IEEE P802.11
Wireless LANs

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| Proposed CR for Clause 35.3.16.6. Sync PPDU start time |
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Abstract

This submission proposes comment resolutions pdeferred CIDs to 35.3.16.6 Start time sync PPDUs medium access for LB266 on 11be D2.0:

12409, 12426, 12441, 10716, 13956

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: added CID 10716 + some minor typo fixes

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| **CID** | **Commenter** | **Comment** | **Proposed Change** | **Resolution** |
| 12409 | Juseong Moon | When NSTR link pairs are more than 2, more description is requied to cover more cases including backoff status. | As in comment | RevisedExtend condition 1b)**TGbe editor:** Apply the changes tagged with #12409 in this document  |
| 12426 | Yongho Kim | Because end time shall be aligned in case of non-AP STAs' sync transmission, MPDU transmitted on one link might need padding to align the end time with the other link's transmission. Mult-TID A-MPDU with the TID of the selected EDCAF and the other TIDs whose backoff counter reached zero is more efficient than just padding. In order to allow flexibility in forming multi-TID A-MPDU with different ACs, multi-TID A-MPDU construction rule needs to be eased to construct multi-TID A-MPDU regardless of AC priority. | As in comment | RevisedThe use of ACs, other than AC that the AC associated with the EDCAF that gains an EDCA TXOP is governed by clause 10.23.2.7 Sharing an EDCA TXOP.Modified the text in to align with the text in clause 10.23.2.7 “Sharing an EDCA TXOP” **TGbe editor:** Apply the changes tagged with #12426 in this document  |
| 12441 | Ryuichi Hirata | In 11-22/0554r1, an issue was raised regarding current start time sync PPDUs. However, it was not treated due to lack of time. | Revisit 11-22/0554r1 and apply the resolution. | RejectedA commenter failed to identify a technical issue with the current spec text We had the initial discussion in document 0974r4 with 21Y/34N count.During CC36 comment resolution we agreed to reassign related comment to the commenter to address it in a separate document. Suggest the commenter to present contribution 0554r1 to resolve problem/issue stated in 0974r4r |
| 10716 | Liangxiao Xin | When using start time sync PPDUs medium access, an MLD shall wait for expiration of the largest number of backoff counters of STAs. This may cause long delay to start transmission of the PPDUs and may lead STA to loose its transmission opportunity. | Add a note: when a non-STR MLD invokes backoff procedures with the same CW on different links at the same time, it may generate one random value to initialize the backoff counters on those links. Commenter will bring the contribution. | RejectedWe had the initial discussion in document 0974r4 with 21Y/34N count.During CC36 comment resolution we agreed to reassign related comment to the commenter to address it in a separate document. Which was done in doc 554r1Suggest the commenter to present contribution 0554r1 to resolve problem/issue stated in 0974r4r |
| 13956 | Geonjung Ko | Start time sync procedure is used for a non-AP MLD associated with an NSTR mobile AP MLD, regardless of whether the non-AP MLD is operating on an NSTR link pair. | Extend the procedure to a non-AP MLD associated with an NSTR mobile AP MLD. | RevisedAgree in principle. Text in 35.3.19.1 explicitly direct non-AP MLD to use Sync Start time procedure when communicating with NSTR mobile AP MLD (with some limitations) Added clarification to clause 35.3.19.1 to explicitly specify that primary and non-primary links need to be classified as NSTR link pair for non-AP MLD**TGbe editor:** Apply the changes tagged with #13956 in this document  |
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**35.3.15.6 Start time sync PPDUs medium access**

Each STA affiliated with an MLD(#11448, 12663, 13930)operating on a pair of NSTR links for that MLD that aligns the start times of PPDUs scheduled for transmission on more than one link shall ensure that the EDCA rules on each link permit access to the medium on all the links at the time of issuance of the PHY-TXSTART.request for each link.

A STA affiliated with an MLD(#11448, 12663, 13931)operating on a link that is a part of an NSTR link pair for that MLD shall follow the channel access procedure described below:

1. The STA may initiate transmission on a link when the medium is idle as indicated by the physical and virtual CS mechanisms and one of the following conditions is met:
2. The STA obtained an EDCA TXOP following procedure in 10.23.2.4 (Obtaining an EDCA TXOP)
3. The backoff counter of the STA is already zero, and the STA operating on the other link of NSTR link pair of the affiliated MLD obtains an EDCA TXOP following the procedure in 10.23.2.4 (Obtaining an EDCA TXOP).
4. When the backoff counter of the STA reaches zero, it may choose to not transmit and keep its backoff counter at zero. A STA with backoff counter that has already reached zero may initiate (#10252,10507,12664) transmission only following condition 1b)
5. A STA with backoff counter that has already reached zero and that chose (#10253) not to transmit following condition 1b), may perform a new backoff procedure following deferral as described in 10.23.2.4 (Obtaining an EDCA TXOP) and 10.3.4.3 (Backoff procedure for DCF) before being allowed to initiate transmission on a link following condition 1a). In such a case, CW[AC] and QSRC[AC] shall be left unchanged

NOTE 1—The backoff counters for each link count down as specified in 10.23.2.4 (Obtaining an EDCA TXOP).

NOTE 2—The decision to choose to not transmit when the backoff counter of the STA reaches zero as in 2) or to perform a new backoff procedure to be allowed to initiate transmission following condition 1a) as in 3) is implementation specific.

A STA that chooses (#12665) not to transmit after the backoff counter reached zero on a link of NSTR link pair may have one or more EDCAF backoff counters with value zero on that link. The STA that initiates transmission on that link following condition a) or b) and has one or more EDCAF backoff counters that already reached zero shall choose only one (#10254) EDCAF for the transmission. The basis for selection is implementation specific. (#10254)

A STA with backoff counter that has already reached zero on a link and has a frame available for transmission shall follow channel access procedures described 10.23.2.4. (Obtaining an EDCA TXOP) after it detects(#10255, 12667) medium transition from busy to idle.

The STA with backoff counter that has already reached zero and is initiating transmission following condition (b) is not mandated to initiate transmission on a slot boundary of the link on which the STA operates. The STA that is initiating transmission following condition b) shall commence the transmission no later than 4us following slot boundary of the link on which the other STA whose backoff counter reaches zero operates.

NOTE 3—The value of 4 µs is derived from aRxTxTurnaroundTime being equal to 4 µs for the purpose of this requirement

**CID 12409**

When NSTR link pairs are more than 2, more description is requied to cover more cases including backoff status.

**Discussion #1:**

Example: An MLD operates on 3 links: 1, 2, 3. (1;2), (2;3) an (1,3) are NSTR link pairs.

Because all link pairs are NSTR and all links are NSTR to each other, the procedure remain the same as:

If STA on link 1 decided to keep BK at zero, it will wait for condition 1b) to initiate the transmission. Such opportunity arises when STA on link 2 or link 3 counted BK down to zero as well. In case if STA on link 2 or STA on link 3 also decide to keep BK at zero(for example – on link 3), the transmission on link 1 and link 3 will commence when STA on link 2 complete contention. When this happens, STA on link 2 will trigger transmission on link 1 and link 3 simultaneously.

Now, before going to the case with 4 NSTR link pairs we should answer one more global question – it is going to happen practically at all?. Yes, from theoretical point of view 4, 5, 6 and so on pair of active links (STR or NSTR) is possible, but is it practical? Having 3 or more RF chains operating in an extremely unfavorable configuration (with the restrictions on TX/RX operation across the link) does not seem to be reasonable.

Another important question is: even if STA decide to operate on three or more NSTR link and decide to synchronize transmission across these links, whan are the chances of success of doing so? From various contribution in past, we know that chances of synchronizing even 2 links are not high even in lightly loaded scenarios…

Anyway, if all pairs are NSTR and all links are NSTR to each other, no need to change/amend existing procedure.

**Discussion #2.**

Commenter provided an example:

There might be cases when STA operates on 3 links: (1, 2), (2,3) which are NSTR link pairs and (1,3) is STR pair. Essentially, NSTR link pairs share one “common” link – link 2. For example, in this combination: (5H, 6L); (6L,6H) and (5L, 6H), which is certainly a possible case. How to synchronize transmission across 3 links in this case if this is needed at all? Or, more extensive, do we need to provide additional rules to explicitly exclude deadlock as provided in an example below”

The mechanism is on per-pair basis. In the example above, link 1 may decide to keep BK at zero with the expectation to synchronize transmission between link 1 and 2. Link 2 at the same time may also kep BK at zero with the expectation to synchronize transmission between 2 and 3. When link 3 count BK to zero it will trigger link 2 transmission, but link 2 cannot trigger link 1 transmission because there is no rules that allow that. A simple solution is to daisy-chain conditions 1b) in this case. If STA on link 3 trigger transmission of a STA on link 2 (which keep its BK at zero), STA1 on link 1 may also this event as condition 1b).

**Proposed resolution: “Revised”; extend condition 1b)**

“b) The backoff counter of the STA is already zero, and the STA operating on the other link of NSTR link pair of the affiliated MLD obtains an EDCA TXOP following the procedure in 10.23.2.4 (Obtaining an EDCA TXOP).“

To:

“b1) The backoff counter of the STA is already zero, and the STA operating on the other link of NSTR link pair of the affiliated MLD obtains an EDCA TXOP following the procedure in 10.23.2.4 (Obtaining an EDCA TXOP)

b2) The backoff counter of the STA is already zero, and the STA operating on the other link of NSTR link pair of the affiliated MLD obtains an EDCA TXOP following condition b1)” (#12409)

**CID 12426**

Because end time shall be aligned in case of non-AP STAs' sync transmission, MPDU transmitted on one link might need padding to align the end time with the other link's transmission. Mult-TID A-MPDU with the TID of the selected EDCAF and the other TIDs whose backoff counter reached zero is more efficient than just padding. In order to allow flexibility in forming multi-TID A-MPDU with different ACs, multi-TID A-MPDU construction rule needs to be eased to construct multi-TID A-MPDU regardless of AC priority

Discussion

The use of ACs, other than AC that the AC associated with the EDCAF that gains an EDCA TXOP is governed by clause 10.23.2.7 Sharing an EDCA TXOP.

*A STA that chooses (#12665) not to transmit after the backoff counter reached zero on a link of NSTR link pair may have one or more EDCAF backoff counters with value zero on that link. The STA that initiates transmission on that link following condition a) or b) and has one or more EDCAF backoff counters that already reached zero* ***shall choose only one (#10254) EDCAF ~~for the transmission~~ to gain an EDCA TXOP*** *(#12426). The basis for selection is implementation specific. (#10254)*

Highlighted text 1) underline that a STA shall choose only one EDCAF to gain TXOP on a link – exactly as it would do using regular contention mechanism 2) make strong connection with the clause 10.23.2.7

The clause 10.23.2.7 provide rules for a STA to select TIDs for transmission and allow multi-TID frame transmissions:

“Otherwise, frames from a higher priority AC may be included when at least one frame from the primary AC has been transmitted and all frames from the primary AC have been transmitted”

The authro believes that extending, if needed at all, AMPDU transmission to multi-TID-multi-AC shall be defined in clause 10.23.2.7. Clause 35.3.16.6 define a addition to the baseline channel access procedure described in 10.23.2.4 (Obtaining EDCA TXOP) and that clause strictly define that only one EDCAF gain TXOP at a time.

The need to extend (again, if needed) shall be carefully studied as mixing MPDUs from different AC may seriously affect QoS differentiation at this STA as well at other STAs in a BSS. At this point, the problem arises only if STAs affiliated with an MLD select for the transmission EDCAFs with extremely different TXQueue length which is at the end implementation specific problem.

Proposed resolution: **Revised**

Modified the text in to align with the text in clause 10.23.2.7 “Sharing an EDCA TXOP”

**CID 13956**

Start time sync procedure is used for a non-AP MLD associated with an NSTR mobile AP MLD, regardless of whether the non-AP MLD is operating on an NSTR link pair.

Discussion:

The text in 39.3.19.1 describe non-AP behavior when it intends to TX on a non-primary link:

*“STAs affiliated with a non-AP MLD that is associated with an NSTR mobile AP MLD and APs affiliated with an NSTR mobile AP MLD shall follow the procedure defined in 35.3.16.6 (Start time sync PPDUs medium access) when intending to transmit in the nonprimary link with the following additional constraints*

*— A STA affiliated with the non-AP MLD may initiate a PPDU transmission to its associated AP affiliated with the NSTR mobile AP MLD in the nonprimary link only if the other STA affiliated with the same MLD in the primary link is also initiating the PPDU as a TXOP holder with the same start time.*

*— An AP affiliated with the NSTR mobile AP MLD may initiate a PPDU transmission to its associated non-AP STA in the nonprimary link only if the other AP affiliated with the same NSTR mobile AP MLD in the primary link is also initiating the PPDU as a TXOP holder with the same start time”*

The quoted text text simply explain that non-AP MLD shall follow rules in clause 35.3.16.6 when it intends to transmit on the non-primary link. The quoted text uses generic “non-AP MLD” associated with NSTR mobile MLD w/o specifying whether primary and non-primary links create NSTR link paior or not for that non-AP MLD.

At the same time, clause 35.3.16.6 explicitly mention “**STA affiliated with MLD operating on an NSTR link pair for that MLD**”.

Theoretically, there might be situations when primary and non-primary link pair is an \_STR\_ link pair (i.e. MLD has no TX/RX constraints) for that non-AP MLD and **not** NSTR link pair as required in clause 35.3.16.6. To resolve this minor inconsistency the following solution is possible:

Proposed resolution: **Revised**

Add a sentence/note in clause 35.3.19.1, under first bullet of text about transmission initiation for non-AP MLD:

*— A STA affiliated with the non-AP MLD may initiate a PPDU transmission to its associated AP affiliated with the NSTR mobile AP MLD in the nonprimary link only if the other STA affiliated with the same MLD in the primary link is also initiating the PPDU as a TXOP holder with the same start time. In such a case non-AP MLD use the pair of primary and non-primary links that are set up by an NSTR mobile AP MLD as an NSTR link pair for that non-AP MLD (for the purpose of channel access procedure as described in 35.3.16.6) (#13956)*

(5 CIDs)

SP:

Do you support to incorporate the changes proposed by the following CIDs in 11/1944r0:

12409, 12426, 12441, 13956, 10716