IEEE P802.11
Wireless LANs

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| MLO TID-link-mapping/link management: Default mode and link enablement |
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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:

802.11be defines a directional-based TID-to-link mapping mechanism among the setup links of a MLD.

* By default, after the multi-link setup, all TIDs are mapped to all setup links.
* The multi-link setup may include the TID-to-link mapping negotiation.
	+ TID-to-link mapping can have the same or different link-set for each TID unless a non-AP MLD indicates that it requires to use the same link-set for all TIDs during the multi-link setup phase.

 NOTE – Such indication method by the non-AP MLD is TBD (implicit or explicit).

* The TID-to-link mapping can be updated after multi-link setup through a negotiation, which can be initiated by any MLD.
	+ Format TBD.

 NOTE – When the responding MLD cannot accept the update, it can reject the TID-to- link mapping update.

[Motion 54, [14] and [84]]

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, [14] and [85]]

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, [14] and [86]]

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

[Motion 102, [14] and [85]]

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, [14] and [85]]

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 [87]]

1. **Proposed spec text**

**33.3.4 Link management**

**33.3.4.1 TID-to-link mapping**

**33.3.4.1.1 General**

The TID-to-link mapping mechanism allows an AP MLD and a non-AP MLD that performed multi-link setup to determine how TIDs are mapped to the setup links in DL and in UL.

By default, all TIDs shall be mapped to all setup links for both UL and DL (see subclause 33.3.4.1.2 (Default mapping mode)).

NOTE - It is TBD whether the negotiation for TID-to-link mapping other than default mapping is optional or mandatory.

A setup link is defined as enabled if at least one TID is mapped to that link and is defined as disabled if no TIDs are mapped to that link. At any point in time, a TID shall always be mapped to at least one setup link, unless admission control is used. By default, as TIDs are mapped to all setup links, all setup links shall be enabled (see subclause 33.3.4.1.2 (Default mapping mode)).

If a link is enabled, it can be used for frame exchange, subject to the power state of the non-AP STA operating on that link. Frames carrying MSDUs or A-MSDUs with TIDs mapped to an enabled link may be transmitted on that link. Frames carrying MSDUs or A-MSDUs with TIDs not mapped to a link shall not be transmitted on that link. Management frames may be send on enabled links, following baseline.

If a link is disabled, it shall not be used for frame exchange, including management frames, and no power state needs to be maintained for the non-AP STA operating on that link.

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 frames carrying MSDUs or A-MSDUs with 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 frames carrying MSDUs or A-MSDUs with that TID, subject to existing restrictions for transmissions of frames that apply to those enabled links.

NOTE 1 - An example of restriction is if the STA is in doze state.

NOTE 2 - If the default mode is used, all TIDs are mapped to all links and all links are therefore enabled. The non-AP MLD can have the corresponding non-AP STA wake up on any link to receive BUs buffered by the AP MLD. The non-AP MLD can therefore use the power state of its non-AP STAs to dynamically change the links it wants to operate on.

**33.3.4.1.2 Default mapping mode**

This mode refers to the default mapping described in subclause 33.3.4.1.1 (General). Under this mode, all TIDs are mapped to all links for DL and UL, and all setup links are enabled. A non-AP MLD and an AP MLD that performed multi-link setup shall operate under this mode under the following conditions:

* TID-to-link mapping negotiation for a different mapping did not occur or was not successful
* TID-to-link mapping negotiation for default mapping was successful

NOTE – It is TBD if support for TID-to-link mapping negotiation is mandatory or optional

**33.3.4.1.2 Negotiation of TID-to-link mapping**

TBD

**33.3.4.1.3 Power state after enablement**

When a link becomes enabled for a STA that is part of a non-AP MLD through multi-link setup sent on that link, the initial power management mode of the STA, immediately after the signaling exchange, is active mode.

When a link is enabled for a STA that is part of a non-AP MLD through signaling (multi-link setup or TID to link mapping update) send on another link, the initial power management mode of the STA, immediately after the exchange, is power save mode, and its power state is doze.

When a link is enabled for a STA that is part of a non-AP MLD through signaling (multi-link setup or TID to link mapping update) send on another link, the initial power management mode of the STA, immediately after the exchange, is power save mode, and its power state is doze, unless explicitly indicated otherwise in the TID-to-link Mapping Update frame or in the (Re)Association Request frame sent by the STA of the non-AP MLD.

**33.3.4.2 Dynamic link transitions**

A non-AP MLD may use the power states of its non-AP STAs to dynamically change the link(s) on which it operates. Figure xxx provides an illustration of operation of a single radio non-AP MLD with default mapping (all TIDs mapped to all setup links), where the non-AP MLD transitions from operating on link 1 with STA 1 to operating on link 2 with STA 2.

While operating on link 1:

* STA 1 of the non-AP MLD may use active mode or power save mode with the awake state to retrieve BUs from the AP MLD and may use power save mode with doze state to save power.
* STA 2 and STA 3 stay in doze state.

While operating on link 2:

* STA 2 of the non-AP MLD may use active mode or power save mode with the awake state to retrieve BUs from the AP MLD and may use power save mode with doze state to save power.
* STA 1 and STA 3 stay in doze state.



Figure xxx – Example of operation of a single radio non-AP MLD with default mapping (all TIDs mapped to all setup links), where the non-AP MLD transitions from operating on link 1 with STA 1 to operating on link 2 with STA 2.

**33.3.4.3 MLD BSS Max Idle period management**

The MLD Max Idle Period of an AP MLD applies at the MLD level and not at the STA level.

The MLD Max Idle Period of an AP MLD defines, for a non-AP MLD that has performed multi-link setup with that AP MLD, the time period during which a non-AP MLD can be inactive (i.e. refrain from transmitting frames to the AP MLD on any of the setup links) without the Multi-link setup to be torn down. A non-AP MLD is considered inactive if none of the APs of the AP MLD have received a Data frame, PS-Poll frame, or Management frame (protected or unprotected) of a frame exchange sequence initiated by a STA from the non-AP MLD for a time period greater than or equal to the time specified by the MLD Max Idle Period of the AP MLD. If the non-AP MLD is inactive for a duration greater than the MLD Max Idle Period, then the AP MLD may tear down the multi-link setup for that non-AP MLD

A non-AP MLD that has performed multi-link setup with an AP MLD derives the MLD Max Idle Period as the maximum value among the values in the Max Idle Period field of the BSS Max Idle Period element advertized by the APs of the AP MLD on the setup links.

The value in the Max Idle Period field of the BSS Max Idle Period element advertized by any AP of the AP MLD shall be the same. A non-AP MLD that has performed multi-link setup with an AP MLD derives the MLD Max Idle Period as the value in the Max Idle Period field of the BSS Max Idle Period element advertized by any AP of the AP MLD.