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**Increasing the reliability of
delivery of multicast frames in
an IBSS network
IEEE P802.11
Wireless Local Area Networks**

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ad-hoc

• proposed new mechanism

**» send multicast frames following PIFS idle time after
multicast ATIM transmission**

- if my ATIM collides, then it has collided with another ATIM (or possibly a beacon, see next paragraph), and the overlap is nearly completely coincident, so PIFS after my ATIM, the medium should be free and my multicast will successfully be delivered UNLESS the colliding ATIM was also announcing a multicast frame, in which case, both STA colliding will wait PIFS and the ATIM colliding STA will both collide their multicast transmissions as well
- a STA multicast ATIM might collide with a beacon - a beacon is longer than an ATIM, and therefore there would be continued carrier after completion of my ATIM transmission, but there should be 70% chance of detecting the continued beacon carrier, and after the drop in that carrier, I will count PIFS and send the multicast frame, so roughly 70% of the time, things should work out reasonably well (again, there could be another multicasting STA involved)

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motion

- **moved that the MAC committee adopt the text changes described within this presentation to change the multicast transmission mechanism in the ad-hoc case in order to effect more reliable delivery of multicast frames**

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PIFS

- **assuming adoption of 96/15, section 6.2.3.2. modified to include statement about PIFS use in multicast in ad-hoc case**
 - » **text of first sentence of first paragraph, section 6.2.3.2., as amended by 96/15:**
 - *The PCF Inter Frame Space shall be used by the PCF to gain priority access to the medium at the start of the Contention Free Period (CFP). PIFS is also used by an AP for the IFS that precedes all multicast transmissions which have the To_DS bit clear (including beacons, broadcast and multicast frames).*

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PIFS use note

» new text of first sentence of first paragraph, section 6.2.3.2., as amended by 96/16:

- The PCF Inter Frame Space shall be used by the PCF to gain priority access to the medium at the start of the Contention Free Period (CFP). *PIFS is also used by an AP for the IFS that precedes all multicast transmissions which have the To_DS bit clear (including beacons, broadcast and multicast frames), as well as by STA in an IBSS that transmit multicast frames following multicast ATIMs.*

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no Backoff req'd before m-cast

• section 6.2.4., after adoption of 96/15

» inserted paragraph from 96/15, old text:

- An exception to this procedure shall be followed for the case of transmission of multicast frames by an AP. In this case, the AP shall utilize both the physical and virtual carrier sense functions to determine the state of the medium. If the medium is busy, the AP shall defer until after a PIFS is detected, and then, without generating a random backoff period, shall immediately commence transmission of the multicast frame. This technique shall be applied to the transmission of all multicast frames, including the Beacon frame.

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no backoff before m-cast

» **new text:**

- An exception to this procedure shall be followed for the case of transmission of multicast frames *with the To_DS bit clear*. In this case, the STA shall utilize both the physical and virtual carrier sense functions to determine the state of the medium. If the medium is busy, the STA shall defer until after a PIFS is detected, and then, without generating a random backoff period, shall immediately commence transmission of the multicast frame. This technique shall be applied to the transmission of all multicast frames, including the Beacon frame. *Note that in the IBSS case, the STA shall transmit a multicast ATIM before the transmission of the multicast DATA frame commences as described in detail in section 8.*

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Backoff

• **section 6.2.5.2., after adoption of 96/15**

» **first paragraph, 96/15 text:**

- The backoff procedure shall be followed whenever a STA desires to transfer an MPDU and finds the medium busy as indicated by either the physical or virtual carrier sense mechanism (Figure 41), *except when the next MSDU to be transmitted is a multicast frame with the To_DS bit clear, and the transmitting station is an AP.*

» **new text:**

- The backoff procedure shall be followed whenever a STA desires to transfer an MPDU and finds the medium busy as indicated by either the physical or virtual carrier sense mechanism (Figure 41), *except when the next MSDU to be transmitted is a multicast frame with the To_DS bit clear, but NOT a multicast ATIM, which does use the special backoff described in section 8.*

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backoff

- » **2nd from last paragraph in 6.2.5.2., as per 96/15:**
 - A station that has just transmitted an MSDU and has another MSDU ready to transmit (queued), shall perform the backoff procedure, *except when the next MSDU to be transmitted is a multicast frame with the To_DS bit clear, and the transmitting station is an AP.* This requirement is intended to produce a level of fairness of access amongst STA to the medium.
- » **2nd from last paragraph in 6.2.5.2., as per 96/15:**
 - A station that has just transmitted an MSDU and has another MSDU ready to transmit (queued), shall perform the backoff procedure, *except when the next MSDU to be transmitted is a multicast frame with the To_DS bit clear, but NOT a multicast ATIM, which does use the special backoff described in section 8.* This requirement is intended to produce a level of fairness of access amongst STA to the medium.

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blanket rule on backoff after TX

- **section 6.2.5.5., another textual instance of backoff that needs an exception for multicast**
 - » **at very end of section we find the following text:**
 - When an MSDU has been successfully delivered, and the station has a subsequent MSDU to transmit, then it shall go through a backoff.
 - » **replace the above paragraph with the following paragraph:**
 - When an MSDU has been successfully delivered, and the station has a subsequent MSDU to transmit, then it shall go through a backoff, *except when the next MSDU to be transmitted is a multicast frame, and the transmitting station is an AP.*

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change to PIFS

- **assuming adoption of 96/15 section 6.2.7. first paragraph needs to be modified**
 - » **1st paragraph as found in 96/15:**
 - When Broadcast or Multicast MPDUs are transferred from a STA that is not the AP and that is not associated with an infrastructure BSS, (the To_DS bit shall be clear), only the basic access mechanism shall be used. Regardless of the length of the frame, no RTS/CTS exchange shall be used. In addition, no ACK shall be transmitted by any of the recipients of the frame.

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change to PIFS

- » **1st new paragraph, case of ad-hoc multicast, uses modified mechanism for multicast:**
 - When Broadcast or Multicast MPDUs are transferred from a STA that is not the AP and that is not associated with an infrastructure BSS, (the To_DS bit shall be clear), then multicast frames shall be announced with a multicast ATIM and the multicast frame shall be transmitted following PIFS medium idle time following the completion of the transmission of the multicast ATIM. No backoff shall be invoked during this frame sequence. Regardless of the length of the frame, no RTS/CTS exchange shall be used. In addition, no ACK shall be transmitted by any of the recipients of the frame.

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text changes

• section 8.2.2.1.

» 1st paragraph, 1st sentence, old text:

- The basic approach is similar to the infrastructure case in that the stations are synchronized, and MSDUs which are to be transmitted to a power conserving station are first announced during a period when all stations are awake.

» 1st sentence, new text:

- The basic approach is similar to the infrastructure case in that the stations are synchronized, and *multicast MSDUs* and MSDUs which are to be transmitted to a power conserving station are first announced during a period when all stations are awake.

» 3rd sentence, old text:

- A power conserving station listens for these announcements to determine if its receiver must be left on.

» 3rd sentence, new text:

- A *STA in the power save mode* listens for these announcements to determine if *the STA shall remain in the awake state*.

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8.2.2.1.

» second paragraph, old text:

- When a MSDU is to be transmitted to a destination station that is in a Power Save (PS) mode, the transmitting station first transmits an ATIM frame during the ATIM Window, in which all the stations including those operating in a Power Save (PS) mode are awake. The ATIM Window is defined as a specific period of time following a beacon during which only ATIM frames can be transmitted. ATIMs are randomized after the beacon using the backoff procedure. ATIMs are acknowledged. If a station receives an ATIM frame during the ATIM Window, it will acknowledge the ATIM and stay awake for the entire Beacon Interval waiting for the announced MSDU(s) to be received. If a Station does not receive an ATIM, it can go back to PS Mode after the end of the ATIM Window. MSDUs announced by ATIMs are randomized after the ATIM Window using the backoff procedure. If a station transmitting the ATIM does not receive an acknowledgment, the station will execute the backoff procedure for retransmission of the ATIM.

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8.2.2.1.

» **second paragraph, to be replaced with the following three paragraphs:**

- When an MSDU is to be transmitted to a destination station that is in a Power Save (PS) mode, the transmitting station first transmits an ATIM during the ATIM Window, in which all the stations including those operating in a Power Save (PS) mode are awake. The ATIM Window is defined as *aATIM_Window* time following a *TBTT*. During the ATIM window, only beacons, ATIMs and multicast frames shall be transmitted. ATIM transmission times are randomized by the transmitting STA after a beacon is either transmitted or received at that STA. ATIM transmission randomization is performed using the backoff procedure with *CWmax* value. *Directed* ATIMs are acknowledged. *Multicast ATIMs* are not acknowledged. If a STA transmitting a *directed* ATIM does not receive an acknowledgment, the STA will execute the backoff procedure for retransmission of the ATIM.

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8.2.2.1.

- If a STA receives a *directed* ATIM frame during the ATIM Window, it shall acknowledge the *directed* ATIM following an SIFS interval shall and stay awake for the entire Beacon Interval waiting for the announced MSDU(s) to be received. If a STA does not receive a *directed* ATIM, the STA shall go back to the *doze state* after the end of the ATIM Window and a medium idle condition have both been detected. *Directed* MSDUs announced by *directed* ATIMs are randomized after the ATIM Window using the *normal* backoff procedure.
- *Multicast frames* are transmitted following *PIFS* idle medium time that begins with the completion of the transmission of a *multicast* ATIM.

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8.2.2.1.

- **4th paragraph:**

- » **existing text:**

- **An ATIM will have a destination address of broadcast/multicast for broadcast/multicast MSDUs. All stations will remain awake if they receive an ATIM with a broadcast/multicast destination address.**

- » **new text:**

- ***An ATIM will have a destination address of broadcast/multicast for broadcast/multicast MSDUs.***

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global change to 8.2.1.4.-7.

- **Change references to Power Management bits to Power Management Bit, or More Data bit, as appropriate in order to conform to new bit names in section 4**

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