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

R3: correct motion list

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:**

802.11be shall define mechanism(s) for an AP of an AP MLD to advertise complete or partial information of other links:

* Partial information to prevent frame bloating.
* For example, frames exchanged during ML setup are expected to carry complete information while Beacon frame is expected to carry partial information.
* The exact set of elements/fields that constitute partial information is TBD.

[Motion 115, #SP93, [10] and [93]]

All APs that are part of the same MLD as a reporting AP and that are collocated with the reporting AP shall be reported in the RNR element that is included in the beacons and the broadcast probe responses transmitted by the reporting AP when the reporting AP is either not part of a multiple BSSID set or corresponds to a transmitted BSSID in a multiple BSSID set.

* Note: an AP is not included if it is not discoverable.
* Note: RNR provides basic information (e.g., operating class, channel, BSSID, short SSID).

[Motion 115, #SP95, [10] and [94]]

802.11be agrees to include in a TBTT Information field of the RNR, corresponding to a reported AP that is part of the same MLD as the reporting AP, an indication that the reported AP is part of the same MLD as the reporting AP when the reporting AP is either not part of a multiple BSSID set or corresponds to a transmitted BSSID in a multiple BSSID set.

* Note: signaling of that indication is TBD.

[Motion 115, #SP96, [10] and [94]]

All APs that are part of the same MLD as a non-transmitted BSSID and that are collocated with the non-transmitted BSSID shall be reported in the RNR element that is included in the beacons and the broadcast probe responses transmitted by the transmitted BSSID that is in the same Multiple BSSID set as the non-transmitted BSSID.

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 beacons and the broadcast probe responses 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 beacons and the broadcast probe responses transmitted by an AP in the same collocated set as the reporting AP on the same channel as the reporting AP.

[Motion 119, #SP127, [3] and [95]]

802.11be agrees to define a mechanism for a STA of a non-AP MLD to send a probe request frame to an AP belonging to an AP MLD, which enables to request a probe response from the AP that includes the complete set of capabilities, parameters and operation elements of other APs affiliated to the same MLD as the AP

* The complete information is defined as all elements that would be provided if the reported AP was transmitting that same frame (exceptions TBD).
* It is TBD if the AP is mandated or not to respond with the requested information.
* Note: Such a directed probe request requesting complete MLO information for one or more APs of the MLD is referred to as an ML probe request.
* Note: A probe response sent in response to an ML probe request containing complete MLO Information for the requested AP(s) is referred to as an ML probe response.

[Motion 115, #SP97, [10] and [94]]

[Motion 119, #SP109, [3] and [96]]

**Straw poll #185**

Do you agree to add MLD-index to the TBTT Information field of the RNR element, which is used to indicate the ID of the AP MLD in which the reported AP is if the reported AP in an AP MLD?

* MLD-Index is set to BSSID Index of a non transmitted BSSID if the reported AP is the in the same MLD as the non-transmitted BSSID and the reporting AP is the same Multiple BSSID set as the non-transmitted BSSID
* MLD-Index is set to zero if the reported AP is in the same MLD as the reporting AP
* MLD-Index of the AP MLD in which the reported AP is shall be unique in the frame sent by the reporting AP ***[#SP185]***

[20/0615r3 (Discovery mechanism for MLD, Ming Gan, Huawei), SP#1, Approved with unanimous consent]

**Straw poll #186**

Do you agree to carry Link ID in the TBTT Information field of the RNR element, which is used to indicate the identifier of the reported AP if the reported AP is in an AP MLD?

* The link identifier (Link ID) uniquely identifies a link (tuple consisting of Operational Class, Channel, BSSID) within an MLD ***[#SP186]***

[20/0615r3 (Discovery mechanism for MLD, Ming Gan, Huawei), SP#2, Approved with unanimous consent]

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) (#SP95,96, 127, 185, 186):

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 andthe 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 (#SP95,96, 127, 185, 186):

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*** (#SP93, 95, 96, 127, 185, 186)***:***

**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, 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.

TGbe editor: (#SP97, 109)***:***

**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.