IEEE P802.11
Wireless LANs

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| Proposed Draft Text for TWT for MLD |
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Abstract

This submission proposes draft text for TWT for MLD based on 802.11be D1.01

Revisions:

* Rev 0: Initial version of the document.

***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.***

***Discussion for the motion***

**The texts are based on the following motion**

Individual TWT agreement(s) could be set up on a setup link for more than one setup link.

[Motion 115, #SP60, [16] and [231]]

A TWT requesting STA affiliated with a TWT requesting MLD may negotiate individual TWT agreements with a TWT responding STA affiliated with a TWT responding MLD

* STA1 of STA MLD and AP1 of AP MLD operating on link 1 can exchange TWT setup frames (in a single negotiation) to negotiate
	+ A TWT agreement on link1 between STA1 and AP1

* + A TWT agreement on link2 between STA2 and AP2

* + 2 TWT agreements, one on link1 between STA1 and AP1, one on link1 between STA2 and AP2
		- These agreements can have same start time and end time, same parameters
		- These agreements can also have different ones as well (specifically ensure no overlap for instance)

Add the case of multiple links indicated by a TWT element

***TGbe Editor: please modify Clause 35.5 as follows:***

35. Extremely High Throughput (EHT) MAC specification

35.5 TWT operation

35.5.1 Individual TWT agreements

A STA affliated with an MLD may negotiate individual TWT agreements with another STA affiliated with another MLD as defined in 10.47.1 (TWT overview) and 26.8.2 (Individual TWT agreements) except the following:

* The STA affiliated with the MLD may indicate the link(s) that are requested for setting up TWT agreement(s) in the Link ID Bitmap subfield, if present, of a TWT element in the TWT request.
	+ If only one link is indicated in the Link ID Bitmap subfield of the TWT element, then a single TWT agreement is requested on behalf of the STA affiliated with the same MLD and that is operating on the indicated link. The Target Wake Time field of the TWT element shall be in reference to the TSF time of the link indicated by the TWT element.
	+ If multiple links are indicated in the Link ID Bitmap subfield of the TWT element, then multiple TWT agreements are requested to be setup; one TWT agreement for each of the STAs affiliated with the same MLD and that are operating on the indicated links.
		- The same TWT parameters are requested for all the links except for the target wake time. The target wake time of each of the links is obtained from the Target Wake Time field of the TWT element and shall be in reference to the TSF time of each of the links indicated by the TWT element, respectively.
* A STA affiliated with a peer MLD that receives a TWT request that contains a Link ID Bitmap subfield in a TWT element shall respond with a TWT response that may indicate the link(s) in the Link ID Bitmap field of a TWT element. The link(s), if present, in the TWT element in the TWT response, shall be the same as the link(s) indicated in the TWT element of the soliciting TWT request.

During the negotiation of TWT agreements, a TWT requesting STA affiliated with an MLD and a TWT responding STA affiliated with another MLD may include multiple TWT elements where each of the Link ID Bitmap subfields in each TWT element indicates different link(s) in the same TWT Setup frame. The TWT parameters provided by each TWT element shall be applied and be in reference to the respective link that is indicated in the TWT element.

An example of TWT agreements negotiated for multiple links is shown in Figure 35-x-a (Example of TWT agreements negotiation across multiple links).

Figure 35-x-a – Example of TWT agreements negotiation across multiple links

In this example, an AP MLD has three affiliated APs: AP 1 operates on 2.4 GHz band, AP 2 operates on 5 GHz band, and AP 3 operates on 6 GHz band. Non-AP STA 1 affiliated with the non-AP MLD sends three TWT elements in a TWT request to AP 1 affiliated with the AP MLD. These three TWT elements indicate the links of AP 1, AP 2, and AP 3 requesting three links to be setup TWT agreements, respectively, have different TWT parameters, such as target wake up time, and all are with a value of Request TWT in the TWT Setup Command field. AP 1 sends three TWT elements in a TWT response to non-AP STA 1 and these three TWT elements indicate the links of AP 1, AP 2, and AP 3 respectively; and they are all with a value of Accept TWT in the TWT Setup Command field. After successful TWT agreements setup on the three links, three TWT SPs with different TWT parameters exist on these three links (link 1 between AP 1 and non-AP STA 1, link 2 between AP 2 and non-AP STA 2, and link 3 between AP 3 and non-AP STA 3), respectively. For these three TWT agreements, the Target Wake Time field of the TWT element that indicates link 1 is in reference to the TSF time of link 1, the Target Wake Time field of the TWT element that indicates link 2 is in reference to the TSF time of link 2 and the Target Wake Time field of the TWT element that link 3 is in reference to the TSF time of link 3.

In another example, non-AP STA 1 affiliated with the non-AP MLD sends one TWT element in a TWT request to AP 1 affiliated with the AP MLD. The TWT element in the TWT request indicates the links of AP 1, AP 2, and AP 3, requesting three links on which to setup TWT agreements (one link between AP 1 and non-AP STA 1, one link between AP 2 and non-AP STA 2, and one link between AP 3 and non-AP STA 3), and carries a value of Request TWT in the TWT Setup Command field. Moreover, the TWT element indicates a Target Wake Time value of T1 and Nominal Minimum TWT Wake Duration of T. AP 1 sends one TWT element in a TWT response to non-AP STA 1 and this TWT element in the TWT response indicates the links of AP 1, AP 2, and AP 3 with a value of Accept TWT in the TWT Setup Command field. After successful TWT agreements setup on three links, three TWT SPs with the same TWT parameters, except for the target wake time, exist on these three links (link 1 between AP 1 and non-AP STA 1, link 2 between AP 2 and non-AP STA 2, and link 3 between AP 3 and non-AP STA 3). For these three TWT agreements, a target wake time value of T1 is in reference to the TSF time of link 1, link 2 and link 3, respectively. Hence, if all these three APs affiliated with the AP MLD have the same TSF time, then these TWT SPs on the three links occur in time is shown in Figure 35-x-b (Example of negotiated TWT SPs occurrence in the time domain). Otherwise, the starting time of these three TWT SPs are not aligned but have the same TWT SP duration and other TWT parameters.



Figure 35-x-b – Example of negotiated TWT SPs occurrence in the time domain