IEEE P802.11
Wireless LANs

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| MLO BA Procedure |
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| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Abhishek Patil | Qualcomm |  |  | appatil@qti.qualcomm.com |
| George Cherian |  |  |  |
| Alfred Asterjadhi |  |  |  |
| Duncan Ho |  |  |  |
| Yanjun Sun |  |  |  |
| Menzo Wentink |  |  |  |
| Rojan Chitrakar | Panasonic |  |  |  |
| Laurent Cariou | Intel |  |  |  |
| Po-Kai Haung |  |  |  |
| Arik Klein | Huawei |  |  |  |
| Yunbo Li |  |  |  |

Abstract

We propose the draft specification skeleton for MLD to help the creation of TGbe draft D0.1.

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Updates based on feedback from TTT members
* Rev 2: Additional updates based on feedback after the doc was presented on 8/20/20
* Rev 3: Incorporated feedback from Arik
* Rev 4: More changes based on offline feedback (Arik, Yunbo, Menzo, Alfred)
	+ Changes marked in green

The texts is prepared for the following motions.

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| MAC | MLO-Multi-link block ack: Procedure | Abhishek Patil | Liwen Chu, Po-kai Huang, Kaiying Lu, Jarkko Kneckt, Tomo Adachi, Rojan Chitrakar, Arik Klein, Taewon Song, Zhou Lan, Ryuichi Hirata, Yusuke Tanaka, Xiaofei Wang, Sebastian Max, Jonghun Han, Ming Gan, Gabor Bajko, Chunyu Hu, Liuming Lu | R1 | Motion 36Motion 67Motion 61Motion 115, #SP85Motion 62Motion 63Motion 115, #SP63Motion 115, #SP64Motion 114Motion 112, #SP26 |

A single block ack agreement is negotiated between two MLDs for a TID that may be transmitted over one or more links.

NOTE – The format of the setup frames is TBD.

[Motion 36, [5] and [121]]

Setup a block ack agreement for multi-link operation by using ADDBA request and ADDBA response frames.

[Motion 67, [21] and [122]]

The established block ack agreement allows the QoS Data frames of the TID, aggregated within the A-MPDUs, to be exchanged between the two MLDs on any available link.

Note – QoS Data frames that are not fragments might be retransmitted on any available link.

[Motion 61, [21] and [123]]

[Motion 115, #SP85, [10] and [124]]

The receive status of QoS Data frames of a TID received on a link shall be signaled on the same link and may be signaled on other available link(s)

[Motion 63, [21] and [123]]

802.11be shall define mechanism for multi-link operation that enables the following:

* A STA of a recipient MLD shall provide receive status for MPDUs received on the link that it is operating on and may provide (if available) information on successful reception of MPDUs received by another STA of that MLD.

[Motion 114, [13] and [126]]

An originator MLD of a BA agreement:

* shall update the receive status for an MPDU corresponding to the BA agreement if the received status indicates successful reception.
* shall not update the receive status for an MPDU corresponding to the BA agreement that has been already positively acknowledged.

[Motion 112, #SP26, [13] and [127]]

For each block ack agreement, there exists one receive reordering buffer based on MPDUs in the MLD which is the recipient of the QoS Data frames for that block ack agreement.

The receive reordering buffer operation is based on the Sequence Number space that is shared between the two MLDs.

[Motion 62, [21] and [123]]

802.11be supports allowing an EHT STA to use HE SU PPDU to carry the solicited BA if the transmit time of HE SU PPDU is less than the PPDU duration of a non-HT PPDU containing the Control frame sent at the primary rate.

[Motion 115, #SP63, [10] and [125]]

802.11be supports allowing an EHT SU PPDU to carry the solicited BA if the transmit time of EHT SU PPDU is less than the PPDU duration of a non-HT PPDU containing the Control frame sent at the primary rate and the soliciting PPDU is EHT PPDU.

[Motion 115, #SP64, [10] and [125]]

**Proposed spec text:**

The baseline for this text is 802.11 REVmd draft 3.4 and 802.11ax D6.1.

33. Extreme High Throughput (EHT) MAC specification

**33.x Multi-link operation**

***TGbe editor: Add new a subclause 33.x.y (Multi-link BlockAck Procedure) under clause 33 as follows:***

**33.x.y Multi-link BlockAck Procedure**

**33.x.y.1 General**

***[Motion 36, [5] and [121]]***

A block ack agreement between two MLDs shall apply to all links to which the TID corresponding to the block ack agreement, is mapped (i.e., there are no independent block ack agreements on a per-link basis).

NOTE – Frame exchanges for a TID might be governed by TID-to-Link mapping rules (see 33.x.a.b (TID-to-Link mapping procedure).

***[Motion 67, [21] and [122]]***

To setup a block ack agreement between two MLDs, a STA of the originator MLD sends an ADDBA Request frame, on any enabled link, indicating the TID for which the block ack agreement is being set up. The Buffer Size and Block Ack Timeout fields in the ADDBA Request frame are advisory. A STA of the recipient MLD shall respond with an ADDBA Response frame. The recipient MLD has the option of accepting or rejecting the request. If the recipient MLD accepts the request, then a block ack agreement exists between the originator MLD and recipient MLD for that TID as defined in 10.25.2 (Setup and modification of the block ack parameters).

***[Motion 61, [21] and [123]]***

***[Motion 115, #SP85, [10] and [124]]***

If an MLD has established a block ack agreement with another MLD, then QoS Data frames for the TID associated with the block ack agreement may be exchanged between the two MLDs on any link to which the TID is mapped and subject to existing restrictions for transmissions of frames that apply to those enabled links, following the procedure described in subclause 33.x.y (Multi-link BlockAck Procedure).

Note – QoS Data frames that are not fragments might be (re)transmitted on any link(s) where the corresponding TID is mapped to.

***[Motion 63, [21] and [123]]***

A STA of a recipient MLD shall provide the receive status on the link where the STA is operating on for any MPDU with ACK policy equal to any value other than No Ack that is received on the link where the STA is operating on.

A STA of a recipient MLD may provide (if available) information on successful reception of any MPDU with ACK policy equal to any value other than No Ack that is received by another STA of that MLD.

***[Motion 112, #SP26, [13] and [127]]***

An originator MLD shall update the receive status for an MPDU corresponding to a BA agreement if the received status indicates successful reception.

An originator MLD shall not update the receive status for an MPDU corresponding to a BA agreement that has already been positively acknowledged.

***[Motion 62, [21] and [123]]***

A recipient MLD shall maintain a receive reordering buffer per peer-MLD/TID. The receive reordering buffer shall be responsible for reordering MSDUs or A-MSDUs so that MSDUs or A-MSDUs are eventually passed up to the next MAC process in order of received sequence number. It shall also be responsible for identifying and discarding duplicate frames (i.e., frames that have the same sequence number as a currently buffered frame) that are part of this block ack agreement. It shall maintain its own state independent of the scoreboard context control to perform this reordering as specified in 10.25.6.6 (Receive reordering buffer control operation). Each received MPDU shall be analyzed by the scoreboard context control as well as by the receive reordering buffer control.

***[Motion 115, #SP63, [10] and [125]]***

***[Motion 115, #SP64, [10] and [125]]***

An EHT STA shall send Control frames following the rules defined in 10.6.6 (Rate selection for Control frames) and 26.15.2 (PPDU format selection) with the following additional exception:

* An EHT STA may transmit a BlockAck frame in an HE SU PPDU or EHT SU PPDU if the transmit time of HE SU PPDU or EHT SU PPDU (respectively) is less than the PPDU duration of a non-HT PPDU containing the Control frame sent at the primary rate (see 10.6.6.5.2 (Selection of a rate or MCS)).