IEEE P802.11  
Wireless LANs

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| --- | --- | --- | --- | --- |
| MLO discovery: Discovery procedures (inclusion probing) and RNR | | | | |
| Date: 2020-08-20 | | | | |
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R2: comments received on the call and from Mark offline

* Leave TBD signaling to make probe request an MLD probe request
* Capturing requirement for uniqueness of MLD ID

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).***

**Motions captured in this document:**

At any point in time, a TID shall always be mapped to at least one link that is set up, unless admission control is used.

[Motion 101, [21] and [116]]

A link, that is setup as part of a multi-link setup, is defined as Enabled if that link can be used for frame exchange and at least one TID is mapped to that link.

NOTE – Frame exchange on a link is subject to the power state of the corresponding non-AP STA.

[Motion 105, [21] and [117]]

Management frames are allowed on all enabled links, following baseline.

[Motion 102, [21] and [116]]

If a TID is mapped in UL to a set of enabled links for a non-AP MLD, then the non-AP MLD can use any link within this set of enabled links to transmit data frames from that TID.

If a TID is mapped in DL to a set of enabled links for a non-AP MLD, then:

* The non-AP MLD can retrieve buffered BUs corresponding to that TID on any links within this set of enabled links.
* The AP MLD can use any link within this set of enabled links to transmit data frames from that TID, subject to existing restrictions for transmissions of frames that apply to those enabled links.
* An example of restriction is if the STA is in doze state.

[Motion 103, [21] and [116]]

802.11be supports adjusting the setting of More Data subfield to fit MLD scenario.

[Motion 112, #SP51, [13] and [118]]

802.11be define mechanism(s) for multi-link operation that enables the following:

* An operational mode for concurrently exchanging frames on more than one link for one or more TID(s).
* An operational mode for restricting exchanging frames of one or more TID(s) to be on one link at a time.

[Motion 9, [1] and [119]]

802.11be supports setting the More Data subfield as follows:

* When AP MLD transmit a BU in one link to a non-AP MLD, if there is at least one additional buffered BU of any TID or management frames that is mapped to this link by TID-to-link mapping or default mapping for the same non-AP MLD, the More Data subfield is set to 1, otherwise the More Data subfield is set to 0.

[Motion 112, #SP52, [13] and [118]]

1. **Proposed spec text**

**TGbe editor: Modify the following subclause as follows**

* Reduced Neighbor Report element
* Neighbor AP Information field

Change the 6th paragraph as follows (based on the paragraph from P802.11ax D6.1):

The TBTT Information Length subfield is 1 octet in length and indicates the length of each TBTT Information field included in the TBTT Information Set field of the Neighbor AP Information field. ~~When~~ If the TBTT Information Field Type subfield is ~~set to~~ 0, the TBTT Information Length subfield:

* contains the length in octets of each TBTT Information field that is included in the TBTT Information Set field of the Neighbor AP Information field
* is set to 1, 2, 5, 6, 7, 8, 9, ~~or~~ 11, 12, 13, 15 or 16; other values are reserved.
* indicates the TBTT Information field contents as shown in Table 9-273 (TBTT Information field content).

Change Table 9-281 (TBTT Information field contents) as follows:

|  |  |
| --- | --- |
| * TBTT Information field contents | |
| TBTT Information Length subfield value | TBTT Information field contents |
| 1 | The Neighbor AP TBTT Offset subfield |
| 2 | The Neighbor AP TBTT Offset subfield and the BSS Parameters subfield |
| 5 | The Neighbor AP TBTT Offset subfield and the Short-SSID subfield |
| 6 | The Neighbor AP TBTT Offset subfield, the Short-SSID subfield, and the BSS Parameters subfield |
| 7 | The Neighbor AP TBTT Offset subfield and the BSSID subfield |
| 8 | The Neighbor AP TBTT Offset subfield, the BSSID subfield, and the BSS Parameters subfield |
| 9 | The Neighbor AP TBTT Offset subfield, the BSSID subfield, the BSS Parameters subfield, and the 20 MHz PSD subfield |
| 11 | The Neighbor AP TBTT Offset subfield, the BSSID subfield and  the Short-SSID subfield |
| 12 | The Neighbor AP TBTT Offset subfield, the BSSID subfield, the Short-SSID subfield and the BSS Parameters subfield |
| 13 | The Neighbor AP TBTT Offset subfield, the BSSID subfield, the Short-SSID subfield, the BSS Parameters subfield and the 20 MHz PSD subfield |
| 15 | The Neighbor AP TBTT Offset subfield, the BSSID subfield, the Short-SSID subfield, the BSS Parameters subfield and the MLD Parameters subfield |
| 16 | The Neighbor AP TBTT Offset subfield, the BSSID subfield, the Short-SSID subfield, the BSS Parameters subfield, the 20 MHz PSD subfield and the MLD Parameters subfield |
| 17–255 | The first 16 octets of the field contain the Neighbor AP TBTT Offset subfield, the BSSID subfield, the Short-SSID subfield the BSS Parameters subfield, the 20 MHz PSD subfield and the MLD Parameters subfield (i.e., same contents as when the length of the TBTT Information field is 16). The remaining octets are reserved. |

Change 9-632 (TBTT Information field format) as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Neighbor AP TBTT Offset | BSSID (optional) | Short-SSID (optional) | BSS parameters | 20 MHz PSD | MLD Parameters |
| Octets: | 1 | 0 or 6 | 0 or 4 | 0 or 1 | 0 or 1 | 0 or TBD |
| * TBTT Information field format | | | | |  |  |

TGbe editor: Insert at the end of this subclause:

The format of the MLD Parameters subfield is defined in Figure xxx (MLD Parameters subfield format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | TBD | TBD | TBD | TBD |
|  | MLD ID | Link ID | Change Sequence | Reserved |
| Bits: | TBD | TBD | TBD | TBD |
| Figure xxx – MLD Parameters subfield format | | | | | |  |  |

The MLD ID subfield indicates the identifier of the AP MLD to which the reported AP is affiliated. If the reported AP is affiliated to the same MLD as the reporting AP, the MLD ID subfield is set to 0. If the reported AP is affiliated to the same MLD as a nontransmitted BSSID that is in the same multiple BSSID set as the reporting AP, the MLD ID subfield is set to same value as in the BSSID Index field in the Multiple BSSID-Index element in the nontransmitted BSSID profile corresponding to the nontransmitted BSSID. If the reported AP is part of another AP MLD, the MLD ID subfield is set following the procedure defined in 33.3.2.1 (AP Behavior). The MLD ID subfield is set to TBD if the reported AP is not part of an AP MLD, or if the reporting AP does not have that information.

NOTE – The MLD ID is unique to an AP MLD in the frame on which it is carried as it is used to identify the list of reported APs affiliated to the same AP MLD.

The Link ID subfield indicates the link identifier of the reported AP within the AP MLD to which the reported AP is affiliated. The MLD ID subfield is set to TBD if the reported AP is not part of an AP MLD, or if the reporting AP does not have that information.

NOTE – The link identifier is unique to an AP within an AP MLD.

The Change Sequence subfield is an unsigned integer, initialized to 0, that increments  
when a critical update to the Beacon frame of the reported AP occurs. The critical updates are defined in 11.2.3.15 TIM Broadcast. The Change Sequence subfield is set to TBD if the reported AP is not part of an AP MLD, or if the reporting AP does not have that information.

***TGbe editor: Insert the new subclause 33.3.2 Discovery of an AP MLD as follows:***

**33.3.2 Discovery of an AP MLD**

**33.3.2.1 AP Behavior**

If neither of these conditions is met:

* + the transmitted Probe Response frame is individually addressed to a STA that has signaled that it does not support operating in a given band (see 9.4.2.53 (Supported Operating Classes element))
  + the APs affiliated to the AP MLD do not intend to be discovered by STAs

then the following applies:

* If an AP is affiliated to an AP MLD then the Beacon and Probe Response frames transmitted by the AP or by the AP corresponding to the transmitted BSSID of the same multiple BSSID set as the AP shall include a TBTT Information field in a Reduced Neighbor Report element with the Neighbor AP TBTT Offset subfield, the BSSID subfield, the Short-SSID subfield, the BSS Parameters subfield and the MLD Parameters subfield, for each of the other APs affiliated to the same AP MLD
* If a reporting AP is part of an AP MLD and is in the same collocated set as APs affiliated with another AP MLD for which there are no affiliated APs operating on the same channel as the reporting AP, each AP of the other AP MLD shall be reported in the RNR element that is included in the Beacon and broadcast Probe Response frames transmitted by the reporting AP if at least one AP of the other AP MLD is in the same multiple BSSID set as an AP affiliated with the AP MLD of the reporting AP, unless the APs of the other AP MLDs are already reported in Beacon and broadcast Probe Response frames transmitted by an AP in the same collocated set as the reporting AP.

If an AP of an AP MLD is reported in an RNR element with the MLD Parameters subfield present in the TBTT Information field for that AP:

* If the reported AP is affiliated to the same MLD as the reporting AP or to the same MLD as a non-transmitted BSSID in the same multiple BSSID set as the reporting AP, the Change Sequence subfield in the MLD Parameters subfield in the TBTT Information field describing the reported AP in a Reduced Neighbor Report element shall be set to the same value as the Change Sequence subfield in the EHT Operation element in frames transmitted on its operating channel by the reported AP or by the transmitted BSSID of the same multiple BSSID set as the reported AP. Otherwise, the Change Sequence subfield shall be set to TBD if the reported AP is not part of an AP MLD, or if the reporting AP does not have that information.
* If the reported AP is affiliated to the same MLD as the reporting AP, the MLD ID subfield shall be set to 0. If the reported AP is affiliated to the same AP MLD as a nontransmitted BSSID that is in the same multiple BSSID set as the reporting AP, the MLD ID subfield shall be set to same value as in the BSSID Index field in the Multiple BSSID-Index element in the nontransmitted BSSID profile corresponding to the nontransmitted BSSID in the Multiple BSSID element transmitted in frames sent by the reporting AP. If the reported AP is affiliated to another AP MLD and the reporting AP intends to carry MLD information for that AP, the MLD ID for this AP MLD shall be unique in the frame that carries the RNR element and shall be selected with additional TBD rules. Otherwise, the MLD ID subfield shall be set to TBD if the reported AP is not part of an AP MLD, or if the reporting AP does not have that information.
* If the reported AP is affiliated to the same MLD as the reporting AP or as a non-transmitted BSSID in the same multiple BSSID set as the reporting AP, the Link ID subfield in the TBTT Information field for the reported AP shall be set to the same value as in the Link ID field in the Per-STA profile corresponding to the reported AP in the ML element transmitted in frames sent by all APs affiliated to the same AP MLD. The Link ID subfield shall be set to TBD if the reported AP is not part of an AP MLD, or if the reporting AP does not have that information.

**33.3.2.2 MLD Probing**

An MLD probe request is a Probe Request frame:

* with the Address 1 field set to the broadcast address, the Address 3 field set to the BSSID of an AP, or with the Address 1 field set to the BSSID of an AP, or with the Address 1 field set to the broadcast address, the Address 3 field set to wildcard BSSID and the SSID field set to the SSID of an AP
* and that includes a TBD signalling that identifies that the Probe Request frame is an MLD probe request and that identifies which APs of the AP MLD are requested.

An MLD probe request allows a non-AP STA to request an AP to include the complete set of capabilities, parameters and operation elements of other APs affiliated to the same AP MLD as the AP. It is TBD how the complete information of an AP affiliated to the same AP MLD as the AP identified in the Address 1 or Address 3 field of the Probe Request frame is requested.

The complete information of a requested AP sent by a reporting AP is defined as all elements that would be provided if the requested AP was transmitting the Probe Response frame, except the following elements, if present: the Reduced Neighbor Report element, the Multiple BSSID element, the ML element, other exceptions TBD.

If an AP that is part of an AP MLD receives an MLD Probe Request from a non-AP STA, it shall respond with an MLD probe response, which is a Probe Response frame with the Address 1 field set to the broadcast destination address that includes an ML element with a STA profile with complete information for each of the APs that are affiliated to the same AP MLD as the AP and that are requested by the MLD probe request.