IEEE P802.11
Wireless LANs

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| CR on Per-TID All Ack in Multi-STA BlockAck Frame |
| Date: 2017-03-13 |
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Abstract

This submission proposes resolutions for multiple comments related to TGax D1.0 with the following CIDs:

* 5402, 6183, 5403, 6184, 7044

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Update discussion

***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.***

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| CID | Page.line | Comment | Proposed Change | Resolution |
| 5402 | 193.58 | A multi-TID A-MPDU may contain A-MPDU subframes with the EOF subfield set to 1 and the MPDU Length subfield set to nonzero value. The STA that receives the A-MPDU acknowledges successful receptions of MPDUs in the above mentioned A-MPDU subframes with Per STA Info fields indicating an Ack. The TID value of a frame in an A-MPDU subframe with the EOF subfield set to 1 and the MPDU Length subfield set to nonzero value is unique among TID values of frames in the A-MPDU.Therefore, when every unsuccessful receptions of MPDUs are for a MPDU in an A-MPDU subframe with the EOF subfield set to 1 and the MPDU Length subfield set to nonzero, the Per STA Info field without Block Ack Starting Sequence Control and Block Ack Bitmap can acknowledge the successful reception of all MPDUs of a TID value without the ambiguity.This can reduce the length of the Multi-STA BlockAck frame. | An HE STA that receives a multi-TID A-MPDU shall respond with a Multi-STA BlockAck frame that contains- One Per STA Info field indicating an Ack for each successfully received MPDU that solicits a response that is preceded by a nonzero length MPDU delimiter whose EOF is 1 (TID value equals that of the QoS Data/QoS Null frame or 15 for the Action frame),- One Per STA Info field indicating a BlockAck for each TID of a successfully received MPDU that solicits a response that is preceded by a nonzero length MPDU delimiter whose EOF is 0 (TID value equals that of the QoS Data frame),- One Per STA Info field with the Ack Type subfield set to 1 for each TID of a successfully received MPDU that solicits a response that is preceded by a nonzero length MPDU delimiter whose EOF is 0 (TID value equals that of the QoS Data frame) only when every unsuccessful receptions are for MPDUs of which the corresponding MPDU delimiter includes the EOF subfield set to 1 and the MPDU Length subfield set to nonzero value. | Revised-Agree in principle.In D1.1, “*the EOF subfield shall be set to 1 in a nonzero length MPDU delimiter that precedes a QoS Data frame, or Action frame if the QoS Data frame or Action frame solicits an immediate Ack frame.*”It means that the TID of a nonzero length MPDU with the EOF subfield set to 1 is unique in the multi-TID A-MPDU.Therefore, if every unsuccessful MPDU in a multi-TID A-MPDU is preceded by an MPDU delimiter whose EOF is 1, the STA that received the multi-TID A-MPDU can be sure that the STA received all other MPDUs of different TIDs except the unsuccessful MPDU. The STA can acknowledge the received MPDUs using Per STA Info subfields with the Ack Type subfield set to 1.TGax editor to make the changes shown in 11-17/0445r1 under all headings that include CID 5402. |
| 6183 | 193.58 | As discussed till now, the shorter Multi-STA BlockAck frame is desirable.When a STA receives all of nonzero length MPDUs with the corresponding EOF subfield set to 0 in a multi-TID A-MPDU, the STA can acknowledge the reception for the MPDUs using a Multi-STA BlockAck frame without the bitmap for the MPDUs indicating each TID. | Please extend the case of a Per STA Info subfield without the Block Ack Starting Sequence Control field and the Block Ack Bitmap field. | Revised-Agree in principle.Please see the resolution for CID 5402.TGax editor to make the changes shown in 11-17/0445r1 under all headings that include CID 5402. |
| 5403 | 38.06 | According to the subclause 27.10.4 (A-MPDU with multiple TIDs), a multi-TID A-MPDU may contain A-MPDU subframes with the EOF subfield set to 1 and the MPDU Length subfield set to nonzero value. The STA that receives the A-MPDU acknowledges successful receptions of MPDUs in the above mentioned A-MPDU subframes with Per STA Info fields indicating an Ack. The TID value of a frame in an A-MPDU subframe with the EOF subfield set to 1 and the MPDU Length subfield set to nonzero value is unique among TID values of frames in the A-MPDU.Therefore, when every unsuccessful receptions of MPDUs are for a MPDU in an A-MPDU subframe with the EOF subfield set to 1 and the MPDU Length subfield set to nonzero, the Per STA Info field without Block Ack Starting Sequence Control and Block Ack Bitmap can acknowledge the successful reception of all MPDUs of a TID value without the ambiguity.This can reduce the length of the Multi-STA BlockAck frame. With this, the description on the Ack Type subfield should be modified. | If the Ack Type subfield is 1 and the TID value of the Per AID TID Info subfield is less than 8 or equal to 15, then the Block Ack Starting Sequence Control and Block Ack Bitmap subfields are not present and the Per STA Info subfield acknowledges successful reception of a single MPDU "or all the MPDUs" indicated by the TID of the Per AID TID Info subfield. | Revised-Agree in principle.Please see the resolution for CID 5402.TGax editor to make the changes shown in 11-17/0445r1 under all headings that include CID 5402. |
| 6184 | 38.06 | As discussed till now, the shorter Multi-STA BlockAck frame is desirable.When a STA receives all of nonzero length MPDUs with the corresponding EOF subfield set to 0 in a multi-TID A-MPDU, the STA can acknowledge the reception for the MPDUs using a Multi-STA BlockAck frame without the bitmap for the MPDUs indicating each TID. | Please extend the case of a Per STA Info subfield without the Block Ack Starting Sequence Control field and the Block Ack Bitmap field. | Revised-Agree in principle.Please see the resolution for CID 5402.TGax editor to make the changes shown in 11-17/0445r1 under all headings that include CID 5402. |
| 7044 | 38.06 | An HE STA can construct a multi-TID A-MPDU containing multiple nonzero length MPDUs with the EOF subfield set to 1 or multiple nonzero length MPDUs with the EOF subfield set to 0. Utilizing the EOF field, a multi-STA BlockAck frame can be more efficient. | As per comment | Revised-Agree in principle.Please see the resolution for CID 5402.TGax editor to make the changes shown in 11-17/0445r1 under all headings that include CID 5402. |

**Discussion:**

In the subclause 27.10.4 of D1.1, “*a multi-TID A-MPDU may contain multiple noncontiguous nonzero length MPDU delimiters with EOF subfield equal to 1, one for each TID that solicits Ack and/or multiple noncontiguous nonzero length MPDU delimiters with EOF subfield equal to 0, one for each TID that solicits BlockAck.*” An MPDU with the EOF subfield set to 1 and the nonzero MPDU Length subfield can be aggregated with other MPDUs.

Also in D1.1, “*the EOF subfield shall be set to 1 in a nonzero length MPDU delimiter that precedes a QoS Data frame, or Action frame if the QoS Data frame or Action frame solicits an immediate Ack frame.*” It means that the TID of a nonzero length MPDU with the EOF subfield set to 1 is not the same with TIDs of other MPDUs in the multi-TID A-MPDU.

Therefore, if every unsuccessful MPDU in a multi-TID A-MPDU is preceded by an MPDU delimiter whose the EOF subfield is 1, the STA that received the multi-TID A-MPDU can be sure that the STA received all other MPDUs of different TIDs except the unsuccessful MPDU. The STA can acknowledge the received MPDUs using Per STA Info subfields with the Ack Type subfield set to 1.

By optionally supporting the transmission of the All Ack signaling for a particular TID (the per-TID All Ack signaling), a recipient STA can send a much shorter multi-STA BlockAck frame. When using the per-TID All Ack signaling is not possible for a recipient STA, it can still send a multi-STA BlockAck frame with the BlockAck Bitmap subfield.

Responding with the multi-STA BlockAck frame with the per-TID All Ack signaling shall be allowed only when the originator had set the All Ack Support subfield to 1. The STA that supports the reception of a multi-STA BlockAck frame under the All Ack context also has the capability to receive the per-TID All Ack signaling without further requirement.

**TGax Editor: *Modify the subclause 27.4.2 as follows***

**27.4.2 Acknowledgement, block acknowledgment or all acknowledgement selection in a Multi-STA BlockAck frame**

A recipient sets the Ack Type and TID subfields in a Per AID TID Info field of the Multi-STA BlockAck frame sent as a response depending on the acknowledgement context.

a) All Ack context: if the originator had set the All Ack Supported subfield to 1 in the HE Capabilities element, then the recipient may set the Ack Type field to 1 and the TID subfield to 14 to indicate the successful reception of all the MPDUs intended to it carried in the eliciting A-MPDU or multi-TID A-MPDU only. Otherwise the recipient shall not set the Ack Type field to 1 and the TID subfield to 14. The Multi-STA BlockAck frame shall contain only one Per STA Info field addressed to an originator in the Multi-STA BlockAck frame.

b) Per-TID All Ack context: if the originator had set the All Ack Support subfield to 1 in the HE Capabilities element and for the recipient every unsuccessful MPDU was preceded by the MPDU delimiter with the EOF subfield set to 1, then the recipient may set the Ack Type field to 1 and the TID field to the TID value of the received MPDUs to indicate the successful reception of all the MPDUs of the TID intended to it carried in the eliciting multi-TID A-MPDU only. The multi-STA BlockAck frame may contain multiple occurrences of these Per STA Info fields that are intended to an originator, one for each successfully received MPDUs of the TID indicated by the TID subfield.

The allowed values for the TID field in this context are 0 to 7 (for indicating acknowledgement of QoS Data or QoS Null frames). (#5402)

c) Ack context: A recipient receiving a single MPDU, that requires an acknowledgment, shall set the Ack Type field to 1 and the TID field to the TID value of that MPDUs to indicate the successful reception of that MPDU.

If multiple single MPDUs in a Multi-TID A-MPDUs are received by a recipient that supports its reception, the Multi-STA BlockAck frame may contain multiple occurrences of these Per STA Info fields that are intended to an originator, one for each successfully received single MPDU requesting an acknowledgment.

The allowed values for the TID field in this context are 0 to 7 (for indicating acknowledgement of QoS Data or QoS Null frames) or 15 (for indicating acknowledgement of an Action frame).

d) BlockAck context: The recipient shall set the Ack Type field to 0 and the TID field of a Per STA Info field to the TID value of MPDUs requesting block acknowledgement that are carried in the eliciting A-MPDU or multi-TID A-MPDU.

The Multi-STA BlockAck frame may contain multiple occurrences of these Per STA Info fields addressed to an originator, one for each MPDU that is requesting block acknowledgement, in which case the Block Ack Starting Sequence Control and Block Ack Bitmap fields shall be set according to 10.24.7 (HT-immediate block ack extensions) for each block ack session, and according to 27.3 (Fragmentation) for each block ack session with dynamic fragmentation.

The allowed values for the TID field in this context are 0 to 7 (for indicating block acknowledgement of QoS Data frames).

Variable bitmap lengths can be included in the Per STA Info field when the originator and recipient negotiate their use as defined in 27.4.3 (Negotiation of block ack bitmap lengths).

An originator shall examine each received Multi-STA BlockAck frame sent by an STA as a response to a soliciting PPDU.

Upon reception of the Multi-STA BlockAck frame the originator performs the following operations for each Per STA Info field that has an AID field addressed to the originator (i.e., the AID subfield is an AID if the originator is a non-AP STA and is 0 when the originator is an AP):

* If the Ack Type field is 0 then the BlockAck Starting Sequence Control, TID and BA Bitmap fields of the Per STA Info field are processed according to 10.24.7 (HT-immediate block ack mechanism), 27.3 (Fragmentation), and as defined below.
* If the Ack Type field is 1 then the Per STA Info field indicates either the acknowledgement of a single MPDU or all MPDUs (#5402) identified by the value of the TID.
* If the Ack Type field is 1 and the TID subfield of Per AID TID Info field is 14, then the Per STA Info field indicates the acknowledgement of all MPDUs carried in the eliciting PPDU as defined by the acknowledgement context.

**TGax Editor: *Modify the 5th paragraph of the subclause 27.10.4 as follows***

**27.10.4 A-MPDU with multiple TIDs**

A multi-TID A-MPDU is an A-MPDU that contains QoS Data frames with two or more different TID values.

An HE STA with dot11MPDUAskedforAckInMultiTIDAMPDU set to true shall set dot11AMPDUwithMultipleTIDOptionImplemented to true. An HE STA with dot11MPDUAskedforAckInMultipleTIDAMPDU set to true shall set the Ack Enabled Multi-TID A-MPDU Support subfield of the HE Capabilities element it transmits to 1; otherwise, the HE STA shall set it to 0. An HE transmitter shall not aggregate MPDU that asks for Ack in a multiple-TID A-MPDU to the HE recipient unless the recipient sets Ack Enabled Multi-TID A-MPDU Support subfield to 1 in its announced HE Capabilities element.

An HE STA shall construct a multi-TID A-MPDU as defined in 9.7 (Aggregate MPDU (A-MPDU)) and 10.13 (A-MPDU operation) except that the EOF subfield shall be set to 1 in a nonzero length MPDU delimiter that precedes a QoS Data frame, or Action frame if the QoS Data frame or Action frame solicits an immediate Ack frame.

A multi-TID A-MPDU may contain multiple noncontiguous nonzero length MPDU delimiters with EOF subfield equal to 1, one for each TID that solicits Ack and/or multiple noncontiguous nonzero length MPDU delimiters with EOF subfield equal to 0, one for each TID that solicits BlockAck.

An HE STA that receives a multi-TID A-MPDU shall respond with a Multi-STA BlockAck frame that contains (see 27.4 (Block acknowledgement)):

* One Per STA Info field indicating an Ack for each successfully received MPDU that solicits a response that is preceded by a nonzero length MPDU delimiter whose EOF is 1 (TID value equals that of the QoS Data/QoS Null frame or 15 for the Action frame),
* One Per STA Info field indicating a BlockAck for each TID of a successfully received MPDU that solicits a response that is preceded by a nonzero length MPDU delimiter whose EOF is 0 (TID value equals that of the QoS Data frame).
* One Per STA Info field with the Ack Type subfield set to 1 for each TID of a successfully received MPDU that solicits a response that is preceded by a nonzero length MPDU delimiter whose EOF is 0 (TID value equals that of the QoS Data frame). (#5402)

**TGax Editor: *Modify the subclause 9.3.1.9.7 as follows***

**9.3.1.9.7 Multi-STA BlockAck variant**

If the Ack Type subfield is 1 and the TID value of the Per AID TID Info subfield is less than 8 or equal to 15, then the Block Ack Starting Sequence Control and Block Ack Bitmap subfields are not present and the Per STA Info subfield acknowledges successful reception of a single MPDU or all MPDUs (#5402) indicated by the TID of the Per AID TID Info subfield. If the Ack Type subfield is 1 and the TID subfield of the Per AID TID Info field is 14, then the Block Ack Starting Sequence Control and Block Ack Bitmap are not present and the Per STA Info field acknowledges successful reception of all the MPDUs carried in the eliciting A-MPDU. The Ack Type field is not set to 1 when responding to a BlockAckReq frame or an MU-BAR frame. If the Ack Type subfield is 0, then the Block Ack Starting Sequence Control and Block Ack Bitmap subfields are present.

The context and the presence of each optional subfields in a Per STA Info subfield in a Multi-STA BlockAck frame is as defined in Table 9-24b (Context of the Per STA Info subfield and presence of optional subfields).

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| **Table** **9-24b—Context of the Per STA Info subfield and presence of optional subfields** |
| **Ack Type subfield value** | **TID subfield values** | **Presence of optional subfields****in the Per STA Info field** | **Context of a Per STA Info field in a Multi-STA BlockAck frame** |
| 0 | 0-7 | Block Ack Starting Sequence Control | Present | Block acknowledgment context:Sent as a response to an A-MPDU that solicits an immediate block acknowledgement or to a BAR frame |
| Block Ack Bitmap | Present |
| 1 | 0-7 | Block Ack Starting Sequence Control | Not present | Acknowledgment context:Sent as a response to an MPDU or VHT Single MPDU that solicits an immediate acknowledgmentAll block acknowledgment context:Sent as a response to an A-MPDU that solicits an immediate response and all MPDUs of the TID contained in the A-MPDU are received successfully (#5402) |
| Block Ack Bitmap | Not present |
| 0 or 1 | 8 to 13 | N/A | N/A | Reserved |
| 0 | 14 | N/A | N/A | Reserved |
| 1 | 14 | Block Ack Starting Sequence Control | Not present | All block acknowledgment context:Sent as a response to an A-MPDU that solicits an immediate response and all MPDUs contained in the A-MPDU are received successfully |
| Block Ack Bitmap | Not present |
| 0 | 15 | N/A | N/A | Reserved |
| 1 | 15 | Block Ack Starting Sequence Control | Not present | Action Ack frame acknowledgment context:Sent as a response to an Action Ack frame carried in an A-MPDU that solicits an immediate acknowledgment |
| N/A | Not present |