IEEE P802.11
Wireless LANs

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| 11be D2.0 CR for 13 part III |
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Abstract

This submission proposes resolutions for the following CIDs:

12782, 12109, 10296

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Add CID 12782
* Rev 2: Editorial revision

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** |
| 12782 | Romain GUIGNARD | 9.6.8.2 | 257.30 | In other section, the terms Target FTR or previous FTR or Current FTR are used. To set the Target AP Address field should not we use "the MAC address of the Target fast BSS transition responder (FTR)" instead of "the MAC address of the fast BSS transition responder (FTR)" which seems to be too generic. | Could you please clarify how to set without ambiguity the Target AP Address field ? | Revised – We use targer FTR rather than just FTR as suggsetd by the commeter.TGbe editor to make the changes shown in 11-22/1733r2 under all headings that include CID 12782 |
| 12109 | Chaoming Luo | 13.6 | 376.27 | Clause 13.6.2 and 13.6.3 also be updated for MLD, e.g., Basic Multilink element should be added in Authentication-Request/Response of Figure 13-10 | 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 11-22/1733r2 under all headings that include CID 12109 |
| 10296 | Michael Montemurro | 13.6 | 376.27 | The FT Resource Request 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. 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 11-22/1733r2 under all headings that include CID 12109 |

**Discussion: None**

-----------------------------------------texts related to (#12782)---------------------------------

* + - 1. **FT Request frame**

***Change the first paragraph as follows:***

The FT Request frame is sent by the STA to its associated AP or by the non-AP MLD through an affiliated STA to its associated AP MLD through an affiliated AP to initiate an over-the-DS fast BSS transition.

***Change the sixth paragraph as follows:***

The Target AP Address field is set to the ~~BSSID value of the target AP~~MAC address of the target fast BSS transi- tion responder (FTR).(#12782)

* + - 1. **FT Response frame**

***Change the first paragraph as follows:***

The FT Response frame is transmitted by the currently associated AP as a response to the STA’s FT Request frame or the currently associated AP MLD through an affiliated AP as a response to the non-AP MLD’s FT Request frame. Figure 9-1140 (FT Response frame Action field format) shows the format of the FT Response frame Action field.

***Change the fifth paragraph as follows:***

The Target AP Address field is set to the ~~BSSID value of the target AP~~target FTR’s MAC address. (#12782)

-----------------------------------------texts related to resource request (#12109)---------------------------------

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

* **FT resource request protocol**
* **Overview**

The FT resource request protocol involves an additional message exchange after the Authentication-Request/Response frame, or FT Request/Response frame, and prior to reassociation.

FTRs capable of fast BSS transition may allow FTOs to request resources prior to reassociation. Availability of the FT resource request protocol is advertised by the target FTR in the MDE. If the Resource Request Protocol Capability subfield is 0, then the FTO shall not send an Authentication-Confirm nor FT Confirm frame to the FTR. An FTR that receives an Authentication-Confirm or FT Confirm frame from a FTO and does not support the FT resource request protocol shall respond with status code INVALID\_PARAMETERS.

The additional message exchange for the FT resource request protocol shall be performed using the same method (over-the-air or over-the-DS) as was used for the Authentication-Request/Response frame or FT Request/Response frame. An FTR that receives an FT Confirm frame that did not previously receive an FT Request frame from the same FTO shall reject the request with status code STATUS\_INVALID\_FT\_ACTION\_FRAME\_COUNT. An FTR that receives an Authentication-Confirm frame that did not previously receive an Authentication-Request frame from the same FTO shall reject the request with status code TRANSACTION\_SEQUENCE\_ERROR.

* **Over-the-air fast BSS transition with resource request**

The over-the-air FT resource request protocol in an RSN is shown in Figure 13-10 (Over-the-air FT resource request protocol in an RSN).



Figure 13-10 – Over-the-air FT resource request protocol in an RSN

The over-the-air FT resource request protocol in a non-RSN is shown in Figure 13-11 (Over-the-air FT resource request protocol in a non-RSN).

To perform an over-the-air FT resource request protocol to a target FTR, after completing the Authentication-Request/Response frame exchange given in 13.5.2 (Over-the-air FT protocol authentication in an RSN) or 13.5.4 (Over-the-air FT protocol in a non-RSN), the FTO and target FTR shall perform the following exchange:

FTO®Target FTR: Authentication-Confirm (FTAA, 0, RSNE[PMKR1Name], MDE, FTE[MIC, ANonce, SNonce, R1KH-ID, R0KH-ID], RIC-Request, Basic Multi-Link element)

Target FTR®FTO: Authentication-Ack (FTAA, Status, RSNE[PMKR1Name], MDE, FTE[MIC, ANonce, SNonce, R1KH-ID, R0KH-ID], RIC-Response, Basic Multi-Link element)

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

The SME of the FTO initiates the resource request exchange through the use of the primitive MLME-RESOURCE-REQUEST.request primitive, and the SME of the FTR responds with MLME-RESOURCE-REQUEST.response primitive.

In the Authentication-Confirm frame that does not include the Basic Multi-Link element, the SA field of the message header shall be set to the MAC address of the FTO, and the DA field of the message header shall be set to the BSSID of the target AP’s BSS. In the Authentication-Confirm frame that includes the Basic MultiLink element, the Address 1 (RA) field and the Address 2 (TA) field of the message header shall be set as defined in 35.3.2 (Multi-link device addressing). In a non-RSN, the FTE and RSNE shall not be present. The elements in the frame, the element contents, and MIC calculation shall be as given in 13.8.4 (FT authentication sequence: contents of third 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 Authentication-Confirm frame with status code STATUS\_INVALID\_MDE.

In an RSN, the R1KH of the target FTR verifies the MIC in the FTE in the Authentication-Confirm frame and shall discard the request if it is incorrect. If the FTE in the Authentication-Confirm frame contains a different R0KH-ID, R1KH-ID, ANonce, or SNonce, the target FTR shall reject the Authentication-Confirm frame with status code STATUS\_INVALID\_FTE. If the RSNE in the Authentication-Confirm frame contains an invalid PMKR1Name, the target FTR shall reject the Authentication-Confirm frame with status code STATUS\_INVALID\_PMKID.

In the Authentication-Ack frame that does not include the Basic Multi-Link element, the SA field of the message header shall be set to the BSSID of the target AP’s BSS, and the DA field of the message header shall be set to the MAC address of the FTO. In the Authentication-Ack frame that includes the Basic MultiLink element, the Address 1 (RA) field and the Address 2 (TA) field of the message header shall be set as defined in 35.3.2 (Multi-link device addressing). In a non-RSN, the FTE and RSNE shall not be present. The Status Code field shall be a value from the options listed in 9.4.1.9 (Status Code field). The elements in the frame, the element contents, and MIC calculation shall be as given in 13.8.5 (FT authentication sequence: contents of fourth message).

In an RSN, the S1KH of the FTO verifies the MIC in the FTE in the Authentication-Ack frame and shall discard the response if the MIC is incorrect.

The FTO may make a request for resources by including a RIC-Request (see 13.11 (Resource request procedures)) in the Authentication-Confirm frame. The RIC-Request is generated by the procedures of 13.11.3.1 (FTO procedures), and the RIC-Response is generated by the procedures of 13.11.3.2 (AP procedures).

If the value of the Status Code field returned by the target FTR in the Authentication-Ack frame is not SUCCESS, then the FTO shall abandon this transition attempt.

In an RSN, on successful completion of the FT authentication exchange of the FT resource request protocol, the PTKSA has been established and proven live. The key replay counter shall be initialized to 0, and the subsequent EAPOL-Key frames (e.g., GTK, IGTK, (11ba)BIGTK, and WIGTK updates) shall use the key replay counter to detect and discard replays. 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.

In a non-RSN, the Authentication-Ack frame contains a TIE with a reassociation deadline. If the FTO does not send a Reassociation Request frame to the target AP within that interval, the FTO shall abandon this transition attempt.

The exchange between the FTO and the target FTR may continue with reassociation (13.7.1 (FT reassociation in an RSN) or 13.7.2 (FT reassociation in a non-RSN)).

* **Over-the-DS fast BSS transition with resource request**

The over-the-DS FT resource request protocol in an RSN is shown in Figure 13-12 (Over-the-DS FT resource request protocol in an RSN).



Figure 13-12 – Over-the-DS FT resource request protocol in an RSN

The over-the-DS FT resource request protocol in a non-RSN is shown in Figure 13-13 (Over-the-DS FT resource request protocol in a non-RSN).



To perform an Over-the-DS FT resource request protocol to a target FTR, after completing the FT Request/Response frame exchange given in 13.5.3 (Over-the-DS FT protocol in an RSN) or 13.5.5 (Over-the-DS FT protocol in a non-RSN), the FTO and target FTR (through the current FTR) shall perform the following exchange, using the mechanism described in 13.10 (Remote request broker (RRB) communication):

FTO®Target FTR: FT Confirm (FTO, TargetAP, RSNE[PMKR1Name], MDE, FTE[MIC, ANonce, SNonce, R1KH-ID, R0KH-ID], RIC-Request, Basic Multi-Link element)

Target FTR®FTO: FT Ack (FTO, TargetAP, Status, RSNE[PMKR1Name], MDE, FTE[MIC, ANonce, SNonce, R1KH-ID, R0KH-ID], TIE[ReassociationDeadline], RIC‑Response, Basic Multi-Link element)

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

The SME of the FTO initiates the FT Confirm frame to the target FTR by issuing an MLME-REMOTE-REQUEST.request primitive with parameters including the contents of the FT Confirm frame (FT Action frame with an FT Action field value indicating FT Confirm) 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 Ack frame (FT Action frame with an FT Action field value indicating FT Ack), it passes it to the SME by use of an MLME-REMOTE-REQUEST.indication primitive, with parameters including the contents of the received Action frame.

The STA Address field of the FT Confirm frame shall be set to the MAC address of the FTO, and the Target AP Address field of the FT Confirm frame shall be set to the MAC address of the target FTR. The elements in the FT Confirm frame, the element contents, and the MIC calculation shall be as given in 13.8.4 (FT authentication sequence: contents of third message). In a non-RSN, the FTE and RSNE shall not be present.

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 Confirm frame with status code STATUS\_INVALID\_MDE.

In an RSN, the R1KH of the target FTR verifies the MIC in the FTE and shall discard the request if it is incorrect. If the FTE in the FT Confirm frame contains a different R0KH-ID, R1KH-ID, ANonce, or SNonce from the values sent in the FT Response frame, the AP shall reject the FT Confirm frame with status code STATUS\_INVALID\_FTE. If the RSNE in the FT Confirm frame contains an invalid PMKR1Name, the FTR shall reject the FT Confirm frame with status code STATUS\_INVALID\_PMKID.

The STA Address field of the FT Ack frame shall be set to the MAC address of the FTO, and the Target AP Address field of the FT Ack frame shall be set to the MAC address of the target FTR. The elements in the FT Ack frame, the element contents, and the MIC calculation shall be as given in 13.8.5 (FT authentication sequence: contents of fourth message). In a non-RSN, the FTE and RSNE shall not be present. The Status Code field value shall be a value from the options listed in 9.4.1.9 (Status Code field), and a TIE may appear.

In an RSN, the S1KH of the FTO verifies the MIC in the FTE in the FT Ack frame and shall discard the response if the MIC is incorrect.

The FTO may make a request for resources by including a RIC-Request (see 13.11 (Resource request procedures)) in the FT Confirm frame. The RIC-Request is generated by the procedures of 13.11.3.1 (FTO procedures), and the RIC-Response is generated by the procedures of 13.11.3.2 (AP procedures).

In order to recover from over-the-DS frame losses, the FTO may retransmit the FT Confirm frame until the reassociation deadline time is reached. If the FTO does not receive a response to the FT Confirm frame or if the value of the Status Code field returned by the target FTR in the FT Ack frame is not SUCCESS, then the FTO shall abandon this transition attempt.

In an RSN, on successful completion of the FT Confirm/Acknowledgment frame exchange, the PTKSA has been established and proven live. The key replay counter shall be initialized to 0, and the subsequent EAPOL-Key frames (e.g., GTK, IGTK, (11ba)BIGTK, and WIGTK updates) shall use the key replay counter to detect and discard replays. 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. Resource request procedures are specified in 13.11 (Resource request procedures).

In a non-RSN, the FT Ack frame contains a TIE with a reassociation deadline. If the FTO does not send a Reassociation Request frame to the target AP within that interval, the FTO shall abandon this transition attempt.

The exchange between the FTO and the target FTR may continue with reassociation (13.7.1 (FT reassociation in an RSN) or 13.7.2 (FT reassociation in a non-RSN)).

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

**13.10.2 Remote request broker (RRB)**

(…existing texts …)

The message flow for a resource request over the DS is given in Figure 13-20 (Sample message flow for over-the-DS resource request). The FTO indicates the destination target FTR as part of the FT Action frame. The RRB on the current FTR encapsulates the FT Action frame and supplies the current FTR MAC address in the Remote Request frame.



Figure 13-20 –Sample message flow for over-the-DS resource request

* **Resource request procedures**
* **General**

When using the resource request procedure, the FTO has the option to request a resource allocation at the target FTR. To request resources, the FTO creates a resource information container (RIC) and inserts it in an appropriate request message to the target FTR. The request message is sent to the target FTR either directly (over the air), or via the current FTR (over the DS), according to the FT procedures described in 13.5 (FT protocol) and 13.6 (FT resource request protocol). In an RSNA, resource requests and responses are exchanged only after the establishment of the PTK and are protected by MICs.

The RIC contains a complete list of resources requested by the FTO. An FTR that receives a resource request from an FTO shall discard any previous resource request from that FTO. In an RSN, this resource request shall first be authenticated by the FTR through checking of the MIC before the FTR discards any previous resource request.

If an FTO is performing a fast BSS transition according to the FT protocol, described in 13.5 (FT protocol), it shall generate a RIC and process the RIC-Response according to the procedures of 13.11.3.1 (FTO procedures), performing the exchange in the Reassociation Request/Response frames.

If an FTO is performing a fast BSS transition according to the FT resource request protocol, described in 13.6 (FT resource request protocol), it shall generate a RIC and process the RIC-Response according to the procedures of 13.11.3.1 (FTO procedures), performing the exchange in the Authentication-Confirm and Authentication-Ack frames (over the air) or FT Confirm and FT Ack frames (over the DS).

* **Resource information container (RIC)**

The RIC refers to a collection of elements that are used to express a resource request or response.

When used in making a request, a RIC has one or more Resource Requests, as shown in Figure 13-21 (RIC-Request format).

|  |  |  |
| --- | --- | --- |
| Resource Request | Resource Request | Resource Request |
| * **RIC-Request format**
 |

Each Resource Request consists of an RDE followed by one or more alternative Resource Descriptors. An example of a Resource Request is shown in Figure 13-22 (Resource Request format).

|  |  |
| --- | --- |
| RDE | Resource Descriptor |
| * **Resource Request format**
 |

Each Resource Descriptor consists of one or more elements. The possible Resource Descriptors that may appear in a RIC, and the elements that they contain, are given in Table 13-3 (Resource types and resource descriptor definitions).

|  |
| --- |
| * **Resource types and resource descriptor definitions**
 |
| **Resource type** | **Resource Descriptor definition** | **Notes** |
| 802.11 QoS | In a request: TSPEC (see 9.4.2.29 (TSPEC element)), followed by zero or more TCLAS (see 9.4.2.30 (TCLAS element)), followed by zero or one TCLAS Processing elements (see 9.4.2.32 (TCLAS Processing element)), followed by zero or one Expedited Bandwidth Request elements (see 9.4.2.93 (Expedited Bandwidth Request element)).In a response: a TSPEC element (see 9.4.2.29 (TSPEC element)), followed by zero or one Schedule elements (see 9.4.2.33 (Schedule element)), followed by zero or more Delay elements (see 9.4.2.31 (TS Delay element)), followed by other optional elements as specified in 11.4 (TS operation). | May be sent by a QoS STA that is an FTO to a QoS AP. Definition of TSPEC elements shall be as given in 11.4 (TS operation). Definition of TCLAS, TCLAS Processing, Expedited Bandwidth Request, and Schedule elements, and the rules for including them in requests and responses, shall be as given in 11.4 (TS operation). Resource request procedures shall be as given in 11.4 (TS operation). |
| Block Ack Parameters  | In a request: RIC Descriptor (see 9.4.2.50 (RIC Descriptor element)), containing a Resource Type field identifying Block Ack.In a response: RIC Descriptor (see 9.4.2.50 (RIC Descriptor element)), containing a Resource Type field identifying Block Ack. | Resource request procedures shall be as given in 11.5 (Block ack operation) or 35.3.8 (Block ack procedures in Multi-link operation). |
| Vendor Specific  | RDE is followed by any Vendor Specific elements required to specify this resource. |  |

If there are multiple Resource Descriptors, then they are treated as choices by the target AP. The AP attempts to allocate whatever is specified in the first Resource Descriptor; if this fails, the AP attempts to allocate whatever is specified in the next Resource Descriptor instead, and so on until a successful allocation or the AP reaches the end of the Resource Descriptor list. Thus, an OR relationship exists between Resource Descriptors that follow an RDE, with the Resource Descriptors appearing in order of preference.

An example of a Resource Request consisting of two alternative Resource Descriptors is shown in Figure 13-23 (Resource Request example #1).

|  |  |  |
| --- | --- | --- |
| RDE | Resource Descriptor | Resource Descriptor |
| * **Resource Request example #1**
 |

For example, when the resource being requested is QoS for downstream traffic, a TSPEC element may be followed by one or more TCLAS elements and, when multiple TCLAS elements are present, a TCLAS Processing element and an Expedited Bandwidth Request (EBR) element. Such an example Resource Request with two alternative TSPECs, the second of which has an EBR, is shown in Figure 13-24 (Resource Request example #2).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RDE | TSPEC | TCLAS | TCLAS | TCLAS Processing | TSPEC | TCLAS | TCLAS | TCLAS Processing | EBR  |
| * **Resource Request example #2**
 |

An example of a RIC with two resource requests, each with a single TSPEC, is given in Figure 13-25 (RIC-Request example #1).

|  |  |  |  |
| --- | --- | --- | --- |
| RDE | TSPEC | RDE | TSPEC |
| * **RIC-Request example #1**
 |

An example of a RIC with one resource request, with a choice of two TSPECs, is given in Figure 13-26 (RIC-Request example #2). This indicates that the target AP can select one of the two TSPECs.

|  |  |  |
| --- | --- | --- |
| RDE | TSPEC | TSPEC |
| * **RIC-Request example #2**
 |

An example of a RIC with a RIC Descriptor is given in Figure 13-27 (RIC-Request example #3). The target AP can acknowledge if the resource specified in the RIC Descriptor is available.

|  |  |
| --- | --- |
| RDE | RIC Descriptor (BlockAck) |
| * **RIC-Request example #3**
 |

When sent by an target FTR in response to a RIC-Request, the RIC-Response consists of a list of one or more Resource Responses including one response for each of the Resource Requests that was contained in the RIC-Request. The basic format of a RIC-Response is shown in Figure 13-28 (RIC-Response format).

|  |  |  |
| --- | --- | --- |
| Resource Response | Resource Response | Resource Response |
| * **RIC-Response format**
 |

Each Resource Response consists of an RDE with the RDE identifier matching the RDE identifier in the request, in the same order as the RDEs appeared in the request. The RDE is followed by zero or one Resource Descriptors. If the request was not successful (as indicated in the RDE status), then the target FTR may include a suggestion that could have been successful. If the resource request was successful, then the particular Resource Descriptor (of the alternatives given by the FTO) is included in the response, as modified by the target FTR during the processing of the resource request. For example, when the resource being requested is QoS for upstream traffic, the TSPEC element may be followed by a Schedule element.

An example of a RIC-Response with two QoS resource responses, each with a single TSPEC and Schedule element, is given in Figure 13-29 (Example QoS RIC-Response).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| RDE | TSPEC | Schedule | RDE | TSPEC | Schedule |
| * **Example QoS RIC-Response**
 |

* **Creation and handling of a resource request**
* **FTO procedures**

The resource request enables an FTO to request resources based on specified Resource Descriptors (e.g., TSPECs) before or at the time the FTO associates with the target FTR. In using TSPECs for requesting QoS resources, the TSPECs in the request need not belong to only active TSs; the FTO can send TSPECs for any TS that it intends to use after the transition and request the same resources that would be requested by a later ADDTS exchange. For each resource, the FTO may provide the AP with a choice of Resource Descriptors in order of preference, any one of which meets the needs of the application.

The FTO shall construct the RIC with a number of Resource Requests, each delineated by an RDE.

The FTO shall indicate the resources required at the target FTR. For QoS resources, each TS shall be requested by a separate RDE and associated TSPEC(s). The RDE Identifier field in the RDE shall be an arbitrary value chosen by the FTO that uniquely identifies the RDE within the RIC. The Status Code field shall be set to SUCCESS, and the Resource Count field shall be set to the number of alternative Resource Descriptors that follow.

Following each RDE, the FTO shall include one or more Resource Descriptors that define the resources required for this TS. When multiple TSPECs follow an RDE as part of a single QoS resource request, a logical “OR” relationship exists between them, and at most one of these TSPECs shall be accepted by the AP. The FTO shall order the Resource Descriptors in decreasing order of preference.

In generating the RDE for QoS resources for a TS, the procedures of 11.4 (TS operation) shall be followed for the generation of TSPECs and inclusion of TCLAS, TCLAS Processing, and Expedited Bandwidth Request elements. If the TS is a downstream flow, then the RDE may also include one or more TCLAS element(s) (defined in 9.4.2.30 (TCLAS element)) and a TCLAS Processing element (defined in 9.4.2.32 (TCLAS Processing element)) if multiple TCLAS elements are included, and an optional Expedited Bandwidth Request (EBR) element, defined in 9.4.2.93 (Expedited Bandwidth Request element). If present, the TCLAS shall appear after the corresponding TSPEC. If present, an EBR element shall appear after the corresponding TSPEC, TCLAS, and TCLAS Processing elements of the TSPEC.

A resource request is considered successful if the status code SUCCESS is returned in each RDE.

If the frame containing the response to the resource request contains a status code other than SUCCESS, the FTO considers that the request has failed and that no resources are being held at the target FTR.

The response from the target FTR contains a RIC-Response, with the RDEs in the response indicating which resources were considered by the target FTR and the setting of the status code indicating which Resource Descriptors were accepted by the target FTR.

The RDE Identifier field in the RDE enables the FTO to match the response with the RDE in the request. The value of the Status Code field is interpreted as follows:

* Status code = SUCCESS indicates that the request has been accepted. The RDE may be followed by the Resource Descriptor that was accepted.
* Status code = not SUCCESS (one of the values from 9.4.1.9 (Status Code field)) indicates that the resources could not be accepted. The RDE may be followed by a suggested Resource Descriptor that could have been accepted.

A response to a successful resource request (other than in a Reassociation Request frame) may contain a reassociation deadline. If the FTO does not initiate a Reassociation Request frame with the target FTR within the reassociation deadline (if appropriate), then the FTR releases resources held for that FTO.

* **FTR procedures**

When a RIC appears in a request message, the FTR shall check its ability to allocate one resource for each RDE in the RIC in the order appearing in the RIC. In a Reassociation Request frame, the QoS Capability element shall be processed prior to the QoS resource requests in the RIC.

The behavior of the FTR shall be identical to that described in the flowchart in Figure 13-30 (Overview of RIC processing at an FTR).

*TGbe editor: Change title of Figure 13-30 to “Overview of RIC processing at a FTR”:*



As shown in Figure 13-30 (Overview of RIC processing at an FTR), the Resource Descriptors are examined by the FTR in the order presented, and the first that could have been allocated is accepted. Thus the preference ordering by the FTO is honored.

The target FTR’s SME examines the resource requests in the RIC. For requests that require processing by the MAC sublayer, the SME generates an MLME-RESOURCE-REQUEST-LOCAL.request primitive. The MAC shall respond with MLME-RESOURCE-REQUEST-LOCAL.confirm primitive that indicates whether the MAC has accepted the resource request. The SME may also send these resource requests to an external entity such as a backend QoS module for its consideration; these procedures are beyond the scope of this standard. The acceptance of a TSPEC by the target AP results in the resource allocation for a TS at the target AP.

In response to a RIC-Request, the FTR shall construct a RIC-Response. The RIC-Response shall contain one RDE for each RDE in the RIC-Request. The RDEs shall be in the same order as in the request, and the RDE Identifier field in each RDE shall be the value of the RDE Identifier field in the corresponding RDE in the request. The Status Code field in the RDE shall be set according to the result of the allocation request as follows:

* Status code = SUCCESS indicates that the resource request has been accepted. The RDE shall also be followed by the Resource Descriptor that was accepted.
* Status code = not SUCCESS indicates that the resources could not be accepted. The Status Code field contains a value from 9.4.1.9 (Status Code field) indicating the reason for the failure. In this case, the FTR may include a single Resource Descriptor following the RDE indicating a suggested resource that could have been accepted. The Resource Count field shall be set to 0 or 1 depending whether the suggested Resource Descriptor is attached. A not SUCCESS status code in an RDE shall not cause a not SUCCESS status code in the frame containing the RIC.

If the resource request included QoS resources and is successful, then the procedures for handling of TSPEC, TCLAS, TCLAS Processing and Expedited Bandwidth Request elements shall be as specified in 11.4 (TS operation), and the AP shall place the TSs into the accepted state. The RIC-Response shall contain the updated accepted TSPEC. Each RDE may also include a Schedule element (as defined in 9.4.2.33 (Schedule element)) after the accepted TSPEC. Upon reassociation, AP shall move all of the TSs from the accepted state into the active state.

If the FTO does not invoke a reassociation within the reassociation deadline, then the TSs that had been accepted shall become inactive, and the resources shall be released. At the point that the FTO reassociates with the target AP (within the reassociation deadline, if appropriate), the TSs are put into the active state. This may be immediate if the RIC-Request was part of a Reassociation Request frame.

*TGbe editor: Change 9.4.2.50 RIC Descriptor element as follows (track change on):*

* **RIC Descriptor element**

The RIC Descriptor element is used with an RDE during a fast BSS transition to negotiate resources that are not otherwise described by elements. See 13.11 (Resource request procedures) for procedures for including this element in a RIC.

Figure 9-428 (RIC Descriptor element format) shows the format of this element.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Element ID | Length | Resource Type | Variable Parameters(#213) |
| Octets: | 1 | 1 | 1 | variable |
| * **RIC Descriptor element format**
 |

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

The Resource Type field is defined in Table 9-220 (Resource type code in RIC Descriptor element).

|  |
| --- |
| * **Resource type code in RIC Descriptor element**
 |
| **Resource type value** | **Meaning** | **Variable parameters** |
| 1 | Block Ack | Block Ack Parameter Set field value as defined in 9.4.1.13 (Block Ack Parameter Set field), Block Ack Timeout field value as defined in 9.4.1.14 (Block Ack Timeout Value field), and Block Ack Starting Sequence Control subfield value as defined in 9.3.1.7 (BlockAckReq frame format). |
| 2 | Block Ack Extension | Block Ack Parameter Set field value as defined in 9.4.1.13 (Block Ack Parameter Set field), Block Ack Timeout field value as defined in 9.4.1.14 (Block Ack Timeout Value field), Block Ack Starting Sequence Control subfield value as defined in 9.3.1.7 (BlockAckReq frame format), ADDBA Extended Parameter Set field value as defined in 9.4.2.139 (ADDBA Extension element). |
| 0, 2–255 | Reserved |  |

The Variable Parameters field(#213) contain any additional data based on the resource type.

*TGbe editor: Change 9.6.8.4 FT Confirm frame and 9.6.8.5 FT Ack frame as follows (track change on):*

* **FT Confirm frame**

The FT Confirm frame in an RSN is confirmation to the target FTR of receipt of the ANonce and indicates the liveness of the PTKSA. The FT Confirm frame is optionally used by the FTO to request resource. Figure 9-1142 (FT Confirm frame Action field format) shows the FT Confirm frame Action field format.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Category | FT Action | STA Address | Target AP Address | FT Confirm frame body |
| Octets: | 1 | 1 | 6 | 6 | variable |
| * **FT Confirm 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~~target FTR’s MAC address.

The FT Confirm frame body contains the information shown in Table 9-484 (FT Confirm frame body).

|  |
| --- |
| **Table 9-484 - FT Confirm frame body** |
| **Order** |  |  |
| 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 | RIC | The RIC Request field is present if resources are being requested. |
| 5 | 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 13.8.4 (FT authentication sequence: contents of third message).

* **FT Ack frame**

The FT Ack frame is transmitted by the currently associated FTR as a response to the FTO’s FT Confirm frame. Figure 9-1143 (FT Ack frame Action field format) shows the FT Ack frame Action field format.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Category | FT Action | STA Address | Target AP Address | Status Code | FT Ack frame body |
| Octets | 1 | 1 | 6 | 6 | 2 | variable |
| * **FT Ack 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~~target 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 Ack frame body contains the information shown in Table 9-485 (FT Ack frame body).

|  |
| --- |
| * **FT Ack frame body**
 |
| **Order** |  |  |
| 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 | Timeout Interval (reassociation deadline) | A TIE containing the reassociation deadline interval is present if resources were requested in the FT Confirm frame and dot11RSNAActivated is false. |
| 5 | RIC | The RIC Response field is present if resources were requested in the FT Confirm frame.  |
| 6 | 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 13.8.5 (FT authentication sequence: contents of fourth message).

*TGbe editor: Change 6.3.33 MLME SAP interface for resource request as follows (track change on):*

* **MLME SAP interface for resource request**
* **MLME-RESOURCE-REQUEST.request**
* **Function**

This primitive is used to perform the over-the-air resource request of an FT resource request protocol. The over-the-air resource request is performed using Authentication frames, with an authentication algorithm number corresponding to FT authentication and an authentication algorithm sequence number of 3 or 4.

* **Semantics of the service primitive**

The primitive parameters are as follows:

MLME-RESOURCE-REQUEST.request(

PeerMACAddress,
Contents of FT Authentication elements,
VendorSpecificInfo
)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| PeerMACAddress | MAC address | Any valid individual MAC address | Specifies the MAC address of the MAC entity that is the intended immediate recipient of the resource request. |
| Content of FT Authentication elements | Sequence of elements | As defined in 13.8 (FT authentication sequence) | The set of elements to be included in the FT Confirm frame, as described in 13.8.4 (FT authentication sequence: contents of third message).  |
| VendorSpecificInfo | A set of elements | As defined in 9.4.2.25 (Vendor Specific element) | Zero or more elements. |

* **When generated**

This primitive is generated by the SME to send the third frame of the over-the-air FT resource request protocol. The third frame is an Authentication frame, with an number corresponding to FT authentication and an Authentication algorithm sequence number of 3.

* **Effect of receipt**

Upon receipt of this primitive, the MLME constructs the appropriate Authentication frame and causes it to be transmitted to the peer MAC address.

* **MLME-RESOURCE-REQUEST.indication**
* **Function**

This primitive is used to enact the security and QoS resource request with a specified peer MAC entity.

* **Semantics of the service primitive**

The primitive parameters are as follows:

MLME-RESOURCE-REQUEST.indication(

PeerMACAddress,
Content of FT Authentication elements,
VendorSpecificInfo
)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| PeerMACAddress | MAC address | Any valid individual MAC address | Specifies the MAC address of the MAC entity that was the sender of the resource request. |
| Content of FT Authentication elements | Sequence of elements | As defined in 13.8 (FT authentication sequence) | The set of elements included in the FT Confirm frame, as described in 13.8.4 (FT authentication sequence: contents of third message).  |
| VendorSpecificInfo | A set of elements | As defined in 9.4.2.25 (Vendor Specific element) | Zero or more elements. |

* **When generated**

This primitive is generated by the MLME at an FTR to indicate that the third frame of the over-the-air FT resource request protocol has been received. The third frame is an Authentication frame, with an authentication algorithm number corresponding to FT authentication and an authentication algorithm sequence number of 3.

* **Effect of receipt**

Upon receipt of this primitive, the SME examines the Transition element and RSNE contents and responds to the peer MAC address using the MLME-RESOURCE-REQUEST.response primitive.

* **MLME-RESOURCE-REQUEST.response**
* **Function**

This primitive is used to enact the security and QoS resource request protocol with a specified peer MAC entity.

* **Semantics of the service primitive**

The primitive parameters are as follows:

MLME-RESOURCE-REQUEST.response(

PeerMACAddress,
Content of FT Authentication elements,
VendorSpecificInfo
)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| PeerMACAddress | MAC address | Any valid individual MAC address | Specifies the MAC address of the MAC entity that is the intended immediate recipient of the resource response. |
| Content of FT Authentication elements | Sequence of elements | As defined in 13.8 (FT authentication sequence) | The set of elements to be included in the FT Ack frame, as described in 13.8.5 (FT authentication sequence: contents of fourth message). This includes an optional response to a resource request (RIC). |
| VendorSpecificInfo | A set of elements | As defined in 9.4.2.25 (Vendor Specific element) | Zero or more elements. |

* **When generated**

This primitive is generated by the SME at an FTR to cause the transmission of the fourth frame in the over-the-air FT resource request protocol. The fourth frame is an Authentication frame, with an authentication algorithm number corresponding to FT authentication and an authentication algorithm sequence number of 4.

* **Effect of receipt**

Upon receipt of this primitive, the MLME constructs the appropriate Authentication frame and causes it to be transmitted to the peer MAC address.

* **MLME-RESOURCE-REQUEST.confirm**
* **Function**

This primitive is used to enact the security and QoS resource request protocol with a specified peer MAC entity.

* **Semantics of the service primitive**

The primitive parameters are as follows:

MLME-RESOURCE-REQUEST.confirm(

PeerMACAddress,
Content of FT Authentication elements,
VendorSpecificInfo
)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| PeerMACAddress | MAC address | Any valid individual MAC address | Specifies the MAC address of the MAC entity that was the sender of the resource response. |
| Content of FT Authentication elements | Sequence of elements | As defined in 13.8 (FT authentication sequence) | The set of elements included in the FT Ack frame, as described in 13.8.5 (FT authentication sequence: contents of fourth message). This includes an optional response to a resource request (RIC). |
| VendorSpecificInfo | A set of elements | As defined in 9.4.2.25 (Vendor Specific element) | Zero or more elements. |

* **When generated**

This primitive is generated by the MLME on receipt of the fourth frame in the FT resource request protocol.

* **Effect of receipt**

Upon receipt of this primitive, the SME examines the content of the message and completes its processing of the resource request.

* **MLME-RESOURCE-REQUEST-LOCAL.request**
* **Function**

This primitive is used to enact the over-the-DS FT resource request protocol for a specified peer MAC entity. The over-the-DS FT resource request protocol is performed by communication between the FTO and the SME of the target FTR, bypassing the MAC of the target FTR. This MLME function is used to allow the MAC of the target FTR to process the resource requests.

* **Semantics of the service primitive**

The primitive parameters are as follows:

MLME-RESOURCE-REQUEST-LOCAL.request(

MACAddress,
Content of Resource Descriptor(s)
)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| MACAddress | MAC address | Any valid individual MAC address | Specifies the MAC address of the MAC entity that is making the resource request. |
| Content of Resource Descriptor(s) | Sequence of elements | As defined in 13.11.2 (Resource information container (RIC)) | Specifies the resource(s) that are being requested. |

* **When generated**

This primitive is generated by the SME at a target FTR upon receiving an over-the-DS resource request to request resources within the local MAC.

* **Effect of receipt**

Upon receipt of this primitive, the MAC checks for resource availability and allocates resources as requested.

* **MLME-RESOURCE-REQUEST-LOCAL.confirm**
* **Function**

This primitive is used to respond to a local resource request for resources from the SME.

* **Semantics of the service primitive**

The primitive parameters are as follows:

MLME-RESOURCE-REQUEST-LOCAL.confirm(

MACAddress,
Content of Resource Descriptor(s),
ResultCode
)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| MACAddress | MAC address | Any valid individual MAC address | Specifies the MAC address of the MAC entity that is making the resource request. |
| Content of Resource Descriptor(s) | Sequence of elements | As defined in 13.11.2 (Resource information container (RIC)) | Specifies the resource(s) that were allocated or could have been allocated. |
| ResultCode | Enumeration | SUCCESS, REFUSED\_REASON\_UNSPECIFIED(#1780),UNSPECIFIED\_FAILURE | Indicates the result of the outcome of a resource request. |

* **When generated**

This primitive is generated by the MAC in response to a local resource request for resources via MLME-RESOURCE-REQUEST-LOCAL.request primitive.

* **Effect of receipt**

Upon receipt of this primitive, the SME prepares a success or failure response to be sent to the FTO via the current FTR.