IEEE P802.11
Wireless LANs

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |
| --- |
| Doze End Time Signaling |
| Date: 2018-10-18 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Matthew Fischer | Broadcom |  |  | Matthew.fischer@broadcom.com |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

 |

Abstract

Proposed language to create a mechanism to signal Doze End Time to be transmitted to a STA using the A-control field.

Changes are referenced to TGax D3.3.

**REVISION NOTES:**

**R0**:

initial

**R1**:

Change resolution of Maximum RX PPDU Duration field from 500 us to 512 us

10.14 PPDU duration constraint – see next change

27.5.3.2.3 Allowed settings of the Trigger frame fields and TRS Control subfield – the Maximum RX PPDU Duration language is moved out of this location and into 10.14 PPDU duration constraint – it was in the wrong place and the wording of the AP behaviour is corrected so that it applies to all transmissions to the STA

9.2.4.6a.7a - Change maximum doze duration resolution from 250 us to 256 us

Update doc references

**R2**:

9.2.4.6a.7a – added text to indicate that Minimum PSDU Allocation value of 0 = no constraint on the minimum allocation size

9.2.4.6a.7a – modified Maximum PSDU Allocation value and field encoding to include a scaling factor

11.2.3.19a – added text to indicate that a STA in doze can exit doze before the end of the doze duration and the remaining doze duration is cancelled

27.5.3.3 – add restriction that minimum PSDU has to be less than maximum PSDU allocation

Update doc references

**R3**:

9.2.4.6a.7a – change “will transition to doze state” to “might transition to doze state”

11.2.3.6 – change Doze Transition subfield to Maximum RX PPDU Duration subfield, added “immediacy” of transition to doze

11.2.3.7 – change DTS to DET and change doze transition to maximum RX PPDU duration

11.2.3.12 – remove the first change as the STA is not allowed to transition to doze while waiting for the response

11.2.3.12 – move the second change to appear in a different paragraph, which discusses the TDLS peer PSM service period and its termination

Update doc references

**R4**:

Update to D3.3

Update doc references

**R5**:

Removed RX Maximum DDSU signaling – control field now only signals DOZE end time

Update doc references

**R6**:

Change meaning of Doze End Time value 0 from signalling transition to Awake state to indefinite Doze End Time

Added text to state that any existing signalling that indicates a transition to Awake state cancels any remaining Doze time that was signalled using the Doze End Time field

Update doc references

**END OF REVISION NOTES**

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGax Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGax Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGax Editor: Editing instructions preceded by “TGax Editor” are instructions to the TGax editor to modify existing material in the TGax draft. As a result of adopting the changes, the TGax editor will execute the instructions rather than copy them to the TGax Draft.***

**CIDs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 15757 | Jarkko Knecht | 27.7.4 | 326.20 | The TWT Information frame is a management frame which handling/reception/parsing the content in the receiving STA takes time. A STA may transmit a TWT Information frame to teminate an ongoing TWT SP. For the receiving device the processing time of the TWT Information frame may be too long for immediate TWT SP termination. The immediate SP termination would be better to do through EOSP or more data bits which handling time is much shorter. | Please change that EOSP (or PM) bit controls the termination of the currently ongoing TWT SP and the TWT Information frame controls the future TWT SPs, i.e. whether the STA be available at future TWT SP. Please allow a STA to terminate the ongoing SP without a transmission of the TWT Information frame. | Revise - TGax editor to make changes as shown in 11-18/1821r6 that are marked with CID 15757 which create a mechanism to signal a transition to doze state. TWT information behavior is unaltered, and still may be used in the original context as another method for TWT SP termination in addition to the requested use of indicating suspend and resume. |

**Discussion:**

Several features within the TGax draft and the baseline 802.11 standard use mechanisms which incorporate some aspect of time scheduling. For example, OFDMA operation, TWT, Power Save and others, either include by definition or are often deployed with some periodic time behaviour in their operation. Additional functions beyond 802.11 but that affect the operation of an 802.11 STA frequently also incorporate schedule-like behaviour. Examples of such functions include those that are defined to operate on an 802.11 STA and functions that are operating within non-802.11 devices, but operate within the same channels as 802.11 STAs. As these many functions operate, they can create windows of time during which the ability of an 802.11 STA to perform 802.11 frame exchanges is reduced, impaired or impossible. Given that there are various features competing for the use of each of the possible time slots of operation for a given 802.11 STA, it is useful to have some ability within 802.11 to signal the existence of known timing constraints among devices so that common periods of operation can be identified and any periods where communication is impaired or impossible can be avoided.

In order to accommodate this desire, this document inclues a set of proposed changes to TGax D3.2 which create a new mechanism for signaling a constraint on the duration of a PPDU that may be transmitted to the constrained STA and to signal a duration of a doze state. The new signaling is included in the A-control field.

In addition, a receiving STA might have constraints on UL and DL transmissions and the proposal includes a mechanism for the STA to express those constraints while adding *recommendations* for an AP to obey those constraints.

**Proposed Changes to TGax D3.3:**

***TGax editor: within TGax D3.3, add the following new definition in the appropriate location within 3.2 Definitions specific to IEEE 802.11:***

**3.2 Definitions specific to IEEE 802.11**

**Doze End Time (DET) STA**: A STA with dot11DozeEndTimeSignalingActivated equal to true that is associated with an AP from which it has received an Extended Capability element that indicates support for Doze End Time signaling. **(#15757)**

***TGax editor: within TGax D3.3, add the following new abbreviation in the appropriate location within 3.4 Abbreviations and acronyms:***

**3.4 Abbreviations and acronyms**

DET Doze End Time **(#15757)**

**9.4.2.26 Extended Capabilities element**

***TGax editor: within TGax D3.3, add another row to Table 9-154 – Extended Capabilities field as shown:***

**Table 9-154—Extended Capabilities field**

|  |  |  |
| --- | --- | --- |
| **Bit** | **Information** | **Notes** |
| 77 | TWT Requester Support | A STA sets the TWT Requester Support field to 1 when dot11TWTOptionActivated is true, dot11HEOptionImplemented is true and TWT requester functionality is supported. Otherwise, the STA sets the TWT Requester Support field to 0. See 10.43 (Target wake time (TWT)). |
| 78 | TWT Responder Support | A STA sets the TWT Responder Support field to 1 when dot11TWTOptionActivated is true, dot11HEOptionImplemented is true and TWT responder functionality is supported. Otherwise, the STA sets the TWT Responder Support field to 0. See 10.43 (Target wake time (TWT)). |
| 79 | OBSS Narrow Bandwidth RU In OFDMA Tolerance Support | An AP STA sets the OBSS Narrow Bandwidth RU In OFDMA Toler-ance Support field to 1 if dot11OBSSNarrowBWRUinOFDMAToler-ated is true, and sets it to 0 otherwise.A non-AP STA sets the OBSS Narrow Bandwidth RU In OFDMA Tolerance Support field to 0. |
| <ANA> | Enhanced Multi- BSSID Adver-tisement Support | This field is reserved for a non-AP STA or when the AP has dot11Mul-tiBSSIDActivated set to false.Set to 1 to indicate that the AP supports enhancements related to dis-covery and advertisement of nontransmitted BSSIDs.Set to 0, other-wise. Also see 11.1.3.8 (Multiple BSSID procedure).(#15056) |
| <ANA> | Doze End Time Support | A STA sets the Doze End Time Support field to 1 when dot11DozeEndTimeSignalingActivated is true and dot11HEOptionImplemented is true and sets it to 0 otherwise. **(#15757)** |

**9.2.4.6.3a HE variant**

***TGax editor: within TGax D3.3, add another row to Table 9-22a – Control ID subfield values, and modify the reserved value, as shown:***

**Table 9-22a—Control ID subfield values**

|  |  |  |  |
| --- | --- | --- | --- |
| **Control ID Value** | **Meaning** | **Length of the Control Information subfield (bits)** | **Content of the Control Information subfield** |
| 0 | Triggered response scheduling (TRS) | 26 | See 9.2.4.6a.1 (TRS Control) |
| 1 | Operating mode (OM) | 12 | See 9.2.4.6a.2 (OM Control) |
| 2 | HE link adaptation (HLA) | 26 | See 9.2.4.6a.3 (HLA Control) |
| 3 | Buffer status report (BSR) | 26 | See 9.2.4.6a.4 (BSR Control) |
| 4 | UL power headroom (UPH) | 8 | See 9.2.4.6a.5 (UPH Control) |
| 5 | Bandwidth query report (BQR) | 10 | See 9.2.4.6a.6 (BQR Control) |
| 6 | Command and status (CAS) | 8 | See 9.2.4.6a.7 (CAS Control) |
| 7 | Doze End Time (DET) **(#15757)** | 26 | See 9.2.4.6a.7a (DET Control) |
| 8-15 | Reserved |  |  |

***TGax editor: within TGax D3.3, insert the following new subclause:***

**9.2.4.6a.7a DET Control** **(#15757)**

If the Control ID subfield in a Control subfield of an A-Control subfield is 7, then the Control Information subfield of the Control subfield is defined as shown in Figure 9-15jk (Control Information subfield for DET Control).

|  |  |
| --- | --- |
|  | B0 B25 |
|  | Doze End Time  |
| Bits: | 26 |

**Figure 9-15jk—Control Information subfield for DET Control**

The Doze End Time is an unsigned integer that indicates the value that the 26 LSbits of the TSF will have when the transmitting STA will transition from the Doze state to the Awake state or will transition from being unavailable to being available, except that the value of 0 indicates that the transmitting STA will remain in the Doze state or will be unavailable indefinitely. **(#15757)**

***TGax editor: within TGax D3.3, modify the following text:***

**11.2.3.5.1 Power management with APSD procedures**

When the GCR-A delivery method is used, the scheduled Service Interval field is 0. If a STA has a GCR agreement with an AP for a group address using the GCR-A delivery method, there is no defined end of the scheduled SP. The STA in PS mode shall enter the awake state and shall remain awake in order to receive the buffered group addressed BUs until the AP changes the delivery method of the stream to a method other than GCR-A or until the GCR agreement is canceled or until the STA receives an acknowledgement for an MPDU containing a Doze End Time subfield. **(#15757)**

**11.2.3.6 AP operation**

***TGax editor: within TGax D3.3, add the following text to the itemized list as item m):***

m) If an MPDU that contains a Doze End Time subfield is received from a STA then immediately after acknowledgement of the receipt of the MPDU, the AP shall assume that the STA has transitioned to the doze state, or immediately after the receipt of the frame if no acknodgement is required and shall cease delivery of any frames to the STA **(#15757)**

**11.2.3.7 Receive operation for STAs in PS mode**

***TGax editor: within TGax D3.3, add the following text at the end of the subclause:***

A DET STA may include an HE variant HT Control field containing the DET Control subfield to signal a transition to the doze state as described in 11.2.3.19a Doze End Time Signaling. **(#15757)**

**11.2.3.8 Receive operation using APSD**

***TGax editor: within TGax D3.3, modify the text as shown:***

c) The STA shall remain awake until it receives a QoS Data frame or QoS Null frame addressed to it, with the EOSP subfield equal to 1 or until it receives an acknowledgement to the transmission of a Doze End Time subfield. **(#15757)**

**11.2.3.12 TDLS peer power save mode**

***TGax editor: within TGax D3.3, modify the text as shown:***

A TDLS peer PSM service period is a period of time during which one or more individually addressed frames are transmitted between two TDLS peer STAs when at least one STA employs TDLS peer PSM. A TDLS peer PSM service period may be initiated during an Awake Window. A TDLS peer STA in power save mode may enter a doze state when it has successfully transmitted to and received from the corresponding TDLS peer STA in power save mode a QoS frame with the EOSP subfield equal to 1 or when it receives an acknowledgement to the transmission of a Doze End Time subfield, ending the TDLS peer PSM service period. A TDLS peer STA in power save mode may enter a doze state when it has successfully received from the corresponding TDLS peer STA in active mode a QoS frame with the EOSP subfield equal to 1. **(#15757)**

***TGax editor: within TGax D3.3, insert the following editing instruction and new subclause:***

***Insert a new subclause at the end of 11.2.3.19:***

**11.2.3.19a Doze End Time Signaling** **(#15757)**

An HE STA with dot11DozeEndTimeSignalingActivated equal to true supports Doze End Time signaling using the A-Control subfield and shall set the Doze End Time Signaling Support subfield to 1 in transmitted Extended Capability elements and is called a DET STA.

A DET STA may transmit DET Control subfields in frames that it transmits to any STA from which it has received an Extended Capability element with the value 1 in the Doze End Time Signaling Support subfield.

A DET STA shall not transmit DET Control subfields in frames that it transmits to any STA from which it has not received an Extended Capability element with the value 1 in the Doze End Time Signaling Support subfield.

A DET STA that transmits a Doze End Time subfield of a DET Control field may transition to doze state or may become unavailable immediately following the receipt of the acknowledgement of the frame that contained the DET Control field and may remain in the doze state or be unavailable until the 26 LSbits of the TSF are equal to the value indicated in the Doze End Time subfield of the same frame when the Doze End time subfield is not set to 0. A DET STA that transmits a frame with the Doze End Time subfield of the DET Control field set to 0 may become unavailable immediately following the receipt of the acknowledgement of the frame that contained the DET Control field and may remain in the doze state or be unavailable indefinitely.

A STA with dot11DozeEndTimeSignalingActivated equal to true that receives a frame containing a Doze End Time subfield with a value that is not equal to 0 shall assume that the transmitting STA is in the doze state or unavailable until the 26 LSbits of the TSF are equal to the value indicated in the Doze End Time subfield of the same frame unless the transmitting STA explicitly indicates earlier than that time that it is in the awake state or available in which case, the previously indicated Doze End Time is cancelled. A STA with dot11DozeEndTimeSignalingActivated equal to true that receives a frame containing a Doze End Time subfield with a value that is equal to 0 shall assume that the transmitting STA is in the doze state or unavailable until the transmitting STA explicitly indicates that it is in the awake state or available. A STA with dot11DozeEndTimeSignalingActivated equal to true shall only use information from the most recently received DET Control field from a STA.

If a STA explicitly indicates a transition to the awake state (see 11.2 (Power management)) any previously signaled Doze End Time value is cancelled. **(#15757)**

**11.2.4.4 STA power state transitions**

***TGax editor: within TGax D3.3, modify the text as shown:***

c) If a STA receives at least one individually addressed ATIM frame containing the STA’s individual address in the RA field during the ATIM window then the STA shall remain in the awake state at least until the earlier of the completion of the successful transmission to and reception from the source STA of each received ATIM frame, a frame with the EOSP subfield equal to 1, the receipt of an acknowledgement to the transmission of a Doze End Time subfield, and the end of the next ATIM window. **(#15757)**

**27.8.5 Power save operation during TWT SPs**

***TGax editor: within TGax D3.3, in subclause 27.8.5 Power save operation during TWT SPs, modify the text as shown:***

A TWT requesting STA or a TWT scheduled STA shall classify any of the following events as a TWT SP termination event:

1) The successful exchange of a TWT Information frame with the TWT responding STA or the TWT scheduling AP (see 27.8.4 (Use of TWT Information frames)).

2) The transmission by the TWT requesting STA or TWT scheduled STA of an acknowledgment in response to an individually addressed QoS Data or QoS Null frame sent by the TWT responding STA or TWT scheduling AP, respectively, that had the EOSP subfield equal to 1.

3) The transmission by the TWT requesting STA or TWT scheduled STA of an acknowledgment in response to an individually addressed frame that is neither a QoS Data frame nor a QoS Null frame, sent by the TWT responding STA or TWT scheduling AP, respectively, with the More Data field equal to 0.

4) The reception of an individually addressed or broadcast QoS Data or QoS Null frame sent by the TWT responding STA or TWT scheduling AP, that does not solicit an immediate response and with the EOSP subfield equal to 1.

5) The reception of an individually addressed frame that is neither a QoS Data frame nor a QoS Null frame, sent by the TWT responding STA or TWT scheduling AP, that does not solicit an immediate response and with the More Data field equal to 0.

6) The reception of a Trigger frame sent by the TWT responding STA or TWT scheduling AP that has the More TF field equal to 0 and is not addressed to the TWT requesting STA or TWT scheduled STA provided that the TWT requesting STA or TWT scheduled STA is either awake for an announced trigger-enabled TWT SP but did not transmit an indication that it is in the awake state to the TWT responding STA or TWT scheduling AP or is awake for an unannounced trigger-enabled TWT SP.

7) The reception of an acknowledgement from the TWT scheduling STA or the TWT responding STA of the reception of a frame transmitted by the TWT scheduled STA or the TWT requesting STA, respectively, that contains a DET Control field with a Doze End Time. **(#15757)**

**TGax Editor: *Add a new MIB variable in C.3 MIB Detail within the dot11StationConfigEntry group as shown:***

**C.3 MIB Detail**

dot11DozeEndTimeSignalingActivated OBJECT-TYPE **(#15757)**

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable. Its value is determined by device capabilities.

This attribute, when true, indicates that the STA implementation is capable of signaling the end time of a doze state or end time of a period of unavailability that the STA enters and is capable of interpreting the signalled end time of a doze state or period of unavailability. The capability is disabled, otherwise."

DEFVAL { false }

::= { dot11StationConfigEntry <XX>}

**End of proposed changes.**