IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Proposed Draft Text for  MLO TID-to-link Mapping | | | | |
| Date: 2021-03-01 | | | | |
| 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 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.
* 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 | The TID-to-Link Mapping element is optionally 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. Otherwise it is not present. |

### 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 | The TID-to-Link Mapping element is optionally present if dot11MultiLinkActivated is true, dot11TIDtoLinkMappingActivated is true, and an AP affiliated to an AP MLD receives the Association Request fame initiating a multi-link setup from a STA affiliated to a non-AP MLD. Otherwise it is not present. |

### 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 | The TID-to-Link Mapping element is optionally 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. Otherwise it is not present. |

### 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 | The TID-to-Link Mapping element is optionally present if dot11MultiLinkActivated is true, dot11TIDtoLinkMappingActivated is true, and an AP affiliated to an AP MLD receives the Reassociation Request fame initiating a multi-link setup from a STA affiliated to a non-AP MLD. Otherwise it is not present. |

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. |

9.4.1.11 Action field

Insert the following new row to Table 9-51 (Category values) while maintaining the numerical order and updateing the reserved range:

### Table 9-51—Category values

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Code** | **Meaning** | **See subclause** | **Robust** | **Group addressed privacy** |
| <ANA> | TID-to-Link Mapping | [9.6.36 (TID-to-Link Mapping Action frame details)](#bookmark55) | Yes | No |

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:***

9.4.2.295c.2 EHT MAC Capabilities Information field

The format of the EHT MAC Capabilities Information field is defined in Figure 9-xxxb (EHT MAC Capabilities Information field format).

|  |  |  |
| --- | --- | --- |
|  | B0 B1 |  |
|  | TID-to-link Mapping Negotiation Supported | Reserved |
| Bits: | 2 | TBD |

Figure 9-788em – EHT Capabilities element format

The subfields of the EHT MAC Capabilities Information field are defined in Table 9-xxx (Subfields of the EHT MAC Capabilities Information field).

|  |  |  |
| --- | --- | --- |
| Table 9-xxx – Subfields of the EHT MAC Capabilities Information field | | |
| Subfield | Definition | Encoding |
| TID-to-link Mapping Negotiation Supported | Indicates support for TID-to-link mapping negotiation. | Set to 0 if dot11TIDtoLinkMappingActivated is false.  Set to 1 if dot11TIDtoLinkMappingActivated is true and it supports to map TIDs to one set of links.  Set to 2 if dot11TIDtoLinkMappingActivated is true and it supports to map TIDs to up to 4 set of links.  Set to 3 if dot11TIDtoLinkMappingActivated is true and it supports to map TIDs to up to 8 set of links.  (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 an uplink or a downlink frames belonging to each TID can be exchanged. The format of the TID-to-Link Mapping element is shown in Figure 9-788el (TID-to-Link Mapping element format).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | zero or more  DL TID-to-Link Mapping | zero or more  UL TID-to-Link Mapping |
|  | Number of | Length | Element ID Extension | TID-to-Link Mapping Control | DL TID-to-Link Mapping Info | UL TID-to-Link Mapping Info |
| Octets: | 1 | 1 | 1 | 1 | n | m |

Figure 9-788el – 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 9-788em (TID-to-Link Mapping Control field format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 B2 | B3 B5 | B6 | B7 |
|  | DL TID-to-Link Mapping Info Count | UL TID-to-Link Mapping Info Count | Link Bitmap Size | Reserved |
| Bits: | 3 | 3 | 1 | 1 |

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

The DL TID-to-Link Mapping Info Count subfield contains the number of DL TID-to-Link Mapping Info fields included in the TID-to-Link Mapping element, minus one.

The UL TID-to-Link Mapping Info Count subfield contains the number of UL TID-to-Link Mapping Info fields included in the TID-to-Link Mapping element, minus one.

The Link Bitmap Size subfield indicates the size of the Link Bitmap subfield in the TID-to-Link Mapping Info field. If it is set to 0, the Link Bitmap subfield in the in the TID-to-Link Mapping Info field is 8 bits. If it is set to 1, the Link Bitmap subfield in the in the TID-to-Link Mapping Info field is 16 bits.

The DL TID-to-Link Mapping Info field contains zero or more TID-to-Link Mapping Info fields that indicate a set of links on which downlink frames belonging to a set of TIDs are sent. The UL TID-to-Link Mapping Info field contains zero or more TID-to-Link Mapping Info fields that indicate a set of links on which uplink frames belonging to a set of TIDs are sent. The format of the TID-to-Link Mapping Info field is shown in Figure 9-788en (TID-to-Link Mapping Info field format).

|  |  |  |
| --- | --- | --- |
|  | B0 B7 |  |
|  | TID Bitmap | Link Bitmap |
| Bits: | 8 | 8 or 16 |

Figure 9-788en – TID-to-Link Mapping Info field format

The TID Bitmap subfield indicates a set of TIDs for which the TID-to-Link Mapping Info field provides the link mapping information. A value of 1 in bit position *i* of the TID Bitmap subfield means that the Link Bitmap subfield in the TID-to-Link Mapping Info field specifes the link mapping information of TID *i*.

The Link Bitmap subfield indicates a set of links on which frames belonging to the set of TIDs specified in the TID Bitmap subfield are sent. A value of 1 in bit position *i* of the Link Bitmap subfield means that the link associated with the link ID *i* is used for exchanging frames belonging to the set of TIDs specified in the TID Bitmap subfield. A value of 0 in bit position *i* of the Link Bitmap subfield means that the link associated with the link ID *i* is not used for exchanging frames belonging to the set of TIDs specified in the TID Bitmap subfield.

* Action frame format details

***Insert the following new subclause at the end of subclause 9.6:***

9.6.36 TID-to-Link Mapping Action frame details

9.6.36.1 General

Several Action field formats are defined to support the TID-to-Link Mapping negotiation. A TID-to-Link Mapping Action field, in the octet immediately after the Category field, differentiates the TID-to-Link Mapping Action field formats. The TID-to-Link Mapping Action field values associated with each Action field format within the TID-to-Link Mapping category are defined in Table 9-526s (TID-to-Link Mapping Action field values).

|  |  |  |
| --- | --- | --- |
| Table 9-526s – TID-to-Link Mapping Action field values | | |
| Value | Meaning | Time Priority |
| 0 | TID-to-Link Mapping Request | No |
| 1 | TID-to-Link Mapping Request | No |
| 2 | TID-to-Link Mapping Teardown | No |
| 3–255 | Reserved |  |

9.6.36.2 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 9-526t (TID-to-Link Mapping Request frame Action field format).

|  |  |
| --- | --- |
| Table 9-526t – TID-to-Link Mapping Request frame Action field format | |
| Order | Information |
| 1 | Category |
| 2 | TID-to-Link Mapping 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 TID-to-Link Mapping Action field is defined in 9.6.36.1 (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 a TID-to-Link Mapping element as specified in 9.4.2.295d (TID-to-Link Mapping) element)).

9.6.36.3 TID-to-Link Mapping Response frame format

The TID-to-Link Mapping Response frame is sent by a STA affiliated to a MLD in response to a TID-to-Link Mapping Request frame, or sent by a STA affiliated to a 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 9-526u (TID-to-Link Mapping Response frame Action field format).

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

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

The TID-to-Link Mapping Action field is defined in 9.6.36.1 (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 a TID-to-Link Mapping element as specified in 9.4.2.295d (TID-to-Link Mapping) element)) in order to suggest a preferred mapping. The TID-to-Link Mapping field is present in the TID-to-Link Mapping Response frame only when the Status Code is set to <ANA> (PREFERRED\_TID\_TO\_LINK\_MAPPING\_SUGGESTED).

9.6.36.4 TID-to-Link Mapping Teardown frame format

The TID-to-Link Mapping Teardown frame is sent by a STA affiliated to a 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 9-526v (TID-to-Link Mapping Teardown frame Action field format).

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

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

The TID-to-Link Mapping Action field is defined in 9.6.36.1 (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)).

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

When both MLDs have not explicitly negotiated a TID-to-link mapping by the following procedure defined in 35.3.6.1.3 (Negotiation of TID-to-link mapping), the MLDs shall operate under default mapping mode (see 35.3.6.1.2 (Default mapping mode)).

* **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:***

A MLD may support TID-to-link mapping negotiation. A 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 EHT MAC Capabilities Information field of the EHT Capabilities element that it transmits. Otherwise it shall set the the TID-to-Link Mapping Negotiation Supported subfield to 0.

When a MLD iniatie a TID-to-link mapping negotiation to a peer MLD that has indicated a support of TID-to-link mapping negotiation, the MLD shall meet the following conditions.

* The MLD shall not request to the peer MLD the TIDs mapping to more than 1 set of links if the TID-to-Link Mapping Negotiation Supported subfield value received from the peer MLD is equal to 0.
* The MLD shall not request to the peer MLD the TID mapping to more than 4 set of links if the TID-to-Link Mapping Negotiation Supported subfield value received from the peer MLD is equal to 1.
* The MLD shall not request to the peer MLD the TID mapping to more than 8 set of links if the TID-to-Link Mapping Negotiation Supported subfield value received from the peer MLD is equal to 2.

In a multi-link (re)setup procedure, a non-AP MLD may initiate a TID-to-link mapping neogitation by include the 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, if the AP MLD accepts the requested link mapping in the TID-to-Link Mapping element in the received TID-to-Link Mapping Request frame, it shall reply to the (Re)Association Request frame according to 11.3.5.3 (AP or PCP association receipt procedures) and 11.3.5.5 (AP or PCP reassociation receipt procedures). Otherwise, the AP MLD shall indicate rejection of the proposed mapping by setting to <ANA> (DENIED\_TID-TO-LINK\_MAPPING) the Status Code in the (Re)Association Response frame. The AP MLD may include the TID-to-Link Mapping element in the (Re)Association Response frame to suggest a preferred mapping when the Status Code in the (Re)Association Response frame is set to <ANA> (PREFERRED\_TID\_TO\_LINK\_MAPPING\_SUGGESTED).

After performed the multi-link (re)setup, to set up or change a TID-to-link mapping, an initiating MLD with dot11TIDtoLinkMappingActivated equal 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. 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. 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. A responding MLD may include the TID-to-Link Mapping element in the TID-to-Link Mapping Response frame to suggest a preferred mapping only when the Status Code in the TID-to-Link Mapping Response frame is set to <ANA> (PREFERRED\_TID\_TO\_LINK\_MAPPING\_SUGGESTED).

A MLD may transmit an unsolicited TID-to-Link Mapping Response frame to suggest a preferred mapping. In which case, the MLD shall include the preferred mapping to the TID-to-Link Mapping element in the the unsolicited TID-to-Link Mapping Response frame and shall set to <ANA> (PREFERRED\_TID-TO-LINK\_MAPPING\_SUGGESTED) the Status Code in the unsolicited TID-to-Link Mapping Response frame.

If indicated by a peer MLD, a 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)).

When a non-AP MLD has successfully negotiated with an AP MLD the UL TID-to-link mapping in which the bit position *i* of the TID Bitmap subfield in UL TID-to-Link Mapping Info field in the TID-to-Link Mapping element is set to 1 and the bit position *j* of the Link Bitmap subfield in UL TID-to-Link Mapping Info field in the TID-to-Link Mapping element is set to 0, the non-AP MLD shall not transmit a PPDU containing a frame with TID *i* on the link associated with the link ID *j*.

When an AP MLD has successfully negotiated with a non-AP MLD the DL TID-to-link mapping in which the bit position *i* of the TID Bitmap subfield in DL TID-to-Link Mapping Info field in the TID-to-Link Mapping element is set to 1 and the bit position *j* of the Link Bitmap subfield in DL TID-to-Link Mapping Info field in the TID-to-Link Mapping element is set to 0, the AP MLD shall not transmit a PPDU containing a frame with TID *i* on the link associated with the link ID *j*.

**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}