IEEE P802.11
Wireless LANs

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| Resolution for CID related to 35.3.8 BSS parameter critical update procedure |
| Date: 2021-03-25 |
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Abstract

This document proposes resolution for CID 2440 related 35.3.8 BSS parameter critical update procedure.

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Added nontransmitted BSSID case
* Rev 2: Revised spec text to clarify and added introduction clause for discussion
* Rev 3: Added a new Flag for beacon approach

***TGbe editor: Please note that baseline is 11be D1.0***

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

***Editing instructions formatted like this are intended to be copied into the TGbe Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGbe Editor: Editing instructions preceded by “TGbe Editor” are instructions to the TGbe editor to modify existing material in the TGbe draft. As a result of adopting the changes, the TGbe editor will execute the instructions rather than copy them to the TGbe Draft.***

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| **CID** | **Pg/Ln** | **Section** | **Comment** | **Proposed Change** | **Resolution** |
| 2440 | 137/52 | 35.3.8 | An AP may provide critical update information in an unsolicited broadcast ML Probe Response frame so that most clients are able to receive the updates and suppress their ML Probe Request to receive the update. | Please design a method to provide the critical update information when the critical update event is occurred on the AP. | **Revised**The Unsolicited PRCU (Unsolicited Probe Responses for Critical Update) Flag subfield was added to the Capability information field (Figure 9-85). An AP of an AP MLD sets the Unsolicited PRCU Flag subfield to 1 when a critical update occurs to any of elements for any AP on the same AP MLD. Otherwise the AP sets the subfield to 0.The AP that indicates the Unsolicited PRCU subfield is set to 1 in the Beacon frame shall send unsolicited broadcast Probe Response frame(s) including the updated BSS parameters for the AP that the critical update occurred until (and including) the next DTIM Beacon frame on the link that the AP is operating on.Also, if a non-AP STA of non-AP MLD receives the Beacon frame or Probe Response frame it transmits the Unsolicited PRCU Flag is set to 1, the non-AP STA shall not send Probe Request frame until next DTIM Beacon frame to avoid probe storm that could arise with the critical update event.**TGbe editor please implement changes as shown in doc 11-21/0501 tagged as 2440.** |

1. **Introduction**

We’ve discussed some of the options to provide the updated BSS parameters occurred as critical update of other APs.

This document describes cons and pros of each options for discussion and proposes the unsolicited broadcast Probe Response frame for critical update.

**Some of the options being discussed include:**

* Probe on affected link or listen to beacon on the affected link
	+ Issues:
		- Has a power impact since the non-AP MLD is required to wake-up on the affected link
		- Transition on the affected link is not smooth – the non-AP MLD needs to first receive the updates before operating on that link
		- Not suitable for single radio non-AP MLD
* Probe on the reporting link
	+ Benefit:
		- Aids power-save – i.e., non-AP MLD is not required to wake-up on the affected link
	+ Issue:
		- Leads to probe storm issue
* Include the updates in the Beacon frame on the reporting link
	+ Benefit:
		- Aids power-save – i.e., non-AP MLD is not required to wake-up on the affected link
	+ Issue:
		- Leads to beacon bloating

Each of the above scheme has major shortcomings.

**Providing updates via an unsolicited broadcast Probe Response frame for Critical Update (PRCU) on the reporting link is the most suitable option**

* Satisfies various requirements & constraints (such as power-save, beacon bloating, probe storm)
* A non-AP MLD can send an ML Probe Request if the AP is no longer sending an unsolicited PRCU carrying the update for another AP of the MLD.
* Unsolicited PRCU Flag in Beacon frame signals if the AP intends to transmit unsolicited PRCU during the beacon interval
	+ Non-AP MLD can make probing decisions based on such signaling
	+ It is recommended that the AP transmits UBPRF until (and including) the DTIM beacon on the reporting link so that most STAs receive the update
* It is recommended that AP transmits unsolicited PRCU at robust rates (same as Beacon frame) to improve the reliability of the frame
* Maintain compliance with existing rules (such as 20 TU for 6 GHz) for sending the unsolicited PRCU.
1. **Proposed spec text**

**9.4.1.4 Capability Information field**

***TGbe editor: Change Figure 9-85 (Capability Information field format (non-DMG STA)) as follows (#2440):***

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 |
|  | ESS | IBSS | Reserved | Reserved | Privacy | Short Preamble | Critical Update Flag | Presence of Critical Update |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 |
|  | SpectrumManagement | QoS | Short Slot Time | APSD | Radio Measurement | EPD | Unsolicited PRCU Flag | Reserved |

Figure 9-85—Capability Information field format (non-DMG STA)

***TGbe editor: Please insert the following paragraphs after the last paragraph of section 9.4.1.4 and before the NOTE:***

(#2440) The Presence of Critical Update subfield is reserved except when the Capability Information field is carried in a Beacon or Probe Response frame transmitted by an AP affiliated with an AP MLD.

An AP affiliated with an AP MLD sets the Presence of Critical Update subfield to 1 if the AP includes a Basic variant Multi-Link element carrying any of the elements which is updated as critical update defined in 11.2.3.15 (TIM Broadcast) for another AP affiliated the same AP MLD as the AP within the Beacon frame transmitted by the AP. Otherwise, the AP sets the subfield to 0.

The Unsolicited Probe Responses for Critical Update (PRCU) Flag subfield is reserved except when the Capability Information field is carried in a Beacon transmitted by an AP affiliated with an AP MLD.

An AP affiliated with an AP MLD sets the Unsolicited PRCU Flag subfield to 1 if the AP has schedule for transmission of an unsolicited broadcast Probe Response frame carrying any of the elements which is updated as critical update defined in 11.2.3.15 (TIM Broadcast) for another AP affiliated the same AP MLD as the AP. Otherwise, the AP sets the subfield to 0.NOTE—An AP sets the Critical Update Flag subfield value, the Presence of Critical Update subfield value, and the Unsolicited PRCU Flag subfield value to 1 in one or more Beacon frames by following the procedure defined in 35.3.8 (BSS parameter critical update procedure).

***TGbe editor: Please modify the clause 35.3.8 as shown below (Track Changes ON):***

**35.3.8 BSS parameter critical update procedure**

If an AP affiliated with an AP MLD is not in a multiple BSSID set or the AP corresponds to a transmitted BSSID in a multiple BSSID set, the AP shall

* include in the Beacon and Probe Response frames it transmits a BSS Parameters Change Count subfield for each of all APs affiliated with the same AP MLD as the AP.
* The BSS Parameters Change Count subfield value for each AP is initial­ized to 0, and shall be incremented (modulo 256) when a critical update occurs to the operational parameters for that AP as defined in 11.2.3.15 (TIM Broadcast).
* The BSS Parameters Change Count subfield for each of other APs affiliated with the AP MLD shall be carried in the MLD Parameters subfield in the TBTT Information field of the Reduced Neighbor Report element corresponding to that AP.
* The BSS Parameters Change Count subfield for the AP shall be carried in the Common Info field of the Basic variant Multi-Link element.
* provide in the Critical Update Flag subfield of the Capability Information field (9.4.1.4 (Capability Information field)) of the Beacon and Probe Response frames it transmits an indication of an update to the value carried in the BSS Parameters Change Count subfield of the MLD Parameters field in the Reduced Neighbor Report element for any AP affiliated with the same AP MLD as the AP or the value carried in the BSS Parameters Change Count subfield in the Common Info field of the Basic variant Multi-Link element.
* Set the Critical Update Flag subfield of the Capability Information field to 1 in the Beacon frame(s) until and including the next DTIM Beacon frame on the link on which the AP is operat­ing if there is a change to a value carried in the BSS Parameters Change Count subfield of the MLD Parameters field in the Reduced Neighbor Report element for any AP in the same AP MLD as the AP or a value carried in the BSS Parameters Change Count subfield in the Common Info field of the Basic variant Multi-Link element.
* Otherwise set the Critical Update Flag subfield of the Capability Information field to 0.
* (#2440) provide in the Presence of Critical Update subfield of the Capability Information field defined in 9.4.1.4 (Capability Information field) of the Beacon it transmits whether or not the Beacon frame carries any of elements for critical update for any AP affiliated with the same AP MLD as the AP.
* Set the Presence of Critical Update subfield of the Capability Information field to 1 in the Beacon frame(s) until and including the next DTIM Beacon frame on the link on which the AP is operating if the AP includes a Basic variant Multi-Link element carrying the updated elements with respect to critical update within the Beacon frame it transmits.
* Otherwise set the Presence of Critical Update subfield of the Capability Information field to 0.
* provide in the Unsolicited PRCU Flag subfield of the Capability Information field defined in 9.4.1.4 (Capability Information field) of the Beacon it transmits an indication of its intent to transmit an unsolicited Probe Response frame for critical update for any AP affiliated with the same AP MLD as the AP.
* Set the Unsolicited PRCU Flag subfield of the Capability Information field to 1 in the Beacon frame(s) until and including the next DTIM Beacon frame on the link on which the AP is operating if the AP intends to send unsolicited broadcast Probe Response frame carrying the updates elements with respect to critical update.
* Otherwise set the Unsolicited PRCU Flag subfield of the Capability Information field to 0.

If an AP affiliated with an AP MLD is not in a multiple BSSID set or the AP corresponds to a transmitted BSSID in a multiple BSSID set, the AP that sets the Critical Update Flag subfield of the Capability Information field to 1 and

* the Presence of Critical Update subfield of the Capability Information field to 1 in the Beacon frame(s) it transmits shall include in the Beacon frame(s) a Basic variant Multi-Link element that contains one or more Per-STA Profile subelement(s) corresponding to the reported AP(s) affiliated with the same AP MLD as the AP where the critical update occurred, each of which Per-STA Profile subelement contains at least the element(s) changed from the most recent critical update.
* the Unsolicited PRCU Flag subfield of the Capability Information field to 1 in the Beacon frame(s) it transmits shall send ML probe response(s) that sets Address 1 field to broadcast address and carries a Basic variant Multi-Link element that contains one or more Per-STA Profile subelement(s) corresponding to the reported AP(s) affiliated with the same AP MLD as the AP where the critical update occurred, each of which Per-STA Profile subelement contains at least the element(s) changed from the most recent critical update. The unsolicited Probe Response frame shall be sent every 20TUs or less after transmission of Beacon frame that sets the Unsolicited PRCU Flag to 1 until it transmits the Beacon frame where the Unsolicited PRCU Flag sets to 0.

If an AP affiliated with an AP MLD is a nontransmitted BSSID in a multiple BSSID set, then the AP that corresponds to the transmitted BSSID in the same multiple BSSID set shall

* include in the Beacon and Probe Response frames it transmits a BSS Parameters Change Count subfield for each of all APs affiliated with the same AP MLD as the AP corresponding to the non-transmitted BSSID
* The BSS Parameters Change Count subfield value for each AP is initial­ized to 0, and shall be incremented (modulo 256) when a critical update occurs to the operational parameters for that AP as defined in 11.2.3.15 (TIM Broadcast).
* The BSS Parameters Change Count subfield for each of other APs affiliated with the AP MLD shall be carried in the MLD Parameters subfield in the TBTT Information field of the Reduced Neighbor Report element corresponding to that AP.
* The BSS Parameters Change Count subfield for the nontransmitted BSSID shall be carried in the Common Info field of the Basic variant Multi-Link element carried in Nontrans­mitted BSSID Profile subelement of the Multiple BSSID element.
* provide in the Critical Update Flag subfield of the Nontransmitted BSSID Capability element (for that nontransmitted BSSID) an indication of an update to the value carried in the BSS Parameters Change Count subfield of the MLD Parameters field in the Reduced Neighbor Report element for any AP affiliated with the same AP MLD as the AP corresponding to the nontransmitted BSSID or a value carried in the BSS Parameters Change Count subfield in the Common Info field of the Basic variant Multi-Link element in the Nontransmitted BSSID Profile corresponding to the nontransmitted BSSID
* Set the Critical Update Flag subfield of the Capability Information field to 1 in the Beacon frame(s) until and including the next DTIM Beacon frame of the nontransmitted BSSID if there is a change to a value carried in the BSS Parameters Change Count subfield of the MLD Param­eters field in the Reduced Neighbor Report element for any AP in the same AP MLD as the AP corresponding to the nontransmitted BSSID or a value carried in the BSS Parameters Change Count subfield in the Common Info field of the Basic variant Multi-Link element in the Non­transmitted BSSID Profile corresponding to the nontransmitted BSSID.
* Otherwise, set the Critical Update Flag subfield of the Capability Information field to 0.
* (#2440) provide in the Presence of Critical Update subfield of the Nontransmitted BSSID Capability element (for that nontransmitted BSSID) of the Beacon it transmits whether or not the Beacon frame carries any of elements for critical update for any AP affiliated with the same AP MLD as the AP corresponding to the nontransmitted BSSID.
* Set the Presence of Critical Update subfield of the Nontransmitted BSSID Capability element to 1 in the Beacon frame(s) until and including the next DTIM Beacon frame on the link on which the AP is operating if the AP includes a Basic variant Multi-Link element carrying the updated elements with respect to critical update within the Beacon frame it transmits.
* Otherwise set the Presence of Critical Update subfield of the Nontransmitted BSSID Capability element to 0.
* provide in the Unsolicited PRCU Flag subfield of the Nontransmitted BSSID Capability element (for that nontransmitted BSSID) of the Beacon it transmits an indication of its intent to transmit an unsolicited Probe Response frame for critical update for any AP affiliated with the same AP MLD as the AP corresponding to the nontransmitted BSSID.
* Set the Unsolicited PRCU Flag subfield of the Nontransmitted BSSID Capability element to 1 in the Beacon frame(s) until and including the next DTIM Beacon frame on the link on which the AP is operating if the AP intends to send unsolicited broadcast Probe Response frame carrying the updates elements with respect to critical update.
* Otherwise set the Unsolicited PRCU Flag subfield of the Nontransmitted BSSID Capability element to 0.

If an AP affiliated with an AP MLD is not in a nontransmitted BSSID in a multiple BSSID set, then the AP that corresponds to the transmitted BSSID in the same multiple BSSID set and that sets the Critical Update Flag subfield of the Nontransmitted BSSID Capability element to 1 and

* the Presence of Critical Update subfield of the Nontransmitted BSSID Capability element to 1 in the Beacon frame(s) it transmits shall include in the Beacon frame(s) a Basic variant Multi-Link element that contains one or more Per-STA Profile subelement(s) corresponding to the reported AP(s) affiliated with the same AP MLD as the AP where the critical update occurred, each of which Per-STA Profile subelement contains at least the element(s) changed from the most recent critical update.
* the Unsolicited PRCU Flag subfield of the Nontransmitted BSSID Capability element to 1 in the Beacon frame(s) it transmits shall send ML probe response(s) that sets Address 1 field to broadcast address and carries a Basic variant Multi-Link element that contains one or more Per-STA Profile subelement(s) corresponding to the reported AP(s) affiliated with the same AP MLD as the AP where the critical update occurred, each of which Per-STA Profile subelement contains at least the element(s) changed from the most recent critical update. The unsolicited Probe Response frame shall be sent every 20TUs or less after transmission of Beacon frame that sets the Unsolicited PRCU Flag to 1 until it transmits the Beacon frame where the Unsolicited PRCU Flag sets to 0.

If a non-AP STA affiliated with a non-AP MLD receives a Beacon frame or Probe Response frame in which the Unsolicited PRCU Flag subfield equals to 1 from an AP MLD with which the non-AP MLD has performed a multi-link setup, the non-AP STA should not send any Probe Request frame to retrieve the updated BSS parameters before it receives the Beacon frame or Probe Response frame where the Unsolicited PRCU Flag subfield sets to 0.