IEEE P802.11Wireless LANs

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| Proposed resolution to 11be cc34 CIDs on group addressed data frames duplicate detection | | | | |
| Date: 2021-03-02 | | | | |
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**Introduction**

This submission proposes the resolution to 11be CC34 CIDs on group addressed frames duplicate detection.

The page and line numbers for proposed changes refer to those in 11be Draft 0.3 [1].

**Comments:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CID | Commenter | Page/Line | Clause | Comment | Proposed change | Resolution |
| 2532 | Qi Wang | 82/45 | 10.3.2.14 | Group addressed frames transmitted over multiple links can cause duplicates. In 11be\_D0.3, there is no mechanism to enable duplicate detection and recovery for group addressed frames. | Please specify a mechanism to enable the detection of duplicated group addressed frames, and receiver requirements for detecting and discarding duplicated group addressed frames. See 11be submission 2020/1028. | Revised.  Specify a MLD level SNS that group addressed data frames shall use to determine the sequence numbers when they are transmitted over multiple links of a MLD. Also specify an MLD level RC2 and its behavior. As a result, duplicated group addressed data frames received over multiple links can be detected and discarded.  11be editor: please incorporate the text changes in:  [https://mentor.ieee.org/802.11/dcn/21/11-21-0410-00-00be-proposed -resolution-to-11be-CID34-CIDs-on-group-addressed-data-frames-duplicate-detection.pptx](https://mentor.ieee.org/802.11/dcn/21/11-21-0410-00-00be-proposed%20-resolution-to-11be-CID34-CIDs-on-group-addressed-data-frames-duplicate-detection.pptx) |
| 1841 | Jarkko Kneckt | 83/20 | 10.3.2.14.2 | The group addressed frames should have a sequence number space that is in MLD level to simplify group addressed frames reception. | Please add MSNS2 for group addressed data frames and MSNS3 for group addressed QoS data frames. | Revised  Specify a MLD level SNS that group addressed data frames shall use to determine the sequence numbers when they are transmitted over multiple links of a MLD. Also specify an MLD level RC2 and its behavior. As a result, duplicated group addressed data frames received over multiple links can be detected and discarded.  11be editor: please incorporate the text changes in:  [https://mentor.ieee.org/802.11/dcn/21/11-21-0410-00-00be-proposed -resolution-to-11be-CID34-CIDs-on-group-addressed-data-frames-duplicate-detection.pptx](https://mentor.ieee.org/802.11/dcn/21/11-21-0410-00-00be-proposed%20-resolution-to-11be-CID34-CIDs-on-group-addressed-data-frames-duplicate-detection.pptx) |
| 1843 | Jarkko Kneckt | 84/18 | 10.3.2.14.3 | The receiver cache should be defined for group addressed data frames that have MLD leve SN space (MSNS2). | Please add receiver cache MRC3 for group addressed QoS data frames that are transmitted using MSNS3. | Revised.  Specify a MLD level SNS that group addressed data frames shall use to determine the sequence numbers when they are transmitted over multiple links of a MLD. Also specify an MLD level RC2 and its behavior. As a result, duplicated group addressed data frames received over multiple links can be detected and discarded.  11be editor: please incorporate the text changes in:  [https://mentor.ieee.org/802.11/dcn/21/11-21-0410-00-00be-proposed -resolution-to-11be-CID34-CIDs-on-group-addressed-data-frames-duplicate-detection.pptx](https://mentor.ieee.org/802.11/dcn/21/11-21-0410-00-00be-proposed%20-resolution-to-11be-CID34-CIDs-on-group-addressed-data-frames-duplicate-detection.pptx) |
| 1844 | Jarkko Kneckt | 84/18 | 10.3.2.14.3 | The group addressed QoS Data frames should be transmitted using MSNS (MLD level SN space), so these frames need MLD level receiver cache. | Please add receiver cache MRC3 for group addressed QoS data frames that are transmitted using MSNS3. | Revised.  Specify a MLD level SNS that group addressed data frames shall use to determine the sequence numbers when they are transmitted over multiple links of a MLD. Also specify an MLD level RC2 and its behavior. As a result, duplicated group addressed data frames received over multiple links can be detected and discarded.  11be editor: please incorporate the text changes in:  [https://mentor.ieee.org/802.11/dcn/21/11-21-0410-00-00be-proposed -resolution-to-11be-CID34-CIDs-on-group-addressed-data-frames-duplicate-detection.pptx](https://mentor.ieee.org/802.11/dcn/21/11-21-0410-00-00be-proposed%20-resolution-to-11be-CID34-CIDs-on-group-addressed-data-frames-duplicate-detection.pptx) |

**Discussion:**

Per 11be SFD [1], group addressed data frames (GADFs) are transmitted independently over multiple links of MLD, and a non-AP MLD needs to select one link to receive GADFs. As a result, a non-AP MLD can receive undetectable duplicated GADFs when the non-AP MLD switches link to receive the GADFs. Using cross-link DTIM indication to select the switch timing to avoid duplicates is not workable, because it introduces unacceptable wait time for link switch, as illustrated in Fig. 1 and Fig. 2 below. See [2] for more details.



Fig. 1 Unacceptable wait time for link switch when no there is no incoming GADFs between DTIM Beacon 1 and DTIM Beacon 2



Fig. 2 Unacceptable wait time for link switch when no there is incoming GADFs between DTIM Beacon 1 and DTIM Beacon 2

As a result, a mechanism is needed to enable the duplicate detection for GADFs received over multiple links.

We propose to define a new sequence number space (SNS) that is shared across all links to be used for the transmission of the GADFs, so that duplicated GADFs received on multiple links can be detected and discarded.

**Proposed resolution for CID 2532, 1841, 1843, 1844:**

***Editor’s note: Please modify the 11be spec as shown below. The proposed changes are with respect to 11be\_D0.3 [3].***

**10.3.2.14 Duplicate detection and recovery**

**10.3.2.14.1 General  
10.3.2.14.2 Transmitter requirements**

***Change the first paragraph as follows:***

A STA maintains one or more sequence number spaces that are used when transmitting a frame to determine the sequence number for the frame. An MLD maintains one or more sequence number spaces that are used when delivering an individually addressed QoS data frame to an associated MLD to determine the sequence number for the frame. When multiple sequence number spaces are supported, the appropriate sequence number space is determined by information from the MAC control fields of the frame to be transmitted. Except as noted below, each sequence number space is represented by a modulo 4096 counter, starting at 0 and incrementing by 1, for each MSDU or MMPDU transmitted using that sequence number space.

***Change the fourth paragraph as follows:***

A transmitting STA shall support the applicable sequence number spaces defined in Table 10-5 (Transmitter sequence number spaces). An MLD shall support the applicable sequence number spaces defined in Table 10-5 (Transmitter sequence number spaces). A STA affiliated with an MLD shall support MSNS1 instead of SNS2 in Table 10-5 (Transmitter sequence number spaces) to determine the sequence number of an individually addressed QoS Data frame that is delivered to the associated MLD. A STA affiliated with an MLD shall support MLD SNS2 defined at the MLD level, instead of SNS1 defined at the link level, in Table-5 to determine the sequence number of a group addressed data frames that is delivered to the associated MLD, where the same group addressed data frame transmitted over multiple links of a MLD shall have the same sequence number. (CID 2532, 1841, 1843, 1844). Applicability is defined by the Applies to the column. The Status column indicates the level of support that is required if the Applies to column matches the transmission. The Multiplicity column indicates whether the sequence number space contains a single counter, or multiple counters and in the latter case identifies any indexes. The Transmitter requirements column identifies requirements for the operation of this sequence number space. The referenced requirements are defined at the end of the table.

***Insert a new row to Table 10-5 (Transmitter sequence number spaces):***.

**Table 10-5—Transmitter sequence number spaces**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sequence number space identifier** | **Sequence number space** | **Applies to** | **Status** | **Multiplicity** | **Transmitter requirements** |
| MSNS1 | Individually addressed QoS Data | Any STA affiliated with an MLD transmitting an individually addressed QoS Data frame | Mandatory | Indexed by <MLD MAC Address that the STA identified by Address 1 is affiliated with, TID> per MLD |  |
| MLD SNS2 | Group addressed data | Any STA affiliated with an MLD transmitting a group addressed data frame | Mandatory | Single instance | TR4 |

(CID 2532, 1841, 1843, 1844).

**10.3.2.14.3 Receiver requirements**

***Change the first paragraph as follows:***

A STA maintains one or more duplicate detection caches. An MLD maintains one or more duplicate detection cache. Table 10-6 (Receiver caches) defines the conditions under which a duplicate detection cache is supported and the rules followed by the receiver for the cache. When a data, Management and Extension frame is received, a record of that frame is inserted in an appropriate cache. The record is identified by a sequence number and possibly other information from the MAC control fields of the frame. When a data, Management and Extension frame is received in which the Retry subfield of the Frame Control field is equal to 1, the appropriate cache, if any, is searched for a matching frame. In DMG, when a group addressed frame is received the appropriate cache is searched for a marching frame. When a PV1 Data frame or PV1 Management frame is received, the appropriate cache is searched for a matching frame, regardless of the presence of the Retry subfield of the Frame Control field. If the search is successful, the frame is considered to be a duplicate. Duplicate frames are discarded.

***Change the first paragraph as follows:***

A receiving STA shall implement the applicable receiver requirements defined in Table 10-6 (Receiver caches) with Status indicated as Mandatory. An MLD shall implement the applicable receiver requirements defined in Table 10-6 (Receiver caches) with Status indicated as Mandatory. All STAs affiliated with an MLD shall implement MRC1 instead of RC2 in Table 10-6 (Receiver caches) to discard duplicate individually addressed QoS Data frames belonging to a TID without BA negotiation that are delivered from the associated MLD. All STAs affiliated with an MLD shall implement MLD RC2 defined at the MLD level, instead of RC1 defined at the link level, in Table 10-6 (Receiver caches) to discard duplicate group addressed data that are delivered from the associated MLD. A group addressed data frame received on any link shall be discarded if its sequence number is smaller than or equal to the values of the entries in MLD RC2. (CID 2532, 1841, 1843, 1844). A receiving STA should implement the applicable receiver requirements defined in Table 10-6 (Receiver caches) with Status indicated as Recommended. A receiving STA may implement the applicable receiver requirements defined in Table 10-6 (Receiver caches) with Status indicated as Optional. Applicability is defined by the Applies to column. The Status column indicates the level of support that is required if the Applies to column matches the received frame. The Multiplicity / Cache size column indicates the indexes that identify a cache entry and the number of entries that shall be supported. The Receiver requirements column identifies requirements for the operation of this cache. The referenced requirements are defined at the end of the table. The requirements relate to caching information that identifies a cache entry and discarding duplicate MPDUs.

***Insert a new row and a new footnote after RR6 to Table 10-6 (Receiver caches):***

**Table 10-6—Receiver caches**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Receiver cache identifier** | **Cache name** | **Applies to** | **Status** | **Multiplicity/Cache size** | **Receiver requirements** |
| MRC1 | Individually addressed QoS Data | Any STA affiliated with an MLD receiving an individually addressed QoS Data frame | Mandatory | Indexed by <MLD MAC Address that the STA identified by Address 2 is affiliated with, TID, sequence number> per MLD.  At least the most recent cache entry per <MLD MAC Address that the STA identified by Address 2 is affiliated with, TID> pair in this cache. | MRR1 |
| MLD RC2 | Group addressed data frame | Any STA affiliated with an MLD receiving a group. addressed QoS data frame | Mandatory | Indexed by <MLD MAC Address of the MLD with which the STA identified by Address 2 is affiliated, sequence number>.  At least the most recent cache entry per <MLD with which the STA identified by Address 2 is affiliated> value. | MLD RR2 |
| MRR1: The MLD shall discard the frame if the Retry subfield of the Frame Control field is 1 and it matches an entry in the cache.  MLD RR2: The MLD shall discard the frame if its sequence number is equal to or smaller than the values of the entries in the cache. . | | | | | |

(CID 2532, 1841, 1843, 1844).

**References**

[1] IEEE 802.11-19/1262r23, “Specification framework for TGbe”, editor: E. Au

[2] IEEE 802.11-21/0041r1, “Group addressed data frame delivery methods for MLO”, Q. Wang, et al.

[3] IEEE P802.11be™/D0.3, Draft standard for information technology – Telecommunications and information exchange between systems local and metropolitan area networks – Specific requirements Part 11: Wireless LAN medium access control (MAC) and physical layer (PHY) specifications, Amendment 9: Enhancements for extremely high throughput (EHT)