IEEE P802.11
Wireless LANs

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| LB 266 CR for Capability Update Notification |
| Date: 2022-08-05 |
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Abstract

This submission proposes resolutions for following 1 CID received for TGbe LB266

: 10773

Revision History:

* Rev 0: Initial version of the document
* Rev 1: Capability changed to be indicated in MLD capabilities and added another status code
* Rev 2: Editorial update and wrong text fix
* Rev 3: Editorial update and wrong text fix
* Rev 4: Unified the protocol using reconfiguration ML element

***TGbe editor: The baseline for this document is 11be D2.3***

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. This introduction is 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).***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 10773 | Chien-Fang Hsu | 9.4.2.313 | 228.46 | In an MLD, some resources may be shared by affiliated STAs or APs, e.g. memory. When the number of enabled links changes, the shared resources can also be re-allocated so that the efficiency can be improved. For example, the max MPDU length can be increased when enabled links are less. There is no such protocol to update capabilities dynamically now. It is necessary to have a new protocol to allow capability change in the MLO. | Add a unified protocol to allow a device to update its capabilities after association when the number of enabled links changes or some other reasons apply. Capabilties such as max MPDU length, A-MSDU max length, max A-MPDU Length Exponent are candidates to be changed when the MLD has less or more enabled links to increase the efficiency. | **Revised**Agree in principle with the commentor. Add corresponding procedures to allow a STA affiliated with non-AP MLD to update its capabilities.**TGbe editor, please apply the changes tagged as 10773 in this document.** |

***TGbe Editor: Editing instructions preceded by “TGbe Editor” are instructions to the TGbe editor to modify existing material in the TGbe draft. As a result of adopting the changes, the TGbe editor will execute the instructions rather than copy them to the TGbe Draft.***

**Discussion:**

Consider a scenario, in the non-AP MLD, total 26K memory is available and the memory is shared by STAs affiliated to the non-AP MLD. After association, all 3 links are enabled, and the max MPDU length is set up to 8K for each link. For some reason, link 3 is disabled, and if the non-AP MLD can re-allocate link 1 and link 2 with 11k memory, respectively, and changes the capabilities of link 1 and link 2 accordingly, efficiency of link 1 and link 2 can be improved. However, in the current specs. there is no such mechanism that the non-AP MLD can update its capabilities while the number of enabled links changes or other usage scenarios apply. The document addresses the topic and provides protocols so that the non-AP MLD can update its capabilities dynamically.



**9.4.1.9 Status Code field**

TGbe editor: ***Add a new row in Table 9-78 (Status codes) as follows(#10773):***

|  |  |  |
| --- | --- | --- |
| **Status code** | **Name** | **Meaning** |
| … | … | … |
| <ANA> | NEED\_MORE\_TIME | Operation parameter update denied at this time and a later request suggested. |
| <ANA> | DENIED\_OPERATION\_PARAMETER\_UPDATE | Operation paramter update denied because the requested operation parameters or capabilities are not acceptable. |

**9.4.2.312.2.2 Common Info field of the Basic Multi-Link element**

TGbe editor: M***ake the following changes in Figure 9-1002l and Table 9-401i***

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 |  | B3 | B4 | B5 |  | B6 B7 |  | B11 | B12 | B13  | B14 B15 |
| Ma | ximu | m |  | TID-To-Li | nk | Fr | equen | cy |  |  |  |
| Number Of Simultaneous Links | SRSSupport | Mapping Negotiation Supported | Separation For STR/AP MLDType Indication | AARSupport | Operation Parameter Update Support | Reserved |
| Bits: |  | 4 |  | 1 |  | 2 |  | 5 |  | 1 | 1 | 2 |

**Figure 9-1002l—MLD Capabilities and Operations subfield format (#10773)**

###  Table 9-401i—Subfields of the MLD Capabilities and Operations field

|  |  |  |
| --- | --- | --- |
| **Subfield** | **Definition** | **Encoding** |
| … | … | … |
| Operation Parameter Update Support (#10773) | Indicates support of Operation Parameter update negotiation. | Set to 1 if dot11OperationParameterUpdateImplemented is true.Set to 0 otherwise.See 35.3.16.2.1 (Non-AP MLD Operation Parameter Update) |

TGbe editor: M***ake the following changes in 9.4.2.312.4 Reconfiguration Multi-Link element***

**9.4.2.312.4 Reconfiguration Multi-Link element**

**…**

The format of the STA Control field is defined in Figure 9-1002x (STA Control field format for the Reconfiguration Multi-Link element).

B0 B3 B4 B5 B6 B7 B8 B9 B15

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Link ID | Complete Profile | MACAddress Present | Delete Timer Present | Reconfiguration Operation Type | Reserved |

Bits: 4 1 1 1 2 7

**Figure 9-1002x—STA Control field format for the Reconfiguration Multi-Link element (#10073)**

The Link ID subfield specifies a value that uniquely identifies the link that the reported AP is operating on.

The Complete Profile subfield is set to 0.

The MAC Address Present subfield indicates the presence of the STA MAC Address subfield in the STA Info field and is set to 1 if the STA MAC Address subfield is present in the STA Info field; otherwise set to 0(#10568).

The Delete Timer Present subfield is set to 1 to indicate the presence of the Delete Timer subfield in the STA Info field, and that the AP corresponding to the Per-STA Profile subelement will be removed at the time indicated by the Delete Timer subfield; it is set to 0 otherwise.

(#10073)The Reconfiguration Operation Type subfield is set to indicate the type of multi-link reconfiguration operation in the Link Reconfiguration Request frame for the link indicated by the Link ID subfield as defined in Table 9-401j.

Table 9-401j – Reconfiguration Operation Type (#10073)

|  |  |
| --- | --- |
| **Value** | **Name** |
| 0 | Reserved |
| 1  | Operation Parameter Update |
| 2-3 | Reserved |

The STA Info field consists of (#10568)fields whose presence is indicated by the subfields of the STA Control field. The subfields in the STA Info field appear in the same order as their corresponding presence sub- field in the STA Control field.

(#10568)The format of the STA Info field is defined in [Figure 9-1002y (STA Info field format for the](#bookmark169) [Reconfiguration Multi-Link element(#10568))](#bookmark169).

|  |  |  |  |
| --- | --- | --- | --- |
| STA Info Length | STA MAC Address | Delete Timer | Operation Parameters |

 Octets: 1 0 or 6 0 or 2 0 or 3

**Figure 9-1002y—STA Info field format for the Reconfiguration Multi-Link element (#10073)**

(#10073)The Operation Parameters subfield in the STA Info field is present when the Reconfiguration Operation Type subfield is set 1; otherwise it is not present.

The Operation Parameters subfield is defined in Figure 9.xxy (Operation Parameters subfiled format).

|  |  |  |
| --- | --- | --- |
|  | PresenceIndication | Operation Parameter Info  |
| Octets: | 1 | 2 |

**Figure 9-xxx —** **Operation Parameters subfiled format**

The Presence Indication subfield in the Operation Parameters subfield is defined in Figure 9.xxy (Presence Indication subfield format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 | B1 | B2 B7 |
|  | Maximum MPDU Length Present | A-MSDULengthPresent | Reserved  |
| bits: | 1 | 1 | 6 |

**Figure 9-xxy — Presence Indication subfield format**

The Maximum MPDU Length Present subfield is set to 1 if the Maximum MPDU Length subfield is present in the Operation Parameter Info subfield. Otherwise, the Maximum MPDU Length Present subfield is set to 0.

The A-MSDU Length Present subfield is set to 1 if the A-MSDU Length subfield is present in the Operation Parameter Info subfield. Otherwise, the A-MSDU Length Present subfield is set to 0.

The Operation Parameter Info subfield contains operation parameters or capabilities to be updated and is shown in Figure 9.xxz (Operation Parameter Info subfield format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 B1 | B2 |  |
|  | Maximum MPDU Length  | A-MSDULength | Pad |
| bits: | 0 or 2 | 0 or 1 | variable |

**Figure 9-xxz — Operation Parameter Info subfield format**

The Maximum MPDU Length subfield is in defined in Table 9-310 (Subfields of the VHT Capabilities Information field).

The A-MSDU Length subfield is in defined in Table 9-221 (Subfields of the HT Capabilities Information field).

The Pad subfield contains all 0s. The number of bits in the Pad subfield is the number of bits required to make the length of the Capability subfield to 2 octets.

### 9.6.35.1 Protected EHT Action field

TGbe editor: Add rows to table 9-623c as follows (#10773)

**Table 9-623d—Protected EHT Action field values**

|  |  |  |
| --- | --- | --- |
| 8 |  Link Reconfiguration Request |  No |
| 9 |  Link Reconfiguration Response |  No |
| 10-255 |  |  |

TGbe editor: ***Insert the following new subclause at the end of subclause 9.6.35*** (#10773)

**9.6.35.x Link Reconfiguration Request frame format**

The Link Reconfiguration Request frame is sent by a STA affiliated with a non-AP MLD to indicate that the STA is to update its status or operation parameters specified in the Reconfiguration Operation Type subfied in the Reconfiguration Multi-Link element. The Action field of the Link Reconfiguration Request frame contains the information is shown in Table 9-xxx (Link Reconfiguration Request frame Action field format).

**Table 9-xxx—Link Reconfiguration Request frame Action field format**

|  |  |
| --- | --- |
| **Order** | **Information** |
| 1 | Category |
| 2 | Protected EHT Action |
| 3 | Dialog Token |
| 4 | Reconfigration Multi-Link element (see 9.4.2.312.4 (Reconfiguration Multi-Link element)) |

The Category field is defined in 9.4.1.11 (Action field).

The Protected EHT Action field is defined in 9.6.35.1 (Protected EHT Action field).

The Dialog Token field is a set to a nonzero value chosen by the STA sending the Link Reconfiguration Request frame to identify the request/response transaction.

**9.6.35.x Link Reconfiguration Response frame format**

The Link Reconfiguration Response frame is sent by an AP affiliated with an AP MLD in response to a Link Reconfiguration Request frame to accept or to reject the request of status or operation parameter update in the Link Reconfiguration Request frame. The Action field of the Link Reconfiguration Response frame contains the information shown in Table 9-xxy (Link Reconfiguration Response frame Action field format).

**Table 9-xxy—Link Reconfiguration Response frame Action field format**

|  |  |
| --- | --- |
| **Order** | **Information** |
| 1 | Category |
| 2 | Protected EHT Action |
| 3 | Dialog Token |
| 4 | Status Code |

The Category field is defined in 9.4.1.11 (Action field).

The Protected EHT Action field is defined in 9.6.35.1 (Protected EHT Action field).

When the Link Reconfiguration Response frame is transmitted as a response to a Link Reconfiguration Request frame, the Dialog Token field is the value in the corresponding Link Reconfiguration Request frame.

The Status Code is defined in 9.4.1.9 (Status Code field) and is set to the value 0 (SUCCESS) or <ANA> (NEED\_MORE\_TIME) or <ANA> (DENIED\_CAPABILITY\_UPDATE).

**35.3.16.2 Multi-link device capability and operation signaling**

…

TGbe editor: ***Insert the following new subclause at the end of subclause 35.3.16.2*** (#10773)

**35.3.16.2.1 Non-AP MLD Operation Parameter Update**

An MLD shall set the Operation Parameter Update Support subfield in the Common Info field of the Basic Multi-Link element it transmits to 1 if its dot11OperationParameterUpdateImplemented is true; otherwise the MLD shall set it to 0. An EHT STA affiliated with an MLD in which dot11OperationParameterUpdateImplemented is true is referred to as *operation parameter update capable*.

An operation parameter update capable non-AP STA affiliated with a non-AP MLD should notify an operation parameter update capable AP affiliated with the associated AP MLD of change in its operation parameters in capabilities elements by transmitting a Link Reconfiguration Request frame including a Reconfigration Multi-Link element with Reconfiguration Operation Type subfield set to 1.

An AP affiliated with an AP MLD shall not transmit a Link Reconfiguration Request frame.

An operation parameter update capable AP affiliated with an AP MLD received a Link Reconfiguration Request frame including a Reconfigration Multi-Link element with Reconfiguration Operation Type subfield set to 1 shall respond with a Link Reconfiguration Response frame. Before the AP affiliated with the AP MLD transmits the corresponding Link Reconfiguration Response frame, the AP affiliated with the AP MLD shall not apply the operation parameters of the non-AP STA affiliated with the non-AP MLD indicated in the Operation Parameter Info subfield in the Reconfiguration Multi-Link element of the Link Reconfiguration Request frame.

Before receiving of the Link Reconfiguration Response frame, the non-AP STA affiliated with the non-AP MLD shall not apply the operation parameters indicated in the Reconfiguration Multi-Link element of the corresponded Link Reconfiguration Request frame.

After receiving of the Link Reconfiguration Response frame in which the Status Code is set to the value 0 (SUCCESS), the non-AP STA affiliated with the non-AP MLD shall apply the operation parameters indicated in the Operation Parameter Info subfield in the Reconfiguration Multi-Link element of the corresponded Link Reconfiguration Request frame.

After receiving of the Link Reconfiguration Response frame in which a Status Code is set to the value <ANA> (NEED\_MORE\_TIME) or <ANA> (DENIED\_CAPABILITY\_UPDATE), the non-AP STA affiliated with the non-AP MLD shall not apply the operation parameters indicated in the Operation Parameter Info subfield in the Reconfiguration Multi-Link element of the corresponded Link Reconfiguration Request frame.

The value of the maximum MPDU Length subfiled carried in the Operation Parameter Info subfield in the Reconfiguration Multi-Link element of the Link Reconfiguration Request frame indicates the value to update the maximum MPDU Length subfiled in VHT Capabilities element (if applicable) or in HE 6 GHz Band Capabilities element (if applicable) or in EHT Capabilities element (if appliable).

The value of the A-MSDU Length subfiled carried in the Operation Parameter Info subfield in the Reconfiguration Multi-Link element of the Link Reconfiguration Request frame indicates the value to update the A-MSDU Length subfiled in HT Capabilities element.