IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DMG Power Save CIDs 8329, 8334 | | | | |
| Date: 2016-07-26 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Payam Torab | Broadcom Ltd. |  |  | payam.torab@broadcom.com |
| Carlos Cordeiro | Intel |  |  | carlos.ordeiro@intel.com |
| Solomon Trainin | Intel |  |  | Solomon.tainin@intel.com |

Abstract

Proposed resolution to CIDs 8329, 8334.

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

Revision History

R0: Initial version

R1: Corrections to Figure on page 3, last revision before presentation

R2: Edits after presentation; keep Triggered Unscheduled PS (8329); keep edits to make the feature available to all STA roles.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 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*

*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.*

***R2 update:*** *Per 9.2.4.1.7, “The Power Management subfield is 1 bit in length and is used to indicate the power management mode of a STA. The value of this subfield is either reserved (as defined below) or remains constant in each frame from a particular STA within a frame exchange sequence (see Annex G). The value indicates the mode of the STA after the successful completion of the frame exchange sequence.” and 802.11 group believes Triggered Unscheduled PS is indeed a new function and should be kept in place.*

*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**

...

A DMG STA sets the Triggered Unscheduled PS subfield to 1 within the Capability Information field when the AP or PCP transmits a Capability Information field in which the Reverse Direction subfield is equal to 1 and is capable of delivering a BU as an RD responder on receipt of a PPDU containing an RDG MPDU with the Power Management subfield set to 1 and sets it to 0 otherwise.

...

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

...

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.

— A Management, Extension or Data frame that triggers an Ack or a BlockAck frame from the AP or PCP, plus Ack and Block Ack frames that respond to the frames sent by the AP or PCP during the reverse direction grant, if the following conditions apply:

— the Power Management subfield in the Frame Control field of a frame sent by the non-AP and non-PCP STA is set to 1

— the AP or PCP has transmitted a Capability Information field in which the Triggered Unscheduled PS subfield is equal to 1

—

— 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.

— A Management, Extension or Data frame that triggers an Ack or a BlockAck frame from a non-AP and non-PCP STA, plus Ack and Block Ack frames that respond to the frames sent by the non-AP and non-PCP STA during the reverse direction grant, if the following conditions apply:

— the Power Management subfield in the Frame Control field of a frame sent by the PCP is set to 1

— the non-AP and non-PCP STA has transmitted a Capability Information field in which the Triggered Unscheduled PS subfield is equal to 1

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 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**

...

NOTE—The number of individually addressed transmissions and group addressed transmissions, the peer STAs addressed for individually addressed transmissions and 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.