IEEE P802.11  
Wireless LANs

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| Proposed Draft Text  MAC MLO: Single STA Trigger | | | | |
| Date: 2021-2-26 | | | | |
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Abstract

This submission proposes draft text to be included in 802.11be Draft 1.0 for the following topic:

* Multi-link channel access – End PPDU alignment
  + In R1 of TGbe that
    - A non-AP STA can include an indication in a PPDU that solicits an AP to transmit a control response frame in an SU PPDU whose duration is indicated by the indication in a new A-ctrl subfield. The new A-ctrl subfield will be specifically designed to include that duration for the control response.
    - The SU PPDU can be carried in at least HE/EHT PPDU to meet the indicated duration. [#SP385]

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Added further discussion and simplified the text to cover optional support case only based on the offline feedback.
* Rev 2: Incorporated email discussion results.
* Rev 3: Further incorporated email discussion results.
* Rev 4: Incorporated comments during the presentation.

**Discussions:**

**Non-AP STAs behaviour**

If a STA that transmits a frame with the proposed A-Control subfield sets the indicated duration of the control response frame that is not reasonable, it is not clear how the responding AP’s behaviour will be. If the indicated duration value is longer than what the AP expects, the AP can adjust the PPDU duration by adding appropriate paddings. However, if the indicated duration value is shorter than what the AP expects, additional rule needs to be defined further. To resolve this, it is needed to define behaviour for non-AP STA that solicits the control response frame. The proposed text is based on a philosophy that the non-AP STA calculates the required duration of the control response frame assuming the longest possible response, because if the indicated duration is longer than what the AP expects, the AP can aadjust the PPDU duration by adding appropriate paddings.

**Mandatory/optional support of parsing the proposed A-Control subfield**

It has not been decided if the support of parsing the proposed A-Control subfield from receiving AP side is mandatory or optional.

If this feature becomes mandatory, all AP MLD needs to generate a PPDU containing a control response frame whose length is directly indicated by the A-Control subfield of the soliciting frame. It will make it easy to align the transmission end time of control response frame for the case of TXOP busrting, however it will require additional complexity to the AP’s implementation.

If this feature becomes optional, it is allowed for an AP MLD to declare that it doesn’t support the parsing of the corresponding A-Control subfield. And, non-AP MLDs shall send UL PPDU on multiple links including the A-Control subfield only if the responding AP MLD supports this feature. It will make flexibility for the AP’s implementation, however it may not be easy to enable multiple frame transmissions within a TXOP (TXOP bursting) on multiple links for those AP MLDs that don’t support this feature.

As it has quite an impact on the AP’s implementation and simultaneous transmission on multiple links are still available without TXOP bursting, the proposed text here is based on optional support of this feature. (Originally there were 2 different versions of the text were prepared, but based on offline discussion the proposed text was modified.)

***TGbe editor: Please update Table 9-22a in a subclause 9.2.4.6.3a (HE variant) as follows:***

* HE variant

***…***

The Control ID subfield indicates the type of information carried in the Control Information subfield. The length of the Control Information subfield is fixed for each value of the Control ID subfield that is not reserved. The values of the Control ID subfield and the associated length of the Control Information subfield are defined in Table 9-22a (Control ID subfield values).

|  |  |  |  |
| --- | --- | --- | --- |
| * Control ID subfield values | | | |
| Control ID value | Meaning | Length of the Control Information subfield (bits) | Content of the Control Information subfield |
| 0 | Triggered response scheduling (TRS) | 26 | See 9.2.4.6a.1 (TRS Control) |
| 1 | Operating mode (OM) | 12 | See 9.2.4.6a.2 (OM Control) |
| 2 | HE link adaptation (HLA) | 26 | See 9.2.4.6a.3 (HLA Control) |
| 3 | Buffer status report (BSR) | 26 | See 9.2.4.6a.4 (BSR Control) |
| 4 | UL power headroom (UPH) | 8 | See 9.2.4.6a.5 (UPH Control) |
| 5 | Bandwidth query report (BQR) | 10 | See 9.2.4.6a.6 (BQR Control) |
| 6 | Command and status (CAS) | 8 | See 9.2.4.6a.7 (CAS Control)) |
| 7 | EHT operating mode (EHT OM) | 6 | See 9.2.4.6a.8 (EHT OM Control) |
| 8 | Single response scheduling (SRS) | 10 | See 9.2.4.6a.xxx (SRS Control) |
| 9-14 | Reserved |  |  |
| 15 | Ones need expansion surely (ONES) | 26 | Set to all 1s |

***…***

***TGbe editor: Please add the following subclause after subclause 9.2.4.6a.8 (EHT OM Control) as follows:***

9.2.4.6a.xxx SRS Control

The Control Information subfield in an SRS Control subfield contains scheduling information for the non-TB PPDU containing the control response to the PPDU carrying the MPDU(s) containing the SRS Control subfield (see 35.3.13.5 PPDU end time alignment)). The format of the subfield is shown in Figure 9-22x (Control Information subfield format in an SRS Control subfield).

|  |  |  |
| --- | --- | --- |
|  | B0      B7 | B8 B9 |
|  | PPDU Response Duration | Reserved |
| Bits: | 8 | 2 |
| **Figure 9-22x – Control Information subfield format in an SRS Control subfield** | | |

The PPDU Response Duration subfield contains the duration of the solicited non-TB PPDU that carries the control response frame that immediately follows the PPDU carrying the SRS Control subfield. The PPDU Response Duration subfield is in units of 4 microseconds and is set as defined in 35.3.15.

**9.4.2.295b.2 Basic variant Multi-Link element**

***TGbe Editor: Insert the following subfields in the MLD Capabilities subfield in figure 9-788ex (MLD Capabilities subfield format):***

|  |  |
| --- | --- |
|  | SRS Support |
| Bits: | 1 bit |

**Figure 9-788ex—MLD Capabilities subfield format**

*[Note to editor: If MLD Capabilities subfield is defined by other PDT/CR document, please use 1 bit from any of reserved bits in the MLD Capabilities subfield that is defind by the other PDT.]*

***TGbe Editor: Insert the following row at the end of Table 9-322xy-MLD Capabilities subfields:***

|  |  |  |
| --- | --- | --- |
| **Subfield** | **Definition** | **Encoding** |
| SRS Support | Indicates support for the reception of a frame that carries an SRS Control subfield. | For an EHT AP:  Set to 1 to indicate that an AP MLD with which the AP is affiliated is capable of receiving a frame with SRS Control subfield. Set to 0 otherwise.  For a non-AP EHT STA:  Set to 0. |

**Figure 9-788ex—MLD Capabilities subfield format**

***TGbe editor: Please add the following at the end of subclause 35.3.13.5 (PPDU end time alignment):***

An AP that is affiliated with an AP MLD shall set the SRS Support subfield in the Common Info field of the Basic variant ML element it transmits to 1 if its dot11SRSOptionImplemented is true; otherwise the AP shall set it to 0.

A non-AP STA shall not transmit a PPDU carrying one or more MPDUs with SRS Control subfield to an AP unless it has received from the AP a Basic variant ML element with the SRS Support subfield equal to 1.

An AP shall not transmit a PPDU carrying one or more MPDUs with SRS Control subfield to a STA.

NOTE —If the received SRS Support subfield from an AP is equal to 1, a non-AP STA might not be able to perform multiple frame transmission in a TXOP over NSTR link pair(s) with the AP, unless the expected duration of solicited PPDU transmitted on NSTR link pair(s) are the same.

When more than one STA that are affiliated with the same NSTR non-AP MLD simultaneously transmit a PPDU to their peer APs that are affiliated with the same AP MLD that sets the SRS Support subfield in the Basic variant ML element it transmits to 1 solicit a control response frame on more than one link and the NSTR non-AP MLD intends to align the PPDU end time of PPDUs carrying the control response frames from the peer APs, then PPDU soliciting the control response frame shall carry one or more MPDUs with SRS Control subfield. The STA shall set the PPDU Response Duration subfield of the SRS Control subfield to a value that is equal to or longer than the maximum of the expected duration of the response PPDUs on all links, where the expected duration of the response PPDU is calculated based on the following parameters:

* PPDU format that includes HE SU PPDU, or EHT MU PPDU,
* Bandwidth that is equal to the bandwidth of the soliciting PPDU,
* NSS and number of LTFs that are equal to one,
* GI that is equal to the longest mandatory GI value (3.2ms),
* MCS that is selected following the rate selection rules defined in10.6.6.5 (Rate selection for control response frames), 26.17.1 (Basic HE BSS operation), 26.15.3 (MCS, NSS, BW and DCM selection), and 35.9 (EHT BSS operation),
* A PSDU length that is equal to or greater than the length of a Multi-STA BlockAck frame with the negotiated BlockAck bitmap size(s).

*[Editorial Note: Depending on the progress of defining MCS selection for EHT PPDU, the referenced sub-clause number (currently 35.9) will be modified accordingly.]*

An EHT AP affiliated with an AP MLD that transmits a PPDU in response to a frame containing an SRS Control subfield shall:

* Have the duration of the PPDU to be equal to the duration that is specified in the PPDU Response Duration subfield of the soliciting SRS Control subfield.
* Use at least the HE SU PPDU format or the EHT MU PPDU format addressed to a single STA for the PPDU transmission. If the PSDU carried in the response PPDU contains an A-MPDU then the contents of the A-MPDU shall be as defined in Table 9-533 (A-MPDU contents in the control response context).

NOTE—If the PPDU carrying the response is an HE SU PPDU or an EHT MU PPDU addressed to one non-AP STA then the AP might use any type of padding to ensure that the duration of the PPDU is equal to the duration that is specified in the PPDU Response Duration subfield of the soliciting SRS Control subfield.