IEEE P802.11
Wireless LANs

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| D1.0 Comment Resolutions on Probe Response |
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Abstract

This document proposes resolutions on CIDs 3377, 3355, 3340, 3315, 3306, 3132, 2954, 2780, 2778, 2777, 2768, 2453, 2043, and 3011 that are related to sending a probe response frame.

Changes in the text refer to: Draft P802.11ai/D1.1

Comments (CID 3377, 3355, 3306, 3315, 3132, 2780)

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| **CID** | **Clause**  | **Page** | **Line** | **Comment** | **Proposed Change** | **Proposed****Resolution** |
| 3377 | 10.1.4.3.9 | 76 | 55 | "If the Probe Response Reception Time element is present in the Probe Request frame, the responding STAwith dot11FILSActivated true shall discard the pending untransmitted Probe Response frame to the Probe Request frame when the elapsed time after reception of the Probe Request exceeds the time indicated by value of the MaxChannelTime field of the Probe Response Reception Time element of the Probe Request frame."What does discarding Probe Response frame mean?If the back-off procedure is ongoing for the Probe Response transmission, it shall stop the back-off procedure?The better wording is that the responding STA shall not schedule a pending Probe Response frame transmission. | Change the sentenc as the following:"If the Probe Response Reception Time element is present in the Probe Request frame, the responding STA with dot11FILSActivated true shall not schedule the pending Probe Response frame transmission to the ProbeRequest frame when the elapsed time after reception of the Probe Request exceeds the time indicated by value of the MaxChannelTime field of the Probe Response Reception Time element of the Probe Request frame." | Reject. The elapsed time may exceed the MaxChannelTime before the scheduling or it may exceed the MaxChannelTime after the scheduling and the Probe Response frame shall be dropped for both cases, but the suggested change misses the second case. Backoff procedure is per AC. If the backoff procedure is ongoing to transmit the Probe Response which is categorized in AC\_BE but the elapsed time exceeds the MaxChannelTime, it is discarded but the backoff procedure goes on for AC\_BE and the next scheduled frame in AC\_BE will be transmitted instead of the discarded Probe Response frame.See detailed rationale in 11-13/1317 |
| 3355 | 10.1.4.3.9 | 76 | 55 | "If the Probe Response Reception Time element is present in the Probe Request frame, the responding STAwith dot11FILSActivated true shall discard the pending untransmitted Probe Response frame to the ProbeRequest frame when the elapsed time after reception of the Probe Request exceeds the time indicated byvalue of the MaxChannelTime field of the Probe Response Reception Time element of the Probe Requestframe."What does discarding Probe Response frame mean?If the back-off procedure is ongoing for the Probe Response transmission, it shall stop the back-off procedure?The better wording is that the responding STA shall not schedule a pending Probe Response frame transmission. | Change the sentenc as the following:"If the Probe Response Reception Time element is present in the Probe Request frame, the responding STA with dot11FILSActivated true shall not schedule the pending Probe Response frame transmission to the ProbeRequest frame when the elapsed time after reception of the Probe Request exceeds the time indicated byvalue of the MaxChannelTime field of the Probe Response Reception Time element of the Probe Requestframe." | Reject. See Resolution of CID 3377 (Duplicated CID) |
| 3306 | 10.1.4.3.9 | 76 | 55 | "If the Probe Response Reception Time element is present in the Probe Request frame, the responding STAwith dot11FILSActivated true shall discard the pending untransmitted Probe Response frame to the ProbeRequest frame when the elapsed time after reception of the Probe Request exceeds the time indicated byvalue of the MaxChannelTime field of the Probe Response Reception Time element of the Probe Requestframe."What does discarding Probe Response frame mean?If the back-off procedure is ongoing for the Probe Response transmission, it shall stop the back-off procedure?The better wording is that the responding STA shall not schedule a pending Probe Response frame transmission. | Change the sentenc as the following:"If the Probe Response Reception Time element is present in the Probe Request frame, the responding STAwith dot11FILSActivated true shall not schedule the pending Probe Response frame transmission to the ProbeRequest frame when the elapsed time after reception of the Probe Request exceeds the time indicated byvalue of the MaxChannelTime field of the Probe Response Reception Time element of the Probe Requestframe." | Reject. See Resolution of CID 3377 (Duplicated CID) |
| 3315 | 10.1.4.3.9 | 76 | 54 | "If the Probe Response Reception Time element is present in the Probe Request frame, the responding STA with dot11FILSActivated true shall discard the pending untransmitted Probe Response frame to the Probe Request frame when the elapsed time after reception of the Probe Request exceeds the time indicated byvalue of the MaxChannelTime field of the Probe Response Reception Time element of the Probe Request frame." Is reception measured at the beginning or the end, or some other point, of the receiving packet? The queuing delay and channel access delay are non-deterministic. Does an AP need to suspend transmission of a frame after it's already being enqueued? Also, the time of reception needs to be precisely. Additionally, modify the sentence to indicate that this requirement only applies to FILS capable AP. | Clarify the behavior so that it doesn't incur undue implementation complexity. Modify the text accordingly. | Revised. The time measurement at the responding STA should start at the end of the reception of the Probe Request frame by the MAC entity of the STA to compare it with the MaxChannelTime. Changed the text accordingly.AP needs to discard probe response frame even after it is already being enqueued if the elapsed time exceeds the MaxChannelTime to reduce unnecessary transmission of Probe Response.The commenter suggested that this requirement only applies to FILS capable AP, but it is already mentioned in the text. See detailed discussion and editing instruction in 11-13/1317 |
| 3132 | 10.1.4.3.9 | 76 | 54 | "If the Probe Response Reception Time element is present in the Probe Request frame, the responding STA with dot11FILSActivated true shall discard the pending untransmitted Probe Response frame to the Probe Request frame when the elapsed time after reception of the Probe Request exceeds the time indicated byvalue of the MaxChannelTime field of the Probe Response Reception Time element of the Probe Request frame." Is reception measured at the beginning or the end, or some other point, of the receiving packet? The queuing delay and channel access delay are non-deterministic. Does an AP need to suspend transmission of a frame after it's already being enqueued? Also, the time of reception needs to be precisely. Additionally, modify the sentence to indicate that this requirement only applies to FILS capable AP. | Clarify the behavior so that it doesn't incur undue implementation complexity. Modify the text accordingly. | Revised. See Resolution of CID 3315 (Duplicated CID) |
| 2780 | 10.1.4.3.9 | 76 | 55 | Handling of transmission Qs at the AP and handling trigger these with timers is hard to do and not accurate procedure. mandating it puts a high bar on implementation. | change "shall" to "should". | Reject. We already have a mandatory feature (MSDU lifetime of 802.11e) of allowing discarding a frame after lifetime even though the frame is in the queue in the legacy spec, and it is already being implemented in legacy devices. So, mandating this feature is feasible in implementation aspect.See detailed rationale in 11-13/1317 |

Discussion on CIDs 3377, 3355, and 3306

Discarding Probe Response frame when the elapsed time after reception of the Probe Request exceeds the indicated MaxChannelTime means that the Probe Response frame is dropped without being transmitted after the MaxChannelTime.

The elapsed time may exceed the MaxChannelTime before the scheduling or it may exceed the MaxChannelTime after the scheduling and the Probe Response frame shall be dropped for both cases since the STA that has sent the Probe Request cannot receive the Probe Response frame after MaxChannelTime and transmitting the Probe Response frame by the responding STA just increases unnecessary traffic.

The commenter suggested the wording “the responding STA shall not schedule a pending Probe Response frame transmission when the elapsed time after reception of the Probe Request exceeds the indicated MaxChannelTime”, but this misses the second case. If the elapsed time did not exceed the MaxChannelTime, Probe Response frame is scheduled for transmission, but it may exceed the MaxChannelTime after scheduling, for example, during backoff procedure or waiting for transmission or retransmission, if the network is very crowded and the responding STA suffers from severe contention and collision. The scheduled Probe Response shall be dropped after the MaxChannelTime even for those cases.

Backoff procedure is per AC. If the backoff procedure is ongoing to transmit the Probe Response which is categorized in AC\_BE but the elapsed time exceeds the MaxChannelTime, it is discarded but the backoff procedure goes on for AC\_BE and the next scheduled frame in AC\_BE will be transmitted instead of the discarded Probe Response frame.

**Proposed resolution**:

Reject

Discussion on CIDs 3315 and 3132

The requesting STA starts a ProbeTimer after it transmits a Probe Request frame (specified in 802.11-2012). It will receive Probe Responses during MaxChannelTime.

The responding STA can check the MaxChannelTime value indicated in the Probe Request frame after the frame is received and decoded by the MAC entity of the STA and it can start to check whether the elapsed time exceeds the MaxChannelTime indicated in the Probe Request frame.



If the responding STA starts to measure MaxChannelTime after its MAC entity receives the probe request frame, then there is a delay between requesting STA’s starting point of counting MaxChannelTime and receiving STA’s MaxChannelTime.

The delay is as follows:

aAirPropagationTime + aRxRFDelay + aRxPLCPDelay

+ Time to decode Probe Request frame at MAC (< aMACProcessingDelay))

aRxRFDelay + aRxPLCPDelay is the time between receipt of the last bit of the provided octet from the WM and the receipt of it by the MAC entity.

For OFDM PHY, aAirPropagationTime << 1 ㎲, and aSIFSTime is 16 ㎲.

aSIFTime = aRxRFDelay + aRxPLCPDelay + aMACProcessingDelay + aRxTxTurnaroundTime = 16 ㎲

So, the total delay is less than 16 ㎲.

MaxChannelTime is implementation specific, but if we assume it is 20 ~ 30 ms,

the delay is just less than 0.05 ~ 0.08 % and the delay can be ignored.

So the time measurement at the responding STA may be started at the end of the reception of the Probe Request frame by the MAC entity of the STA to compare it with the MaxChannelTime.

(Changed the text accordingly).

The queuing delay and channel access delay are non-deterministic and an AP needs to discard probe response frame even after it is already being enqueued if the elapsed time exceeds the MaxChannelTime to reduce unnecessary transmission of Probe Response.

MSDU lifetime is defined in legacy spec, and it uses the similar concept of discarding a frame after lifetime even though the frame is in the queue, so the concept of dropping the enqueued frame is feasible.

The commenter suggested that this requirement only applies to FILS capable AP, but it is already mentioned in the text.

“the responding STA with dot11FILSActivated true shall discard…” means that this feature only applies to FILS capable AP.

**Proposed resolution**:

Revised.

See editing instruction in 11-13/1317.

Discussion on CID 2780

MSDU lifetime is defined in legacy spec, and it uses the similar concept of discarding a frame after lifetime even though the frame is in the queue.

MSDU lifetime is a useful feature since transmitting a frame too late is not meaningful to many applications requiring QoS, and MSDU lifetime can reduce such unnecessary frame transmission.

Discarding Probe Response using MaxChannelTime indicated in the Probe Request also provides similar feature, since transmitting Probe Response after MaxChannelTime is not meaningful to the requesting STAs since they cannot receive Probe Response after MaxChannelTime, and discarding the probe response using MaxChannelTime field can reduce such unnecessary frame transmission.

MSDU lifetime is a mandatory feature of 802.11.

“QSTAs shall maintain a transmit MSDU timer for each MSDU passed to the MAC. The MIB attribute dot11EDCATableMSDULifetime specifies the maximum amount of time allowed to transmit an MSDU for a given AC. The transmit MSDU timer shall be started when the MSDU is passed to the MAC. If the value of this timer exceeds the appropriate entry in dot11EDCATableMSDULifetime, then the MSDU, or any remaining, undelivered fragments of that MSDU, shall be discarded by the source QSTA without any further attempt to complete delivery of that MSDU.”

We already have a mandatory feature of allowing discarding a frame after lifetime even though the frame is in the queue in the legacy spec, and it is already being implemented in legacy devices. So, mandating this feature is feasible in implementation aspect.

Comments (CID 2777, 2768, and 2453)

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| **CID** | **Clause**  | **Page** | **Line** | **Comment** | **Proposed Change** | **Proposed****Resolution** |
| 2777 | 10.1.4.3.8 | 76 | 35 | if the Probe Response Reception time element is not present the default value of MaxProbeResponseTime should be used. however this text is non specific as to what should the AP STA do in this case. | in case a the Probe Req from an 11ai STA did not include a Probe Response Reception Time Element, limit the AP to compare the time difference to the next TBTT to within the defualt MaxProbeResponseTime. | Reject. The behavior is the same as the legacy Probe Response transmission procedure.If the default MaxProbeResponseTime used by the responding STA is too short compared with the MaxChannelTime value of the requesting STA, the requesting STA might not receive Probe Response frame from the responding STA. See detailed rationale in 11-13/1317 |
| 2768 | 10.1.4.3.5 | 74 | 1 | it is not clear how MaxChannelTime is different than other parameters coming from MLME-SCAN.request and resulting in a fields within the Probe Request and its IEs. | remove paragraph 1 L1-4 in p74. | Reject. The MaxChannelTime may be present in Probe Request. When the field is present, the description how to set the field need to be provided.  |
| 2453 | 10.1.4.3.5 | 74 | 2 | Clarification, since sentence is not complete | When present, the MaxChannelTime field of the Probe Response Reception Time element of the Probe Request frame is set to the MaxChannelTime of the MLME-SCAN.request as defined in 8.4.2.178 | Revised. See editing instruction in 11-13/1317 |

Discussion on CID 2777

The behavior when Probe Response Reception time element (MaxChannelTime field) is not included in the Probe Request frame is not specified in the 11ai Draft, and it means that the behavior is the same as the legacy Probe Response transmission procedure.

In legacy spec, MaxChannelTime field is not included in the Probe Request frame and the MaxChannelTime value of the requesting STA is not known to the responding STA.

When the legacy STA responds with Probe Response frame and if it is not successful, it retransmits the Probe Response frame until the retry limit.

802.11ai STA should follow the same transmission rule if MaxChannelTime field is not included in the Probe Request frame, and we do not have to mention it in the 11ai draft.

The commenter suggested that default MaxProbeResponseTime should be used, but if the requesting STA does not include MaxChannelTime field in the Probe Request frame, the responding STA does not know how long the requesting STA will be available to receive the Probe Response. Without any indication from the requesting STA, responding STA’s default MaxProbeResponseTime is different from the MaxChannelTime of the requesting STA, and if the default MaxProbeResponseTime used by the responding STA is too short compared with the MaxChannelTime value of the requesting STA, the requesting STA might not receive Probe Response frame from the responding STA. It is safe to use legacy rule if the responding STA do not know the MaxChannelTime of the requesting STA.

**Proposed resolution**:

Reject

Comments (CID 3340 and 2954)

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| **CID** | **Clause**  | **Page** | **Line** | **Comment** | **Proposed Change** | **Proposed****Resolution** |
| 3340 | 10.1.4.3.9 | 76 | 48 | To send or not to send | This subclause seems to offer even more conditions that should have been included in 10.1.4.3.7 criteria for sending a probe response so it should be merged with that subclause | Revised. See editing instruction in 11-13/1317 |
| 2954 | 10.1.4.3.9 | 76 | 48 | To send or not to send | This subclause seems to offer even more conditions that should have been included in 10.1.4.3.7 criteria for sending a probe response so it should be merged with that subclause | Revised. See Resolution of CID 3340 (Duplicated CID) |

Discussion on CID 3340 and 2954

**10.1.4.3.9 Sending a response to probe request**

“If the Probe Response Reception Time element is present in the Probe Request frame, the responding STA with dot11FILSActivated true shall discard the pending untransmitted Probe Response frame to the Probe Request frame when the elapsed time after reception of the Probe Request exceeds the time indicated by value of the MaxChannelTime field of the Probe Response Reception Time element of the Probe Request frame.”

The above sentence is related to Probe Response criteria, so it is better to move it to **10.1.4.3.7 Criteria to respond to probe request**.

**Proposed resolution**:

Revised.

See editing instruction in 11-13/1317

Comments (CID 2778 and 2043)

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| **CID** | **Clause**  | **Page** | **Line** | **Comment** | **Proposed Change** | **Proposed****Resolution** |
| 2778 | 10.1.4.3.9 | 76 | 50 | This paragraph make non 11ai and Legacy station non std compliant, an 11ai AP with Dot11FILSActivated will send broadcast Probe Rsp, the ACTIVE SCAN procedure at a legacy or non 11ai STA will be "waiting on event" which is unicast (directed frame) and thus procedure will fail. | Limit transmission of Broadcast Probe Rsp to STA's indicating FILS support. | Reject. If the Probe Response frame is broadcasted, then even the legacy or non 11ai STA can receive it. Every STA receives the frame with broadcast address. In 11ai, there is no way to indicate that the STA supports FILS in Probe Request frame.Defining FILS indication in Probe Request frame is beyond the scope of this comment resolution.See detailed rationale in 11-13/0xxx  |
| 2043 | 10.1.4.3.9 | 76 | 48 | "If dot11FILSActivated is true, Probe Response frames shall be transmitted either as directed frames to theaddress of the STA that generated the probe request or to the broadcast address. If dot11FILSActivated isfalse, Probe Response frames shall betransmitted as directedframes to the address of the STA that generated the probe request."This confuses the use of transmitted Probe Response frames as a condition with an action. i.e. "If dot11FILSActivated is true, Probe Response frames shall be transmitted" may be interpreted as an instructuction to continuously transmit these frames. | Reword to clarify the event as part of the condition. e.g."A STA in which dot11FILSActivated is true that transmits a Probe Response frame shall set the Address 1 field to theaddress of the STA that generated the probe request or shall set it to the broadcast address. ... <similar changes to next sentence and next subclause>" | Revised. See editing instruction in 11-13/0xxx  |

Discussion on CID 2778

If the Probe Response frame is broadcasted, then even the legacy or non 11ai STA can receive it. Every STA receives the frame with broadcast address. Once the broadcasted Probe Response frame is received by the legacy or non 11ai STA, it will decode it and it can determine that it is a Probe Response frame.

There is no explicit rule in the existing spec that the STA should only use the unicast Probe Response frames.

In current 11ai Draft, there is no way to indicate that the STA supports FILS in Probe Request frame. There is no mandatory field that indicates the FILS support in the Probe Request frame. Defining FILS indication in Probe Request frame is beyond the scope of this comment resolution.

**Proposed resolution**:

Rejected.

Discussion on CID 2043

Agree with the commenter.

**Proposed resolution**:

Revised.

See editing instruction in 11-13/1317

Comments (CID 3011)

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| **CID** | **Clause**  | **Page** | **Line** | **Comment** | **Proposed Change** | **Proposed****Resolution** |
| 3011 | 10.1.4.3.9 | 76 | 48 | In the sentence "If dot11FILSActivated is true, Probe Response frames shall be transmitted either as directed frames to the address of the STA that generated the probe request or to the broadcast address." the Probe Response frames are transmitted either as unicast or broadcast frames but it does not say when to use unicast or broadcast. If a STA is allowed to choose either one without any condition and all STAs decide to respond with broadcast Probe Response frames, the reliability of reception of the Probe Response frames drops because there is no retransmissions for broadcast frames. | The spec should indicate when to transmit unicast or broadcast Probe Response frames. | RejectBroadcast Probe Response should be used in very congested environment, but how to decide network is congested so that the Probe Response should be used is implementation issue for AP and cannot be included in the spec.See detailed rationale in 11-13/1317  |

Discussion on CID 3011

Unicast Probe Response and broadcast Probe Response have cons and pros.

Broadcast Probe Response is good for reducing network traffic caused by Probe Response flooding, but it does not provide reliability of reception of the frame.

Unicast Probe Response provides better reliability than broadcast probe response, but it will increase the network traffic compared with broadcast Probe Response. When network is very congested and if unicast Probe Response is used, STAs may not receive the Probe Response during their MaxChannelTime and might not find the AP. In such congested situation, Broadcast Probe Response should be used, but it is AP’s decision whether the network is congested and whether to use Broadcast Probe Response or not. How to decide network is congested so that the Probe Response should be used is implementation issue and cannot be included in the spec.

**Proposed resolution**:

Reject

**Editing Instructions 1**:

***Change the sentence in Section 10.1.4.3.5 of TGai Draft D1.1 as follows: (P76L22)***

A Probe Request frame may contain MaxChannelTime field in the FILS Request Parameters element ~~Probe Response Reception Time element~~. When ~~present,~~ the MaxChannelTime field of the FILS Request Parameters ~~Probe Response Reception Time~~ element of the Probe Request frame is present, the value of the MaxChannelTime field is set to the MaxChannelTime of the MLME-SCAN.request as defined in 8.4.2.178.

**Editing Instructions 2**:

***Move the following sentence from Section 10.1.4.3.9 (Sending a response to probe request) to Section 10.1.4.3.7(Criteria to respond to probe request) and modify the sentence in TGai Draft D1.1 as follows: (after line 37(after bullet f)) in Page 78)***

**10.1.4.3.9 Sending a response to probe request**

~~If the Probe Response Reception Time element is present in the Probe Request frame, the responding STA with dot11FILSActivated true shall discard the pending untransmitted Probe Response frame to the Probe Request frame when the elapsed time after reception of the Probe Request exceeds the time indicated by value of the MaxChannelTime field of the Probe Response Reception Time element of the Probe Request frame.~~

**10.1.4.3.7 Criteria to respond to probe request**

**……**

If the MaxChannelTime field of the FILS Request Parameters element ~~Probe Response Reception Time element~~ is present in the Probe Request frame, the responding STA with dot11FILSActivated true shall discard the pending untransmitted Probe Response frame to the Probe Request frame when the elapsed time measured from the end of the ~~after~~ reception of the Probe Request frame by the MAC entity of the responding STA exceeds the time indicated by value of the MaxChannelTime field of the ~~Probe Response Reception Time~~ FILS Request Parameters element of the Probe Request frame.

**Editing Instructions 3**:

***Change the sentence in Section 10.1.4.3.9 of TGai Draft D1.1 as follows: (P79L8)***

**10.1.4.3.9 Sending a response to probe request**

~~If dot11FILSActivated is true, Probe Response frames shall be transmitted either as directed frames to the~~

~~address of the STA that generated the probe request or to the broadcast address. If dot11FILSActivated is~~

~~false, Probe Response frames shall be transmitted as directed frames to the address of the STA that generated the probe request.~~

A STA in which dot11FILSActivated is true that transmits a Probe Response frame shall either set the Address 1 field to the address of the STA that generated the probe request or shall set it to the broadcast address. A STA in which dot11FILSActivated is false that transmits a Probe Response frame shall set the Address 1 field to the address of the STA that generated the probe request.

***Change the sentence in Section 10.1.4.3.9 of TGai Draft D1.1 as follows: (P79L31)***

A STA in which ~~If~~ dot11InterworkingServiceActivated is true~~, the STA~~ may include in the Probe Response frame a ANQP Configuration Sequence Number element containing the current sequence number of the AP's GAS configuration information. The current AP's ANQP Configuration information can be acquired by GAS query mechanism as described in 10.24.3.