IEEE P802.11
Wireless LANs

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| Spec Text for NSTR Capability update |
| Date: 2021-05-01 |
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Revisions:

* R0: Initial version of the document.
* R1: some updates base on offline discussion
	+ Delete OMI related part, and leave to future discussion
	+ Below two bullets are deleted,
		- Before the channel switch it is STR, and after the channel switch the frequency separation between the two links is equal to or larger than the value before the channel switch, in which case it is STR after the channel switch;
		- Before the channel switch it is NSTR, and after the channel switch the frequency separation between the two links is equal to or smaller than the value before channel switch, in which case it is NSTR after the channel switch.
* R2: remove one paragraph about channel switch for future discussion.
	+ After a STA affiliated with a non-AP MLD switchs to a new channel, the non-AP MLD shall transmit an NSTR Capability Update frame to its associated AP MLD to report the updated NSTR capability status of a link pair, except if one link of the link pair is in the 2.4 GHz band, while another link is in the 5 GHz or 6 GHz bands after channel switch, in which case it is STR after the channel switch.

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| **CID** | **Commenter** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 1795 | Insun Jang | 142.40 | 35.3.13.4 | Currently, a non-AP MLD would signal STR/NSTR capability for all pairs of links during multi-link setup. When a non-AP MLD indicates a NSTR link pair during ML setup and then want to change the ability change to perform STR on that pair of links, it needs to be signaled through a method (currently it is TBD) | Instead of a new frame design only for STR capability change, because we already discussed EHT operating mode indication method for 320MHz/16SS, it would be better to consider that the ability change to perform STR can be also one of operating mode. In other words, EHT OM control field needs to include the ability change to perform STR as one of operating mode change | Revised EHT OM has already been defined. As the discussion in doc **21/0757r3**, the OM and STR capability update cannot be carried in one frame. Therefore, a new frame for NSTR capability update in introduced and the transmit order of OM and NSTR capability update are also defined. TGbe editor to make the changes with the CID tag (#1795) in doc **21/0757r3** |
| 2888 | Stephen McCann | 142.43 | 35.3.13.4 | I do not understand the sentence "The limitation of updating frequency of the ability to perform STR as well as the switching delay is TBD." | Please can this sentence be re-written, as I don't understand what it means. | RevisedThis sentence is deleted. The bahaviors of NSTR update are added. TGbe editor to make the changes with the CID tag (#2888) in doc **21/0757r3** |
| 1702 | GEORGE CHERIAN | 142.38 | 35.3.13.3 | "The ability of a non-AP MLD to perform STR on a pair of setup links may change after multi-link setup. The non-AP MLD may use TBD signaling on any enabled link to inform the AP MLD about the ability change to perform STR."Please specify how long can an AP MLD take to apply the switching. Also, suggest to use management signaling | As in the comment | RevisedAn Action frame is used for NSTR update. TGbe editor to make the changes with the CID tag (#1702) in doc **21/0757r3** |

**Discussion:**

**NSTR Capability Update frame and OM procedure:**

In subclause 26.9.2 of Draft 8.0 of 802.11ax specification, there are statements describing that an OMI initiator changes its parameters through OM Control subfield:

*An OMI initiator that sends a frame that includes an OM Control subfield should change its OMI parameters, Rx NSS and Channel Width, as follows:*

 *— When the OMI initiator changes a ROM parameter from higher to lower, it should make the change for that parameter only after the TXOP in which it received the immediate acknowledgment from the OMI responder.*

 *— When the OMI initiator changes a ROM parameter from lower to higher, it should make the change for that parameter only after the TXOP in which it expects to receive acknowledgment from the OMI responder.*

When the NSTR capability of a link pair changes due to the channel OMI procedure, how to handle the channel width update and NSTR capability update need be discussed.

Firstly, let me give an example for the case when channel bandwidth is reduced. At the beginning, a non-AP STA that is affiliated with a non-AP MLD operating with 320 MHz on link 1, and link pair formed by link 1 and link 2 is NSTR. Later this non-AP STA changes the operating channel width to 80 MHz through OMI. Accordingly, the link pair formed by link 1 and link 2 changes to STR.

Assuming the NSTR capability update information and OM Control subfield are carried in the same frame, if this frame is received by the OMI responder, but the OMI initiator fails to receive the acknowledgement frame, then the OMI initiator will not change the channel width from 320 MHz to 80 MHz. However, the OMI response through the OMI initiator already changes to 80 MHz, and the link pair of link 1 and link 2 becomes STR. After that, the OMI responder will operate STR rules to the OMI initiator, it will cause problem. In conclusion, the NSTR capability update information and OM Control subfield cannot be carried in the same frame under this case.

Let’s assume the OMI initiator tranmits NSTR capability update frame first, and then the frame contains OMI Control. Then AP MLD (that contains the OMI responder) will have an incorrect understanding about the NSTR capability of the link pair (AP considers it is STR, but it is NSTR indeed). Similar problem exist as in the scenario mentioned in the previous paragraph.

So the right order is that the OMI initator successfully transmits the frame containing OMI Control, and then transmits the frame that contains OMI Control subfield.

Similarly, let me give another example for the case that channel bandwidth is increased. At the beginning, a non-AP STA that is affiliated with a non-AP MLD operating with 80 MHz on link 1, and link pair formed by link 1 and link 2 is STR. Later this non-AP STA changes the operating channel width to 320 MHz through OMI. Accordingly, the link pair formed by link 1 and link 2 changes to NSTR.

Assuming the NSTR capability update information and OM Control subfield are carried in the same frame, if this frame is not received by the OMI responder, the OMI initiator still needs to change the channel width from 80 MHz to 320 MHz according to OMI rules, and the link pair of link 1 and link 2 will change to NSRT accordingly. At this time the OMI response through the OMI initiator is still operating on 80 MHz, and the link pair of link 1 and link 2 is STR. Therefore, the OMI responder continue operating STR rules to the OMI initiator, it will cause problems. In conclusion, the NSTR capability update information and OM Control subfield cannot be carried in the same frame under this case.

Let’s assuming OMI initiator tranmits the frame contains OMI Control first, and then NSTR Capability update frame. Then AP MLD (that contains the OMI responder) will have an incorrect understanding about the NSTR capability of the link pair (AP considers it is STR, but it is NSTR indeed) before NSTR Capability update frame is correctly received. Similar problem exists.

So the right order is that the OMI initator successfully transmits the frame containing OMI Control subfield, and then transmit the frame that contains OMI Control.

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| --- | --- | --- | --- |
| 320MHz🡪80MHz | High🡪Low | NSTR🡪STR | *change the BW only after the TXOP in which it received the immediate acknowledgment* |
| 80MHz🡪320MHz | Low🡪High | STR🡪NSTR | *change for BW only after the TXOP in which it expects to receive acknowledgment*  |

**Updating frequency and switch delay:**

I didn’t get any idea how to define the updating frequency and swith delay, so I delete below sentence in 757r0. I will collect opinions from the group and modify it accordingly if it is necessary.

*The limitation of updating frequency of the ability to perform STR as well as the switching delay is TBD.*

1. **Introduction**

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGbe Draft. The introduction and the explanation of the proposed changes are not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGbe Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

1. **Proposed spec text**

The baseline for this text is TGbe D0.4

***TGbe editor: Modify the Table 9-526q in 9.6.35.1 (EHT Action field) as follows:***

**Table 9-526q—EHT Action field values**

|  |  |
| --- | --- |
| Value | Meaning |
| 0 | EHT Compresed beamforming/CQI |
| 1 | NSTR Capability Update |
| 2-255 | Reserved |

***TGbe editor: add 9.6.35.2 (NSTR Capability Update frame format) as follows:***

**9.6.35.2 NSTR Capability Update frame format**

The NSTR Capability Update frame is transmitted by a STA affiliated with a non-AP MLD to an AP affliated with the associated AP MLD to report the updated status of NSTR capabilities of the non-AP MLD. The Action field of an NSTR Capability Update frame contains the information shown in Table 9-526s (NSTR Capability Update frame Action field values).

**Table 9-526s—NSTR Capability Update frame Action field values**

|  |  |
| --- | --- |
| Value | Meaning |
| 1 | Category |
| 2 | EHT Action |
| 3 | Basic variant Multi-Link |

The Category field is defined in Table 9-51 (Category values).

The EHT Action field is defined in Table 9-526q (EHT Action field values).

The Basic variant Multi-Link element, definded in 9.4.2.295b.2 (Basic variant Multi-Link element), includes an NSTR Indication Bitmap subfield(s) to report the NSTR capabilities of the reporting non-AP MLD.

***TGbe editor: Modify the paragraphes in 35.3.14.4 (Capability signaling) as follows:***

**35.3.14.4 Capability signaling**

The ability of a non-AP MLD to perform STR on a pair of setup links may change after multi-link setup. The non-AP MLD may transmit an NSTR Capability Update frame on any enabled link to inform the associated AP MLD about the ability to perform STR.

This ability might change due to an AP of an AP MLD performing Extended Channel Switching following procedures in 11.9 (Extended Channel Switching) and 35.3.9.2 (Channel switching, enhanced channel switching, and channel quieting).

The AP MLD shall update the NSTR capability status of its associated non-AP MLD after receiving an NSTR Capability Update frame from the non-AP MLD. If the NSTR statuses of some link pairs are not included in the NSTR Capability Update frame, the AP MLD does not update the NSTR statuses of these link pairs. The AP MLD may update the NSTR capability status a time period after it received the NSTR Capability Update frame, the length of the time period is an implementation choice.

***End of change***