IEEE P802.11
Wireless LANs

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| Proposed Text Changes for Client Management |
| Date: 2017-09-011 |
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Abstract

This submission proposes resolutions for the client management (e.g. client association, roaming, spatial reuse) comment related to TGax D1.0 with the following CID: 5163.

R1: changes highlighted in green. Modified Suggested BSS transition to allow for move to other ESS. Changed “managed ESS” to “Planned ESS”. Added roaming thresholds to assist client.

R2: reverted 11.24.7.4 back to R0. Clarified 11.3.8 that STA is not required to associate with AP in ESS (in blue)

R3: changes highlighted in pink. Added ER BSS to Neighbor report. Moved description of Planned ESS to new subsection. Added collection of BSS color to Neighbor reporting for SR. Collapsed BSS transition threshold to one threshold.

R4: In 11.3.8, changed “Reason Code” to “Status Code”

R5: Elaboration on Beacon report rules for Spatial Reuse. (also reset the highlighting and started with green again.)

R6: Updates from conference call in Blue. Tied RSSI Threshold to Beacon RSSI. Updated Spatial Reuse language

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

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

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **Section** | **Pg / Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 5163 | 10.3.2.4a | P115L46 | Regarding "10.3.2.4a Duration-based RTS/CTS. In dense environments, managing RTS usage by an AP can help the overall interference situation since the AP may have better view of the network situation.", while this a good start in adding control by the AP over non-AP STAs other aspects of client management need to addressed. In an large, dense, managed ESS, the network has much better visibility into the best selection of AP and band that the client should initially associate with and then subsequently select during roaming. The network also needs to be able to control usage of probe request and probe response in an ESS in improve network efficiency. | Add tighter management by the network of client association and roaming | RevisedPlease see document 11-17/YYYYr0 |

**Discussion:**

In order to maximize network efficiency in a dense ESS, the network needs to be able to direct clients to associate/re-associate to the most appropriate AP. One method of doing so is via “**Neighbor report information upon rejection with suggested BSS transition**”, and the clients following the AP’s direction. Furthermore, we need to modify the Neighbor Report element to be HE aware. Clients also need to use the information in the BSS Transition Management request to better inform its decision when roaming in a dense ESS.

TGax Editor: Please modify this section as follows:

**11.3.8 Neighbor report information upon rejection with suggested BSS transition**

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

An HE STA that has received from an HE AP an Authentication or (Re)Association Response frame that has the Status Code field set to REJECTED\_WITH\_SUGGESTED\_BSS\_TRANSITION and that includes one or more Neighbor Report elements for BSSs that are part of the ESS of the HE AP shall, if it re-attempts to associate with the ESS, select an AP from (one of) the Neighbor Report element(s).

TGax Editor: Please modify this section as follows:

**9.4.2.37 Neighbor Report element**

…

The BSSID Information field can be used to help determine neighbor service set transition candidates. It is 4 octets in length and contains the subfields as shown in Figure 9-296.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 B1  | B2  | B3  | B4 B9 | B10  | B11  | B12 | B13 | B14 | B15 | B16 B31 |
|  | APReachability | Security | Key Scope | Capabilities | MobilityDomain | HighThroughput | Very HighThroughput | FTM | High Efficiency | ER BSS | Reserved |
| Bits: | 2 | 1 | 1 | 6 | 1 |  | 1 | 1  | 1 | 1 | 1 | 16 |

**Figure 9-296—BSSID Information field**

…

The FTM field is set to 1 to indicate that the AP represented by this BSSID is an AP that has set the Fine Timing Measurement Responder field of the Extended Capabilities element to 1. The FTM field is set to 0 to indicate either that the reporting AP has dot11FineTimingMsmtRespActivated equal to false, or the reported AP has not set the Fine Timing Measurement Responder field of the Extended Capabilities element to 1 or that the Fine Timing Measurement Responder field of the reported AP is not available to the reporting AP at this time.

The High Efficiency subfield is set to 1 to indicate that the AP represented by this BSSID is an HE AP and that the HE Capabilities element, if included as a subelement in the report, is identical in content to the HE Capabilities element included in the AP’s Beacon frame. Otherwise the High Efficiency subfield is set to 0.

When the High Efficiency subfield is 1 the ER BSS subfield is set to 1 to indicate that the BSS corresponding to the HE AP representing this BSSID is an extended range BSS (see 27.16.5 (ER Beacon Generation in an ER BSS)). Otherwise the ER BSS subfield is set to 0.

Bits 16–31 are reserved.

…

The Subelement ID field values for the defined subelements are shown in Table 9-151.

**Table 9-151—Optional subelement IDs for Neighbor report**

TGax Editor: Add two new rows to Table 9-151 for “HE Operation” and “HE Capabilities” Subelements

**11.24.7.1 BSS transition capability**

***Modify the subclause as follows:***

**…**

Implementation of BSS transition management is optional for a WNM STA that is not a non-AP HE STA. A STA that implements BSS transition management has dot11BSSTransitionImplemented equal to true. When dot11BSSTransitionImplemented is true, dot11WirelessManagementImplemented shall be true. A STAwhose dot11BSSTransitionActivated is true shall support BSS transition management and shall set to 1 the Transition field of the Extended Capabilities elements that it transmits. A non-AP HE STA shall have dot11BSSTransitionImplemented and dot11BSSTransitionActivated equal to true.

The provisions in this clause for BSS transition management and network load balancing do not apply in an

IBSS.

***Modify the subclause as follows:***

**11.24.7.4 BSS transition management response**

When the STAS transition management responsetion management and network load balancing

response primitive.

The STA’s SME may include the result of its BSS transition decision in the Target BSSID field and BTM Status Code field in the MLME-BTM.response primitive. A BTM Status Code field set to a value of 0 (i.e., Accept) indicates the STA will transition from the current BSS. The non-HE STA-HE) indicates the STA will transition from the current BSS. The ode field set to a value of 0 (i.e.,n is true, dot11Wireless to a value of 0 (i.e., Accept) indicating rejection if it is unable to comply with this BSS transition management request.

The HE STA’s SME receiving an MLME-BTM.indication primitive shall issue an MLME-BTM.response primitive with a valid status code not equal to a value of 0 (i.e., Accept) indicating rejection if it is unable to comply with this BSS transition management request.

**Discussion:**

To further assist the roaming capability of clients in a managed ESS, it would be helpful to indicate to the clients that they are infact in a managed ESS and when they reach the physical edge of an ESS. APs that are at the edge of an ESS (e.g. APs near an exit to a stadium of office building) could broadcast such an indication so that clients could prepare for more aggressive roaming or switching to a different system.

TGax Editor: Please modify this section as follows:

**9.4.2.1 General**

***Insert the following new rows into Table 9-77 (Element IDs) (header row shown for convenience):***

|  |  |  |  |
| --- | --- | --- | --- |
| **Element**  | **Element ID**  | **Element ID Extension**  | **Extensible** |
| ESS Report | 255 | <255> | Yes |

TGax Editor: Please add this section as follows:

**9.4.2.XY ESS Report element**

The format of the ESS Report element is shown in Figure 9-XYZ.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |
| Element ID | Length | Element ID Extension | ESS Information |
| Octets: 1 | 1 | 1 | 1 |  |  |  |  |  |  |  |  |

**Figure 9-XYZ—ESS Report element format**

The Element ID, Length and Element ID Extension fields are defined in 9.4.2.1.

The format of the ESS Information field is defined in Figure 9-XYZ1.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| B0  | B1  | B2 | B7 |  |  |  |  |
| Planned ESS | Edge Of ESS | Recommended BSS Transition Threshold Within The ESS |
| Bits: 1 | 1 | 6 |  |  |  |  |  |

**Figure 9-XYZ1—ESS Information field**

The Planned ESS subfield indicates whether the BSS is part of an ESS which is planned with several BSSs in overlapping configuration. This subfield is set to 1 to indicate that the ESS is deployed to ensure blanket coverage over the Extended Service Area (ESA). Otherwise this subfield is set to 0 and the Edge Of ESS and Recommended BSS Transition Threshold Within The ESS subfields are reserved.

The Edge Of ESS subfield indicates whether the BSS is at the edge of the ESS. This subfield is set to 1 to indicate the BSS is at the edge of the ESS. Otherwise this subfield is set to 0.

The Recommended BSS Transition Threshold Within The ESS subfield indicates the RSSI below which an associated STA is recommended to initiate BSS transition to a neighbor BSS belonging to the ESS.

The resolution for the Recommended BSS Transition Threshold Within The ESS subfield is 1 dB. The encoding is defined in Table 9-XYZ1 (Recommended BSS Transition Threshold Within The ESS subfield encoding) .

|  |
| --- |
| Table 9-XYZ1 Recommended BSS Transition Threshold Within The ESS subfield encoding |
| Subfield | Description |
| 0-62 | 100 dBm to 37 dBm |
| 63 | Indicates no recommendation |

The use of the ESS Report element is described in 11.24.27.5.

TGax Editor: Please modify this section as follows:

**9.3.3.1 Beacon frame format**

***Insert the following new rows into Table 9-27 (*Beacon frame body*) (header row shown for convenience):***

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <next number> | ESS Report | The ESS Report element is optionally present when dot11HEOptionImplemented is true; otherwise it is not present. |

TGax Editor: Please modify this section as follows:

**9.3.3.6 Association Response frame format**

***Insert the following new rows into Table 9-30 (*Association Response frame body*) (header row shown for convenience):***

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <next number> | ESS Report | The ESS Report element is optionally present when dot11HEOptionImplemented is true; otherwise it is not present. |

TGax Editor: Please modify this section as follows:

**9.3.3.8 Ressociation Response frame format**

***Insert the following new rows into Table 9-32 (*Reassociation Response frame body*) (header row shown for convenience):***

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <next number> | ESS Report | The ESS Report element is optionally present when dot11HEOptionImplemented is true; otherwise it is not present. |

TGax Editor: Please modify this section as follows:

**9.3.3.10 Probe Response frame format**

***Insert the following new rows into Table 9-34 (*Probe Response frame body*) (header row shown for convenience):***

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <next number> | ESS Report | The ESS Report element is optionally present when dot11HEOptionImplemented is true; otherwise it is not present. |

TGax Editor: Please add this section as follows:

**11.24.7.5 Planned ESS**

The AP can indicate that it is in a planned ESS to assist associated STAs’ roaming. If it does, it indicates whether it is at the physical edge of the ESS, and can provide a recommendation on the RSSI level to consider for BSS transition.

The Planned ESS subfield in the ESS Information field indicates whether the AP is part of an ESS which is planned with several BSSs in overlapping configuration, whereby an associated STA may adjust its BSS transition algorithms accordingly.

Note - in a planned ESS the non-AP STA could use the Recommended BSS Transition Threshold Within The ESS subfield to modify when it starts scanning for a new BSS. However, how the non-AP STA adjusts its BSS transition algorithms is implementation specific and beyond the scope of this standard.

The Edge Of ESS subfield in the ESS Information field indicates to the non-AP STA that it is associated with a BSS at the edge of an ESS (e.g. exit of a building).

Note - the non-AP STA can prepare for more aggressive roaming or the device the non-AP STA is in can prepare for switching to a different system. However, how the non-AP STA uses the edge of an ESS information is implementation specific and beyond the scope of this standard.

The Recommended BSS Transition Threshold Within The ESS subfield indicates to the non-AP STA the Beacon RSSI below which it should initiate a BSS transition. The value of the Edge Of ESS subfield and the Recommended BSS Transition Threshold Within The ESS subfield may be changed by the AP STA if conditions in the ESS change. An HE AP should not change the value of the Planned ESS subfield within the lifetime of the BSS.

**Discussion:**

The AP/network management entity is also going to need information from the STAs engaging in Spatial Reuse. As SR changes the interference environment, the AP/network management entity needs information from the Beacon Report to map the interference environment and make intelligent SR parameter, channel number, and channel bandwidth settings. Without such information, STAs may cause undo interference and reduce network capacity, counter to the goal of Spatial Reuse.

TGax Editor: Please modify this section as follows:

**27.9 Spatial reuse operation**

**27.9.1 General**

The objective of the HE spatial reuse operation is to improve the system level performance, the utilization of medium resources and power saving in dense deployment scenarios by early identification of signals from overlapping basic service sets (OBSSs) and interference management.

When the conditions specified in 27.9 (Spatial reuse operation) are met that allow the transmission of an SR PPDU, an HE STA may transmit an SR PPDU to either an HE STA or a non-HE STA.

An HE AP participating in spatial reuse may request an associated non-AP HE STA to gather information regarding the neighborhood by sending a Beacon request (as described in 9.4.2.21.7 (Beacon request)). An HE AP shall not set a measurement mode in a Beacon request to an associated STA to a mode that the STA has not explicitly indicated support for via the RM Enabled Capabilities element. An HE AP that sends a Beacon request:

* May request that the non-AP HE STA gather information of BSSes matching a particular BSSID and/or SSID
* May request that the non-AP HE STA generate a report only for the channel the requesting AP is operating on or is considering switching to
* Shall request that the non-AP HE STA include the HE Operation element of neighboring HE APs in order to help determine the BSS Color information of the neighboring AP(s)

An HE AP may use information from Beacon reports from associated STAs to make decisions related to spatial reuse. The exact algorithm is beyond the scope of this specification.

An HE AP shall not send Beacon request to a STA from which it has received an indication that it is incapable of Beacon reporting.

A non-AP HE STA that performs spatial reuse operation shall respond to a Beacon request from its associated AP with a Beacon report as specified in section 11.11.9.1. A non-AP HE STA that does not perform spatial reuse may reject the Beacon request; if it does it shall do so by returning a Beacon report that has an Incapable field equal to 1 in the Measurement Report Mode field.

Note: A non-AP STA might refuse a Beacon request under certain conditions (see 11.11.1 (General))