IEEE P802.11
Wireless LANs

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| Comment Resolution on TDLS |
| Date: Nov 8th, 2023 |
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 Abstract

This submission proposes resolutions for the following 1 comment received for TGbe LB271:

* 8 CID: 19962 19954 19959 19960 19955 19957 19958 19964

SP: Do you agree to the resolutions provided in doc 11-23/1781r2 for the following CIDs for inclusion in the latest 11be draft?

19962 19954 19959 19960 19955 19957 19958 19964

Revisions:

* Rev 0: Initial version.
* Rev 1: Clarified that the Link ID Bitmap can not be present during the advertisement phase.
* Rev 2: Based on online discussion—
	+ Added a capability indication
	+ Added clarification of advertising the new schedule on the intended link “as soon as practical”
	+ Clarified that R-TWT negotiation can happen only if the STA operating on the intended link also supports R-TWT.

***TGbe editor: Please note Baseline is 11be D4.1***

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.

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| --- | --- | --- | --- | --- |
| **CID** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 19962 | 580.22 | Broadcast TWT operation procedure for MLD is currently missing and needs to be added. | as in comment. | **Revised**Agree in principle. Currently, the broadcast TWT operation for MLDs is missing in the spec and needs to be added.**TGbe editor, please make change as shown in this doc 11-22/1781r2 tagged by #19962.** |
| 19954 | 611.35 | 11be includes multi-link operation and restricted TWT operation. However, how restricted TWT will operate on multi-link devices (MLDs) is not clear. In general, mechanism for Broadcast TWT, which is a basis for restricted TTWT, for MLDs need to be defined. | Please provide text for R-TWT/B-TWT negotiation for MLD. | **Revised**Agree in principle. Currently, the broadcast TWT operation for MLDs is missing in the spec and needs to be added.**TGbe editor, please make change as shown in this doc 11-22/1781r2 tagged by #19962.** |
| 19959 | 580.22 | aligned schedule is defined for broadcast TWT. However, the broadcast TWT for MLD subclause is currently incomplete. Provide additional details to make the clause complete. | as in comment. | **Revised**Agree in principle. Currently, the broadcast TWT operation for MLDs is missing in the spec and needs to be added.**TGbe editor, please make change as shown in this doc 11-22/1781r2 tagged by #19962.** |
| 19960 | 580.22 | procedures for Aligned schedule and Broadcast TWT negotiation over one link for multiple links are currently missing and needs to be provided. | as in comment. | **Revised**Agree in principle. Currently, the broadcast TWT operation for MLDs is missing in the spec and needs to be added.**TGbe editor, please make change as shown in this doc 11-22/1781r2 tagged by #19962.** |
| 19955 | 611.35 | A procedure for a STA affiliated with a non-AP MLD requesting for aligned R-TWT schedule to be established over multiple links between the AP MLD and the non-AP MLD is currently missing? Such procedure would be quite helpful in power saving and traffic management for the client devices and need to be provided. | as in comment. | **Rejected**The aligned broadcast TWT operation is currently an advertisement-only procedure, and the group has not reach a consensus to introduce a request-response based approach for aligned broadcast TWT. |
| 19957 | 580.22 | A STA affiliated with an MLD should be able to actively request for an aligned schedule over multiple links to the AP MLD. Such procedure is missing and needs to be provided. | as in comment. | **Rejected**The aligned broadcast TWT operation is currently an advertisement-only procedure, and the group has not reach a consensus to introduce a request-response based approach for aligned broadcast TWT. |
| 19958 | 580.22 | aligned TWT requesting and negotiation procedure defined for individual TWT should be extended and generalize for broadcast TWT as well. | as in comment. | **Rejected**The aligned broadcast TWT operation is currently an advertisement-only procedure, and the group has not reach a consensus to introduce a request-response based approach for aligned broadcast TWT. |
| 19964 | 611.37 | How a STA affiliated with a non-AP MLD can request aligned R-TWT schedule over multiple of its enabled links is not clear. Such a procedure would be very helpful for the latency-sensitive traffic handling for the non-AP MLD and needs to provided. | as in comment. | **Rejected**The aligned broadcast TWT operation is currently an advertisement-only procedure, and the group has not reach a consensus to introduce a request-response based approach for aligned broadcast TWT. |

**Discussion:**

Currently, the procedure for broadcast TWT negotiation for one link by performing frame exchanges on another link is missing in the spec, and this document is trying to fill in this gap. Based on the offline and online discussion, following are some Q&A for clarification:

Q: Why not use the MLO Link Information element?

A: First of all, unlike an individual TWT element, a broadcast TWT element can carry multiple broadcast TWT schedules. Each of the broadcast TWT schedules can apply for a different link (please note that this is not the same thing as saying a particular schedule applied to multiple links). Using an MLO Link Information element would impose a limitation on this and restrict all the schedules to be applied to one link only, as indicated by the bitmap in the MLO Link Information element. Secondly, from the implementation point of view, it makes more sense to use similar stacks for implementing both the individual TWT and the broadcast TWT. Currently, for individual TWT, Link ID Bitmap in the individual TWT element is used for MLO operation. Accordingly, it would be good to re-use the Link ID Bitmap for the broadcast TWT element as well instead of using the MLO Link Information element for broadcast TWT and Link ID Bitmap for the individual TWT.

Q: Will there be any parsing issue since, unlike the individual TWT, the broadcast TWT is advertised for legacy STAs as well.

A: No, the Link ID Bitmap will only be present in the broadcast TWT parameter set during the individually-addressed negotiation and won’t be present during the advertisement in the Beacons or Probe Response frames.

Overall sketch of the changes (based on the feedback):

1. Re-use the Link ID Bitmap defined for individual TWT parameter set to broadcast the TWT parameter set as well
2. Only one link can be indicated in the Link ID Bitmap in the broadcast TWT parameter set.
3. No link negotiation allowed—the responder can only indicate the same link as that indicated in the request frame.
4. For target wake time, the TSF of the intended link will be followed.

**xxxxxxxxxxxxxxxxxxxx End of the discussion part xxxxxxxxxxxxxxxxxxxxxxx**

***TGbe editor: Please Change Figure 9-1001I (Extended MLD Capabilities And Operations subfield format) as follows***



**Figure 9-1001l—Extended MLD Capabilities And Operations subfield format**

***TGbe editor: Please add a new row to the Table 9-404k (Subfields of the Extended MLD Capabilities And Operations subfield) as follows:***

**Table 9-404k—Subfields of the Extended MLD Capabilities And Operations subfield**

|  |  |  |
| --- | --- | --- |
| **Subfield** | **Definition** | **Encoding** |
| …. | …. | …. |
| Cross-Link Broadcast TWT Setup Support | Indicates support for broadcast TWT operation for a STA affiliated with an MLD by including a Link ID Bitmap subfield in a broadcast TWT parameter set field.  | Set to 1 if dot11crossLinkBroadcastTWTSetupOptionImplemented is true.Set to 0 otherwise. See 35.3.24.3 (Broadcast TWT Operation).  |

***TGbe editor: Please Change Figure 9-761 (Broadcast TWT Parameter Set field format) as follows:***

 

**Figure 9-761: Broadcast TWT Parameter Set field format (#19962)**

***TGbe editor: Please* change the paragraph (The Link ID Bitmap subfield indicates the links…) in Clause 9.4.2.198 (TWT element) as follows:**

The Link ID Bitmap subfield indicates the links to which an individual or broadcast TWT parameter set contained in the TWT element sent by a STA affiliated with an MLD applies (see 35.3.24.2 (Individual TWT agreements), 35.3.24.3 (Broadcast TWT operation)). A value of 1 in bit position i of the Link ID Bitmap subfield indicates that the TWT parameter set in the TWT element sent by a STA affiliated with an MLD applies to the link identified by link ID i. A value of 0 in bit position i of the Link ID Bitmap subfield indicates that the TWT parameter set in the TWT element sent by a STA affiliated with an MLD does not apply to the link identified by link ID i.

***TGbe editor: Please* add the following paragraph in clause 9.4.2.198 (TWT element) after the 9th paragraph (The Link ID Bitmap field..)**

In a broadcast TWT element, if the Link ID Bitmap Present field is set to 1, then the Link ID Bitmap field is present in all the broadcast TWT parameter sets in the broadcast TWT element; otherwise, the Link ID Bitmap field is not present in any of the broadcast TWT parameter set. In a broadcast TWT parameter set in a broadcast TWT element, the Link ID Bitmap field is not present if the Negotiation Type subfield in the Control field of the broadcast TWT element is set to 2.

***TGbe editor: Please insert the following paragraphs in clause 35.3.24.3 (Broadcast TWT operation) as the beginning paragraphs in this clause***

**35.3.24.3 Broadcast TWT operation (#19962)**

An MLD with dot11crossLinkBroadcastTWTSetupOptionImplemented equal to true shall set the Cross-Link Broadcast TWT Setup Support subfield of the Extended MLD Capabilities And Operations subfield of the Common Info field of a Basic Multi-Link element to 1. A TWT scheduling AP affiliated with an AP MLD shall not send a broadcast TWT element with the Link ID Bitmap Present subfield of the Control field of the broadcast TWT element set to 1 to a STA affiliated with a non-AP MLD if the AP MLD has not received a Basic Multi-Link element from the non-AP MLD with the Cross-Link Broadcast TWT Setup Supportsubfield of the Extended MLD Capabilities And Operations subfield of the Common Info field of the Basic Multi-Link element set to 1. A TWT scheduled STA affiliated with a non-AP MLD shall not send a broadcast TWT element with the Link ID Bitmap Present subfield of the Control field of the broadcast TWT element set to 1 to an AP affiliated with an AP MLD if the non-AP MLD has not received a Basic Multi-Link element from the AP MLD with the Cross-Link Broadcast TWT Setup Supportsubfield of the Extended MLD Capabilities And Operations subfield of the Common Info field of the Basic Multi-Link element set to 1.

A TWT scheduled STA affiliated with the non-AP MLD or the TWT scheduling AP affiliated with the AP MLD, while negotiating for a broadcast TWT schedule, may indicate the link between the AP MLD and the non-AP MLD for which the negotiation is being conducted. The TWT scheduled STA or the TWT scheduling AP transmitting the TWT element may make the link indication in the Link ID Bitmap subfield in the Broadcast TWT Parameter Set field corresponding to the broadcast TWT schedule.

* If a link is indicated in a Link ID Bitmap subfield in the Broadcast TWT Parameter Set field transmitted by a TWT scheduled STA affiliated with the non-AP MLD or a TWT scheduling AP affiliated with the AP MLD, the corresponding broadcast TWT schedule is negotiated on behalf of the STA affiliated with the same MLD and operating on the indicated link between the AP MLD and the non-AP MLD. The value of the Target Wake Time field in the Broadcast TWT Parameter Set field shall be in reference to the TSF time of the link indicated in the Link ID Bitmap subfield in the Broadcast TWT Parameter Set field.

A TWT scheduling AP affiliated with the AP MLD or a TWT scheduled STA affiliated with the non-AP MLD that receives a broadcast TWT parameter set containing a Link ID Bitmap subfield may indicate the link in the Link ID Bitmap subfield of the corresponding Broadcast TWT Parameter Set field in the TWT element in the response frame it transmits. The Link ID Bitmap subfield, if present in the Broadcast TWT Parameter Set field in the response frame, shall indicate the same link as that indicated in the corresponding Broadcast TWT Parameter Set field in the TWT element it received.

* If the Link ID Bitmap Present subfield in the Control field in a broadcast TWT element is set to 1, then all the Broadcast TWT Parameter Set fields included in the broadcast TWT element shall contain a Link ID Bitmap subfield; otherwise, none of the Broadcast TWT Parameter Set field included in the broadcast TWT element shall contain any Link ID Bitmap subfield.
	+ If a TWT scheduling AP affiliated with an AP MLD or a TWT scheduled STA affiliated with a non-AP MLD receives a broadcast TWT element that sets the Link ID Bitmap Present subfield to 0, it would indicate that all the broadcast TWT parameter set(s) included in the received broadcast TWT element apply to the link on which the broadcast TWT element is received.
* The AP MLD or the non-AP MLD shall not transmit a TWT element over a link set up between them that includes a TWT parameter set field containing a Link ID Bitmap subfield with $k$-th bit in the bitmap set to 1 if the corresponding $k$-th link is disabled for the non-AP MLD through TID-to-Link mapping.

For R-TWT operation between an AP MLD and a non-AP MLD, the AP MLD or the non-AP MLD shall not transmit a TWT element over any of the setup links between them that includes an R-TWT parameter set with the $k$-th bit in the Restricted TWT DL TID Bitmap subfield or Restricted TWT UL TID Bitmap subfield, if present, set to 1 if the TID $k$ for the respective direction is not mapped on the intended link for which the restricted TWT schedule is being negotiated or if the STA affiliated with the non-AP MLD and operating on the intended link does not set the Restricted TWT Support subfield in its transmitted EHT Capabilities element to 1.

If a TWT scheduling AP affiliated with an AP MLD successfully negotiates membership with a TWT scheduled STA affiliated with a non-AP MLD for a new broadcast TWT schedule which was previously not advertised by the AP in its BSS, and the membership negotiation is conducted by exchanging the corresponding TWT element(s) with another AP affiliated with the same AP MLD that the TWT scheduling AP is affiliated with, then the TWT scheduling AP shall start advertising the new broadcast TWT schedule as soon as practical following the procedure specified in 26.8.3 (Broadcast TWT operation).

**Annex C**

(normative)

**ASN.1 encoding of the MAC and PHY MIB**

**C.3 MIB Detail**

***TGbe editor: Please add following new MIB attribute in Annex C as shown below ():***

Dot11EHTStationConfigEntry ::=

SEQUENCE{

dot11EHTPPEThresholdsRequired TruthValue,

dot11TIDtoLinkMappingActivated TruthValue,

dot11EHTEPCSPriorityAccessActivated TruthValue,

dot11MSDTimerDuration Unsigned32,

(#16903)dot11MSDTXOPMax Unsigned32,

dot11MultiLinkActivated TruthValue,

dot11MLDAssociationSAQueryMaximumTimeout Unsigned32,

dot11EHTMCSFeedbackOptionImplemented INTEGER,

dot11EHTEMLSROptionImplemented TruthValue,

dot11EHTEMLSROptionActivated TruthValue,

dot11EHTEMLMROptionImplemented TruthValue,

dot11EHTEMLMROptionActivated TruthValue,

dot11OperationParameterUpdateImplemented TruthValue,

dot11EHTLinkReconfigurationOperationActivated TruthValue,

 dot11EHTNSTRStatusUpdateImplemented. TruthValue

 dot11crossLinkBroadcastTWTSetupOptionImplemented TruthValue

}

….

dot11crossLinkBroadcastTWTSetupOptionImplemented OBJECT-TYPE

 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 station implementation is

capable of broadcast TWT operation for a STA affiliated with an MLD by including a Link ID Bitmap subfield in a broadcast TWT parameter set field.

"

 DEFVAL {false}

 ::= { dot11EHTStationConfigEntry X }