IEEE P802.11
Wireless LANs

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| MLO BA Procedure |
| Date: 2020-08-20 |
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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: Minor updates based on feedback from TTT members after the doc was presented on 8/20/20

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]]***

If an originator MLD that has performed multi-link setup with a recipient MLD, intends to setup block ack agreement for a TID with the recipient MLD, it shall set up a single block ack agreement for the TID that is applicable to all the setup links.

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

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

To setup the block ack agreement, a STA affiliated with the originator MLD sends an ADDBA Request frame 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 affiliated with the recipient MLD, shall respond with an ADDBA Response frame. The recipient MLD has the option of accepting or rejecting the request. When the recipient MLD accepts, then a block ack agreement exists between the originator MLD and recipient MLD 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 block ack agreement with another MLD for a TID, QoS Data frames belonging to that TID may be exchanged between the two MLDs on any link where the TID is mapped, 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.

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

A STA of a recipient MLD shall provide receive status for MPDUs with ACK policies other than no-ACK and that are 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 MPDUs with ACK policies other than no-ACK and received by another STA of that MLD.

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

The originator MLD:

* shall update the receive status for an MPDU corresponding to a BA agreement if the received status indicates successful reception.
* 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]]***

The recipient MLD shall maintain a receive reordering buffer control per peer-MLD/TID, which contains a related control state. 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)).