IEEE P802.11
Wireless LANs

|  |
| --- |
| 11be D3.0 CR for 4.5.3 and 11.3 |
| Date: 2023-03-08 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Po-Kai Huang | Intel |  |  |  |

Abstract

This submission proposes resolutions for the following CIDs:

15185, 15186, 15187, 15290, 15291, 15292, 15293, 15353, 15493, 18067

15189, 15508, 15509, 15510, 18280,

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Green tag.
* Rev 2: Revision based the discussion during teleconference.
* Rev 3: Revision for CID 18067
* Rev 4: Revision based on the discussion during teleconference

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 D3.0 Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGbe D3.0 Draft. (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***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.***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 15185 | Henry Ptasinski | 4.5.3.2 | 66.08 | What does "where each non-AP STA affiliatedwith the non-AP MLD is within one BSS" mean? Can a non-AP STA be within more than one BSS? | Clarify. Add example diagrams. | Rejected – The commenter asks a question, and the explanation is provided below. The major bullet says BSS transition, so we mention a non-AP STA is within one BSS and this self explains why this is also BSS transition. The sentence does not say a non-AP STA is within more than one BSS.  |
| 15186 | Henry Ptasinski | 4.5.3.2 | 66.12 | Which of the previously mentioned BSS is referenced by "where each non-AP STA affiliated with the non-AP MLD is within another BSS"? | Clarify. Add example diagrams. | Rejected – The commenter asks a question, and the explanation is provided below. Another BSS is used due to movement to another AP MLD. It does not reference anything of the “from one AP MLD” |
| 15187 | Henry Ptasinski | 4.5.3.2 | 66.17 | What happens to the other affiliated STAs when the MLD is moving "to another BSS within the same ESS and becoming a non-AP"? | Clarify. Add example diagrams. | Rejected –The commenter asks a question, and the explanation is provided below. Non-AP MLD can remove those STAs since they are not used when connection to AP under non-MLO. Non-AP MLD can also just delete maintained information and keep interface around. These behaviors are not related to interop, so do not need to be specified. |
| 15290 | Bo Sun | 4.5.3.2 | 66.06 | How about the movement of a non-AP STA affiliated with a non-AP MLD from one AP affiliated with an AP MLD to another AP affiliated with the same AP MLD? Is that considered as BSS-transition as well or just link change? | Clarify | Rejected – The commenter asks a question, and the explanation is provided below. The commenter seems to talk about potential add/remove link which is a different topic. When talking about MLD, the bullet talks about the whole MLD movement rather than just specific link change.  |
| 15291 | Bo Sun | 4.5.3.3 | 67.03 | It's strange to suddenly use term "IEEE 802.11 link" here since it's not clear or explained anywhere whether the "link" in "multi-link" is exactly the IEEE 802.11 link. | Explain the "link" in "multi-link" and its relation with IEEE 802.11 link before use these terms. | Rejected – We note that IEEE 802.11 link is used by baseline in the context of the referenced sentence. It is normal to use the same wording for that specific context. *Within a robust security network (RSN), association is handled differently. In an RSNA, the IEEE 802.1X Port determines when to allow data traffic across an IEEE 802.11 link …* |
| 15292 | Bo Sun | 4.5.3.3 | 67.22 | It's better to say "Which AP MLD is serving non-AP MLD Y?" since there're two questions mentioned. | as comment. | Accepted - |
| 15293 | Bo Sun | 4.5.3.3 | 67.36 | How about an AP affiliated with an AP MLD may be assoicated with non-AP STA MLDs and non-AP STAs at the same time? If the statement is to give potential instances, then it should include all potential cases. | as comment. | Rejected –Association is between two STAs or two MLDs. AP affiliated with the AP MLD does not associate with non-AP MLD.  |
| 15353 | John Wullert | 4.5.3.3 | 67.06 | Text suggests that MLD must use multiple links | Change "between two STAs or multiple IEEE 802.11 links between two MLDs" to "between two STAs or one or more IEEE 802.11 links between two MLDs". | Revised –Agree in principle with the commenter. TGbe editor to make the changes shown in 11-23/0335r2 under all headings that include CID 15353 |
| 15493 | Chaoming Luo | 4.5.3.2 | 66.14 | A non-AP MLD maybe transitions to multiple co-located non-AP STAs, each associated with a different legacy AP (e.g., dual-band 11ax AP). | Add description for the case and clarify the MAC addresses of the non-AP STAs may be kept no change. | Rejected –Connecting to two 11ax APs requires two associations. One association to two assocaitions is not transition. It is just the device’s choice to create additional interface for additional connection. For two assocaitions under non-MLO, MAC addresses of the client can not be the same. Same MAC address in this case will create issues for DS mapping.  |
| 18067 | Abhishek Patil | 4.5.3.3 | 66.56 | Is ‘STA [that] is not affiliated with an MLD’ same as a ‘non-MLO [non-AP] STA’? There are several occurrences of both throughout the TGbe spec. | Please harmonize the terminology throughout the Tgbe draft. Since the term non-MLO is defined, use the term ‘non-MLO (non-AP) STA’ at all instances of ‘(non-AP) STA (that is) not associated with a (non-AP) MLD’. | Revised -Non-MLO and MLO refers to the operations on both sides rather than just a single STA.For descriptions invovles with just a STA, usage of STA not affiliated with an MLD is more suitable for the context. We harmonize the terms to use STA not affiliated with an AP MLD rather than usage of non-MLO STA.***multi-link operation (MLO):*** *Operations such as, but not limited to, discovery, authentication, multi-link setup, and frame exchanges, between two multi-link devices (MLDs) as described in 35.3 (Multi-link operation).****non-multi-link operation (non-MLO):*** *Operations that do not involve (#15944)multi-link operation between two MLDs as described in 35.3 (Multi-link operation).*TGbe editor to make the changes shown in 11-23/0335r4 under all headings that include CID 18067 |
| 15189 | Henry Ptasinski | 11.3.2 | 363.37 | Where are these variables stored for an MLD? For non-MLD cases, they're part of the MLME (REVme D1.4 Clause 11.3.1: "A STA (local) for which dot11OCBActivated is false keeps an enumerated state variable for each STA (remote) with which direct communication via the WM is needed. ... The state variable is kept within the MLME"). In the MLD case, each affiliated STA has its own MLME. | Define an "MLD-MLME" entity, add it to figure 4-30b, and explain its behavior vs. the individual STA MLMEs (comparable to REVmd D1.4 Clause 4.9.3 MM-MLME). | Rejected – 4.9.3 defines MM-SME rather than MM-MLME. 4.9.3 is for multiple MAC-SAP but MLD has one MAC-SAP. Suggestion to use 4.9.3 does not seem to be correct.In 4.9.6, the description also has mentioned that SME of the MLD coordinates MLME. *The SME is responsible for coordinating the MLD and each of the affiliated STAs through the MLME, and to maintain an RSNA key management entity and IEEE 802.1X Authenticator or Supplicant in each upper MAC sublayer component, for MLO.* |
| 15508 | Chaoming Luo | 11.3.4 | 366.23 | In 11me D2.0 P2428L33 clause 11.3.3 (Frame filtering based on STA state), the definition of class 1 frame "xiii) In an HE BSS Basic Trigger frame and Multi-STA BlockAck frame" should remove the word "In an HE BSS" in 11be, since it also applys to EHT. | As in comment | Rejected – EHT STA is a HE STA. STA associates with EHT AP will still follows HE rules.  |
| 15509 | Chaoming Luo | 11.3.6.3 | 373.25 | The PeerSTAAddress parameter only identifies one entity, while in MLD case, there may be MAC addresses of affiliated STAs (e.g., in an attacker MLD) which confilicts with MAC addresses existing associated STAs.Same issue lies in P378L55. | Add SA Query for MAC addresses of affiliated STAs of the non-AP MLD. | Rejected – For MLO, association is only between MLDs rather than affilated STAs. Questions related to overall association only need to care about MLD. MAC addresses of affiliated STAs over the setup link are already verified during 4-way. |
| 15510 | Chaoming Luo | 11.3.6.4 | 376.06 | The sentence is confusing. Does it imply if the affiliated non-AP STA has MAC addr equal to the MLD MAC addr may send a Reassociation Request frame without Basic Multi-Link element to any AP affiliated with that AP MLD? | Remove "and has MAC address not equal to the MLD MAC address of the non-AP MLD" | Rejected – If the MAC address is the same, then it indeed can send reassociation request frame without multi-link element and does BSS transition to non-MLO mode.  |
| 18280 | Mark Hamilton | 11.3.6.4 | 376.33 | Per 11.3.6.4, numbered lists within (c), a transition from an AP to the same AP, or from an AP MLD to the same AP MLD are explicitly covered as to what items are deleted/reset and which are retained (not affected). However, it is left unclear what happens when the transition is to/from an AP MLD and an AP affiliated with that AP MLD (that is, transitioning to/from MLO to/from legacy mode). The BSS-transitions listed in 4.5.3.2 seem to imply that all such transitions that would change legacy/MLO behavior have to be to "another" (meaning \_not\_ the same) BSS(s), so maybe such legacy/MLO transition while remaining on the same "logical AP device" is not possible? But, discussion in the group seems to believe this should be possible and is desirable. | Clarify if the lists in (c) are intended to apply when transitioning from an AP to an AP MLD within the same device (and how that would be signalled/understood by the non-AP STA, if so). Also clarify in the lists of BSS-transitions in 4.5.3.2 how to classify such a transition (probably just delete "another" and/or "different" from the third and fourth bullets). | Rejected – In baseline, for non-MLO, it is possible to transition to the same AP although the texts also use another. See below. *“A STA movement from one BSS in one ESS to another BSS within the same ESS.”*MLD texts follow similar writing style and will include to same AP or AP MLD if we accept the same logic of baseline texts. Simply changing MLD texts without changing baseline texts is probably not the right practice.Finally, note that (c) applies for all allowed reassociation modes. Note that (a) only requires existing association to the same ESS.*a) If the STA (with respect to the AP or PCP) or non-AP MLD (with respect to the AP MLD) is not**associated in the same ESS or the state for the new AP, AP MLD, or PCP is State 1, the MLME shall**inform the SME of the failure of the reassociation by issuing an MLME-REASSOCIATE.confirm**primitive, and this procedure ends.*Fundamentally, we only need to compare the address, the following texts mention that as long as the value in CurrentAPAddress is different from the new one, then all states are deleted. *In the case of reassociation to a different AP, AP MLD, or PCP (the CurrentAPAddress parameter is not the new AP’s or PCP’s MAC address or the new AP MLD’s MAC address), all the states, agreements and allocations listed above are deleted or reset to initial values.*For the case of same MAC address, then it follows the following description.*If the MLME-REASSOCIATION.request primitive has the new AP’s, AP MLD’s, or PCP’s MAC address in the CurrentAPAddress parameter (reassociation to the same AP, AP MLD, or PCP), the following states, agreements and allocations shall be deleted or reset to initial values:* |

**Discussion: Reference texts provided below**

* + - 1. **Mobility types**

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

The three transition types of significance to this standard that describe the mobility of STAs or MLDs within a network are as follows:

* + - * + ***No-transition:*** In this type, two subclasses that are usually indistinguishable are identified:

Static—no motion.

Local movement—movement within the PHY range of the communicating STAs, i.e., movement within a basic service area (BSA).

* + - * + ***BSS-transition:*** This type is defined for a STA or an MLD as follows:
* ~~a~~A STA movement from one BSS in one ESS to another BSS within the same ESS.
* A non-AP MLD movement from one AP MLD in one ESS, where each non-AP STA affiliated with the non-AP MLD is within one BSS and different non-AP STAs affiliated with the non-AP MLD are within different BSSs, to another AP MLD within the same ESS, where each non-AP STA affiliated with the non-AP MLD is within another BSS and different non-AP STAs affili- ated with the non-AP MLD are within different BSSs.
* A non-AP MLD movement from one AP MLD in one ESS, where each non-AP STA affiliated with the non-AP MLD is within one BSS and different non-AP STAs affiliated with the non-AP MLD are within different BSSs, to another BSS within the same ESS and becoming a non-AP STA, where the MLD MAC address of the non-AP MLD is the same as the MAC address of the non-AP STA.
* A non-AP STA movement from one BSS in one ESS to an AP MLD within the same ESS and becoming a non-AP MLD, where each non-AP STA affiliated with the non-AP MLD is within another BSS, different non-AP STAs affiliated with the non-AP MLD are within different BSSs and the MAC address of the non-AP STA is the same as the MLD MAC address of the non-AP MLD.

A fast BSS transition is a BSS transition that establishes the state necessary for data connectivity before the reassociation rather than after the reassociation.

* + - * + ***ESS-transition:*** This type is defined as STA movement from a BSS in one ESS to a BSS in a different ESS. This case is supported only in the sense that the STA might move. Maintenance of upper-layer connections cannot be guaranteed by IEEE Std 802.11; in fact, disruption of service is likely to occur.

***Move the following third paragraph as the first paragraph of this subclause:***

The different association services support the different categories of mobility.

*TGbe editor: Change Clause 4.5.3.3 as follows (track change on):*

**4.5.3.3 Association**

***Change the first three paragraphs as follows:***

To deliver an MSDU within an ESS via the DS, the DS needs to know which AP or AP MLD within the ESS to deliver the MSDU, so that the MSDU might ultimately be delivered to the addressed IEEE 802.11 non- AP STA or non-AP MLD. This information is provided to the DS by the concept of association. Association is necessary, but not sufficient, to support BSS-transition mobility. Association is sufficient to support no- transition mobility. Association is one of the services in the DSS.

Before a non-AP STA or a non-AP MLD is allowed to ~~send~~deliver an MSDU via an AP or an AP MLD, respectively, it first becomes associated with the AP or the AP MLD, respectively.

For a non-GLK STA that is not affiliated with an MLD, the act of becoming associated with an AP invokes the association service, which provides the STA to AP mapping to the DS. For a non-AP MLD, the act of becoming associated with an AP MLD invokes the association service (see 11.3 (STA authenticationAuthentication and association)), which provides the non-AP MLD to AP MLD mapping to the DS. How the information provided by the association service is stored and managed within the DS is not specified by this standard.

***Change the fifth paragraph as follows:***

Within a robust security network (RSN), association is handled differently. In an RSNA, the IEEE 802.1X Port determines when to allow data traffic across an IEEE 802.11 link between two STAs or one or more(#15353) IEEE 802.11 link(s) between two MLDs. A single IEEE 802.1X Port maps to one association, and each association maps to an IEEE 802.1X Port. An IEEE 802.1X Port consists of an IEEE 802.1X Controlled Port and an IEEE 802.1X Uncontrolled Port. The IEEE 802.1X Controlled Port is blocked from passing general data traffic between two STAs or between two MLDs until an IEEE 802.1X authentication procedure completes successfully over the IEEE 802.1X Uncontrolled Port. Once the AKM completes successfully, data protection is enabled to prevent unauthorized access, and the IEEE 802.1X Controlled Port unblocks to allow protected data traffic. IEEE 802.1X Supplicants and Authenticators exchange protocol information via the IEEE 802.1X Uncontrolled Port. It is expected that most other protocol exchanges use the IEEE 802.1X Controlled Ports. However, a given protocol might need to bypass the authorization function and make use of the IEEE 802.1X Uncontrolled Port.

***Change the seventh, eighth, and ninth paragraphs as follows:***

At any given instant, a non-AP STA is associated with no more than one AP, and a non-AP MLD is associated with no more than one AP MLD. This allows the DS to determine a unique answer to the questions, “Which AP is serving non-AP STA X?” and “Which AP MLD is serving non-AP MLD Y(#15292)?” Once an association is completed between a non-AP STA and an AP, a non-AP STA can make full use of a DS (via the AP) to communicate. Similarly, once an association is completed between a non-AP MLD and an AP MLD, a non-AP MLD can make full use of a DS (via the AP MLD) to communicate. Association between a non-AP STA and an AP is always initiated by the non-AP STA, not the AP. Association between a non-AP MLD and an AP MLD is always initiated by the non-AP MLD, not the AP MLD.

An AP or an AP MLD might be associated with many non-AP STAs or non-AP MLDs, respectively, at the same time.

A non-AP STA or a non-AP MLD learns what APs or AP MLDs, respectively, are present and what opera- tional capabilities are available from each of those APs or AP MLDs and APs affiliated with each AP MLD, respectively, and then invokes the association service to establish an association with an AP or an AP MLD, respectively. A FILS STA is able to discover, authenticate and associate with the AP with a reduced number of frame transmissions. For details of how a STA learns about what APs are present, see 11.1.4 (Acquiring synchronization, scanning).

*TGbe editor: Change Clause 4.9 as follows (track change on):*

**4.9.6 Reference model for multi-link operation (MLO)**

(…existing texts…)

An AP MLD always operates in cooperation with one or more affiliated APs, one for each link. The MLD lower MAC sublayer components implement link specific functions that operate independently of the lower MAC in other affiliated APs. Use of these MLD lower MAC functions is shared by the AP MLD’s upper MAC sublayer, and the affiliated AP’s upper MAC sublayer (see Figure 4-30c (High level architecture for AP MLD with affiliated APs)). Some behaviors of MLO require the use of one or more affiliated APs’ upper MAC components. In particular, the affiliated AP MLD upper MAC sublayer components support group addressed traffic, and any group or individually addressed traffic to or from any non-AP STAs that are not affiliated with non-AP MLDs(#18067).

(…existing texts…)

The non-AP MLD reference model includes the MLD upper MAC sublayer and MLD lower MAC sublayers (one for each link). The single upper MAC within a non-AP MLD can operate at any given time in either MLO over one or more lower MAC and PHY pairs for association to an AP MLD, or as a non-AP STA that is not affiliated with a non-AP MLD using only one set of lower MAC and PHY pairs for association to an AP (#18067) (which may or may not be affiliated with an AP MLD). A single Supplicant on the non-AP MLD manages the PTKSA, and multiple group key security associations (one set per link). The reference architecture when operating in MLO is shown in Figure 4-30d (High level architecture for non-AP MLD with affiliated non-AP STAs).

(…existing texts…)

The reference architecture of Figure 4-24 (Portion of the ISO/IEC basic reference model covered in this standard) applies when operating as a non-AP STA that is not affiliated with a non-AP MLD(#18067).

*TGbe editor: Change Clause 5.1.5.1 as follows (track change on):*

**5.1.5.1 General**

(…existing texts…)

For an AP MLD to support group addressed transmissions and also associations from non-AP STAs that are not affiliated with non-AP MLDs (#18067), Figure 5-2a (MAC data plane architecture (MLO) for unicast data frames) is combined with **n** affiliated APs, within a structure as shown in Figure 4-30c (High level architecture for AP MLD with affiliated APs). The affiliated APs’ upper MAC sublayer components are the same as those for the AP MLD, but handle group addressed security associations (GTK, IGTK, and BIGTK), and handle traffic to and from associated non-AP STAs (not operating in MLO) with single link security associations for pairwise transient keys (PTKs). The overall structure is as shown in Figure 5-2b (MAC data plane architecture for AP MLD and affiliated APs).

(…existing texts…)

*TGbe editor: Change Clause 7.1 as follows (track change on):*

**7.1 Introduction**

(…existing texts…)

The affiliated AP(s) will each provide a mapping to their associated non-AP STAs that are not affiliated with non-AP MLDs(#18067), by their MAC addresses. Thus, the non-AP devices form distinct sets of MAC addresses, and the DS can deliver any service tuples with a one-to-one mapping of destination address to DS SAP.

(…existing texts…)