IEEE P802.11
Wireless LANs

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| Proposed Spec Text for fragmentation operation |
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Abstract

This document provides proposals for text spec related to fragmentation capabilities.

1. **Introduction**

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGax Draft. The introduction and the explanation of the proposed changes are not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGax Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGax Editor: Editing instructions preceded by “TGax Editor” are instructions to the TGax editor to modify existing material in the TGax draft. As a result of adopting the changes, the TGax editor will execute the instructions rather than copy them to the TGax Draft.***

1. **Proposed changes**

Currently, every HE STA defines its fragmentation capabilities in the HE capabilities element, with the fragmentation support subfield in the HE MAC capabilities information field, as illustrated in table 9-262z - (Subfields of the HE MAC Capabilities Information field).

|  |
| --- |
| * Subfields of the HE MAC Capabilities Information field
 |
| Subfield | Definition | Encoding |
| Fragmentation Support | Indicates the level of dynamic fragmentation that is supported by a STA as a recipient. | Set to 0 for no support for dynamic fragmentation.Set to 1 for support for dynamic fragments that are contained within a VHT single MPDU, no support for dynamic fragments within an A-MPDU that is not a VHT Single MPDU.Set to 2 for support for dynamic fragments that are contained within a Single MPDU(#11ah) and support for up to one dynamic fragment for each MSDU and each MMPDU within an A-MPDU or multi-TID A-MPDU that is not a Single MPDU(#11ah).Set to 3 for support for dynamic fragments that are contained within a Single MPDU(#11ah) and support for multiple dynamic fragments for each MSDU within an (#1160)A-MPDU or multi-TID AMPDU and up to one dynamic fragment for each MMPDU in a multi-TID A-MPDU that is not a Single MPDU(#11ah). |

Problem statement:

Supporting fragmentation requires implementation constraints, especially with regards to memory size. These constraints are proportional to the number of STAs from which the STA can receive fragments. For an AP, there is therefore a high difference of implementation constraints to support fragmentation for a single associated STA, or more 100s of associated STAs.

According to the current spec, if an AP support fragmentation, it will support it all the time, for every associated STA, irrespective of the number of associated STAs. We propose a more dynamic negotiation mechanism, where fragmentation level can changed dynamicaly per STA and per TID, as part of the BlockAck negotiation.

Proposed resolution:

As per the spec today, ADDBA request and response frames can include an ADDBA extension element described in 9.4.2.139 (ADDBA extension element).

We propose to add a new HE fragmentation operation field in the ADDBA capabilities field, in order to indicate the fragmentation level that is supported for that particular BA aggrement.

We propose the following changes

***TGax Editor: Modify the section 9.4.2.139 as described below***

* ADDBA Extension element (11ad)

The ADDBA Extension element is shown in Figure 9-530 (ADDBA Extension element format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | Element ID | Length | ADDBA Capabilities |
| Octets: | 1 | 1 | 1 |
| * ADDBA Extension element format(11ad)
 |

The Element ID and Length fields are defined in 9.4.2.1 (General).(#1429)(Ed)(#7363)

The ADDBA Capabilities field is shown in Figure 9-531 (ADDBA Capabilities field format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 | B1 B2 | B3 B7 |
|  | No-Fragmentation | HE fragmentation operation | Reserved |
| Bits: | 1 | 2 | 7 |
|  | * ADDBA Capabilities field format(11ad)
 |

(Ed)The ADDBA Extension element can be included in the ADDBA Request and Response (#2069)frames.(#3085)

The No-Fragmentation (#3097)subfield determines whether a fragmented MSDU can be carried in the MPDU sent under the (#2353)block ack agreement. When this (#3097)subfield set to 1 in the ADDBA Request frame, it indicates that the originator is not fragmenting sent MSDUs. When this (#3097)subfield set to 1 in the ADDBA Response frame, it indicates that the recipient is not capable of receiving fragmented MSDUs.

The HE fragmentation operation subfield determines the level of dynamic fragmentation that is supported as a recipient for the TID which is defined in the ADDBA frame.

* When this (#3097)subfield is set to 0 in the ADDBA Request frame, it indicates that the originator does not intend to send fragmented MSDUs for the TID specified in the Block Ack Parameter Set field of the ADDBA request frame.
* When this (#3097)subfield set to 1 in the ADDBA Request frame, it indicates that the originator intends to send fragmented MSDUs under fragmentation level 1 (see 25.3.3.2 (Level 1 dynamic fragmentation)) for the TID specified in the Block Ack Parameter Set field of the ADDBA request frame.
* When this (#3097)subfield set to 2 in the ADDBA Request frame, it indicates that the originator intends to send fragmented MSDUs under fragmentation level 2 (see 25.3.3.3 (Level 2 dynamic fragmentation)) for the TID specified in the Block Ack Parameter Set field of the ADDBA request frame.

When this (#3097)subfield set to 0 in the ADDBA Response frame, it indicates that the recipient is not capable of receiving fragmented MSDUs for the TID specified in the Block Ack Parameter Set field of the ADDBA Response frame.

When this (#3097)subfield set to 1 in the ADDBA Response frame, it indicates that the recipient is capable of receiving fragmented MSDUs under fragmentation level 1 only for the TID specified in the Block Ack Parameter Set field of the ADDBA Response frame.

When this (#3097)subfield set to 2 in the ADDBA Response frame, it indicates that the recipient is capable of receiving fragmented MSDUs under fragmentation levels 1 and 2 for the TID specified in the Block Ack Parameter Set field of the ADDBA Response frame.

***TGax Editor: Modify the section 25.3.3 as described below***

* Procedure at the originator(#1484)
* General(#Ed)

An originator STA transmitting an MPDU or A-MPDU that contains one or more dynamic fragments shall solicit an immediate response from the recipient STA for each of the fragments contained in the MPDU or A-MPDU, except when the fragments are sent under level 3 dynamic fragmentation (see 25.3.3.4 (Level 3 dynamic fragmentation(#1484))).(#2629)(#1794).

NOTE—The originator STA sends the fragments in order as defined in 10.5 (Fragmentation), except for level 3 dynamic fragmentation.

If the originator STA received explicit indications in response frames that none of the transmissions of previously transmitted fragment(s) of an MSDU or MMPDU have been successfully received then the STA may retransmit the full MSDU or MMPDU instead of retransmitting all the failed fragments. Otherwise, the originator STA may retransmit the failed fragment, in which case the frame body length and contents of the retransmitted fragment shall be the same as the first transmitted fragment and shall remain fixed for the lifetime of the MSDU or MMPDU at that STA.(#1225)

NOTE—An explicit indication is the absence of a valid Ack frame, BlockAck frame or Multi-STA BlockAck frame that is expected to be present in the first MPDU of the immediately received A-MPDU, or the absence of a BA Information field in the immediately received Multi-STA BlockAck frame for the TID of the transmitted fragment(s).(#1225)

An originator STA shall not transmit to a recipient STA an MPDU or A-MPDU containing dynamic fragments that do not satisfy the conditions in the subclauses below.(#1480)(#1479)(#1478)(#750)

* Level 1 dynamic fragmentation(#1484)

An originator STA may transmit to a recipient STA an MPDU(#1472) or VHT single MPDU(#1473) that contains one dynamic fragment of an MMPDU if the recipient STA has indicated a value 1 in the HE Fragmentation Support field of its HE Capabilities element.

An originator STA may transmit to a recipient STA an MPDU(#1472) or VHT single MPDU(#1473) that contains one dynamic fragment of an MSDU:

* At the condition that the recipient STA has indicated a value 1 in the HE Fragmentation Support field of its HE Capabilities element,
* And, if, for the TID of the MSDU, the ADDBA Extension element is present within the corresponding ADDBA Response frame transmitted during the block ack agreement handshake, at the condition that the HE fragmentation operation subfield in the ADDBA Extension element is 1.

The originator STA shall follow the rules defined in 10.13.8 (Transport of VHT single MPDUs) for generating the VHT single MPDU.(#Ed)

* Level 2 dynamic fragmentation(#1484)

An originator STA may transmit fragmented MMPDUs to a recipient STA under fragmentation level 2 if the recipient STA has indicated a value 1 in the HE Fragmentation Support field of its HE Capabilities element.

An originator STA may transmit fragmented MSDUs to a recipient STA under fragmentation level 2:

* At the condition that the recipient STA has indicated a value 1 in the HE Fragmentation Support field of its HE Capabilities element,
* And, if, for the TID of the MSDU, the ADDBA Extension element is present within the corresponding ADDBA Response frame transmitted during the block ack agreement handshake, at the condition that the HE fragmentation operation subfield in the ADDBA Extension element is 2.

Under fragmentation level 2, an originator STA may transmit to a recipient STA an MPDU, VHT single MPDU, or A-MPDU(#1473) that contains:

* One dynamic fragment of an MSDU or MMPDU in an MPDU or VHT single MPDU(#1474)
* The originator STA shall follow the rules defined in 10.13.8 (Transport of VHT single MPDUs) for generating the VHT single MPDU
* Up to one dynamic fragment of an MSDU or MMPDU for each MSDU and for the MMPDU in an A-MPDU format(#1474)(#2464)
* The originator STA shall follow the rules defined in 10.24.7.7 (Originator’s behavior) for generating the A-MPDU and the rules defined in 25.10.4 (A-MPDU with multiple TIDs) for generating the multi-TID A-MPDU (that can contain the fragment of the MMPDU)(#1476)
* Level 3 dynamic fragmentation(#1484)

An HE STA may transmit an L3 Frag BA Request frame to a receiver STA that has indicated a value of 3 in the HE Fragmentation Support field of the HE Capabilities element it transmits. The receiver STA that accepts the HT-Immediate block ack session shall respond with an L3 Frag BA Response if it has allocated resources for operating in a block ack session with level 3 fragmentation enabled. Otherwise, it shall respond with a BA Response frame to indicate that it has not allocated resources for operating in a block ack session where level 3 fragmentation is enabled.(#2268)(#2198)(#1800)(#1796)(#1663)

NOTE—A block ack session with level 3 fragmentation enabled requires a block acknowledgment record that maintains up to 4 bits per MSDU (one bit for each fragment of the MSDU).(#2268)(#2198)(#1800)(#1796)(#1663)

An originator STA may transmit to a recipient STA, which has indicated a value 3 in the HE Fragmentation Support field of its HE Capabilities element, an MPDU, VHT single MPDU, or A-MPDU(#1473) that contains:

* One dynamic fragment of an MSDU or MMPDU in an MPDU or VHT single MPDU(#1474)
* The originator STA shall follow the rules defined in 10.13.8 (Transport of VHT single MPDUs) for generating the VHT single MPDU
* Up to four dynamic fragments of an MSDU(#1475) for each MSDU and up to one dynamic fragment of an MMPDU(#1476)(#1475)(#2465) in an A-MPDU
* The originator STA shall set the Fragment Number subfield of each MPDU to a value less than 4
* The originator STA shall follow the rules defined in 10.24.7.7 (Originator’s behavior) for generating the A-MPDU with the exception that the A-MPDU shall contain MPDUs whose range of the Sequence Number subfields does not exceed *BL*/4, where *BL* is the length of the Block Ack Bitmap field of the BlockAck or Multi-STA BlockAck(#Ed) frame that corresponds to a TID of a transmitted fragment (see 10.24.7 (HT-immediate block ack extensions) and 25.4 (Block acknowledgement).(#697)(#Ed)(#166)(#1818)