IEEE P802.11  
Wireless LANs

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| --- | --- | --- | --- | --- |
| Resolution of SAR Related CIDs | | | | |
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|  |  |  |  |  |

Abstract

This submission proposes resolutions for SAR related CIDs.

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| --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Comment** | **Proposed change** | **Resolution** |
| 4221 | C.3 | Thre is no MIB variable associated with SAR feature. | Add MIB variable for SAR enablement | **Revised** |

**6.3.27.2 MLME-ADDBA.request**

**6.3.27.2.2 Semantics of the service primitive**

*Change last row in table at P44 L4 as follow*

*Change last row in table at P44 L26 as follow*

*Change last row in table at P45 L19 as follow*

*Change last row in table at P46 L5 as follow*

|  |  |  |  |
| --- | --- | --- | --- |
| SAR Configuration | SAR Configuration element | As defined in 9.4.2.265 | Specifies the segmentation and reassembly parameters. The parameter is present if dot11SAROptionImplemented is true and is absent otherwise |

*Add text at P476 L17 as follow*

dot11SAROptionImplemented OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable. Its value is determined by device capabilities.

This attribute, when true, indicates the STA is Segmentation and Reassembly (SAR) capable. This attribute, when false, indicates the STA is not SAR capable. The default value of this attribute is false."

DEFVAL { false }

::= { dot11EDMGSTAConfigEntry 3 }

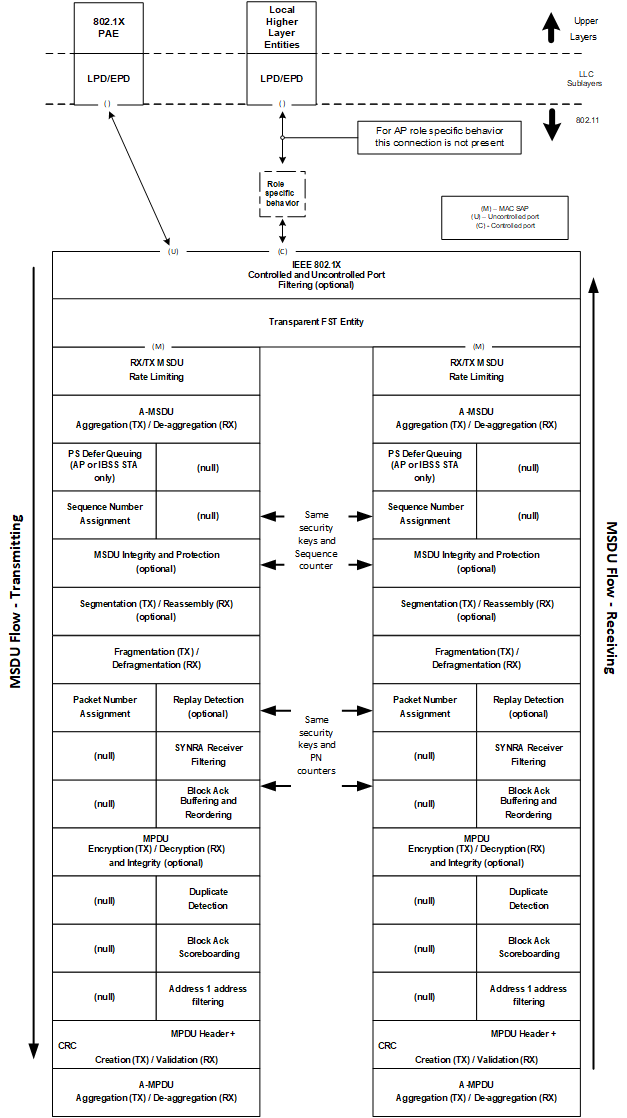
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Comment** | **Proposed change** | **Resolution** |
| 4216 | 5.1.5.2 | The modified Figure 5.2 has two 802.1AC Convergence function boxes at the 802.1 convergence bridging and related function layer. This is not in agreement with 802.11mdD2.0 which does not have this "layer" in the figure. | Delete the 802.1 convergence bridging and related function layer and the two 802.1AC Convergence function boxes from the Figure. | Accepted |

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| **CID** | **Clause** | **Comment** | **Proposed change** | **Resolution** |
| 4292 | 5.1.5.1 | Segmentation uses the MSDU sequence number, according to the description. But, it occurs above (before, for TX) the assignment of MSDU sequence numbers, in the stack. Also, from the (relatively simple) description of segmentation in 10.72.2 don't imply that there is MSDU-level integretity protection done on each segment, so the segmentation of an MSDU must occur below (after) the integrity protection is completed. And, likewise, the MSDU integrity checking must occur after (above) reassembly. | Move segmentation and reassembly to below "MSDU Integrity and Protection" in the stack diagram (Figure 5-1). Similarly, in Figure 5-2. Move "segmentation" and "reassembly" in the text in 5.1.5.1 to occu in the matching sequence. | Accepted |

*Note to the Editor on the changes made to Figure 5.1 as follow*



*Note to the Editor on the changes made to Figure 5.2 as follow*



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Comment** | **Proposed change** | **Resolution** |
| 4411 | 10.43.11.3 | There is a gap where a large PDU (e.g., 1 MB / video PDU) needs to be sent without retransmission (time constraint), i.e., either received or dropped. The only way to accomplish this is obviously a larger MSDU size, but the next best thing can be SAR - as long as it is defined independent of how those MPDUs are transmitted.  That is, SAR should stay relevant with MPDUs sent under Block Ack, Immediate Ack or no Ack, with the understanding that if one MPDU (MSDU Segment) is lost all relevant MPDUs can be dropped.  This is still not the same as having a 1 MB MSDU (MSDU segments can go out in different A-MPDUs/TXOPs if I understand), but reasonably better. | Decouple the SAR definition from underlying Block Ack agreement; Extend text to allow MPDUs sent under any Ack policy (No Ack, Immediate Ack and Block Ack); Clarify that in receiver, MSDU is dropped if one of its segments is no received. | Revised |

**Discussion**

SAR was revised to allow negotiation through Association procedure and to be enabled also for DMG STA and not only EDMG.

Major functionality of the SAR feature rely and described in section Block Ack Acknowledgement (10.26)

In specific, the segmentation and reassembly frame construction is heavily depending the Sequence Number processing the originator and responder do as part of Block ack agreement.

In details, SAR functionality is involved in all below procedures:

10.26.2 Setup and modification of the block ack parameters

10.26.6.1 Introduction to HT-immediate block ack extensions

10.26.6.2 HT-immediate block ack architecture

10.26.6.6 Receive reordering buffer control operation

10.26.6.6.2 Operation for each received Data frame

10.26.6.6.3 Operation for each received BlockAckReq

10.26.6.7 Originator’s behaviour

26.6.8 Maintaining block ack state at the originator

Detaching the SAR from Block Ack functionality is not strait forward task and cannot be implemented at this time of the project.

A-MPDU is allowed to be used only with ack policy, which is either Implicit BAR, or Block Ack, or Scheduled Ack

Allowing SAR segments to be carried in A-MPDU with no Ack policy deviates from the 802.11 general line in which it is not allowed, mechanism for receiver buffer protection like Buffer Size, Window Size, Flow Control could not be employed hence could resulting with loss of data.



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| --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Comment** | **Proposed change** | **Resolution** |
| 4450 | 10.72.1 | "Segmentation and reassembly shall not be used under an unsolicited block ack agreement." There is no solid reason for this restriction. The relevant information to support SAR under unsolicited block ack may be exchanged during association establishment. | Consider: - adding the SAR Configuration element to the Association request and response. - adding new filed like number of TID supported under SAR to the Unsolicited Block Ack Extension element - adding new field of SAR capability under unsolicited BA to the Unsolicited Block Ack Extension element - making relevant changes in the normative text | **Revised**  SAR Configuration IE should be added to the Assoc Req/Rsp per each supported TID with SAR Functionality |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Comment** | **Proposed change** | **Resolution** |
| 4449 | 10.72.1 | "An EDMG STA supports segmentation and reassembly if the Segmentation and Reassembly Support subfield is equal to 1 in the STA's EDMG Capabilities element." There is nothing specific that makes this feature EDMG restricted. Consider to enable it for DMG. | Move the SAR capability from the EDMG Capabilities element to the DMG capabilities | Revised  SAR Configuration IE can be sent by DMG Station as well. SAR Text is changed to be with DMG and not EDMG |

Note to the Editor: The following changes are made for CIDs 4449 and 4450.

*Add in P34 L1 as follow*

MLME-ASSOCIATE.request( ….

….

Unsolicited Block Ack Extension

SAR Configuration,

VendorSpecificInfo

)

*Add last row at table in P34 L4 as follow*

|  |  |  |  |
| --- | --- | --- | --- |
| SAR Configuration | SAR Configuration element | As defined in 9.4.2.265 | Specifies the segmentation and reassembly parameters. The parameter is present if dot11SAROptionImplemented is true and is absent otherwise |

*Add in P35 L14 as follow*

MLME-ASSOCIATE.confirm( ….

….

Unsolicited Block Ack Extension

SAR Configuration,

VendorSpecificInfo

)

*Add last row at table in P35 L18 as follow*

|  |  |  |  |
| --- | --- | --- | --- |
| SAR Configuration | SAR Configuration element | As defined in 9.4.2.265 | Specifies the segmentation and reassembly parameters. The parameter is present if dot11SAROptionImplemented is true and is absent otherwise |

*Add in P36 L25 as follow*

MLME-ASSOCIATE.indication( ….

….

Unsolicited Block Ack Extension

SAR Configuration,

VendorSpecificInfo

)

*Add last row at table in P35 L29 as follow*

|  |  |  |  |
| --- | --- | --- | --- |
| SAR Configuration | SAR Configuration element | As defined in 9.4.2.265 | Specifies the segmentation and reassembly parameters. The parameter is present if dot11SAROptionImplemented is true and is absent otherwise |

*Add in P37 L30 as follow*

MLME-ASSOCIATE.response( ….

….

Unsolicited Block Ack Extension,

TDDSlotStructureList,

SAR Configuration,

VendorSpecificInfo

)

*Add last row at table in P38 L1 as follow*

|  |  |  |  |
| --- | --- | --- | --- |
| SAR Configuration | SAR Configuration element | As defined in 9.4.2.265 | Specifies the segmentation and reassembly parameters. The parameter is present if dot11SAROptionImplemented is true and is absent otherwise |

*Add in P39 L13 as follow*

MLME-REASSOCIATE.request( ….

….

Unsolicited Block Ack Extension,

SAR Configuration,

VendorSpecificInfo

)

*Add last row at table in P39 L18 as follow*

|  |  |  |  |
| --- | --- | --- | --- |
| SAR Configuration | SAR Configuration element | As defined in 9.4.2.265 | Specifies the segmentation and reassembly parameters. The parameter is present if dot11SAROptionImplemented is true and is absent otherwise |

*Add in P40 L29 as follow*

MLME-REASSOCIATE.confirm( ….

….

Unsolicited Block Ack Extension,

SAR Configuration,

VendorSpecificInfo

)

*Add last row at table in P40 L33 as follow*

|  |  |  |  |
| --- | --- | --- | --- |
| SAR Configuration | SAR Configuration element | As defined in 9.4.2.265 | Specifies the segmentation and reassembly parameters. The parameter is present if dot11SAROptionImplemented is true and is absent otherwise |

*Add in P41 L50 as follow*

MLME-REASSOCIATE.indication(….

….

Unsolicited Block Ack Extension,

SAR Configuration,

VendorSpecificInfo

)

*Add last row at table in P42 L2 as follow*

|  |  |  |  |
| --- | --- | --- | --- |
| SAR Configuration | SAR Configuration element | As defined in 9.4.2.265 | Specifies the segmentation and reassembly parameters. The parameter is present if dot11SAROptionImplemented is true and is absent otherwise |

*Add in P43 L3 as follow*

MLME-REASSOCIATE.response(….

….

Unsolicited Block Ack Extension,

SAR Configuration,

VendorSpecificInfo

)

*Add last row at table in P43 L8 as follow*

|  |  |  |  |
| --- | --- | --- | --- |
| SAR Configuration | SAR Configuration element | As defined in 9.4.2.265 | Specifies the segmentation and reassembly parameters. The parameter is present if dot11SAROptionImplemented is true and is absent otherwise |

**9.3.3 Management frames**

*Insert the following row in Table 9-29 (Association Request)*

*Insert the following rows in Table 9-30 (Association Response)*

*Insert the following row in Table 9-31 (Reassociation Request)*

*Insert the following rows in Table 9-32 (Reassociation Response)*

|  |  |  |
| --- | --- | --- |
| TBD | SAR Configuration | The SAR Configuration element is optionaly present if dot11SAROptionImplemented is are true and is absent otherwise |

*Change the following text in P158 L5*

**9.4.2.265 SAR Configuration element**

The Segmentation and Reassembly (SAR) Configuration element is formatted as shown in Figure 86. The SAR Configuration element can be included in the ADDBA Request and Response frames and in the Association Request and Response frames, in case the originator requests the recipient to use segmentation and reassembly for a corresponding TID. The SAR Configuration element indicates the specific segmentation parameters for the TID.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | SAR Parameters | MSDU Buffer Size | MPDU Buffer Size |
| Octets: | 1 | 1 | 1 | 2 | 2 | 2 |

**Figure 86 —SAR Configuration element format**

The Element ID, Length and Element ID Extension fields are defined in 9.4.2.1.

The SAR Parameters field is defined in Figure 87

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 | B1 B3 | B4 B7 | B8 B11 | B12 B15 |
|  | SAR Enabled | MSDU Modulo | MPDU Modulo | SAR TID | Reserved |
| Bits: | 1 | 3 | 4 | 4 | 4 |

**Figure 87 —SAR Parameters field format**

The SAR Enabled subfield set to 1 indicates that segmentation and reassembly is to be used with the parameters indicated in this element for the corresponding TID.

The MSDU Modulo subfield indicates the number of bits to be allocated to the length of the MSDU Sequence Number subfield within the Sequence Control field. The MPDU Modulo subfield indicates the number of bits to be allocated to the length of the MPDU Sequence Number subfield within the Sequence Control field. The sum of the values of the MSDU Modulo subfield and the MPDU Modulo subfield is equal to fourteen.

The SAR TID subfield contains the value of the TC or TS for which the SAR operation is being requested

The MSDU Buffer Size field indicates the number of buffers available for this particular TID. Each buffer is capable of holding the number of octets equal to the maximum supported MSDU size as indicated in the Segmentation and Reassembly Capability field of the STA’s EDMG Capabilities element.

The MPDU Buffer Size field indicates the number of buffers available for this particular TID. Each buffer is capable of holding a number of octets equal to the maximum supported MSDU size for a DMG PPDU as indicated in Table 9-19 or to the last value agreed between the peers via an ADDTS Request and Response frame exchange for this TID, if any.

**10.72 EDMG segmentation and reassembly operation**

**10.72.1 General**

*Change the following text in P341 L17*

An DMG STA that supports segmentation and reassembly may segment large MSDUs received at the MAC SAP

*Change the following text in P341 L29*

An DMG STA supports segmentation and reassembly if the Segmentation and Reassembly Support subfield is equal to 1 in the STA’s EDMG Capabilities element.

*Change the following text in P341 L33*

Segmentation and reassembly is established for a particular TID through the use of an ADDBA Request and ADDBA Response frame exchange that includes the SAR Configuration element or through the use of Association Request and Association Response under an unsolicited block ack agreement.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Comment** | **Proposed change** | **Resolution** |
| 4285 | 10.72 | The resolution to CID 3646 did not answer the question. I agree that segmentation as defined in 11ay is different from fragmentation in the baseline, in the way the sequence numbers are transmitted (and the Start/End indications). But that doesn't explain why this new facility is needed, and the existing fragmentation factility was not sufficient or couldn't be extended. If there is sound reason why this facility is better, then it should be defined such that it can be used by any STA, and not only EDMG STAs. | Merge the new aspects of the EDMG segmentation and reassembly feature into the existing fragmentation/defragmentation feature, and consider whether it needs to be limited to EDMG STAs or could be generalized. | Rejected |

**Discussion**

Segmentation and Reassembly was designed to allow MAC layer STA to send large MSDUs without the need of higher layers to segment and reassemble it, though to save CPU utilization, Airtime, power and more.

Fragmentation in its current architecture, allow transmission of no more of 16 fragments (Fragment Number is 4 bits in the Sequence Control Field). Since SAR rely on MPDU Sequence numbering and Start/End indications to reassemble segmented MSDU, it is not limited as fragmentation and MSDU Size can be up to 4MB.

In addition fragmentation is an optional capability for DMG/EDMG STA hence its bits can be reused for other purposes. For other 802.11 devices, fragmentation is still mandatory feature.



***10.2.7 Fragmentation/defragmentation overview***

*…….*

*Transmission of fragmented MPDUs by a DMG STA outside of an A-MPDU depends on setting of the No-*

*Fragmentation field in the ADDBA Extension element within the ADDBA Response frame transmitted*

*during the block ack agreement handshake. The MSDU shall not be fragmented if the No-Fragmentation*

*field in the ADDBA Extension element within the ADDBA Response frame transmitted during the block*

*ack agreement handshake is 1. If the No-Fragmentation field in the ADDBA Extension element within the*

*ADDBA Response frame is 0, the originator may send fragmented nonaggregated MSDU with Normal Ack*

*policy under block ack agreement.*

My understanding is that 802.11ay group cannot alter fields in the “9.4.2.27 Extended Capabilities element” which is the IE to indicate general STA capabilities for other 802.11 STAs.

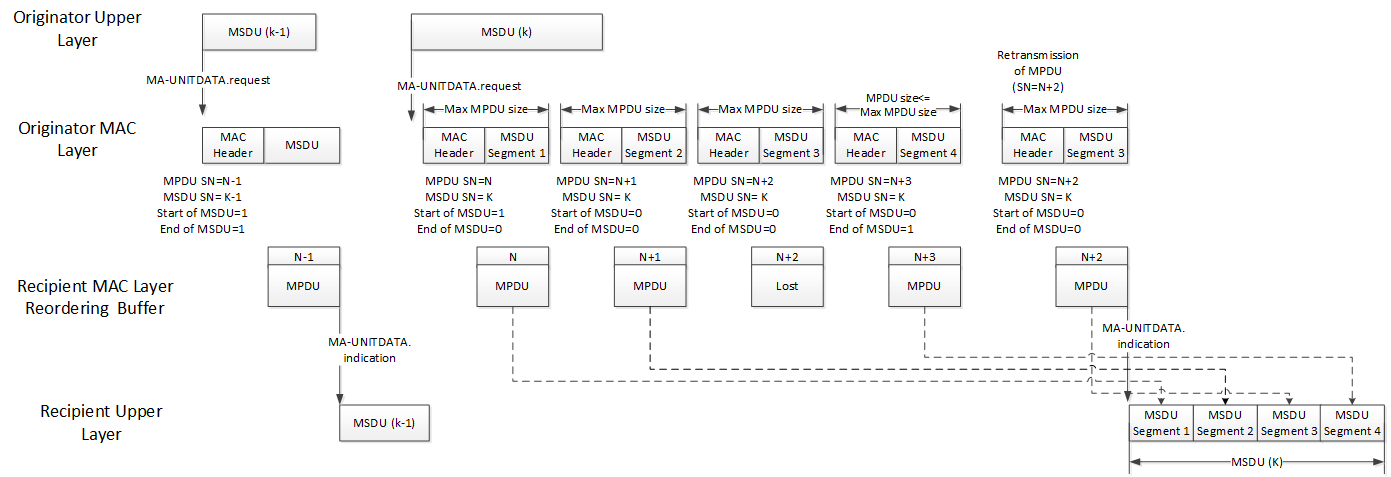
If we would like to generalize Segmentation, the proposal need to be brought 802.11md for discussion and cannot be decided in 802.11ay.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Comment** | **Proposed change** | **Resolution** |
| 4293 | 10.72.1 | MA-UNITDATA-STATUS.indication does not indicate that a frame was successfully delivered to the peer, only that it was successfully checked for correct/usable parameters provided to the .request, and that it has been queued for transmission. See 5.2.3.4 for details. | Delete the third sentence of this paragarph, and remove the second occurrence of MA-UNITDATA-STATUS.indication in Figure 158 (in the upper right corner). | Revised |

*Change test at P342 L1*

Figure 158 depicts an example of the transmission of MSDUs using the segmentation and reassembly procedure. In this example, the upper layer of the originator uses the MA-UNITDTA.request primitive to pass MSDUs to the MAC layer for delivery to the recipient.. MAC level acknowledgements are not depicted in the figure. Delivered MPDUs reside in the recipient’s reordering buffer. A MA-UNITDATA.indication primitive is used to deliver the complete MSDU to the recipient’s upper layer. 7 Moreover, in this example, MSDU *K* – 1 contains one segment delivered in the MPDU with SN = N – 1, which is successfully delivered to the recipient’s reordering buffer and then released to the recipient’s upper layer. MSDU *K* comprises of four MSDU segments that are transmitted to the recipient by MPDUs with SN = N, N+1, N+2, and N+3. The first transmission attempt of MPDU SN=N+2 fails and is retransmitted. The entire MSDU *K* is released to the recipient’s upper layer upon arrival of all MSDU segments at the recipient’s reordering buffer.

*Replace Figures 158 and 159 with the following*



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Comment** | **Proposed change** | **Resolution** |
| 4451 | 9.2.4.4.2 | "The Start of MSDUn subfield ..." What is the MSDUn about? It is not clear why the "n" is needed in the name of this field. MSDU is an abbreviation of medium access control service data unit and in no place in the entire 802.11 document the abbreviation is modified. Suggest to remove the unnecessary "n" | Remove the unnecessary "n". The same about "End of MSDUn" | Accepted |

*Instruct the editor to replace all occurrences of MSDUn with MSDU*

**SP/M:** Do you accept the resolutions given in this document?