IEEE P802.11
Wireless LANs

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| Resolution for CID 11700 |
| Date: 2022-08-01 |
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Abstract

This submission proposes resolution for CID 11700 received in LB266 (11be D2.0).

***TGbe editor: The baseline for this document is 11be D2.0***

**Revisions:**

* Rev 0: Initial version of the document.
* Rev 1: updated based on offline feedback
* Rev 2: provide two potential solutions based on offline discussions with members
* Rev 3,4: based on offline feedback from members

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 TGbe Draft. This introduction is not part of the adopted material.

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

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 11700 | 9.4.2.316 | 525.12 | The current Target Wake Time field is 2 octets in the TWT element for R-TWT with a granularity of one TU. This may not allow to specify start times that have less than one TU resolution | Please clarify | **Revised**Agree with the comment. A mechanism is provided to allow a STA to align the R-TWT SP start time with the latency sensitive traffic arrival defined in frames per second.TGbe editor, please implement changes as shown in 11-22/1373r4 tagged as 11700 |

### Discussion:

Per 11be D2.0 P208L6, in subclause 9.4.2.199 (TWT element), we have the following Broadcast TWT Parameter Set field format:



**Figure 9-766-Broadcast TWT Parameter Set field format**

The Broadcast TWT Parameter Set field includes a Target Wake Time field that is 2 octets.

Also, per baseline REVme D1.3, in subclause 9.4.2.199 (TWT element), the Target Wake Time field is 8 octets in case of Individual TWT whereas in case of Broadcast TWT, the Target Wake Time field is 2 octets with the lowest bit of the 2 octets corresponding to bit 10 of the relevant TSF value.

In addition, per baseline REVme D1.3 P4218L41, we have: The TWT scheduling AP shall set the Target Wake Time field to TSF [10:25], where TSF corresponds to the next TWT that is scheduled for this TWT parameter set when it queues for transmission the frame that contains the TWT element. The TSF timer at which the next TWT is scheduled has bits 0 to 9 equal to 0 and bits 26 to 63 equal to the same value as the respective bits in the current TSF timer.

Thus, the current rules allow to negotiate a Target Wake Time that has 1 TU resolution (>= 1024 µsec). However, latency sensitive traffic such as XR and cloud gaming traffic arrival is defined it terms of frames per second (fps), e.g., 60 fps (1 frame every 16.667 ms), and hence requires a finer time resolution. Although, the TWT Wake Interval allows a lower resolution, the upcoming TWT beacon announcements will carry only 1 TU resolution. Thus, the difference between the start time of the R-TWT SP and the latency sensitive traffic arrival will get accumulated. As a result, the current Target Wake Time field does not allow to align the latency sensitive traffic arrival time with the R-TWT SP start time and the latency sensitive traffic may not be able to benefit from the R-TWT SP. In this proposal, we address this issue.

**Target Wake Time field mismatch issue:**



We add a NOTE as good practice for implementation to avoid decoding errors that can happen at the receiving STA where the receiving STA use different B63-B26 than those intended by the transmitting STA for determining the SP start time during the lifetime of an R-TWT schedule.

### Proposed Text:

**Option 1:**

***TGbe editor: Add an entry to the end of Table 9-128 (Element IDs) as follows (CID 11700):***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element**  | **Element ID** | **Element ID Extension** | **Extensible** | **Fragmentable** |
| Extended TWT element (see 9.4.2.xxx Extended TWT element) | **255** | **ANA** | **Yes** | **Yes** |

***TGbe editor: Add this new subclause under 9.4.2 (CID 11700)***

9.4.2.xxx Extended TWT element

The Extended TWT element is shown in Figure 9-xxx (Extended TWT element format).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   | Element ID | Length | Element ID extension | Extended TWT Control | Extended TWT Information  |
| **Octets:** | 1 | 1 | 1 | 1 | variable |

**Figure 9-xxxx — Extended TWT element format**

The Element ID, Length, and Extended Element ID fields are defined in 9.4.2.1 (General).

The format of the Extended TWT Control field is shown in Figure 9-xxxx (Extended TWT Control field format):

|  |  |  |
| --- | --- | --- |
|   | Count | Reserved |
| **Bits:** | 5 | 3 |

**Figure 9-xxxx — Extended TWT Control field format**

The Count subfield in the Extended TWT Control field contains an unsigned integer that specifies the number of Extended Broadcast TWT Parameter subfields included in the Extended TWT information field.

The Extended TWT Information field includes one or more Extended Broadcast TWT Parameter field (see Figure 9-xxx (Extended Broadcast TWT Parameter field format)).

The Extended Broadcast TWT Parameter field is 2 octets. The format of the Extended Broadcast TWT Parameter field is shown in Figure 9-xxxx (Extended Broadcast TWT Parameter field format):

|  |  |  |  |
| --- | --- | --- | --- |
|   | Broadcast TWT ID | Reserved | Extended Target Wake Time |
| **Bits:** | 5 | 1 | 10 |

**Figure 9-xxxx — Extended Broadcast TWT Parameter field**

The Broadcast TWT ID subfield contains an unsigned integer that specifies the Broadcast TWT ID of the corresponding Restricted TWT parameter set carried in the same frame for which the transmitting STA is providing the extended TWT information.

The Extended Target Wake Time field contains an unsigned integer that specifies bit 0 to 9 of the relevant TSF timer at which the next TWT is scheduled for the R-TWT schedule with the specified Broadcast TWT ID.

The subfields values of the Extended Broadcast TWT Parameter field are set as described in 35.9.2 (R-TWT agreement setup) and 35.9.3 (R-TWT service periods announcement).

TGbe editor: Add a row at the end of table 9-589 as follows ***(CID 11700)***

### 9.6.24.8 TWT Setup frame format

**Table 9-589—TWT Setup frame Action field format**

|  |  |
| --- | --- |
| **Order** | **Information** |
| 1 | Category |
| 2 | Unprotected S1G Action |
| 3 | Dialog Token |
| 4 | One or two TWT (9.4.2.199 (TWT element)) |
| 5 | Extended TWT Element (9.4.2.xxx (Extended TWT element)) |

The TWT Setup frame contains an Extended TWT Element if used for the establishment of a Restricted TWT agreement (see 35.9.2.2 (The setup procedure)) with one TWT element.

TGbe editor: Add a row toward the end of table 9-60 as follows ***(CID 11700)***

### 9.3.3.2 Beacon frame format

**Table 9-60—Beacon frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <Last assigned + 1> | Extended TWT element | The Extended TWT element is present if the dot11RestrictedTWTOption Implemented is true and the AP has at least one R-TWT schedule as described in 35.9.3 (R-TWT service periods announcement). Otherwise, it is not present. |

TGbe editor: Add a row toward the end of table 9-63 as follows ***(CID 11700)***

**9.3.3.6 Association Response frame format**

**Table 9-63—Association Response frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <Last assigned + 1> | Extended TWT element | The TWT element is present if dot11RestrictedTWTOptionImplemented is true and the soliciting Association Request frame is sent by an EHT STA that has the Restricted TWT Support subfield in transmitted EHT Capabilities elements set to 1, and the AP has at least one R-TWT schedule as described in 35.9.3 (R-TWT SPs announcement). Otherwise, it is not present. |

TGbe editor: Add a row toward the end of table 9-63 as follows ***(CID 11700)***

**9.3.3.8 Reassociation Response frame format**

**Table 9-65—Reassociation Response frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <Last assigned + 1> | Extended TWT element | The Extended TWT element is present if dot11RestrictedTWTOptionImplemented is true and the soliciting Reassociation Request frame is sent by an EHT STA that has the Restricted TWT Support subfield in transmitted EHT Capabilities elements set to 1, and the AP has at least one R-TWT schedule as described in 35.9.3 (R-TWT SPs announcement). Otherwise, it is not present. |

TGbe editor: Add a row toward the end of table 9-67 as follows ***(CID 11700)***

**9.3.3.10 Probe Response frame format**

**Table 9-67—Probe Response frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <Last assigned + 1> | Extended TWT element | The Extended TWT element is present if the dot11RestrictedTWTOptionImplemented is true and the AP has at least one R-TWT schedule as described in 35.9.3 (R-TWT service periods announcement). Otherwise, it is not present. |

***TGbe editor: Please add this paragraph at the end of subclause 35.9.2.2 (The setup procedure) (CID 11700)***

**35.9.2.2 The setup procedure**

An R-TWT scheduled STA or R-TWT scheduling AP when negotiating an R-TWT schedule with an extended target wake time shall provide the extended target wake time in the Extended TWT element in the transmitted TWT setup frame that includes a restricted TWT parameter set with Negotiation Type subfield set to 3 if the R-TWT parameter set specifies a target wake time as described in 9.4.2.199 (TWT element).

The R-TWT scheduled STA or R-TWT scheduling AP shall set the Broadcast TWT ID subfield of the Extended TWT element to the same value as that of the corresponding R-TWT parameter set for which the STA or the AP is providing extended TWT information.

The R-TWT scheduled STA or R-TWT scheduling AP shall set the Extended Target Wake Time subfield to TSF [0:9], where TSF corresponds to the next TWT that is requested or scheduled for this TWT parameter set when it queues for transmission the frame that contains the TWT element and the Extended TWT element. The TSF timer at which the next TWT is requested or scheduled has bits 0 to 9 equal to the same value as the respective bits 0 to 9 of the Extended Target Wake Time subfield, bits 10 to 25 equal to the same value as the respective bits 0 to 15 of the Target Wake Time field, and bits 26 to 63 equal to the same value as the respective bits in the current TSF timer.

***TGbe editor: Please add this paragraph at the end of subclause 35.9.3 (r-TWT service periods announcement) (CID 11700)***

**35.9.3 R-TWT service periods announcement**

An R-TWT scheduling AP, while advertising an R-TWT schedule with an extended target wake time, shall include an Extended TWT element in all transmitted Management frames that includes a TWT element with Restricted TWT Parameter Set field(s). The R-TWT scheduling AP shall set the values of the Extended TWT element fields as specified in 35.9.2.2 (The setup procedure).

**Option 2 (Keep the TWT in TU resolution):**

***TGbe editor: Please add this paragraph at the end of subclause 35.9.3 (r-TWT service periods announcement) (CID 11700)***

**35.9.3 R-TWT service periods announcement**

An R-TWT scheduling AP when announcing an R-TWT schedule, shall set the Target Wake Time field in the TWT element in transmitted Management frames to TSF [10:25], where TSF corresponds to the first R-TWT SP start time of the corresponding R-TWT agreement.

An EHT STA with dot11RestrictedTWTOptionImplemented set to true shall determine the start time of an R-TWT SP that happens after the first R-TWT SP in a periodic R-TWT schedule as follows:

Next R-TWT SP start time = TSF timer - mod(TSFtimer - TSFfirst R-TWT, TWT Wake Interval) + TWT Wake Interval

Where the TSF timer is greater than TSFfirst R-TWT and TSFfirst R-TWT is the TSF timer corresponding to the start time of the first R-TWT SP in the corresponding R-TWT schedule.

***TGbe editor: Please add this NOTE after the following paragraph “If transmitted by a TWT requesting STA or a TWT scheduled STA and the TWT Setup Command subfield contains a value corresponding …” in subclause 9.4.2.199 (TWT element) (CID 11700)***

NOTE – If the Broadcast field is set to 1, the Target Wake Time field carries only B10:B25 of the relevant TSF timer, and changes in the B26:B63 of the corresponding TSF Timer are not communicated to the receiving STA. Hence, an EHT STA with dot11RestrictedTWTOptionImplemented set to true must consider when setting up an R-TWT schedule the rollover of B26:B63 of the TSF Timer that may happen at the receiving STA during the lifetime of the R-TWT schedule (i.e., resulting from the Target Wake Time field and Broadcast TWT Persistence field).

~~SP1: Which option as described above (11-22/1373r1) do you support to move forward with the resolution for CID 11700?~~

* ~~Option 1 (proposed resolution related to adding Extended TWT element)~~
* ~~Option 2 (proposed resolution related to keeping TWT field in TU resolution)~~
* ~~Abstain~~

SP2: Do you agree to the resolution in Option (2) for CID 11700 provided in doc 11-21/1373r4 to be included in the latest 11be draft?