IEEE P802.11
Wireless LANs

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| CC36-CR-for-Individual TWT |
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Abstract

This submission proposes draft text for TWT for MLD

5281 6240 6241 6242

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.***

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| **CID** | **Commenter** | **Clause** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 5281 | Insun Jang | 35.3.10 | 265.48 | When a non-AP MLD requests to an AP MLD individual TWT for multiple links, it may multiple TWT elements. In this case, the AP MLD should respond to the non-AP MLD by considering TWT Setup command. For example, for two links with the same parameters, it may have different TWT Setup command (e.g., Accept or Suggest/Reject) | As in the comment, we need to design mechanism(s) to respond to individual TWT request for multiple links by considering TWT Setup command | Revised-Agree with the comment and add the missing part-one TWT set up for multiple links.TGbe editor:Please implement the changes as shown in doc 11-22/0552r0 tagged as 5281　 |
| 6240 | Ming Gan | 35.x | 0.00 | TWT operation for MLD is missing | as in the comment | Revised-Agree with the comment and add the missing part-one TWT set up for multiple links.TGbe editor:Please implement the changes as shown in doc 11-22/0552r0 tagged as 6240 |
| 6241 | Ming Gan | 35.x | 0.00 | In the approved document 21/80r9, the case of multi-link indicated by one TWT element is missing | as in the comment | Revised-Agree with the comment and add the missing part-one TWT set up for multiple links.TGbe editor:Please implement the changes as shown in doc 11-22/0552r0 tagged as 6241 |
| 6242 | Ming Gan | 35.x | 0.00 | In the approved document 21/80r9, TWT operation for MLD should be MLD level, please update the the text | as in the comment | Revised-Agree with the comment and update the corresponding text.TGbe editor:Please implement the changes as shown in doc 11-22/0552r0 tagged as 6242 |

35.8 TWT operation

35.8.2 Individual TWT agreements

***TGbe Editor: please modify the following paragraphs in subcClause 35.8.2 as follows (CID #5281 6240 6241 6242 ):***

An MLD may negotiate individual TWT agreements with another MLD as defined in 10.47.1 (TWT overview) and 26.8.2 (Individual TWT agreements) except the following:

* A TWT requesting 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 that the TWT element is sent.
* 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 is operating on each of the indicated link.
	+ The same TWT parameters are requested for all the links. 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 the link the TWT element is sent.
* A TWT responding 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 indicates the link(s) in the Link ID Bitmap field of a TWT element. The link(s) 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 individual 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 individual TWT is uniquely identified by the tuple<TWT flow identifier, MLD MAC address of the MLD with wich TWT requesting STA is affiliated, MLD MAC address of the MLD with wich TWT responding STA is affiliated, Link ID associated with the indicated link in the Link ID bitmap >.

An example of TWT agreements negotiated for multiple links is shown in Figure 35-32 (Example of TWT agreements negotiation across multiple links).



Figure 35-32 – 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 1 within ±30 μs difference and the Target Wake Time field of the TWT element that link 3 is in reference to the TSF time of link 1 within ±30 μs difference as per subclause 35.3.1 (General).

In another example with the same configuration, non-AP STA 1 affiliated with the non-AP MLD sends a TWT element in a TWT request to AP 1 affiliated with the AP MLD. The TWT element indicates the links of AP 1, AP 2, and AP 3 requesting three links on which to setup TWT agreements (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), and carries a value of Request TWT in the TWT Set 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 a TWT element in a TWT response to non-AP STA 1 and the TWT element sent by AP 1 confirms the links of AP 1, AP 2, and AP 3 with a value of Accept TWT in the TWT Set Command field. After successful TWT agrements setup on 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, link 2 and link 3 is in reference to the TSF time of link 1. As per subclause 35.3.1 (General), an AP MLD or an NSTR mobile AP MLD shall correct the clock drift to be within ±30 μs between TSF timers of any two APs affiliated with the AP MLD or the NSTR mobile AP MLD. In this case, the starting time of these TWT SPs on three links is almost aligned given the TSF offset compensation. An example of how these TWT SPs on the three links occur in time is shown in Figure 35-x (Example of negotiated TWT SPs in the time domain)



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