IEEE P802.11  
Wireless LANs

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| --- | --- | --- | --- | --- |
| **Comment resolution for ML Reconfiguration (light version)** | | | | |
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Abstract

Proposed draft text for multi-link (ML) reconfiguration, broadly referring to a set of post-association procedures to make changes to links between APs and non-AP STAs affiliated with two MLDs, and without disassociation.

The submission proposes text changes based on 2 CIDs from Comment Collection (CC) 34: 1857, 2513. All proposed changes are based on Draft 1.0.

# Revision History

|  |  |  |
| --- | --- | --- |
| **Date** | **Revision** | **Changes** |
| 2021-04-16 | 0 | Initial draft |
| 2021-04-30 | 1 | Note about co-hosted BSSs and non-transmitted BSSIDs when adding APs |
| 2021-05-16 | 2 | Minor edits, terminology |
| 2021-05-29 | 3 | AP removal announcement through the Reconfiguration variant of ML element  ML Configuration Request/Response/Notify frames renamed to ML Reconfiguration |
| 2021-06-16 | 4 | Minor bug fixes, inheritance rules for complete profile |
| 2021-06-18 | 5 | Limiting to AP add/remove procedures, using the Reconfiguration variant of ML element |
| 2021-06-22 | 6 | Removing NSTR Bitmap, focus on STR APs |
| 2021-06-23 | 7 | Add MLD MAC Address, bring back the Common Info field |

# Comments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** | **Proposed Resolution** |
| 1857 | 125.59 | 35.3.1 | The AP MLD Multi Link Operation (MLO) should specify how AP MLD adds new affiliated AP(s) or removes affiliated AP(s). AP MLD may need to add or delete the affiliated AP in order to optimize network performance or to minimize its power consumption in order to be nature friendly. | Please describe how AP MLD may add new affiliated APs and/or remove affiliated APs. | Agree in principle with the comment.  Resolution: Revised, please implement the changes as shown in doc.:IEEE 802.11-21/0534r6 and identified with the CID 1857. |
| 2513 | 132.23 | 35.3.5.3 | There are cases when an AP of an AP MLD will need to shutdown. In such scenarios other links affiliated with the MLDs should not be affected. | Add a single link tear down procedure. | Agree in principle with the comment.  Resolution: Revised, please implement the changes as shown in doc.:IEEE 802.11-21/0534r6 and identified with the CID 2513. |

**Discussion on CIDs 1857 and 2513:**

The comments ask to clarify how AP MLD may add a new affiliated AP or delete an affiliated AP. Currently, 802.11be does not specify this operation, which may lead to interoperability issues in the 802.11be deployments.

An AP MLD may need to adjust the number of available affiliated APs based on traffic load, interference and the number of associated STAs. All devices should be environmentally friendly, so it is important to minimize and optimize AP MLD power consumption. Detailed description of the AP MLD configuration use cases is described in the submission 20/810r1.

802.11be should specify how an AP MLD adds a new affiliated AP.

The baseline 802.11 allows an AP to signal that it will terminate/stop operating by sending a BSS Transition Management Request frame with BSS Termination Included field set to 1 to all associated STAs. The current 802.11 description forces the AP to disassociate all STAs before the BSS is terminated.

The disassociation of the non-AP MLD terminates data transmission in all links of the non-AP MLD. This is not desired in ML setup, because non-AP MLD may have links with other affiliated APs and data transmission with these APs may continue without interrupts. 802.11be should clarify when the disassociation of the non-AP MLD is needed and how non-AP MLD operates if one of the APs to which it has a link is deleted.

CID 2513 requests to clarify signaling to delete a link. It is not clear whether the comment refers to a single “AP-side” link (what is identified by a Link ID), or to one of the links in an ML configuration between an AP MLD and a non-AP MLD (called client-side, for reference). We interpret the comment as the AP-side link and propose a procedure.

### **9.4.2.295b Multi-Link element**

### 9.4.2.295b.1 General

TGbe editor: Add a new row to Table 9-322am (Type subfield encoding) in numerical order, and update the Reserved row:

Table 9-322am—Type subfield encoding

|  |  |
| --- | --- |
| **Type subfield value** | **Multi-Link element variant name** |
|  |
| 0 | Basic |  |
| 1 | Probe Request |  |
| 2 | Reconfiguration |  |
| 3-7 | Reserved |  |

TGbe editor: Modify the paragraph at P128L19 as follows:

The Presence Bitmap subfield is used to indicate the presence of various subfields in the Common Info field as described in 9.4.2.295b.2 (Basic variant Multi-Link element), 9.4.2.295b.3 (Probe Request variant Multi-Link element), and 9.4.2.295b.4 (Reconfiguration variant Multi-Link element)).

TGbe editor: Modify the paragraph at P128L24 as follows:

The Common Info field carries information that are common to all the links except for Link ID Info subfield and BSS Parameters Change Count subfield that are for the link on which Multi-Link element is sent and is optionally present based on the value of the Type subfield (see 9.4.2.295b.2 (Basic variant Multi-Link element), 9.4.2.295b.3 (Probe Request variant Multi-Link element), and 9.4.2.295b.4 (Reconfiguration variant Multi-Link element)).

TGbe editor: Modify the paragraph at P128L35 as follows:

The Link Info field carries information specific to the links and is optionally present based on the value of the Type subfield (see 9.4.2.295b.2 (Basic variant Multi-Link element), 9.4.2.295b.3 (Probe Request variant Multi-Link element) and 9.4.2.295b.4 (Reconfiguration variant Multi-Link element)).

TGbe editor: Add the following new sub-clause:

### 9.4.2.295b.4 Reconfiguration variant Multi-Link element [#1857], [#2513]

The Reconfiguration variant Multi-Link element is used to announce an ML reconfiguration operation (see 35.3.6 (Multi-link reconfiguration)).

The format of the Presence Bitmap subfield of the Reconfiguration variant Multi-Link element is defined in Figure 9-788eh0 (Presence Bitmap subfield of the Reconfiguration variant Multi-Link element format).

|  |  |  |
| --- | --- | --- |
|  | B0 | B1 B11 |
|  | MLD MAC Address Present | Reserved |
| Bits: | 1 | 11 |

Figure 9-788eh0—Presence Bitmap subfield of the Reconfiguration variant Multi-Link element format

The MLD MAC Address Present subfield is set to 1 if the MLD MAC Address field is present in the Common Info field. Otherwise, the subfield is set to 0.

The format of the Common Info subfield of the Reconfiguration variant Multi-Link element is defined in Figure 9-322n1 (Common Info field of the Reconfiguration variant Multi-Link element format).

|  |  |
| --- | --- |
|  | MLD MAC  Address |
| Octets: | 0 or 6 |

Figure 9-322n1—Common Info field of the Reconfiguration variant Multi-Link element format

The Link Info field contains one or more subelements. The subelement format and ordering of subelements are defined in 9.4.3 (Subelements).

The Subelement ID field values for the defined subelements are shown in Table 9-322an1 (Optional subelement IDs for the Reconfiguration variant Multi-Link element).

Table 9-322an1— Optional subelement IDs for the Reconfiguration variant Multi-Link element

|  |  |  |
| --- | --- | --- |
| **Subelement ID** | **Name** | **Extensible** |
| 0 | Per-STA Profile | Yes |
| 1-220 | Reserved |  |
| 221 | Vendor Specific | Vendor defined |
| 222-255 | Reserved |  |

One or more Per-STA Profile subelements are included in the list of subelements.

Each Per-STA Profile subelement starts with a STA Control field, followed by a variable number of fields and elements, as defined in 35.3.6 (Multi-link reconfiguration).

The format of a Per-STA Profile subelement is defined in Figure 9-788ez2 (Per-STA Profile subelement format for the Reconfiguration variant Multi-Link element).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Subelement  ID | Length | STA Control | STA Info | STA Profile |
| Octets: | 1 | 1 | 2 | variable | variable |

Figure 9-788ez2—Per-STA Profile subelement format for the Reconfiguration variant Multi-Link element

The format of the STA Control field is defined in Figure 9-788ek2 ([STA Control field format for the Reconfiguration variant Multi-Link element)](#bookmark46).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 B3 | B4 | B5 | B6 | B7 B15 |
|  | Link ID | Complete  Profile | MAC Address Present | Delete  Timer Present | Reserved |
| Bits: | 4 | 1 | 1 | 1 | 9 |

Figure 9-788ek2—STA Control field format for the Reconfiguration variant Multi-Link element

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 1 when the Per-STA Profile subelement of the Multi-Link element is complete as defined in 35.3.2.2 (Advertisement of complete or partial per-link information). Otherwise, the 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. An STA sets this subfield to 1 when the element carries complete profile.

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.

The STA Info field consists of zero or more 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 subfield in the STA Control field.

The STA MAC Address subfield of the STA Info field carries the MAC address of the AP that can operate on the link identified by the Link ID subfield and is affiliated with the same MLD as the STA that transmitted the Reconfiguration variant Multi-Link element. The STA MAC Address subfield has the same format as the STA MAC Address subfield for the Basic variant Multi-Link element, shown in Figure 9-788ep (STA MAC Address subfield format).

The Delete Timer subfield of the STA Info field indicates the number of target beacon transmission times (TBTTs) of the AP corresponding to the Per-STA Profile subelement until the AP is removed. The format of the Delete Timer subfield is defined in Figure 9-788ek3 (Delete Timer subfield format).

|  |  |
| --- | --- |
|  | Delete Timer |
| Octets: | 2 |

Figure 9-788ek3—Delete Timer subfield

The Vendor Specific subelements have the same format as their corresponding elements (see 9.4.2.25 (Vendor Specific element)). Zero or more Vendor Specific subelements are included in the list of optional subelements.

9.6.35 Protected EHT Action frame details

9.6.35.1 Protected EHT Action field

TGbe editor: Add the following rows to the end of Table 9-526p and change the reserved range:

|  |  |
| --- | --- |
| Table 9-526p—Protected EHT Action field values | |
| Value | Meaning |
| 6 | ML Reconfiguration Notify |
| 7–255 | Reserved |

TGbe editor: Add the following new subclause:

9.6.35.8 ML Reconfiguration Notify frame format [#1857], [#2513]

The ML Reconfiguration Notify frame is an Action frame of category Protected EHT. The Action field of an ML Reconfiguration Notify frame contains the information shown in Table 9-xxx2 (ML Reconfiguration Notify frame Action field format).

|  |  |
| --- | --- |
| Table 9-xxx2—ML Reconfiguration Notify frame Action field format | |
| Order | Information |
| 1 | Category |
| 2 | Protected EHT Action |
| 3 | Dialog Token |
| 4 | Multi-Link |

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

The Protected EHT Action field is defined in 9.6.36.1 (General).

The Dialog Token field is a nonzero value chosen by the transmitting AP MLD to identify different transmissions of the frame.

The Multi-Link element is defined in 9.4.2.295b (Multi-Link element); the variant of the Multi-Link element used in the frame is the Reconfiguration variant (9.4.2.295b.4 (Reconfiguration variant Multi-Link element)).

TGbe editor: Add the following new clause and renumber other sections under 35.3 accordingly; the requested section number is the section immediately after Multi-link (re)setup (35.3.5 in 11be Draft 1.0), to maintain a logical flow.

35.3.6 Multi-link reconfiguration [#1857], [#2513]

35.3.6.1 General

*Multi-link reconfiguration* (ML reconfiguration, or reconfiguration for short) refers to a set of procedures through which an AP MLD can add affiliated APs to the AP MLD, or remove affiliated APs from the AP MLD.

### 35.3.6.2 Adding or removing affiliated APs

### 35.3.6.2.1 Adding new affiliated APs

An AP MLD may add new affiliated APs anytime. New affiliated APs may be announced through Reconfiguration variant Multi-Link and Reduced Neighbor Report elements in Beacon and Probe Response frames.

NOTE—The MAC address of any new co-hosted AP is assumed to be within the address space defined by the value of the Max Co-Hosted BSSID Indicator field (see 9.4.2.249 (HE Operation element) and 26.17.7 (Co-hosted BSSID set)). Similarly, the MAC address of any new nontransmitted BSSID is assumed to be within the address space defined by the value of the MaxBSSID Indicator (see 9.4.2.45 (Multiple BSSID element) and 11.1.3.8 (Multiple BSSID procedure)).

### 35.3.6.2.1 Removing affiliated APs

An AP MLD may remove one or more of its affiliated APs anytime. The AP MLD shall announce removal of one or more of its affiliated APs through a Reconfiguration variant Multi-Link element (see 9.4.2.295b.4 (Reconfiguration variant Multi-Link element)) transmitted in (i) all Beacon frames of all its affiliated APs, as well as all Probe Response frames it transmits, until all affiliated APs marked for removal have been removed, or (ii) at least one ML Reconfiguration Notify frame sent to each associated non-AP MLD such that for any affiliated AP that is to be removed, every associated non-AP MLD is notified of the affiliated AP removal before the affiliated AP is removed.

For each affiliated AP that is about to be removed, the AP MLD shall include a Per-STA Profile subelement with the subfields of the Per-STA Control field of the Reconfiguration variant Multi-Link element set as following: The Link ID subfield shall identify the AP, the Delete Timer Present subfield shall be set to 1, and the Delete Timer subfield shall be set to the number of target beacon transmission times (TBTTs) of that affiliated AP before it is removed. The initial value of the Delete Timer subfield shall be longer than the MLD max idle period.

If an AP removal is to be announced while other AP removals are in progress, the Reconfiguration variant Multi-link element shall include updated values of the Delete Timer subfield for all APs that are about to be removed.

An AP affiliated with the AP MLD that is going to be removed shall also follow the procedure in 11.21.7 (BSS transition management for network load balancing) to notify non-AP STAs that are not affiliated with any MLD and are associated with that AP of the corresponding BSS termination.

Once an AP affiliated with an AP MLD to which a non-AP MLD has a setup link is removed, from the non-AP MLD perspective the link to the removed AP has been deleted and the non-AP MLD shall not transmit any frames to that AP.