geiger	T	Define X MPDU ID	Don't know what this means
5.2.11	Greg Ennis	T	Replace paragraphs 2 through 4 with algorithm based upon the current frame format	MPDUID no longer present

5.2.11	Iwen Yao	T Approve		It is indicated that the MPDU ID is generated based on a hashing algorithm while the specific hashing procedure is not specifed.
5.2.11	Joe Kubler	T	all but the first paragraph should be replaced to reflect usage of sequence control field. The following could be used:Duplicate frame filtering is facilitated through the inclusion of a sequence control field. All fragments of an MSDU will have the same dialog token which the station will only increment for new MSDUs sent on the source-destination pair. The retry bit will be set whenever a data MPDU is retransmitted because the transmitter of the MPDU failed to receive an ACK.	MPDU ID is gone, replaced with sequence control field
5.2.11	John Hayes	T	The MPDU_ID_CACHE shall keep the last (MSDU/MPDU_minimum)*3 on a FIFO basis for the purpose of conparason with the most recent MPDU_ID.	This value is currently undefined. The proposed value accouts the the maximum number of fragments for a given PHY for 3 MSDU transfers.
5.2.11	Mark Demange	t	MPDU ID is not defined in the frame formats section.	This description is not consistent with the frame formats section. This mechanism was removed from the frame formats and needs to be removed from this point in the document.
5.2.11	Renfro	T		Entire section needs to be updated to reflect recent changes. MPDU_ID is not current terminology.
5.2.11	Rick White	T	The MPDU ID field is no longer part of the Frame.	Holdover from earlier draft.
5.2.11	Rick White	T	Duplicate detection is facilitated through the use of the Sequence Control field	Not through the use of MSDU ID
5.2.11	Rick White	T	This section must be rewritten to reflect the use on the Sequence Control field for duplicate detection.	

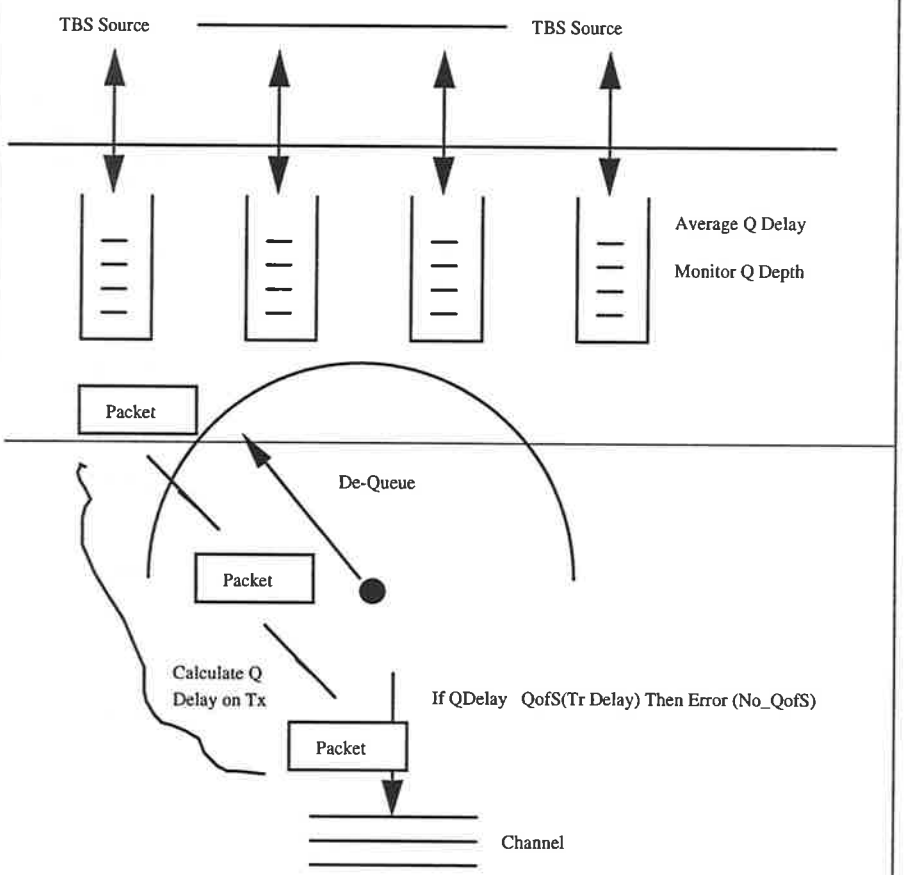
5.2.11	Tim Phipps	T	*Replace entire section with:* Since MAC-level acknowledgments and retransmissions are incorporated into the protocol, there is the possibility that a frame may be received more than once. Such duplicate frames shall be filtered out within the destination MAC. Duplicate frame filtering is facilitated through the inclusion of a dialog token (consisting of a sequence number and fragment number) field within DATA and MANAGEMENT frames. MPDUs which are part of the same MSDU shall have the same sequence number, and different MSDUs will (with a very high probability) have a different sequence number. The sequence number is generated by the transmitting station as an incrementing sequence of numbers. The receiving station shall keep a cache of recently-received <source-address, sequence-number, fragment-number> tuples. A destination STA shall reject a frame which has the RETRY bit set in the CONTROL field as a duplicate if it receives one which matches both source-address, sequence-number and fragment-number in the cache . The cache shall keep the last X tuples on a FIFO basis for the purpose of comparison. There is the small possibility that a frame will be improperly rejected due to such a match; however, this occurrence would be rare and would simply result in a lost frame similar to an FCS error. The Destination STA shall perform the ACK procedure even if the frame is subsequently rejected due to duplicate filtering.	The old text made reference to the MPDU-ID. This replacement text retains the old meaning in the context of the new frame formats. Note, alternative and more efficient schemes (e.g. using the fact that the sequence is an *incrementing* sequence) may be possible. Should this section require that *some* duplicate detection mechanism is required, but not prescribe the details?
5.2.11.	P. Brenner	E	Rewrite the paragraph for the new frame formats.	There is no MPDUID any more!
5.2.12	Wim Diepstraten	E	Change section title to: "Fast Response on a Poll Control frame." and deletethe last sentence.	This description relates to the possibility that an AP can directly send the Data within SIFS following the Poll frame, or should Ack the Poll frame when the stored data has not yet been queued for transmission. This possibility is listed in section 4.3.
5.2.12	Bob O'Hara	T	Delete this section.	This is already define in section 4.3
5.2.12	C. Heide	t	remove this section.	there can be some well defined instances (such as during the CF) where fast responses used, but allowing it as carte blanche as this section does is to open to abuse. Two STAs could seize the channel for a long transaction. Also, it destroys the NAV mechanism.
5.2.12	C. Thomas Baumgartner	t	Need to define how the NAV update works in this paragraph.	Definition of operation needed so that it is not abused while still claiming compliance

5.2.12	David Bagby	T	**~~3. Fast Response Possibility~~** ~~[The following paragraph should be discussed by the group. JES]Note that instead of an Ack frame, it is also possible to directly transmit the response frame back to the transmitter of the received frame. This would allow a class of fast implementations, which could for instance directly respond to a Poll frame with the requested Data frame itself, which in turn should be acknowledged by an Ack frame.~~ ~~Another example is in the Contention Free (CF) period, where stations respond to a Poll bit in frames coming from the AP.~~	See imbeded comments and annotations
5.2.12	Fischer, Mike.	T	Replace title with: ÒFast Response OperationÓ Replace text with: ÒIn certain cases a response is transmitted directly by the recipient of a frame, obviating the need for a separate ACK transmission. This occurs when responding to a PowerSave Poll control frame at an AP which has buffered traffic for the station which transmitted the PowerSave Poll. Another instance where ACK transmissions do not occur is during the contention free burst, when the acknowledgements are indicated in the subtype of the subsequent CFÐData frame.Ó	replace words which sound like they are unmodified since before the adoption of the DFWMAC proposal into the draft standard in November 1993
5.2.12	McKown	T	802.11 must decide: do we care that a single duplex video link, executed with "fast response capability," would lock out all other users?	oversight
5.2.12	P. Brenner	T	Clarify that the "fast response" is allowed only for POLL frames.	It may be misunderstood in such a way that two stations could keep exchanging frames without releasing the medium.
5.2.12	Renfro	T		This must either be part of the standard or not. This is the kind of thing which can result in loss of interoperability based upon specific implementation.
5.2.12	Rick White	T	This section should be removed.	Fast response in not discussed any way else in the draft and does not satisfy the basic access mechanism.
5.2.12.	Mahany	E	Change Heading to "Fast Response"	Possible Implies an Option
5.2.12.	Fischerma:Fast Response Possibility	T	Section should be deleted, unless all instances of this exchange can be concretely described.	D1 is very vague in the use of the behavior described in this section.
5.2.13	Greg Smith	E	This Section should be removed	802.11 does not support DTBS
5.2.13	Joe Kubler	E	delete entire section. DTBS is gone.	
5.2.13	John Hayes	E	Remove section 5.2.13	DTBS was decided against during the November plenary meeting.
5.2.13	Mahany	E	Delete Reference to User Classes, replace with established terminology,	This is new concept here
5.2.13	McKown	E	delete reference to distributed time-bounded service	oversight
5.2.13	A. Bolea	T		Not clear to me what this paragraph is trying to say. I think it should be either clarified or deleted.
5.2.13	Belanger	T	The entire section should be removed.	We have a Time Bounded Service that uses the Point Coordination Function. The MAC should only specify one technique. The priority signaling mechanism that would be required to implement this correctly has never been defined and accepted by the committee.

5.2.13	Bill Huhn	T	DTBS should be removed from the draft.	There was insufficient support for any of the distributed time bounded service proposals put forward at the meetings. This mechanism and all references to it should be removed. Additionally, there is definition for a point coordinated time bounded service making the DTBS service unnecessary.
5.2.13	C. Heide	t	remove this section	(1) the 3rd paragraph says that "DTBS assumes that the MAC Service provides multiple hierarchical independent levels of channel access priority." THE DCF does not do this. (2) this section appears to say that if data is not sent within a certain time it will be discarded. This could be called a time bounded service, but by this definition throwing away all of a user's data meets the requirement.
5.2.13	C. Thomas Baumgartner	t	Add STATEMENT that this section is a general description of a service to be defined fully for actual implmentation at a later date	There is not a complete enough definition to allow for compliance testing so we need to add this warning.

5.2.13	David Bagby	T	**4. Distributed Time Bounded Service (DTBS)** The cmtee has consistently voted against support for a DTBS, therefore the vestiges of that effort must be removed from the draft. A piece of functionality with only partial definition and insufficient cmtee support can not exist in a draft forwarded for sponsor ballot.[DB36] ~~An optional Distributed Time Bounded Service (DTBS) may be based on the connectionless-mode MAC Service provided by the DCF. DTBS can be characterized as a "best effort" service providing bounded transit delay and delay variance.~~ ~~DTBS requires a mechanism to map requested Quality of Service (QoS) onto channel access priority. QoS parameters include transit delay, delay variance, and user priority. If the MAC Service user does not explicitly state QoS parameters, the MAC Service provider shall use default values. MAC Service requests that cannot be satisfied are rejected by the MAC Service provider, thus avoiding overload conditions.~~ ~~DTBS assumes that the MAC Service provides multiple hierarchically independent levels of channel access priority. Hierarchical independence means that increasing load from lower priority classes does not degrade the performance of higher priority classes.~~ ~~**4. Quality of Service**~~ ~~Associated with each MAC connectionless-mode transmission, certain measures of QoS are requested by the sending MAC Service user when the primitive action is initiated. The requested measures (or parameter values and options) are based on a priori knowledge by the MAC Service user of the service(s) made available to it by the MAC Service provider. Knowledge of the characteristics and type of service provided (i.e., the parameters, formats, and options that affect the transfer of data) is made available to the MAC Service user through some layer management interaction prior to (any) invocation of the MAC connectionless-mode service. Thus the MAC Service user not only has knowledge of the characteristics of the parties with which it can communicate, it also has knowledge of the statistical characteristics of the service it can expect to be provided with for each MAC Service request.~~	See imbeded comments and annotations

5.2.13	David Bagby continuation	T	~~5. Transit Delay~~ ~~Transit delay is the elapsed time between MA-UNITDATA.request primitives and the corresponding MA-UNITDATA.indication primitives. Elapsed time values are calculatetd only on MSDUs that are transferred successfully.~~ ~~Successful transfer of a MSDU is defined to occur when the MSDU is transferred from the sending MAC Service user to the intended receiving MAC Service user without error.~~ ~~For connectionless-mode transfer, transit delay is specified independently for each MAC connectionless-mode transmission. In general, satisfaction of the transit delay bound is managed by the sender.~~ ~~5. Delay Variance~~ ~~Delay variance is the jitter associated with transit delay. In general, satisfaction of the delay variance bound is managed by the receiver and may be used to regenerate the regular periodic interval of related sequences of MSDUs.~~ ~~5. User Priority~~ ~~The MAC Service user may transfer to the MAC Service provider a priori knowledge about the characteristics of the parties with which it can communicate via the user priority QoS parameter.~~ ~~5. Mapping QoS onto Channel Priority~~ ~~There is a standardized mapping of QoS Transit Delay and Delay Variance parameters to initial Time to Live (TTL). The inititial transmit queue position is determined by TTL, possibly qualified by the QoS User Priority parameter. All MSDUs in the transmit queue count down their associated TTL while waiting to reach the head of the queue and be dequeued for transmission.~~ ~~The channel access priority is determined, in a standardized way, from remaining TTL at dequeue time. At transmission time, the measured queue delay must be subtracted from the TTL to give the Residual Time to Live (RTL) i.e. the time left before the MSDU becomes out of date. RTL may be used in subsequent handling of the MSDU. If RTL should become less than or equal to zero, the MSDU should in all cases be discarded.~~	

5.2.13		David Bagby continuation	T		

~~**Figure 5-14: Mapping QoS onto Channel Access Priority**~~

~~6. Partitioning of Channel Capacity~~

~~Partitioning of channel capacity amongst conceptual user classes (e.g. low priority async requests and higher priority time bounded requests) is a natural side effect of the mapping of TTL to channel access priority at dequeue time. Since *all* queued MSDUs progress towards the head of the queue as a function of their decreasing TTL, the relationship between channel access priority and conceptual user class is a function of channel load.~~

5.2.13	David Bagby continuation	T	~~7. Channel Access Priority Mechanism~~	
5.2.13	Geiger	T		
5.2.13	Greg Ennis	T	Replace entire section with "The provision of a Time Bounded Service based upon the Distributed Coordination Function is for further study".	DTBS mechanism is unknown.
5.2.13	Jim Panian	T	The time bounded service, a required function, needs to be architected and sufficiently described in the standard.	
5.2.13	Mahany	T	Delete	This section is incomplete and does not describe an interoperable DTBS implementation. Deletion reflects votes taken w.r.t. DTBS in the November 1994 Meeting
5.2.13	Rick White	T	This section and all of its subsections should be removed.	This is due to the fact that the MAC subgroup has rejected Distributed Time Bounded services more than once and no channel access mechanism has been approved. The idea of distributed time bounded services is a misnomer. It is not a time bounded service but a priority mechanism which incurs no penalty for its use. User will set their 802.11 MAC to the highest priority even for asynchronous traffic.
5.2.13	Simon Black	T	Delete entire section.	The text in this section regarding Distributed Time-Bounded Services (DTBS) is not sufficiently complete or well thought-out for a draft standard.
5.2.13	Tim Phipps	T	*Remove section and sub-sections.*	This description of DTBS is incomplete and inadequate for an implementation.
5.2.13	Tom T.	T	Remove this section from the standard.	I was under tmpression that DTBS got voted out in the Nov/94 meeting.
5.2.13	Wim Diepstraten	T	Due to lack of a Channel Access Priority mechanism in section 5.2.13.4 this section is not relevant, unless a form of DTBS purely based on Queuing priority is desired.	Future versions of the standard that do specify a DTBS priority mechanism can not coexist with current versions in the same environment, because implementations based on the current standard do not have a notion of access priority.
5.2.13	Sonnenberg	Tech.	Delete whole section relating to DTBS, including all references in the draft to this function.	The mechanisms to make it work properly do not appear to have been solved. I also have a concern over the applicability of such a function in an 802.11 WLAN environment.
5.2.13, et seq	Bob O'Hara	T	Delete.	This describes a mechanism that may be implemented above the MAC without any penalty. There is no need to increase the complexity of the MAC with this functionality.
5.2.13.1	bdobyns	T	How does the MAC calculate Transit Delay? What specific PHY MIB parameters does it use? Are the right parameters defined in the PHY MIB?	
5.2.13.1	Geiger	T	How is the QoS delivered in the MA-DATA_UNIT primitive.	Add QoS parameter

5.2.13.1.1	Geiger	E/T	MA-UNITDATA.request s/b MA_UNIT-DATA.request Transit Delay	Consistency How is transit delay established?
5.2.13.1.2	Geiger	T	Delay Variance	How is the delay variance calculated? Is there some field in the data frame used to store arrival time versus time to live?
5.2.13.2	bdobyns	T	How does the MAC calculate Delay Variance? What specific PHY MIB parameters does it use? Are there the right parameters?	
5.2.13.2	Geiger	T	MSDU should be discarded. This is not enough! RTL, TTL, should define MIB variables for a given connection	The reason for RTL expiring is that congestion or over booking of the network has occurred. Dropping a MSDU is only part of the task. There must also be a mechanism to inform the source of the MSDU that congestion has occur and congestion control is being exercised.
5.2.13.4	Jeff Rackowitz	E	Add notes about intentionally left blank or To be specified.	
5.2.13.4	A. Bolea	T		Text is missing.
5.2.13.4	Gegier	T	Channel Access Priority Mechanism	Determine access mechanism for connection oriented services.
5.2.13.4	Lewis	T	explain mechanism	
5.2.13.4	Paul Pirillo	T	Insert a definintion of Channel Access Priority Mechanism, including the equation that relates QoS, delay, delay variance, and user priority level. Define the range of values for User Priority.	This will enable me to see the capabilities and limitations of DTBS, and its impact on sychronous and asynchronous data types.
5.2.13.4	Paul Pirillo	T	Insert a definintion of Channel Access Priority Mechanism, including the equation that relates QoS, delay, delay variance, and user priority level. Define the range of values for User Priority.	This will enable me to see the capabilities and limitations of DTBS, and its impact on sychronous and asynchronous data types.
5.2.13.4	Renfro	T		Missing
5.2.13.4	**Siep**	**T**	**Channel Access Priority Mechanism[must be specified or deleted]**	**A standard must be complete in order to be functional.**
5.2.13.4.	Fischerma:Channel Access Priority Mechanism	T	committee shall provide text	This section is empty. I do not know what the intention of the committee was in including this section and therefore am unable to provide the text necessary to correct the problem.
5.2.2	Sarosh Vesuna		Add this sentence at the end of the section. " The duration information is also available in all data & ACK frames"	The current text seems to imply that a Virtual Carrier sense can only be accomplished if RTS/CTS is used.
5.2.2	Geiger	T	Remove this section concerning RTS/CTS functionality	RTS/CTS is not licensed for use.
5.2.2	Greg Smith	T	NAV needs to be present in data packets	RTS/CTS is not always used so how is NAV set
5.2.2	Mahany	T	Update text to reflect use of NAV as described in 5.3.2.2	NAV also has use in PCF
5.2.2	Rick White	T	NAV information is also contained in data frames of fragmented MSDUs. This must be added.	
5.2.3	Sarosh Vesuna			Why do the Response frames need an ACK.
5.2.3	Bob O'Hara	E	add comma after "frame."	Proper usage.
5.2.3	Rick White	E	Remove: "The gap between the received frame and the ACK frame shall be the SIFS."	The idea of SIFS has not been introduced. The introduction of SIFS should indicate that one of its uses is for ACKs.
5.2.3	Wim Diepstraten	E	Correct FC to FCS. The line above the list should read: "The following directed frame types shall be acknowledged with an Ack frame."	Note that a Probe request is not acknowledged, because it is a Broadcast frame.
5.2.3	John Hayes	E/T	Add: Broadcast and Multicast frames do not get acknowledged.	As specified in section 5.2.8
5.2.3	Bob O'Hara	T	List must reflect frame types in table 4-1	Correct inconsistencies

5.2.3	David Bagby	T	The following frame types shall be acknowledged with an ACK frame: the list of type is out of date with the sec 4 frame formats, I think the correct list is: a) type = Asynchronous Data b) type = Management ~~a) Data~~ ~~b) Poll~~ ~~c) Request~~ ~~d) Response~~	See imbeded comments and annotations
5.2.3	Fischer, Mike.	T	The listing of Poll frames as being acknowledged by an ACK frame is in conflict with section 4.4, in which ACK is only sent in response to the Poll (recommend changing to PowerSave Poll globally in another comment) when there are no buffered data frames to send in response to the Poll. Recommendation is to modify (b) here to state ÒPowerSave Poll, only when there are no buffered frames to send to the station transmitting the PowerSave Poll. If there are buffered frames, the transmission of the first buffered frame shall acknowledge the PowerSave Poll.Ó	The sole purpose for PSP mode and the related PowerSave Poll control frame is to allow extremely low power stations to participate in WLAN communication. To require Ack response to this frame when there is buffered traffic just wastes time during which the PSP stationÕs receiver is powered on to send redundant information, given that the first of the buffered data frames provides an implicit acknowledgement of the poll.
5.2.3	Greg Ennis	T	Replace section with: "This standard requires that an ACK frame be transmitted in response to the successful receipt of a frame under certain circumstances. The relevant situations in which an ACK is required are identified in the sections pertaining to the processing of the various received frame types. Frame types whose reception may elicit a subsequent ACK are DATA, POLL, REQUEST, RESPONSE, and ATIM. The interval between a frame and its associated ACK shall be a SIFS as described in Section 5.2.4.1.	ACKS are not always required.
5.2.3	Rick White	T	ACKs are only used on directed frames.	
5.2.3	Rick White	T	All frame types that require an acknowledgment should be list, not just a generic category such as request.	Completeness
5.2.3	Rick White	T	All frame types need to be revisited to determine if they require an ACK.	The list provided is not inclusive.
5.2.3.	P. Brenner	T	All unicast directed Management frames shall be acknowledged	The MAC State Machine should treat Management frames exactly the same way that DATA frames.
5.2.4	Sarosh Vesuna		Change first sentence of the 2nd para to " It should be **noted** that the different ....."	Editorial
5.2.4	Tom T.	E	In last paragraph change word noticed with noted.	
5.2.4	bdobyns	T	Error tolerances for all IFS timings, slot time and other timing "constants" must be specified and made part of the standard. Error tolerances should be constructed out of PHY MIB static entries. e.g. aSIFS_Error_Tolerance = aChannel_Transit_Variance + 2 * aSymbol_Duration	No two machines will ever synchronize completely. Tolerances must be built into the system to permit interoperabliity.

5.2.4	David Bagby	T	It should be noticed that the different IFSs are independent of the station bitrate, and are fixed per each PHY ~~(even in multi-rate capable PHYs)~~, IFS times shall be specified in units of bit time. This is the most natural for the mac to deal with and avoids conversion problems with odd time granularities.	See imbeded comments and annotations
5.2.4	Geiger	T	The IFS is divided into equal time units called slots. The first slot is called the SIFS slot. The next slot is called the PIFS slot. All slots following the PIFS slot are called DIFS slots. These slots provide a corresponding number of priority levels for access to the wireless media. It should be noted that the IFS time intervals for the most part are PHY specific. Only a small part of the timing is dependent on MAC processing delays. The timing for these intervals are available as part of the PHY Specific MIB for a given PHY.	MAC & PHY operations need to occur on slot boundaries. I believe that it is less confusing to someone reading the standard to use slot definitions rather than timings from the last transmission. i.e.., Is the SIFS mark shown in figure 5-7, the start of the SIFS slot or the end. It could be either. Only after examining the DIFS slot period can you back towards the SIFS and figure out the actual SIFS slot is between the SIFS mark and the PIFS mark.
5.2.4	Isabel Lin	T		SIFS, PIFS, and DIFS are "described" but not "defined" in this section and its subsections. Their definitions are referred to be PHY dependant. However, by reading related PHY sections, there are no specific "definitions" to each parameters. When trying to derive those values from related PHY sections, one finds it very difficult since those PHY sections use different terms to describe the necessary parameters. What needs to be done: In this section and its subsections, use consistent terms to explicitly define the components to be used to derive IFS, PIFS, and DIFS. In each related PHY sections, include explicit definitions of those components using consistent terms.
5.2.4	Rick White	T	Provide a figure that illustrates the inter-frame spaces. Figure 5-7 could be used.	Picture is worth 1000 words.
5.2.4	Rick White	T	List the three different inter-frame spaces in this section.	Makes things easier to understand.
5.2.4	Ryan Tze	T		SIFS, PIFS, and DIFS are described but not defined in this section and its subsections. Their definitions are referred to be PHY dependant. But each PHY section does not have specific definitions for each parameters. PHY sections also use different terms to describe the necessary parameters. What needs to be done: In this section and its subsections, use consistent terms to define the components to be used to derive SIFS, PIFS, and DIFS. In each PHY sectios include explicit definitios of those components using consistent terms.

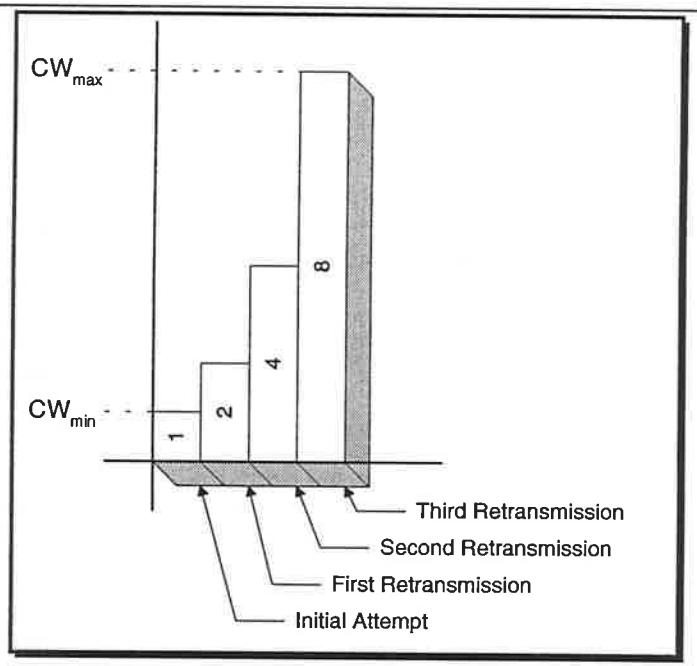
5.2.4 and 5.2.6	D. Johnson	T	**5.2.4 PCF- IFS (PIFS)** This PCF priority level shall be used only by the PCF to send any of the Contention Free Period (CFP) frames. The PCF shall be allowed to transmit after it detects the medium free for the period PIFS (PCF Interframe Space), at the start of and during a CF-Burst. Alternatively, in cases where regulations require the point coordinator STA to contend for access, the contention window for the PCF begins after the PIFS time. **Figure 5-8: Backoff Procedure** The wording around the lower right arrow will need to be changed to conform to the revision. **5.2.6.2 Backoff Procedure** The backoff procedure shall be followed whenever a STA desires to transfer an MPDU and finds the medium busy. The backoff procedure consists of selecting a backoff time from the equation in Section 5.2.5 Random Backoff Time. ~~The Backoff Timer shall decrement only when the medium is free. The Backoff Timer shall be frozen while the medium is sensed busy.~~ Decrementing the Backoff Timer shall begin~~resume~~ whenever a medium free period longer than DIFS is detected. Transmission shall commence whenever the Backoff Timer reaches zero providing the medium is free for a period of DIFS or longer prior to when the timer reaches zero. **Figure 5-8: Backoff Procedure** This illustration will need to be changed to conform to the revised wording. 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 STA to the medium. The effect of this procedure is that when multiple stations are deferring and go into random backoff, then the station selecting the lowest delay through the random function will win the contention. ~~The advantage of this approach is that stations that lost contention will defer again until after 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 method tends toward fair access on a first come, first served basis.~~	Allows an IEEE STA with the DCF to operate with the spectrum etiquette pf Part 15.321 and thereby operate in the UPCS asynchronous sub-band. Although the currently specified back-off procedure favors STAs which have been in back-off longest, it cannot be implemented on the basis of power detection. An etiquette cannot determine when a retransmission is needed. Further, typical user information transfers normally consist of multiple frames, thus the delay to the user is more dependent on the average delay each frame experiences. This average delay will be no longer with the proposed change. It retains the definition of the PIFS for those cases where PCF operation is permitted. This is one of the reasons for the no vote.
5.2.4.1	Sarosh Vesuna		Change last sentence of 2nd para as "Clearly T2R must be less than or equal to **SIFSmin.**	The T2R must happen in a time shorter than the time in which the receiving station can turnaround & transmit.
5.2.4.1	bdobyns	T	Specific values for SIFS must be calculated. Give the formula or equasion in terms of static PHY MIB parameters. e.g. aSIFS = max(aRxTx_Turnaround_Time, aTxRx_TurnaroundTime) + max(aTx_Propogation_Delay, aRx_Propogation_Delay) + aCCA_Rise_Time + aCCA_Fall_Time	See section 9 for definitions of the PHY MIB parameters.

5.2.4.1	bdobyns	T	SIFSmax and SIFSmin are not MAC MIB parameters. How are these related to PHY parameters? How are they calculated?	
5.2.4.1	C. Heide	t	the last sentence of the second paragraph should be "Clearly the T2R must be less than or or equal to SIFSmin.".	if a STA-1 transmits an RTS and the STA sending the CTS in response is allowed to send that CTS after a SIFSmin, then STA-1 had better have a T2R of no greater than SIFSmin.
5.2.4.1	C. Thomas Baumgartner	t	Change 2nd last sentence of 2nd paragraph to "In relation to SIFmax the transmit to receive time..."	Without the addition this sentence was confusing until one reads the next paragraph and then comes back to this paragraph.
5.2.4.1	C. Thomas Baumgartner	t	In third paragraph add a sentence which gives the formula for SIFSmin exactly. I'm not expert but is is something like SIFSmin=T2R time of specific PHY plus the transmitter turn-on delay of specific PHY less the result of (total preamble time less amount of preamble required by specific PHY to achieve signal capture)	The 3rd paragraph is a nice theoretical discussion on the reasoning for setting SIFSmin but this is a standard that defines exact specifications not a discourse on why a specific number is specified.
5.2.4.1	David Bagby	T	values for SIFS not speced, must be done before sponsor ballot.[DB41]	See imbeded comments and annotations
5.2.4.1	McKown	T	should mention propagation time too	clarity
5.2.4.1	Rick White	T	¶ 1: Rewrite "This inter-frame space shall be used for an ACK frame, a CTS frame, a Data frame of a fragmented MSDU, and by a STA responding to any polling as is used by the Point Coordination Function (PCF) (See Section 5.3, Point Coordination Function) ~~and between frames in the sequences described in section 4.3.~~"	
5.2.4.1	Rick White	T	The figure that was generated at the January 1995 meeting depicting the components of a SIFS and descriptive text would be very helpful in this section	
5.2.4.1	Tom T.	T	Add to this section the following: The SIFSmax period for each PHY shall be equal to: SIFSmax = max(20μsec, R2T)	My interpretation of the second line of paragraph two is that the SIFSmax is equal to the R2T time specified in the PHY. This would mean that it would be: 0 μsec for the IR PHY 5 μsec for the DS PHY 19 μsec for the FH PHY This would seem to require that the MAC respond instantaneously in the DS PHY case (2 μsec turn-on delay + 2 or 3 μsec. delay in PHY and MAC chips) or before the end of the packet for the IR PHY (assuming at least one bit clocking delay in the PHY and one in the MAC). This is unnecessarily restrictive on the MAC. The MAC part of this standard should specify the minimum SIFSmax that it can live with.
5.2.4.1	Wim Diepstraten	T	The SIFS is a parameter that specifies a timing gap on the medium. There is no reason to specify a max and min value, because they do relate to implementation aspects.	The definition and use of the minimum and maximum specification of the SIFS is unclear and should not be needed.
5.2.4.1.	Fischerma:SIFS	T	Need actual value of SIFS interval.	

5.2.4.2	bdobyns	T	Specific values for PIFS must be calculated. Give the formula or equasion in terms of static MAC or PHY MIB parameters. e.g. aPIFS = 4 * aSIFS + ACK where ACK = aPLCP_Time + 12 * aBSS_BASIC_RATE	See section 9 for definitions of the PHY MIB parameters.
5.2.4.2	David Bagby	T	values for PIFS not speced, must be done before sponsor ballot.[DB42]	See imbeded comments and annotations
5.2.4.2	Geiger	T	SIFS The SIFS is the first slot occurring after the end of a transmission. The time from the end of the last transmission to the start of the SIFS slot is called the SIFS_start_Time. These times are different for the STA transmitting the last frame and all the STAs only receiving the last frame. These times are PHY specific and are define as part of the PHY Specific MIB for a given PHY. Also included in the determination of this time period is some delay on the part of the MAC to process the address.	We need to be consistent in our description of how things work. We talk about slots in some places and time intervals in others. Lets all talk slots and define the IFS in terms of slots. It make the PHY and MAC implementation easier to understand.
5.2.4.2	Tom T.	T	Add : The PIFS period for each PHY shall be equal to: PIFS = max (2 * SIFS, Slot Time)	The standard must state the value of PIFS. It currently does not. The PIFS must be long enough that the PCF is sure that it has not heard the response ACK or CF-Burst frame. With the equation shown it will be guaranteed at least one slot time to determine this.
5.2.4.2.	Fischerma:PIFS	T	Need actual value of PIFS interval.	
5.2.4.2.	P. Brenner	T	PIFS must be defined as Bigger than SIFS + Slot Time	There is no definition of the PIFS value
5.2.4.3	bdobyns	T	Specific values for DIFS must be calculated. Give the formula or equasion in terms of static MAC or PHY MIB parameters. e.g. aDIFS = 2 * aSIFS + ACK where ACK = aPLCP_Time + 12 * aBSS_BASIC_RATE	See section 9 for definitions of the PHY MIB parameters.
5.2.4.3	David Bagby	T	values for DIFS not speced, must be done before sponsor ballot.[DB43]	See imbeded comments and annotations
5.2.4.3	Rick White	T	Rewrite: "A STA using the DCF shall be allowed to transmit after it detects the medium free for the period DIFS and its Backoff Time has expired~~, as long as it is not in a backoff period~~.	
5.2.4.3	Tom T.	T	Add: The DIFS period for each PHY shall be equal to: DIFS = 2 Slot Times	The standard must state the value of DIFS. It currently does not. The DIFS must be at least one slot time longer than the PIFS so that everyone will have time to detect the PCF response after a PIFS period.
5.2.4.3.	Fischerma:DIFS	T	Need actual value of DIFS interval.	
5.2.4.3.	M. Rothenberg	T	The DIFS time must be bigger than (2 * SIFS + ACK Time)	The DIFS must prevent collisions even when the previous message was not correctly decoded.
5.2.4.3.	P. Brenner	T	DIFS must be defined as Bigger than PIFS + Slot Time	There is no definition of the DIFS value

5.2.4.3.	P. Brenner	T	DIFS must be defined as Bigger than 2 * SIFS + ACK Time	The DIFS must be "robust" enough to prevent collisions even when the previous message was not correctly received
5.2.5	Sarosh Vesuna		Change text " ..... determine the state of the **medium**. If the **medium** is busy, ..."	Does not sound right as currently stated.
5.2.5	bdobyns	E	The text and formula for BackoffTime = CW * Random() * SlotTime strongly imply that Random() is a floating point valued function taking values in the range [0...1], but this is not clearly stated.	This is the normal Random() specification for *mathematicians* but hapless engineers often thing in terms of an integer valued rand() style function.
5.2.5	bdobyns	E	Specify the formulas in terms of PHY MIB or MAC MIB parameters.	clarity
5.2.5	Greg Smith	E	Backoff Time = CW + Random()*slot time	I think its '+' not '*'
5.2.5	Wim Diepstraten	E	Change the definition to: Backoff Time = INT(CW * Random() * Slot time where: CW = An integer between CWmin and Cwmax (Example CWmin=32 and Cwmax=256) Random()= Pseudo random number between 0 and 1. Change figure 5-6 such that it contains example numbers for Cwmin and Cwmax. So use 32, 64, 128, 256 rather then 1, 2, 4, and 8. The values for CWmin and CWmax need to be specified as part of the standard.	The description together with the supplied figure is confusing, in that it may suggest that Cwmin=1 and Cwmax=8, because the actual values are not yet specified. The parameters, and associated retry limits need to be specified as part of the standard. The Cwmin and Cwmax values should be fixed as part of the standard, because they do affect the access fairness between stations. The standard could be specified such that different values for Cwmin are specified between an AP and a Station, to indeed affect relative access priority between an AP and a Station, which is benificial for total system throughput.
5.2.5	A. Bolea	T		Random() should be defined as a Uniformly Distributed Random Number between 0 and 1. Exact definition should be left to implementation. CWmin and CWmax should be specified. (8 and 64 are good numbers to keep the protocol overhead rate down in the case described by the second to last paragraph of section 5.2.6.2). Slot time should be given. Change Equation such that Backoff time is an integer number of slot times. Figure 5-6 should be changed accordingly(another retransmission should be added to the figure to show that the CW is limited to CWmax.
5.2.5	bdobyns	T	Either specify an algorithm for Random() or specify a spectral test or similar "goodness" test for Random()	fairness depends on it.
5.2.5	bdobyns	T	What happens when CW_{max} is reached? Does the CW stay at CW_{max} for the remainder of the retries (ethernet behavior)? Or is CW_{max} a just a synonym for $2^{max\_retries}$?	
5.2.5	bdobyns	T	"The CW shall increase expotentially..." what is an exponent on what else? Do you want 3.14159^{retry_count}? How about "The CW shall increase expotentially according the the function $CW = 2^{retry\_count}$ ..."	Figure 5-6 helps, but the text is ambiguous.
5.2.5	bdobyns	T	Where are numerical values for CW_{min} and CW_{max} specified? They're MAC MIB parameters, but can they vary from one implementation to another?	what fun!
5.2.5	bdobyns	T	Specific values for aSlot_Time must be calculated. Give the formula or equasion in terms of static PHY MIB parameters. e.g. aSlot_Time = max(aRxTx_Turnaround_Time, aTxRx_TurnaroundTime) + max(aTx_Propogation_Delay, aRx_Propogation_Delay) + aCCA_Rise_Time + aCCA_Fall_Time	See section 9 for definitions of the PHY MIB parameters.
5.2.5	Bob O'Hara	T	Define "Random" function	All functions must be defined

5.2.5	David Bagby	T	STA desiring to initiate transfer of asynchronous MPDUs shall utilize the carrier sense function to determine the state of the media. If the media is busy, the STA shall defer until after a DIFS gap is detected, and then generate a random backoff period for an additional deferral time before transmitting. This process resolves contention between multiple STA that have been deferring to the same MPDU occupying the medium. Backoff Time = CW * Random() * Slot time where: CW = An integer between CW_{min} and CW_{max} Random() = Need definition for Random() function.[DB44] Slot Time = Transmitter turn-on delay + medium propagation delay + medium busy detect response time. The Contention Window (CW) parameter shall contain an initial value of CW_{min} for every MPDU queued for transmission. The CW shall increase exponentially after every retransmission attempt., up to a maximum value CW_{max}. This is done to improve the stability of the access protocol under high load conditions. See Figure 5-6.	See imbeded comments and annotations

5.2.5		David Bagby continuation	T	 **Figure 5-6: Exponential Increase of CW** unanswered questions from editor's notes in D1 draft. What happens when the number of retransmission attempts reaches the CWmax limit? Can a STA attempt transmission forever, or should we have a failure mechanism defined?.*[DB47]*	
5.2.5		Geiger	T	Define Random() function. First of all it needs to result in a integer. Secondly, you need to bound the min-max integer to bound the access delay. Slot Time = PHY specific parameter	Everybody should do this the same way to increase the odds of picking unique backoffs.
5.2.5		Greg Ennis	T	replace "Random() = " with "Random() = a random number between 0 and 1 using a uniform distribution	random must be defined
5.2.5		Greg Ennis	T	CWmin and CWmax should be specified to be 4 and 32 respectively.	Specification is currently unclear on this
5.2.5		Greg Ennis	T	Change figure to reflect actual values of CWmin and CWmax	Figure currently implies CWmin = 1
5.2.5		Mahany	T	Define Random Function for this algorithm, or its properties.	Omission
5.2.5		Mahany	T	Reference Respective PHY MIB tables for slot time definition	Completeness

5.2.5	Renfro	T	Change to: Backoff Time = Integer[CW x Random()] x Slot Time CW = Integer between CWmin and CWmax Random() = Uniformly distributed random number between 0 and 1	This results in Backoff Time falling on integer slot times between 0 and CW. Good values are CWmin = 8 and CWmax = 64. These should result in good performance without undue overhead for the typically small LANs supported by this standard.
5.2.5	Rick White	T	The units of the Backoff Timer are not defined. In order for the backoff timer to work properly, the backoff timer should be integer multiplies of the slot time. This says that when the backoff timer expires, a STA will access the medium at the being of a slot time. In other words, the backoff timer should indicate the number of slot times to backoff. This must be resolved.	
5.2.5	Rick White	T	Must define the Random Function.	Not defined.
5.2.5	Rick White	T	Must define the Slot Time. Definition of Slot Time given is not correct. See diagram from Jan. 95 meeting.	Not defined.
5.2.5	Rick White	T	Must define the proper values for CWmin and CWmax.	Not defined. I don't think that 1 and 8 are the appropriate values.
5.2.5	Rick White	T	Must define the exponent of the exponential increase after each retransmission attempt.	Not defined.
5.2.5	Rick White	T	Must resolve the editor's comments related to retransmission.	
5.2.5	Tom T.	T	Replace everything after first paragraph with paraphrased text from ISO/IEC 8802-3:1993 Section 4.2.3.2.5 and modified equation described below. Backoff Time is an integer multiple of Slot time. Backoff Time = r * Slot Time The number of Slot times to delay before the nth retransmission attempt is chosen as a uniformly distributed random integer r given by: $r = R \bmod 2^{CWn}$ where: $CWn = \min((CWmin + n), Cwmax)$ $R = $ A uniformly ditributed random integer between 0 and 2^{CWmax} CWmax, CWmin are integers Algorithms used to generate the integer R should be designed to minimize the correlation between the numbers generated by any two stations at any given time. Slot Time = Transmitter turn-on delay + medium propagation delay + medium busy detect response time.	The equation shown in 5.2.5 indicates a multiplication of CW with Random(). Although the magniture of Random() was not defined, it must be large enough to spread deffering STAs into different slot times to avoid future collisions. The number of slots is strictly given by the magnitude of Random() therefore multiplying it by CW does not buy you any more randomization. The changes on the left allow for an exponentially increasing number of slots to be randomly selected for each re-transmission.
5.2.5 et seq	McKown	E	STA > station	sanity
5.2.5, figure 5D6	Fischer, Mike.	T	Add statement that the numbers in the vertical bars are exemplary, and the diagram does not specify a value for CWmax.	This matches the original intent of this drawing according to statements by the authors of the first document in which this drawing appeared.
5.2.5.	Geiger	E	Define CW prior to using it in the equation.	Clarity

5.2.5.	Fischerma:Random Backoff Time	T	adopt 802.3 proposed BLAM backoff method	BLAM approaches a solution to the problem of "network capture" which is due to the fact that the loser of a first-round collision backoff contest is increasingly likely to continue to be the loser in the subsequent retries because the loser is selecting from a larger and larger set of backoff values, while the new competition (in the form of a brand new frame from the winner) will start with a small CW because he is sending a brand new packet.
5.2.5.	Fischerma:Random Backoff Time	T	define acceptable distribution values for Random() function	Need some sort of definition in order to allow for conformance testing and to insure that network access fairness is maintained.
5.2.5. figure 5-6	Fischerma:Exponential Increase of CW	T	Contention window should be powers of two minus 1, i.e. instead of 1, 2, 4, 8..., values in diagram should increase as follows: 1, 3, 7, 15...	Implementation is more straightforward.
5.2.6	David Bagby	E	**8. -DCF Access Procedure**	See imbeded comments and annotations
5.2.6	Bob O'Hara	T	Last sentence must be corrected to reflect frame types in table 4-1.	Correct inconsistencies
5.2.6	C. Thomas Baumgartner	t	Change the first paragraph to "The SCMA/CA access method is the foundation of the 802.11 MAC. The operational rules vary slightly between Distributed Coordination Function and Point Coordination function."	Original paragraph is incorrect. CSMA/CA is in operation at all time in this protocol. During the contention free period the access to the medium is stil controlled by the same CA mechanisms.
5.2.6	Greg Ennis	T	replace "RTS" with "Beacon, RTS"	Beacons must defer
5.2.6	Rick White	T	¶ 2: Two cases - When media has been free for greater than or equal to DIFS plus CWmax and when it has not.	
5.2.6	Rick White	T	The list of frames defined for initial transmissions is not complete. A list must be generated defining all frame types that are initial transmission.	Completeness
5.2.6.1	Bob O'Hara	E	replace "of them indicate" with "function indicates"	Proper usage.
5.2.6.1	Bob O'Hara	T	This section must be corrected to reflect the frame types in table 4-1	Correct inconsistencies
5.2.6.1	Greg Ennis	T	paragraph 4 and 5: replace "Data" with "Beacon, Data"	Beacons must defer
5.2.6.1	Rick White	T	¶ 4: A STA will only attempt an initial transmission after the DIFS plus slot selected in contention window.	
5.2.6.1	Tom T.	T	Add following text to the end of the second paragraph: In an FH PHY the hop time interval shall be considered equivalent to "medium busy". Change third paragraph to read: A STA with a pending MPDU shall first determine the state of the medium as described above. If the medium is currently free and has been free for greater or equal to a DIFS time then the STA shall transmit immediately. This rule applies both when using the DCF access method exclusively and when using the PCF access method in the Contention Area.	The definition of Busy medium in this section is used in section 5.2.6.2 in the definition of the Backoff Procedure. If we don't freeze the Backoff Timer during the hop time then several STAs timer's can expire during the 224 µsec hop time interval, causing a collision at the start of the next dwell interval. Main objection was with word 'may' which I assume implies the STA could always use the Random Backoff Time algorithm. This makes it an option and I don't believe there should be options in the core of the MAC. (Also wording was a little ambiguous asto identifying this paragraph as one of the two choices described in section 5.2.6)