IEEE P802.11
Wireless LANs

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| Resolution for CID 7086 for D5.0 |
| Date: 2016-02-02 |
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Abstract

This submission proposes resolution for CID 7086.

Green indicates material agreed to in the group,

yellow material to be discussed, red material rejected by the group and

cyan material not to be overlooked.

The “Final” view should be selected in Word.

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| --- | --- | --- |
| Identifiers | Comment | Proposed change |
| CID 7086Graham Smith10.3.4.21289.48 | "There are conditions, specified in 10.3.4.3 (Backoff procedure for DCF) and 10.3.4.5 (Control of the channel), where the random backoff procedure shall be followed even for the first attempt to initiate a frame exchange sequence." This appears to indicate that the random back off for the first transmission is an exception rather than the rule. In fact the DCF clauses leave a lot to be desired, are difficult to follow and do not seem to stress the basic DCF Sequence. | The commenter will bring a contribution to 'clean up' and clarify DCF operation. |

Discussion:

**10.3.4.2 Basic Access**

P1289.40 “

In general, a STA **may transmit a pending MPDU** when it is operating under the DCF access method, either in the absence of a PC, or in the CP of the PCF access method, **when the STA determines that** t**he medium is idle for greater than or equal to a DIFS,** **or an EIFS** if the immediately preceding medium-busy event was caused by detection of a frame that was not received at this STA with a correct FCS value. **If**, under these conditions, **the medium is** **determined** by the CS mechanism **to be** **busy** when a STA becomes ready to initiate the initial frame of a frame exchange sequence (described in Annex G), exclusive of the CF period, **the random backoff procedure** described in 10.3.4.3 (Backoff procedure for DCF) **shall be followed**. ***There are conditions, specified in 10.3.4.3 (Backoff procedure for DCF) and 10.3.4.5 (Control of the channel), where the random backoff procedure shall be followed even for the first attempt to initiate a frame exchange sequence***.”

This last sentence appears to indicate that the random back off is an exception but we have read clearly that if the medium is busy it must backoff. **The backoff is initiated for a first attempt if the medium is busy**. Already stated, so this sentence adds nothing and possibly confuses. DELETE.

Also, it should be noted that ‘back-to-back” packets always have a backoff interval between them. (10.3.4.3). So one might question the “In general” statement at the beginning. If we want to refer to the two clauses, then there is a better way to do it rather than hint at some special cases. (See Resolution).

**Next I have a problem with the DIFS or EIFS criteria for “idle time”.** Clearly the medium has to be idle.

Waiting DIFS is straightforward. I have a packet to transmit, I check medium is free for DIFS, a set time period, no problem.

If the last packet the STA received had an FCS error, say x ms previously, and EIFS has expired, what does it wait? 0 us or DIFS or again EIFS, or the remaining bit of EIFS if not expired? I think it should wait DIFS if the EIFS has expired, and the remaining duration of EIFS if it has not expired and it is greater than DIFS.

Hence it should be the greater of DIFS or EIFS after the reception

**“**when the STA determines that the medium is idle for a period ofaDIFS, or an EIFS timed from the immediately preceding medium-busy event if caused by detection of a frame for which the PHY-RXEND.indication primitive contained an error or a frame for which the FCS value was not correct, whichever is the greater..

One could argue we do not need to spell out what EIFS is everythime as P1273.40 (10.3.2.3.7. EIFS) spells it out, so alternative might be: “when the STA determines that the medium is idle for a period of a DIFS, or an EIFS (see 10.3.2.3.7) from the end of the immediately preceding medium-busy event, whichever is the greater.”

P1288.13

**10.3.3 Random backoff time**

*“A STA desiring to initiate transfer of Data frames and/or MMPDUs using the DCF shall invoke the CS mechanism (see 10.3.2.1 (CS mechanism)) to determine the busy/idle state of the medium.* ***If the medium is busy****, the STA shall defer until the* ***medium is determined to be idle*** *without interruption for a* ***period of time equal to DIFS*** *when the last frame detected on the medium was received correctly, or after the medium is determined to be idle without interruption for a period of time equal to EIFS when the last frame detected on the medium was not received correctly. After this DIFS or EIFS medium idle time, the STA shall* ***then generate a random backoff*** *period (defined by Equation 10-1) for an additional deferral time before transmitting, unless the backoff timer already contains a nonzero value, in which case the selection of a random number is not needed and not performed.”*

The DIFS EIFS criteria is OK here because it is the ‘busy’ packet that is detected. So the STA waits for the end of packet then DIFS or EIFS. That’s clear.

P1290.30

**10.3.4.3 Backoff procedure for DCF**

 ***“A STA shall invoke the backoff procedure to transfer a frame when finding the medium busy as indicated by either the physical or virtual CS mechanism (see Figure 10-15 (Backoff procedure)). A transmitting STA shall invoke the backoff procedure when the STA infers a failed transmission as defined in 10.3.2.7 (CTS and DMG CTS procedure) or 10.3.2.9 (Ack procedure).”***

This states that only back off if the medium is busy or failed transmission. OK.

P1291.7 (still in 10.3.4.3)

“**A backoff procedure shall be performed immediately after the end of every transmission** with the More Fragments bit equal to 0 of an MPDU with the Type subfield equal to Data, Management, or Control with subtype PS-Poll, **even if no additional transmissions are currently queued**. In the case of successful acknowledged transmissions, this backoff procedure shall begin at the end of the received Ack frame.

……………..

The result of this procedure is that **transmitted frames from a STA are always separated by at least one backoff interval**.”

This states that **after having transmitted a packet**, the STA performs a backoff interval, so **clearly “back-to-back” packets are sent with at least one backoff interval between the packets**. (This is true because I measured this in order to detyermine the randomness of the CWmin selection). BUT also must do this even if another packet is not queued. STRANGE! It should be so much more straightforward.

So, if I get this right, the DCF rules seem to be.

(as per 10.3.3) when a frame is ready to be transmitted:

1. Sense if medium busy or free (invoke the CS mechanism)
2. If medium is free:
	1. Wait for the greater of
		1. DIFS
		2. EIFS after end of reception of a frame for which the FCS value was not correct
	2. If still free, transmit packet, then go to 4.
3. If medium busy or becomes busy
	1. Wait for medium to be free for period of DIFS or EIFS if reception of a frame for which the FCS value was not correct
	2. Back off Random (0, CWmin)
	3. Go to DCF count down procedure, 5
4. If packet succeeds or fails,
	1. Back off Random (0, CWmin)
	2. Start count down procedure, go to 5.

DCF Count down procedure (as per 10.3.4.3):

1. Sense if medium busy or free (invoke the CS mechanism)
2. If free:
	1. Count down Backoff Timer
3. If medium busy or becomes busy:
	1. Suspend count down
4. When medium becomes free, wait for DIFS or EIFS, then continue to count down Back off Timer
5. When Backoff Timer reaches 0,
	1. if packet in queue, transmit go to 10
	2. If no packet in queue go to beginning and wait for new packet.
6. If packet fails, i.e. no ACK within AckTimeout, then invoke back off procedure with double the CW).
7. If packet succeeds,
	1. Back off Random (0, CWmin)
	2. Start count down procedure.
8. When Backoff Timer reaches 0, ready for next packet to be transmitted, go to 1.

REALLY COMPLICATED. Was it always so? Maybe I will look at the original.

I wonder if anyone actually does this?? I suspect not. Also it is not what is desired. The backoff should be invoked for all transmissions, including the very first one, so as to minimize clashes. The extra time is negligible for the rare case of just isolated packets. **Here is what it should be** **(and is probably what most have implemented)**

Packet ready to transmit

1. Sense if medium busy or free (invoke the CS mechanism)
2. If medium is free:
	1. Wait for the greater of
		1. DIFS
		2. EIFS after end of reception of a frame for which the FCS value was not correct
	2. Go to 4
3. If medium busy or becomes busy
	1. Wait for medium to be free for period the greater of of DIFS or EIFS
4. Back off Random (0, CWmin)
	1. Go to DCF count down procedure, 5

DCF Count down procedure:

1. Sense if medium busy or free (invoke the CS mechanism)
2. If free:
	1. Count down Backoff Timer
3. If medium busy or becomes busy:
	1. Suspend count down
4. When medium becomes free, wait DIFS or EIFS, then continue to count down Back off Timer
5. When Backoff Timer reaches 0,
	1. transmit packet, go to beginning

Covers all timings except the very first initial packet only waiting DIFS. **If only...so much easier to express!!**

“In general, a STA may transmit a pending MPDU when it is operating under the DCF access method, either in the absence of a PC, or in the CP of the PCF access method, when the STA determines that the medium is idle for greater than or equal to a DIFS, or an EIFS if the immediately preceding medium-busy event was caused by detection of a frame that was not received at this STA with a correct FCS value. If, under these conditions, the medium is determined by the CS mechanism to be busy when a STA becomes ready to initiate the initial frame of a frame exchange sequence (described in Annex G), exclusive of the CF period, the random backoff procedure described in 10.3.4.3 (Backoff procedure for DCF) shall be followed. There are conditions, specified in 10.3.4.3 (Backoff procedure for DCF) and 10.3.4.5 (Control of the channel), where the random backoff procedure shall be followed even for the first attempt to initiate a frame exchange sequence.”

As follows:

“A STA may transmit a pending MPDU when it is operating under the DCF access method, either in the absence of a PC, or in the CP of the PCF access method, when the STA determines that the medium is idle when a frame is queued for transmission, and remains idle for a period of a DIFS, or an EIFS (10.3.2.3.7) from the end of the immediately preceding medium-busy event, whichever is the greater. If the medium is determined by the CS mechanism to be busy when a frame is queued for transmission or at any time during this DIFS or EIFS period, exclusive of the CF period, the random backoff procedure described in 10.3.4.3 (Backoff procedure for DCF) shall be followed.."

Original

“In general, a STA may transmit a pending MPDU when it is operating under the DCF access method, either in the absence of a PC, or in the CP of the PCF access method, when the STA determines that the medium is idle for greater than or equal to a DIFS, or an EIFS if the immediately preceding medium-busy event was caused by detection of a frame that was not received at this STA with a correct FCS value. If, under these conditions, the medium is determined by the CS mechanism to be busy when a STA becomes ready to initiate the initial frame of a frame exchange sequence (described in Annex G), exclusive of the CF period, the random backoff procedure described in 10.3.4.3 (Backoff procedure for DCF) shall be followed. There are conditions, specified in 10.3.4.3 (Backoff procedure for DCF) and 10.3.4.5 (Control of the channel), where the random backoff procedure shall be followed even for the first attempt to initiate a frame exchange sequence.”

Graham proposed:

“A STA may transmit a pending MPDU when it is operating under the DCF access method, either in the absence of a PC, or in the CP of the PCF access method, when the STA determines that the medium is idle when a frame is queued for transmission, and remains idle for a period of a DIFS, or an EIFS (10.3.2.3.7) from the end of the immediately preceding medium-busy event, whichever is the greater. If the medium is determined by the CS mechanism to be busy when a frame is queued for transmission or at any time during this DIFS or EIFS period, exclusive of the CF period, the random backoff procedure described in 10.3.4.3 (Backoff procedure for DCF) shall be followed."

Discussion resulted in

“A STA may transmit a pending MPDU when it is operating under the DCF access method, either in the absence of a PC, or in the CP of the PCF access method, when the STA determines that the medium is idle when a frame is queued for transmission, and remains idle for a period of a DIFS, or an EIFS (10.3.2.3.7) from the end of the immediately preceding medium-busy event, whichever is the greater and the backoff timer is zero. Otherwise the random backoff procedure described in 10.3.4.3 (Backoff procedure for DCF) shall be followed."

**Resolution**

REVISED

At P1289.40

Replace:

“In general, a STA may transmit a pending MPDU when it is operating under the DCF access method, either in the absence of a PC, or in the CP of the PCF access method, when the STA determines that the medium is idle for greater than or equal to a DIFS, or an EIFS if the immediately preceding medium-busy event was caused by detection of a frame that was not received at this STA with a correct FCS value. If, under these conditions, the medium is determined by the CS mechanism to be busy when a STA becomes ready to initiate the initial frame of a frame exchange sequence (described in Annex G), exclusive of the CF period, the random backoff procedure described in 10.3.4.3 (Backoff procedure for DCF) shall be followed. There are conditions, specified in 10.3.4.3 (Backoff procedure for DCF) and 10.3.4.5 (Control of the channel), where the random backoff procedure shall be followed even for the first attempt to initiate a frame exchange sequence.”

*With*

“A STA may transmit a pending MPDU when it is operating under the DCF access method, either in the absence of a PC, or in the CP of the PCF access method, when the STA determines that the medium is idle when a frame is queued for transmission, and remains idle for a period of a DIFS, or an EIFS (10.3.2.3.7) from the end of the immediately preceding medium-busy event, whichever is the greater and the backoff timer is zero. Otherwise the random backoff procedure described in 10.3.4.3 (Backoff procedure for DCF) shall be followed."