IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 11be D2.0 CR for 13 part II | | | | |
| Date: 2022-10-10 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Po-Kai Huang | Intel |  |  |  |

Abstract

This submission proposes resolutions for the following CIDs:

12784, 12405, 10295, 12108

Revisions:

* Rev 0: Initial version of the document.

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 D2.0 Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGbe D2.0 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.***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 12784 | Romain GUIGNARD | 13.1 | 368.37 | There is no mention of AP MLD in the Over-the-DS method, does it mean the usage of this method is limited to legacy ? | Could you please clarify the usage of the "Over-the-DS" method for MLD case? | Revised –  Agree in principle with the commenter.  TGbe editor to make the changes shown in 11-22/1733r0 under all headings that include CID 12784 |
| 12405 | Sebastian Max | 13.1 | 368.37 | A non-AP MLD should be able to use the Over-the-DS method for FT, not only the Over-the-Air method | Ammend the Over-the-DS description to include the "target AP MLD" and the "current AP MLD", not only the "target AP" and the "current AP". | Revised –  Agree in principle with the commenter.  TGbe editor to make the changes shown in 11-22/1733r0 under all headings that include CID 12784 |
| 10295 | Michael Montemurro | 13.5 | 374.06 | The "over the DS" FT protocol needs to be updated to support MLO | Commenter is willing to collaborate on a submission with a set of changes. | Revised –  Agree in principle with the commenter.  TGbe editor to make the changes shown in 11-22/1733r0 under all headings that include CID 12784 |
| 12108 | Chaoming Luo | 13.5.3 | 376.27 | 11be should also update clause 13.5.3 and 13.5.4 and 13.5.5: change "target AP" to "FTR" appropriately; change "the Target AP Address field of the FT Request frame shall be set to the BSSID of the target AP's BSS" to "the Target AP Address field of the FT Request frame shall be set to the FTR's MAC address" | As commented | Revised –  Agree in principle with the commenter. We note that non-RSN is not upgraded based on the previous discussion for over-the-air.  TGbe editor to make the changes shown in 11-22/1733r0 under all headings that include CID 12784 |

**Discussion: None**

-----------------------------------------texts related to over-the-DS (#12784)---------------------------------

*TGbe editor: Change Clause 13 as follows (track change on):*

**13 Fast BSS transition**

**13.1 Overview**

***Change the first four paragraphs as follows:***

Fast BSS transition seeks to reduce the length of time that connectivity is lost between a STA and the DS or between (#10680)a non-AP MLD and the DS during a BSS transition. The FT protocols are part of the reassociation service and only apply to (#13502)a STA or an MLD transition to an AP or an AP MLD~~STA~~ ~~transitions between APs~~ within the same mobility domain within the same ESS (see 4.5.3.2 (Mobility types)).

The FT protocols require information to be exchanged during the initial association (or a later reassociation) between a STA [known as the *FT Originator* (FTO)] and AP [known as the *FT Responder* (FTR)] or between a non-AP MLD [known as the *FT Originator* (FTO)] and AP MLD [known as the *FT Responder* (FTR)]. The initial exchange is referred to as the *FT initial mobility domain association*. Subsequent reassociations to FTRs within the same mobility domain may make use of the FT protocols.

Two FT protocols are defined:

* *FT protocol.* This protocol is executed when an FTO makes a transition to a target FTR and does not require a resource request prior to its transition.
* *FT resource request protocol.* This protocol is executed when an FTO requires a resource request prior to its transition.

For an FTO to move (#13505)~~from its current AP~~ to a target FTR utilizing the FT protocols, the message exchanges are performed using one of two methods:

* *Over-the-Air.* The FTO communicates directly with the target FTR using IEEE

802.11 authentication with the FT authentication algorithm.

* *Over-the-DS.* The FTO communicates with the target FTR via the current FTR. The communication between the FTO and the target FTR is carried in FT Action frames between the FTO and the current FTR. Between the current FTR and target FTR, communication is via an encapsulation method described in 13.10.3 (Remote Request/Response frame definition). The current FTR converts between the two encapsulations.
* **FT protocol**
* **Over-the-DS FT protocol in an RSN**

A FTO shall not initiate an over-the-DS FT authentication to a target FTR whose MDE contains the Fast BSS Transition over DS bit equal to 0.

The over-the-DS FT protocol in an RSN is shown in Figure 13-6 (Over-the-DS FT protocol in an RSN).

To perform an over-the-DS fast BSS transition to a target FTR, the FTO and the target FTR (through the current FTR) shall perform the following exchange:

FTO®Target FTR: FT Request (FTO address, TargetAP address, RSNE[PMKR0Name], MDE, FTE[SNonce, R0KH-ID], Basic Multi-Link element)

Target FTR®FTO: FT Response (FTO address, TargetAP address, Status, RSNE[PMKR0Name], MDE, FTE[ANonce, SNonce, R1KH-ID, R0KH-ID], Basic Multi-Link element)

where the Basic Multi-Link element is included when the target FTR is an AP MLD.



Figure 13-6 – over-the-DS FT protocol in an RSN

The SME of the FTO initiates the FT Request frame to the target FTR by issuing an MLME-REMOTE-REQUEST.request primitive with parameters including the contents of the FT Request frame (FT Action frame with an FT Action field value indicating FT Request) to be sent. The MAC of the FTO transmits this Action frame. For processing at the current FTR and target FTR, see 13.10 (Remote request broker (RRB) communication). When the MAC of the FTO receives the FT Response frame (FT Action frame with an FT Action field value indicating FT Response), it passes it to the SME by use of MLME-REMOTE-REQUEST.indication primitive, with parameters including the contents of the received Action frame. The MLME interfaces on the FTO, current FTR, and the target FTR for executing the over-the-DS fast BSS transition are shown in Figure 13-7 (MLME interfaces for over-the-DS FT protocol messages).



Figure 13-7 – MLME interfaces for over-the-DS FT protocol messages

The STA Address field of the FT Request frame shall be set to the MAC address of the FTO, and the Target AP Address field of the FT Request frame shall be set to the MAC address of the target FTR. The elements in the FT Request frame, and their required contents, shall be as given in 13.8.2 (FT authentication sequence: contents of first message).

If the contents of the MDE received by the target FTR do not match the contents advertised in the Beacon and Probe Response frames if the FTR is an AP or in the Beacon and Probe Response frames of any AP affiliated with the FTR if the FTR is an AP MLD, the target FTR shall reject the FT Request frame with status code STATUS\_INVALID\_MDE. If the contents of the RSNE do not indicate a negotiated AKM for which the Authentication type column indicates FT authentication (see Table 9-188 (AKM suite selectors)), the target FTR shall reject the FT Request frame with status code STATUS\_INVALID\_AKMP. If the FTE in the FT Request frame contains an invalid R0KH-ID, the target FTR shall reject the FT Request frame with status code STATUS\_INVALID\_FTE. If the RSNE in the FT Request frame contains an invalid PMKR0Name, and the target FTR has determined that it is an invalid PMKR0Name, the target FTR shall reject the authentication request with status code STATUS\_INVALID\_PMKID. If the requested R0KH is not reachable, the target FTR shall respond to the FT Request frame with status code R0KH\_UNREACHABLE. The target FTR may reject the FT Request frame for limiting the FTO’s reassociation to the target FTR by using the status code REQUEST\_DECLINED. If the FTO selects a pairwise cipher suite in the RSNE that is different from the ones used in the initial mobility domain association, then the target FTR shall reject the FT Request frame with status code STATUS\_INVALID\_PAIRWISE\_CIPHER.

The STA Address field of the FT Response frame shall be set to the MAC address of the FTO, and the Target AP Address field of the FT Response frame shall be set to MAC address of the target FTR. The elements in the FT Response frame, and their required contents, shall be as given in 13.8.3 (FT authentication sequence: contents of second message). The Status Code field shall be a value from the options listed in 9.4.1.9 (Status Code field).

The R1KH of the target FTR uses the value of PMKR0Name and other information from the frame to calculate PMKR1Name. If the target AP does not have the key identified by PMKR1Name, it may retrieve that key from the R0KH identified by the FTO. See 13.2 (Key holders). Upon receiving a new PMK-R1 for a FTO, the target FTR shall delete the prior PMK-R1 security association and PTKSAs derived from the prior PMK‑R1.

The FTO and the target FTR compute the PTK and PTKName using the PMK-R1, PMKR1Name, ANonce, and SNonce, as specified in 12.7.1.6.5 (PTK). The PTKSA shall be deleted by the target FTR if it does not receive a Reassociation Request frame from the FTO within the reassociation deadline timeout value.

If the FTO does not receive a response to the FT Request frame, it may reissue the request following the restrictions given for Authentication frames in 11.3 (STA authentication and association). If the Status Code field value returned by the target FTR is SUCCESS, the FTO and target FTR transition to State 2 (as defined in 11.3 (STA authentication and association)); the FTO may continue with reassociation (13.7.1 (FT reassociation in an RSN)). Handling of errors returned in the Status Code field shall be as specified for Authentication frames in 11.3 (STA authentication and association).

* **Remote request broker (RRB) communication**
* **Overview**

The RRB mechanism allows the FTO to communicate with a target FTR through the FTO’s existing association (with the current FTR). The FTO transmits an FT Action frame (including the address of the FTO and the MAC address of the target FTR) to the current FTR. The current FTR includes the contents of the FT Action frame (Request or Confirm) inside a Remote Request frame and transmits it to the target FTR over the DS. The target FTR processes the remote request and responds to the FTO by sending an FT Action frame (Response or Acknowledgment) through the current FTR.

The SME of the FTO initiates an exchange with a target FTR by issuing an MLME‑REMOTE-REQUEST.request primitive with parameters including the contents of the FT Action frame to be sent. The MAC of the FTO transmits this Action frame. When the MAC of the current FTR receives an FT Action frame, it passes it to the RRB by use of an MLME‑REMOTE-REQUEST.indication primitive, with parameters including the contents of the received Action frame.

When the RRB of the current FTR has received a response from the target FTR, it uses the MLME‑REMOTE-REQUEST.request primitive to send the response, as an FT Action frame, to the requesting FTO. The MAC of the current FTR transmits this Action frame. When the MAC of the FTO receives an FT Action frame, the MAC passes the Action frame to the SME by use of an MLME‑REMOTE-REQUEST.indication primitive, with parameters including the contents of the received Action frame.

* **Remote request broker (RRB)**

The RRB resides in the SME on the FTRs and acts as a forwarding agent (at the current FTR) and termination point (at the target FTR) for protocol messages over the DS.

The RRB allows FTRs that are part of the same mobility domain to exchange information over the DS. FTRs that advertise the same MDID shall be reachable over the DS and support the over-the-DS communication.

As a termination point, when the RRB at the target FTR receives a request frame from the current FTR, it interacts with the MAC and other parts of the SME to process the request and respond with a Remote Response frame, through the RRB on the current FTR, back to the requesting FTO.

As a forwarding agent, when the RRB at the current FTR receives a request from an FTO directed to another FTR in the same mobility domain, the current FTR forwards the request to that target FTR. The RRB on the current FTR converts Action frames into Remote Request frames and converts Remote Response frames into Action frames.

The target FTR and the current FTR shall reside in the same mobility domain. The RRB on the current FTR shall transmit Remote Request frames to the target FTR based on the MAC address of the target FTR (supplied in the FT Action frames) using the same procedures as preauthentication, as described in 12.6.10.2 (Preauthentication and RSNA key management).

* **Remote Request/Response frame definition**

This subclause defines a mechanism to transport the remote request and remote response between the current FTR and the target FTR. Any other mechanism may be used.

The Remote Request frame is transmitted over the DS from the current FTR to the target FTR. The Payload for the Remote Request/Response frame is given in Table 13-2 (Remote Request/Response Payload format). Remote Request/Response frames shall use an (#2186)EtherType of 89-0d, as specified in Annex H. The Remote Request/Response frame contains Version, Type, and Length fields, along with the AP Address.

|  |  |
| --- | --- |
| * **Remote Request/Response Payload format** | |
| **Size** | **Information** |
| 1 | FT Packet Type |
| 2 | FT Action Length |
| 6 | AP Address |
| Variable | FT Action Frame |

The FT Packet Type field shall be set to 0 for remote request and to 1 for remote response.

The FT Action Length field shall be set to an unsigned number representing the length in octets of the FT Action Frame field, following the bit ordering conventions of 9.2.2 (Conventions).

The AP Address field shall be set to the MAC address of the current FTR. The target FTR shall use this address as the destination address when sending the Remote Response frame as a response to the Remote Request.

The FT Action Frame field shall be set to the contents of the FT Action frame, from the Category field to the end of the Action frame body.

(…existing texts…)

*TGbe editor: Change Clause 9.6.8 as follows (track change on):*

* **FT Action frame details**
* **General**

Four Action frame formats are defined to support fast BSS transitions over the DS, which are initiated through the currently associated fast BSS transition originator (FTR). The FT Action frames are sent over the air between the fast BSS transition originator (FTO) and the current FTR. The Action frame is used as a transport mechanism for data that are destined for the target FTR. An FT Action field, in the octet immediately after the Category field, differentiates the FT Action frame formats. The FT Action field values associated with each FT Action frame format are defined in Table 9-481 (FT Action field values).

|  |  |
| --- | --- |
| * **FT Action field values** | |
| **FT Action field value** | **Description** |
| 0 | Reserved |
| 1 | FT Request frames |
| 2 | FT Response frames |
| 3 | FT Confirm frames |
| 4 | FT Ack frames |
| 5–255 | Reserved |

* **FT Request frame**
* The FT Request frame is sent by the FTO to its associated FTR to initiate an over-the-DS fast BSS transition.

Figure 9-1140 (FT Request frame Action field format) shows the format of the FT Request frame Action field.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Category | FT Action | STA Address | Target AP Address | FT Request frame body |
| Octets: | 1 | 1 | 6 | 6 | variable |
| * **FT Request frame Action field format** | | | | | |

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

The FT Action field is defined in 9.6.8.1 (General).

The STA Address field is set to the fast BSS transition originator’s (FTO’s) MAC address.

The Target AP Address field is set to the ~~BSSID value of the target~~ FTR.

The FT Request frame body contains the information shown in Table 9-482 (FT Request frame body).

|  |  |  |
| --- | --- | --- |
| * **FT Request frame body** | | |
| **Order** | **Information** | **Notes** |
| 1 | RSN | A RSNE is present if dot11RSNAActivated is true. |
| 2 | Mobility Domain | The MDE is present. |
| 3 | Fast BSS Transition | An FTE is present if dot11RSNAActivated is true. |
| 4 | Basic Multi-Link element | A Basic Multi-Link element is present if the target FTR is an AP MLD |

The usage of these elements is defined in 13.8.2 (FT authentication sequence: contents of first message).

* **FT Response frame**

The FT Response frame is transmitted by the currently associated FTR as a response to the FTO’s FT Request frame. Figure 9-1141 (FT Response frame Action field format) shows the format of the FT Response frame Action field.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Category | FT Action | STA Address | Target AP Address | Status Code | FT Response frame body |
| Octets: | 1 | 1 | 6 | 6 | 2 | variable |
| * **FT Response frame Action field format** | | | | | | |

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

The FT Action field is defined in 9.6.8.1 (General).

The STA Address field is set to the FTO’s MAC address.

The Target AP Address field is set to the ~~BSSID value of the target AP~~FTR’s MAC address.

The Status Code field is a value from the options listed in 9.4.1.9 (Status Code field).

If the Status Code field is SUCCESS, then the FT Response frame body contains the information shown in Table 9-483 (FT Response frame body).

|  |  |  |
| --- | --- | --- |
| * **FT Response frame body** | | |
| **Order** | **Information** | **Notes** |
| 1 | RSN | The RSNE is present if dot11RSNAActivated is true. |
| 2 | Mobility Domain | The MDE is present. |
| 3 | Fast BSS Transition | An FTE is present if dot11RSNAActivated is true. |
| 4 | Basic Multi-Link element | A Basic Multi-Link element is present if the target FTR is an AP MLD |

The usage of these elements is defined in 13.8.3 (FT authentication sequence: contents of second message).

**35.3.5.4 Usage and rules of Basic Multi-Link element in the context of multi-link (re)setup  
, authentication, and FT action frame exchange between two MLDs(#11564)**

(…existing texts…)

(#10631)A STA affiliated with an MLD shall include a Basic Multi-Link element in an Authentication frame or FT action frame   
that it transmits with the following rules:

* the STA shall include the MLD MAC address of the MLD with which the STA is affiliated in the  
  Common Info field of the element
* the STA shall set all subfields in the Presence Bitmap subfield of the Multi-Link Control field of the  
  element to 0
* the STA shall not include the Link Info field of the element.

*TGbe editor: Change 6.3.34 MLME SAP interface for remote requests as follows (track change on):*

* **MLME SAP interface for remote requests**
* **MLME-REMOTE-REQUEST.request**
* **Function**

This primitive is used by the SME of a FTO (to send over-the-DS requests) and the SME of an FTR (to send over-the-DS responses) to request the MAC to send an FT Action frame.

* **Semantics of the service primitive**

The primitive parameters are as follows:

MLME-REMOTE-REQUEST.request(

PeerMACAddress,  
Content of FT Action Frame  
)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| PeerMACAddress | MAC address | Any valid individual MAC address | Specifies the MAC address of the MAC entity that is the destination of the Action frame |
| Content of FT Action Frame | Sequence of octets | As defined in 9.6.8 (FT Action frame details) | The Action frame to send to the MAC entity. |

* **When generated**

This primitive is generated by the SME to send an FT Action frame to a specific peer MAC entity.

* **Effect of receipt**

Upon receipt of this primitive, the MAC forwards the Action frame to the MAC entity identified in the Action frame.

* **MLME-REMOTE-REQUEST.indication**
* **Function**

This primitive is used by the MAC to indicate to the SME the reception of an FT Action frame.

* **Semantics of the service primitive**

The primitive parameters are as follows:

MLME-REMOTE-REQUEST.indication(

PeerMACAddress,  
Contents of FT Action Frame  
)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| PeerMACAddress | MAC address | Any valid individual MAC address | Specifies the MAC address of the MAC entity that issued the Action frame. |
| Content of FT Action Frame | Sequence of octets | As defined in 9.6.8 (FT Action frame details) | The Action frame received from the MAC entity. |

* **When generated**

This primitive is generated by the MAC as a result of the receipt of an FT Action frame from a specific peer MAC entity.

* **Effect of receipt**

Upon receipt of this primitive, the remote request broker (RRB) in the SME of the current FTR forwards the Action frame to the target FTR identified in the Action frame.