IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Proposed Draft Text for  MLO TID-to-link Mapping | | | | |
| Date: 2021-03-28 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Yongho Seok | MediaTek Inc. | 2840 Junction Ave, San Jose, CA 95134 |  | [yongho.seok@mediatek.com](mailto:yongho.seok@mediatek.comnewracom.com) |
| Abhishek Patil | Qualcomm |  |  | [appatil@qti.qualcomm.com](mailto:appatil@qti.qualcomm.com) |
| Laurent Cariou | Intel |  |  |  |
| Arik Klein | Huawei |  |  |  |
| Jason Yuchen Guo | Huawei |  |  |  |
| Payam Torab | Facebook |  |  |  |
| Yong Liu | Apple |  |  |  |

Abstract

This submission proposes draft text for MLO TID-to-link mapping based on the following portions of the SFD and [11-21/128r0](https://mentor.ieee.org/802.11/dcn/21/11-21-0128-00-00be-mac-pdt-spec-text-for-tid-mapping-negotiation.docx) (contributed by Abhishek Patil):

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Updated based on the offline comments.
* Rev 2: Updated based on the offline comments (Abhi, Laurent, Arik, Jason, Payam, and Yong).

In R1, 802.11be defines a directional-based TID-to-link mapping mechanism among the setup links of an 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.
* The support of the TID-to-link mapping negotiation is optional.

[Motion 144, #SP311, [35] and [218]]

***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).***

***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.***

### 9.3.3.5 Association Request frame format

Insert a new row to Table 9-34 (Association Request frame body):

### Table 9-34—Association Request frame body

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <ANA> | TID-to-Link Mapping | One or two TID-to-Link Mapping elements are present if dot11MultiLinkActivated is true, dot11TIDtoLinkMappingActivated is true, and a STA affiliated to a non-AP MLD initiates a multi-link setup with an AP affiliated with an AP MLD and jointly initiates a TID-to-link-mapping negotiation. Otherwise it is not present.   * If two TID-to-Link Mapping elements are present, the Direction subfield in one of the TID-to-Link Mapping elements is set to 0 (Downlink) and the Direction subfield in the other of the TID-to-Link Mapping elements is set to 1 (Uplink). |

### 9.3.3.6 Association Response frame format

Insert a new row to Table 9-35 (Association Response frame body):

### Table 9-35—Association Response frame body

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <ANA> | TID-to-Link Mapping | One or two TID-to-Link Mapping elements are present if dot11MultiLinkActivated is true, dot11TIDtoLinkMappingActivated is true, and the AP sends an Association Response frame in response to an Association Request fame that is initiating a multi-link setup from a STA affiliated to a non-AP MLD and jointly initiating a TID-to-link mapping negotiation. Otherwise it is not present. Otherwise it is not present.   * If two TID-to-Link Mapping elements are present, the Direction subfield in one of the TID-to-Link Mapping elements is set to 0 (Downlink) and the Direction subfield in the other of the TID-to-Link Mapping elements is set to 1 (Uplink). |

### 9.3.3.7 Reassociation Request frame format

Insert a new row to Table 9-36 (Reassociation Request frame body):

### Table 9-36—Reassociation Request frame body

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <ANA> | TID-to-Link Mapping | One or two TID-to-Link Mapping elements are present if dot11MultiLinkActivated is true, dot11TIDtoLinkMappingActivated is true, and a STA affiliated to a non-AP MLD initiates a multi-link setup with an AP affiliated with an AP MLD and jointly initiates a TID-to-link-mapping negotiation. Otherwise it is not present.   * If two TID-to-Link Mapping elements are present, the Direction subfield in one of the TID-to-Link Mapping elements is set to 0 (Downlink) and the Direction subfield in the other of the TID-to-Link Mapping elements is set to 1 (Uplink). |

### 9.3.3.8 Reassociation Response frame format

Insert a new row to Table 9-37 (Reassociation Request frame body):

### Table 9-37—Reassociation Response frame body

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <ANA> | TID-to-Link Mapping | One or two TID-to-Link Mapping elements are present if dot11MultiLinkActivated is true, dot11TIDtoLinkMappingActivated is true, and the AP sends an Association Response frame in response to an Association Request fame that is initiating a multi-link setup from a STA affiliated to a non-AP MLD and jointly initiating a TID-to-link mapping negotiation. Otherwise it is not present. Otherwise it is not present.   * If two TID-to-Link Mapping elements are present, the Direction subfield in one of the TID-to-Link Mapping elements is set to 0 (Downlink) and the Direction subfield in the other of the TID-to-Link Mapping elements is set to 1 (Uplink). |

9.4.1.9 Status Code field

Insert the following new row to Table 9-50 (Status codes) while maintaining the numerical order and updateing the reserved range:

|  |  |  |
| --- | --- | --- |
| Table 9-50—Status codes | | |
| Status code | Name | Meaning |
| <ANA> | DENIED\_TID\_TO\_LINK\_MAPPING | Request denied because the requested TID-to-link mapping is unacceptable. |
| <ANA> | PREFERRED\_TID\_TO\_LINK\_MAPPING\_SUGGESTED | Preferred TID-to-link mapping suggested. |

9.4.2 Elements

9.4.2.1 General

Insert a new row to Table 9-92 (Element IDs):

### Table 9-92—Element IDs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Element ID** | **Element ID Extension** | **Extensible** | **Fragmentable** |
| TID-to-Link Mapping (see 9.4.2.295d (TID-to-Link Mapping element)) | 255 | <ANA> | Yes | Yes |

***TGbe editor: Change the following paragraphs of the subclause as follows:***

9.4.2.295b.2 Basic variant Multi-Link element

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 B3 | B4 | B5 | B6 B7 | B8 B15 |
|  | Maximum Number Of Simultaneous Links | NSTR Link-Pair Present | NSTR Bitmap Size | TID-to-link Mapping Negotiation Supported | Reserved |
| Bits: | 4 | 1 | 1 | 2 | 8 |

Figure 9-788eh1 – MLD Capabilities field format

|  |  |  |
| --- | --- | --- |
| Table 9-322xy – Subfields of the MLD Capabilities field | | |
| Subfield | Definition | Encoding |
| TID-to-link Mapping Negotiation Supported | Indicates support for TID-to-link mapping negotiation. | For a non-AP MLD:  Set to 0 if dot11TIDtoLinkMappingActivated is false. Set to 1 if dot11TIDtoLinkMappingActivated is true and it supports to map each TID to the same or different link set.  Set to 2 if dot11TIDtoLinkMappingActivated is true and it supports to map all TIDs to the same link set.  The value 3 is reserved.  For an AP MLD:  Set to 0 if dot11TIDtoLinkMappingActivated is false.  Set to 1 if dot11TIDtoLinkMappingActivated is true and it supports to map each TID to the same or different link set.  The values 2-3 are reserved.  (see 35.3.6.1.3 (Negotiation of TID-to-link mapping)). |

***Insert the following new subclause at the end of subclause 9.4.2:***

9.4.2.295d TID-to-Link Mapping element

The TID-to-Link Mapping element indicates links on which frames belonging to each TID can be exchanged. The format of the TID-to-Link Mapping element is shown in Figure 9-788eq (TID-to-Link Mapping element format).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | TID-to-Link Mapping Control | Link Mapping Of TID 0  (Optional) | … | Link Mapping Of TID 7  (Optional) |
| Octets: | 1 | 1 | 1 | 2 | 0 or 2 |  | 0 or 2 |

Figure 9-788eq – TID-to-Link Mapping element format

The Element ID, Length, and Element ID Extension fields are defined in 9.4.2.1 (General).

The format of the TID-to-Link Mapping Control field is defined in Figure 9-788er (TID-to-Link Mapping Control field format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 B1 | B2 | B3 B7 | B8 B15 |
|  | Direction | Default Link Mapping | Reserved | Link Mapping Presence Indicator |
| Bits: | 2 | 1 | 5 | 8 |



Figure 9-788er – TID-to-Link Mapping Control field format

The Direction subfield is set to 0 (Downlink) if the TID-to-Link Mapping element provides the link mapping information for the downlink frame. It is set to 1 (Uplink) if the TID-to-Link Mapping element provides the link mapping information for the uplink frame. It is set to 2 (Bidirectional link) if the TID-to-Link Mapping element provides the link mapping information for both the uplink and downlink frames. The value of 3 is reserved.

The Default Link Mapping subfield is set to 1 if the TID-to-Link Mapping element represents the default link mapping. Otherwise, it is set to 0.

The Link Mapping Presence Indicator subfield represents which the Link Mapping Of TID *n* field is present in the TID-to-Link Mapping element. A value of 1 in bit position *n* of the Link Mapping Presense Indicator subfield means that the Link Mapping Of TID *n* field is present in the TID-to-Link Mapping element. Otherwise, the Link Mapping Of TID *n* field is not present in the TID-to-Link Mapping element. When the Default Link Mapping subfield is set to 1, this subfield is reserved.

The Link Mapping Of TID *n* field (where *n* = 0,…,7) indicate the link(s) on which frames belonging to the TID *n* are sent. A value of 1 in bit position *i* of the Link Mapping Of TID *n* field means that TID *n* is mapped to the link associated with the link ID *i* for the direction as specified in the Direction subfield.

* Action frame format details

***TGbe editor: Change Table 9-526q as follows:***

|  |  |  |
| --- | --- | --- |
| Table 9-526q – EHT Action field values | | |
| Value | Meaning | Time Priority |
| 0 | EHT compressed beamforming/CQI | Yes |
| 1 | TID-to-Link Mapping Request | No |
| 2 | TID-to-Link Mapping Response | No |
| 3 | TID-to-Link Mapping Teardown | No |
| ~~1~~4–255 | Reserved |  |

***TGbe editor: Insert the following new subclauses at the end of subclause 9.6.35.2:***

9.6.35.3 TID-to-Link Mapping Request frame format

A STA affiliated to an MLD uses the TID-to-Link Mapping Request frame to negotiate a TID-to-link mapping for setup links with a peer MLD. The Action field of the TID-to-Link Mapping Request frame contains the information shown in Table 9-526s (TID-to-Link Mapping Request frame Action field format).

|  |  |
| --- | --- |
| Table 9-526s – TID-to-Link Mapping Request frame Action field format | |
| Order | Information |
| 1 | Category |
| 2 | EHT Action |
| 3 | Dialog Token |
| 4 | TID-to-Link Mapping (see 9.4.2.295d (TID-to-Link Mapping element)) |

The Category field is defined in 9.4.1.11 (Action field).

The EHT Action field is defined in 9.6.35.1 (General).

The Dialog Token field is a value chosen by the STA sending the TID-to-Link Mapping Request frame to identify the request/response transaction.

The TID-to-Link Mapping field contains one or two TID-to-Link Mapping element(s) as specified in 9.4.2.295d (TID-to-Link Mapping) element)). When it contains two TID-to-Link Mapping elements, the Direction subfield in one of the TID-to-Link Mapping elements is set to 0 (Downlink) and the Direction subfield in the other of the TID-to-Link Mapping elements is set to 1 (Uplink).

9.6.35.4 TID-to-Link Mapping Response frame format

The TID-to-Link Mapping Response frame is sent by a STA affiliated to an MLD in response to a TID-to-Link Mapping Request frame, or sent by a STA affiliated to an MLD to suggest a preferred TID-to-link mapping. The Action field of the TID-to-Link Mapping Response frame contains the information shown in Table 9-526t (TID-to-Link Mapping Response frame Action field format).

|  |  |
| --- | --- |
| Table 9-526t – TID-to-Link Mapping Response frame Action field format | |
| Order | Information |
| 1 | Category |
| 2 | EHT Action |
| 3 | Dialog Token |
| 4 | Status Code |
| 5 | TID-to-Link Mapping (see 9.4.2.295d (TID-to-Link Mapping element)) |

The Category field is defined in 9.4.1.11 (Action field).

The EHT Action field is defined in 9.6.35.1 (General).

The Dialog Token field is the value in the corresponding TID-to-Link Mapping Request frame. If the TID-to-Link Mapping Response frame is not being transmitted in response to a TID-to-Link Mapping Request frame, then the Dialog token is set to 0.

The Status Code is defined in 9.4.1.9 (Status Code field).

The TID-to-Link Mapping field contains zero, one, or two TID-to-Link Mapping element(s) as specified in 9.4.2.295d (TID-to-Link Mapping) element)) in order to suggest a preferred mapping. It contains one or two TID-to-Link Mapping element(s) if the Status Code is set to <ANA> (PREFERRED\_TID\_TO\_LINK\_MAPPING\_SUGGESTED). Otherwise, it does not contain the TID-to-Link Mapping element. When it contains two TID-to-Link Mapping elements, the Direction subfield in one of the TID-to-Link Mapping elements is set to 0 (Downlink) and the Direction subfield in the other of the TID-to-Link Mapping elements is set to 1 (Uplink).

9.6.35.5 TID-to-Link Mapping Teardown frame format

The TID-to-Link Mapping Teardown frame is sent by a STA affiliated to an MLD to request the teardown of an existing TID-to-link mapping that have been recently negotiated. The Action field of the TID-to-Link Mapping Teardown frame contains the information shown in Table 9-526u (TID-to-Link Mapping Teardown frame Action field format).

|  |  |
| --- | --- |
| Table 9-526u – TID-to-Link Mapping Teardown frame Action field format | |
| Order | Information |
| 1 | Category |
| 2 | EHT Action |
| 3 | Reason Code |

The Category field is defined in 9.4.1.11 (Action field).

The EHT Action field is defined in 9.6.35.1 (General).

The Reason Code is defined in 9.4.1.7 (Reason Code field).

* **TID-to-link mapping**

***TGbe editor: Change the following paragraphs of the subclause as follows:***

* **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 35.3.6.1.2 (Default mapping mode)). When both MLDs have explicitly negotiated a TID-to-link mapping by the following procedure defined in 35.3.6.1.3 (Negotiation of TID-to-link mapping), each TID can be mapped to the same or different link set.

~~NOTE 1—It is TBD whether the negotiation for TID-to-link mapping other than default mapping is optional or mandatory.~~

* **Default mapping mode**

~~This mode refers to the default mapping described in~~ [~~35.3.6.1.1 (General)~~](#bookmark10)~~.~~ 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 if a TID-to-link mapping negotiation for a different mapping did not occur or was not successful or was torn down.

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

* Negotiation of TID-to-link mapping

***TGbe editor: Please add the following paragraphs to this subclause as shown below:***

An MLD may support TID-to-link mapping negotiation. An MLD that supports TID-to-link mapping negotiation has dot11TIDtoLinkMappingActivated equal to true and shall set to a nonzero value the TID-to-Link Mapping Negotiation Supported subfield in the MLD Capabilities field of the Basic variant Multi-Link element that it transmits. Otherwise it shall set the the TID-to-Link Mapping Negotiation Supported subfield to 0. If the TID-to-Link Mapping Negotiation Supported subfield value received from a non-AP MLD is equal to 2, the AP MLD shall not send to the non-AP MLD the TID-to-Link Mapping element that does not map all TIDs to the same link set.

In a multi-link (re)setup procedure, a non-AP MLD may initiate a TID-to-link mapping neogitation by include the TID-to-Link Mapping element in the (Re)Association Request frame if an AP MLD has indicated a support of TID-to-link mapping negotiation.

After receiving the (Re)Association Request frame containing the TID-to-Link Mapping element, the AP MLD shall reply to the (Re)Association Request frame according to 11.3.5.3 (AP or PCP association receipt procedures), 11.3.5.5 (AP or PCP reassociation receipt procedures), and 35.3.5 Multi-link (re)setup with the following additional rules:

* The AP MLD can accept the requested link mapping in the TID-to-Link Mapping element in the received (Re)Association Request frame only if it accepts the multi-link (re)setup. In which case, it shall not include in the (Re)Association Response frame the TID-to-Link Mapping element.
* Otherwise, it shall indicate rejection of the proposed mapping by including in the (Re)Association Response frame the TID-to-Link Mapping element that suggests a preferred mapping.

After the multi-link (re)setup is successful, to set up or to change the TID-to-link mapping, an initiating MLD with dot11TIDtoLinkMappingActivated equal to true shall send an individually addressed TID-to-Link Mapping Request frame to a responding MLD that has indicated a support of TID-to-link mapping negotiation.

After receiving the individually addressed TID-to-Link Mapping Request frame, the responding MLD shall send an individually addressed TID-to-Link Mapping Response frame to the initiating MLD according to the following rules:

* If the responding MLD accepts the requested link mapping in the TID-to-Link Mapping element in the received TID-to-Link Mapping Request frame, it shall set to 0 (SUCCESS) the Staus Code in the TID-to-Link Mapping Response frame and it shall not include in the (Re)Association Response frame the TID-to-Link Mapping element.
* Otherwise, the responding MLD shall indicate rejection of the proposed mapping by setting to <ANA> (DENIED\_TID-TO-LINK\_MAPPING) the Status Code in the TID-to-Link Mapping Response frame. The responding MLD may include the TID-to-Link Mapping element in the TID-to-Link Mapping Response frame to suggest a preferred mapping

An MLD may suggest a preferred mapping to a peer MLD by sending an unsolicited TID-to-Link Mapping Response frame that includes the TID-to-Link Mapping element and sets the Status Code to <ANA> (PREFERRED\_TID-TO-LINK\_MAPPING\_SUGGESTED).

If indicated by a peer MLD, an MLD should take into account the preferred mapping when it initiates a new mapping. In addition, an AP MLD should take into account the traffic flow(s) affiliated with the non-AP MLD and the capabilities and constraints (if any) of the non-AP MLD.

NOTE – A non-AP MLD can indicate its constraints (such as single radio) during multi-link setup.

A multi-link multi-radio (MLMR) non-AP MLD should accept a mapping initiated by its associated AP MLD.

When two MLDs have negotiated a TID-to-link mapping, either MLD may teardown the negotiated mapping by sending an individually addressed TID-to-Link Mapping Teardown frame. After teardown, the MLDs shall operate in default mapping mode (see 35.3.6.1.2 (Default mapping mode)).

If an MLD has successfully negotiated the TID-to-link mapping with a peer MLD, both the MLD and the peer MLD shall update an uplink and downlink mapping information for the negotiated TIDs. The previous uplink and downlink mapping information of TIDs which are not updated by the current negotiation are not affected.

When an MLD has successfully negotiated with a peer MLD an uplink or/and downlink TID-to-link mapping in which the bit position *i* of the Link Mapping Of TID *n* field in the TID-to-Link Mapping element is set to 0, the TID *n* shall not be mapped to the link associated with the link ID *i* in an uplink or/and downlink.

When an MLD has successfully negotiated with a peer MLD an uplink or/and downlink TID-to-link mapping in which the bit position *i* of the Link Mapping Of TID *n* field in the TID-to-Link Mapping element is set to 1, the TID *n* shall be mapped to the link associated with the link ID *i* in an uplink or/and downlink.

**Annex C**

**C.3 MIB Detail**

***Please make changes to the following paragraphs this subclause as follows:***

-- dot11EHTStationConfigTable ::= { dot11smt <ANA> }

***Insert the following after the dot11HEStationConfigTable TABLE:***

-- \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

-- \* dot11EHTStationConfig TABLE

-- \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

dot11EHTStationConfigTable OBJECT-TYPE

SYNTAX SEQUENCE OF Dot11EHTStationConfigEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Station Configuration attributes. In tabular form to allow for multiple instances on an agent."

::= { dot11smt <ANA> }

dot11EHTStationConfigEntry OBJECT-TYPE

SYNTAX Dot11EHTStationConfigEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry (conceptual row) in the dot11EHTStationConfig Table.

ifIndex - Each IEEE 802.11 interface is represented by an ifEntry. Interface tables in this MIB module are indexed by ifIndex."

INDEX { ifIndex }

::= { dot11EHTStationConfigTable 1 }

Dot11EHTStationConfigEntry ::=

SEQUENCE {

dot11TIDtoLinkMappingActivated TruthValue

}

dot11TIDtoLinkMappingActivated OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This is a control variable.

It is written by an external management entity or the SME.

Changes take effect as soon as practical in the implementation.

This attribute, when true, indicates that TID-to-link mapping negotiation is enabled.

TID-to-link mapping negotiation is disabled otherwise."

DEFVAL { false }

::= { dot11EHTStationConfigEntry 1}