IEEE P802.11
Wireless LANs

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| Support for Leader-Based Simultaneous MRG Block Ack in 802.11aa |
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Abstract

This submission contains the normative text related to changes required in P802.11aa/D1.0 in order to support Leader-Based Simultaneous MRG Block ACK. The latter is a retransmission scheme that enables multiple stations to transmit feedback at the same time, thus removing the dependency of the increase in protocol overhead on the MRG group size. It is a desired feature of this scheme that frames containing feedback are transmitted at the same time, and loss of feedback is exploited as useful information.

This document is based on the presentations listed in the references below. This document is based on 802.11aa Draft 1.0. Editorial instructions are relative to the contents of 802.11aa Draft 1.0.

This document is recursively based upon

* IEEE P802.11aa Draft 1.0

**4. Abbreviations and acronyms**

***Add the following abbreviations:***

SBA Simultaneous Block Ack

SBAR Simultaneous Block Ack Request

**3. Definitions**

***Insert new definitions 3.aa10 through 3.aa11 retaining the alphabetic ordering:***

**3.aa10** **MRG SBAR mode:** An MRG Block Ack mode in which Block Ack feedback from the non-AP group members of an MRG group may be transmitted at the same time. This is done when the AP switches to SBAR mode by transmitting an MRG BAR in which the MRG SBAR Mode bit is equal to 1.

**3.aa11** **SBA Leader / Leader:** A non-AP STA that has been selected as the leader of an MRG group by the AP that has transmitted a block of MRG frames to this group and has terminated this block with an MRG BAR in which the MRG SBAR Mode subfield in the MRG BAR Information field is equal to 1.

***Change MRG BAR Information, Figure 7-14aa***

(Editorial note: the change is the Variable size of MRG BAR Bitmap Control)

|  |  |  |
| --- | --- | --- |
| Octets: 1 | Variable | Variable |
| MRG BAR Information Length | MRG BAR Bitmap Control | MRG BAR Partial Bitmap |

**Figure 7-13aa— MRG BAR Information**

***Add MRG BAR Bitmap Control Field, Figure 7-14aa, after Figure 7-13aa***

|  |  |  |
| --- | --- | --- |
| MRG SBAR Mode  | SBAR Minimum  | MRG BAR Bitmap Offset |
| Bits: 1  | 8  | 7  |

**Figure 7-14aa— MRG BAR Bitmap Control Field**

***Change text insertion on page 7, lines 23-38***

The MRG BAR Bitmap Control field is either a single octet or a double octet. The leftmost bit is the MRG SBAR Mode bit. If the MRG SBAR Mode bit is set to 1, the MRG BAR Bitmap Control Field contains an SBAR Minimum subfield, which is a single octet. Otherwise, this subfield is omitted. The remaining 7 bits of the field form the Bitmap Offset subfield.

The SBAR Minimum subfield contains the number of previous frames, counted from the value in the Block Ack Starting Sequence Control subfield in the BA Information field, that have been transmitted up to now to the MRG group address as given in the MRG Group Address field of the Block Ack frame, excluding frames that had the DEI bit set to 0.

The MRG BAR virtual bitmap could be up to 2008 bits, one per AID, and is organized into 251 octets such that AID number N (0 ≤ N ≤ 2007) in the bitmap corresponds to bit number (N mod 8) in octet number floor(N / 8) where the low-order bit of each octet is bit number 0, and the high order bit is bit number 7. If the MRG SBAR Mode bit is set to 0, the AP requests that the non-AP STA with AID equal to N respond to the BAR containing the MRG BAR Information field if bit number N is 1, and not respond if bit number N is 0. The responding sequence is in ascending AID order, as described in 9.10.10.1. If the MRG SBAR Mode bit is set to 1, the AP requests that the non-AP STA with AID equal to N acts as the MRG leader for the MRG group upon reception of the BAR containing the MRG BAR Information field if bit number N is 1, whereas only exactly one bit may be set in the bitmap in this case, as described in 9.10.10.2. The MRG BAR Partial Bitmap field consists of octets numbered P1 through P2 of the MRG BAR virtual bitmap, where P1 is the largest even number such that bits numbered 1 through (P1 × 8) – 1 in the bitmap are all 0 and P2 is the smallest number such that bits numbered (P2 + 1) × 8 through 2007 in the bitmap are all 0. In this case, the Bitmap Offset field value contains the number floor(P1/2), and the MRG BAR Information Length field is set to (P2 – P1) + 2.

If the list of STAs that are requested to respond to the BlockAckReq is empty, then the MRG BAR Bitmap Offset subfield is 0 and the MRG BAR Partial Bitmap field is encoded as a single octet equal to 0.

***Change MRG BAR Information, Figure 7-16***

(Editorial note: the change is adding the SBA Leader bit subfield)

BA Ack

Policy

Multi-TID

Compressed

Bitmap

MRG

Reserved

TID\_INFO

B0

B1

B2

B3

Bits:

1

1

1

1

4

B5

B11

B12

B15

6

**Figure 7-16—BA Control field**

SBA Leader

B4

1

***Append text insertion on page 8, lines 32-34, as follows***

When the MRG field is set to 1, the BlockAck is sent in response to a BlockAckReq with an MRG group address in the RA field. The BlockAck includes the MRG Group Address field when the MRG field is set to 1, and omits the field otherwise. When the SBA Leader field is set to 1, the BlockAck is sent in response to a BlockAckReq with the MRG SBAR Mode bit set to 1, and the AID of this STA is equal to the AID as signalled in the MRG BAR Bitmap of the immediate previous BlockAckReq frame. Additionally, in this case the BA information field is encoded as a single octet equal to 0. When the SBA Leader field is set to 0, the BlockAck is sent in response to a BlockAckReq with the MRG SBAR Mode bit set to 1, and the AID of this STA is not equal to the AID as signalled in the MRG BAR Bitmap of the immediate previous BlockAckReq frame.

***Insert text on page 42, line 13***

**9.10.10.1 MRG Block Ack with explicit feedback**

***Insert text on page 44, line 10***

**9.10.10.1 MRG Block Ack with implicit feedback**

After an AP transmits between one and MRG Buffer Size MSDUs or A-MSDUs with RA set to the same MRG group address and with the DEI set to 0, when the Ack Policy for that group address is MRG-Block-Ack, the AP may send a BlockAckReq with SBA Mode set to 1 to the group address. The BlockAckReq lists exactly one of the MRG group members in the MRG BAR Information field, and this STA then is the leader of this group. If the source of the MRG group addressed stream is a STA within the BSS, the leader shall not be this STA.

NOTE-How the AP determines the leader for this group is beyond the scope of this standard.

When a non-AP STA receives a BlockAckReq with a RA equal to an MRG group address and with the SBA Mode set to 1, the non-AP STA shall determine how manydata or management frames it has received, counted starting from the Block Ack Starting Sequence Control subfield in the MRG BAR until the reception of the MRG BAR in which the SBAR Minimum field is present. The SBAR Minimum field carries the value of the variable *k*.

When the non-AP STA’s AID is listed in the MRG BAR Information field, the non-AP STA is the leader of the MRG group and shall transmit a BlockAck frame in which the SBA Leader field is set to 1 after one SIFS period if and only if the non-AP STA has not received less than *k* data or management frames, not counting data frames in which the DEI has been 0. Otherwise, i.e. when the non-AP STA is the leader and has received less than *k* data or management frames, this STA shall not respond to said BAR at all.

When the non-AP STA’s AID is not listed in the MRG BAR Information field, the non-AP STA is not the leader of the MRG group and shall transmit a BlockAck frame in which the SBA Leader field is set to 0 after one SIFS period if and only if the non-AP STA has received less than *k* data or management frames, not counting data frames in which the DEI has been 1. Otherwise, i.e. when the non-AP STA is not the leader and has received at least *k* data or management frames, this STA shall not respond to said BAR at all.

AP

Block

AckReq

MRG group member 1 (leader)

Data

DEI=0

MRG group member 2

MRG group member 3

Data

DEI=0

Data

DEI=0

Block

Ack

Has received

at least *k* frames

Block

Ack

Data

DEI=1

Block

Ack

Has received

at least *k* frames

Block

AckReq

**Figure 9-aa2: Typical frame exchange with MRG-Block-Ack Ack policy and SBA mode enabled**

A typical frame exchange sequence using the MRG-Block-Ack Ack policy with SBA mode enabled for a single TID and a single group address is shown in Figure 9-aa2.

An AP may only transmit a sequence of consecutive frames, in which the DEI is either equal to 0 or 1 in all of them, to a single MRG group address once it intends to transmit a BAR with SBAR Mode bit set to 1 after this sequence. After an AP has transmitted a BAR with SBAR Mode bit set to 1, it may not retransmit any of the already transmitted frames. Instead, it may transmit a sequence of consecutive frames in which the DEI is 1. Further sequences of consecutive frames which have the DEI set to 1 may be transmitted without transmitting any individual data frame more than once, until no more frames in which the DEI is equal to 1 are remaining. While doing so, the AP shall keep the value in the Block Ack Starting Sequence Control subfield constant. The AP may continue transmitting frames in which the DEI is equal to 0 with a different value for the Block Ack Starting Sequence Control subfield if it either drops consecutive remaining frames in which the DEI is equal to 1 or if no frames in which the DEI is 1 are available in the buffer.

NOTE- The buffering strategy an AP needs to implement in order to distinguish whether consecutive sequences to a single MRG group address and all with DEI either equal to 0 or equal to 1 are available is beyond the scope of this standard.

An AP which has sent the BAR with SBAR Mode bit set to 1 shall assume that reception of a BA with SBA Leader field set to 1 after a delay of no more than

SIFS + TXTIME(BlockAck)

implies that the leader receiver has received at least *k* frames (not counting data frames in which the DEI has been 1), and all non-leader receivers did so, aswell. Lack of reception of a BA from the non-AP leader STA at the AP after said delay shall imply that less than *k* frames have been received at one, more than one or all of the STAs in the MRG group.

An AP that intends to transmit a BAR with SBAR Mode bit set to 1 shall do so and may then release any transmitted frame from its buffer. A non-AP STA receiving a BAR with SBAR Mode bit set to 1 may deliver the received block of frames immediately to the upper layers, regardless of whether the block is complete or incomplete.

**References:**

* doc.: IEEE 802.11-10/0788r3 – “Aggregate Block-ACK definition”
* doc.: IEEE 802.11-10/0892r1 – “Replies to Q&A following 10/0788r2**”**
* doc.: IEEE 802.11-10/0768r2 – “Cancellation of aggregate Multicast feedback – measurement results”
* doc.: IEEE 802.11-09/1150r2 – “Feedback-jamming Multicast ARQ results with capture effect”
* doc.: IEEE 802.11-09/0290r1 – “Feedback-jamming Multicast ARQ”
* doc.: IEEE 802.11-09/0247r0 – “Quasi-reliable Multicast”