IEEE P802.11
Wireless LANs

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| DMG Power Save CIDs 8329, 8334 |
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Abstract

Proposed resolution to CIDs 8329, 8334.

All changes are relative to Draft P802.11REVmc\_D6.0.

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| --- | --- | --- | --- | --- | --- | --- |
| Torab, Payam | 8329 | 654.52 | 9.4.1.4 | Triggered Unscheduled PS is unnecessary and has limited applicability; a DMG STA can always set PM to 0, retrieve data and set PM to 1 back at the end of an exchange with a PCP or AP; setting PM back to 1 often comes without overhead cost because of traffic availability in both directions, and in general when a STA is in PS mode and occasionally fetches a few BUs spending a transaction to go back to PM=1 is not a factor anyway. The STA may or may not choose to use RD in the process (and if using RD it has explicit control over the retrieval process using the Buffered AC information in QoS Control field), but there is no reason to introduce a new named capability ("Triggered Unscheduled PS") for a behavior that is already supported by the standard. Also behavior may need to be made different for PBSS and infrastructure BSS given the power difference between PCP and AP. | Text will be provided to undo the damage by CID 7165, along the lines of removing capability, removing dependency on RD, but keeping the "Buffered AC" addition to the QoS Control field; different behavior for PBSS and infrastructure BSS may be needed. | MAC |

*Discussion*

*Triggered Unscheduled PS, introduced through CID 7165 on Draft 5.0 (DCN 802.11-16/0580r4), provides a mechanism for STA to retrieve BUs from an AP or PCP through the Reverse Direction (RD) mechanism. Document -0580- introduced three components,*

1. *Indicating buffered ACs in QoS Control field bits 10-13*
2. *Allowing CF-End to be transmitted by a STA while in unscheduled power save mode*
3. *Defining a capability to retrieve BUs through the reverse direction (RD) protocol*

*We propose to remove the third component as it is covered by existing mechanisms before this addition, in a general and a flexible way, and independent of exercising the RD protocol or the BSS type. Refer to Figure A through Figure D below.*

*In addition, PBSS power save mechanisms are defined with as much symmetry as possible for PCP and non-PCP STAs, as PCP STAs do not have a power advantage. Minor extensions below ensure the first and second components above are also applicable to PCP.*

RTS

CTS

QoS Null

RDG=1

AC=VO

PM=1

ACK

MPDUs

AC\_VO

BUs for AC\_VO

BA

CF-End

RTS

CTS

QoS Null

RDG=1

AC=VO

PM=0

(leaving PS)

ACK

MPDUs

AC\_VO

BUs for AC\_VO

BA

CF-End

QoS Null

RDG=0

PM=1

(going back to PS)

ACK

PM=1

RTS

CTS

QoS Null

RDG=1

AC=VO

PM=0

ACK

MPDUs

AC\_VO

BUs for AC\_VO

ACK/ BA

CF-End

Data

RDG=0

PM=1

ACK/ BA

PM=1

RTS

CTS

Data

RDG=1

AC=VO

PM=0

ACK/ BA

MPDUs

AC\_VO

BUs for AC\_VO

ACK/ BA

CF-End

Data

RDG=0

PM=1

ACK/ BA

PM=1

“Triggered Unscheduled PS” as defined in

11-16-0580-04-000m-dmg-cid-7165.docx

Examples of many flexible ways the STA can retrieve BUs without a new “capability”, using RD, not using RD, with traffic in one direction, with traffic in both directions, leaving PS after TXOP, staying in PS after TXOP

TXOP

*Text changes (mostly remove some of the additions to Draft 6.0 through Document 802.11-16/0580)*

**9.2.4.5.16 Buffered AC subfield**

The Buffered AC subfield is a 4-bit bitmap that indicates buffered traffic for four ACs as defined in Figure 9-7 (Buffered AC subfield). At least one BU for the indicated AC is buffered if the related subfield is set to 1. The Buffered AC subfield is reserved except in QoS Data frames and QoS Null frames. A non-AP and non-PCP STA can use information contained in the Buffered AC subfield to determine the ACs for which BU are buffered for it.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B10 | B11 | B12 | B13 |
|  | BU for AC\_VO | BU for AC\_VI | BU for AC\_BE | BC for AC\_BK |
| Bits: | 1 | 1 | 1 | 1 |

**Figure 9-7—Buffered AC subfield**

**9.4.1.4 Capability Information field**

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|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0 B7 | B8 |  | B9 B11 | B12 | B13 B15 |
|  | DMG Parameters | Spectrum Management |  | Reserved | Radio Measurement | Reserved  |
| Bits: | 8 | 1 |  | 2 | 1 | 3 |
| * Capability Information field (DMG STA)(#7165)(11ad)
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**11.2.6.2.2 Non-AP and non-PCP STA operation without a wakeup schedule**

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A non-AP and non-PCP STA in doze state shall limit the frames it transmits to the following:

— A Management, Extension or Data frame that triggers an Ack or a BlockAck frame from the AP or PCP, with the Power Management subfield in the Frame Control field of the frame set to 0, i.e., a frame to indicate the STA intent to transition out of unscheduled PS mode.

— An RTS, DMG CTS-to-self, CF-End, Grant, SSW or SSW-Feedback frame.

**11.2.6.3.2 PCP operation without a wakeup schedule**

A PCP in doze state shall limit the frames it transmits to the following:

— A Management, Extension or Data frame that triggers an Ack or a BlockAck frame from a non-AP and non-PCP STA, with the Power Management subfield in the Frame Control field of the frame set to 0, i.e., a frame to indicate the PCP intent to transition out of unscheduled PS mode.

— An RTS, DMG CTS-to-self, CF-End, Grant, SSW or SSW-Feedback frame.

**11.2.6.2.2 Non-AP and non-PCP STA operation without a wakeup schedule**

To change its power state without a wakeup schedule, a non-AP and non-PCP STA shall inform the AP or PCP by completing a successful frame exchange that is initiated by the STA and that includes a Management frame, Extension frame or Data frame, and also an Ack or a BlockAck frame from the AP or PCP.

**11.2.6.3.2 PCP operation without a wakeup schedule**

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Alternatively, to change its power state without a wakeup schedule, the PCP shall inform all associated STAs by completing a successful frame exchange that is initiated by the PCP and that includes a Management frame, Extension frame or Data frame, and also an Ack or a BlockAck frame from the associated STA. The Power Management subfield(s) in the Frame Control field of the frame(s) sent by the PCP in this exchange that contain a BU or are QoS Null frame indicate the power state that the PCP shall adopt upon successful completion of the entire frame exchange. The PCP shall not change its power state using a frame exchange that does not receive an Ack or BlockAck frame from the associated STA, or using a BlockAckReq frame.

**11.2.6.4 ATIM frame usage for power management of non-AP STAs**

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| Torab, Payam | 8334 | 1615.48 | 11.2.6.4 | It is not clear that ATIM frames can be sent in one TXOP to multiple STAs. | Text will be provided to clarify that channel access between ATIM frame transmissions is not necessary. | MAC |

*Discussion*

*Add to the IBSS NOTE.*

**11.2.7 ATIM frame and frame transmission in an IBSS, DMG infrastructure BSS and PBSS**

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NOTE—The choice between individually addressed and group addressed transmissions, the peer STAs addressed for individually addressed transmissions, the number of group addressed transmissions, and also how often to exercise channel access in between successive ATIM transmissions in an awake or ATIM window are implementation choices outside the scope of the standard. A STA might base its choices on factors such as the number of peer STAs it is aware of, the expected traffic from each of these peer STAs, and the reliability of frame exchanges with these peer STAs.