IEEE P802.11 Wireless LANs

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| Proposed802.11ai Specification Text for AP/Network Status Information |
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Abstract

This submission proposes the 802.11ai specification text for the AP/Network Status information, based on the feature described in Section 6.3,4 in the 802.11ai Specification Framework Document (SFD), 12/0151r14[Ref-1], and also based on a further detailed proposal in Contribution 13/0008[Ref-5].

The numbering of the clauses is taken from 2012 revision of IEEE802.11 standard [Ref-2].

# Introduction

To facilitate a fast initial link setup, a high-level description about the feature of providing AP availability indicator in Beacon / Probe Response has been accepted in Subsection, 6.3.4, in the 802.11ai Specification Framework Document (SFD), 12/0151r14.

The 802.11Task Group (TGai) has issued a new call for contributions for Specification Tex for the TGai detailed Draft Text,12/0992r2[Ref-4].

As a response to the TGai Call-for-Contributions, this document proposes further detailed text for TGai Specification Document, to provide detailed descriptions / specifications for the feature of the AP availability information provisioning.

# Conventions

In this contribution, the proposed 802.11ai Specification Document text will be presented as an amendment text based on the baseline 802.11 standard, 802.11-2012 [Ref-2], and the current TGai draft specification, 11ai/D0.2 [Ref-3]. The following format conventions are used:

1. The new added text is marked as blue underline text;
2. The deleted text is marked as ~~red strikethrough text~~;
3. The unchanged baseline standard text stays in black text in the context of proposed TGai specification text;
4. The editorial instruction is marked as *italic text highlighted by Yellow*;
5. The quoted TGai SFD text is marked as *green italic text*; and
6. Any other text, e.g., discussions, proposed motions, etc., is in black text, but not in the context of proposed TGai specification text.

# Background

Based on Subsection 6.3.4 in TGai Specification Framework Document (SFD) [Ref-1], the following text is included to provide a high-level description about the feature of provisioning the AP availability indicator:

*AP may include an indicator for AP availability to attachment to the Beacon and Probe Response.*

In additions, multiple contributions have been submitted to TGai previously to provide further details about this feature. The following are some examples:

* 1. KDDI: 11/1565r0[Ref-6], AP Status Broadcast
		+ include IEs, e.g., BSS load or other IEs related with AP status and performance in Beacon.
		+ Include WAN Status info in GAS Query Response;
	2. China Mobile contribution: 12/0545r1[Ref-7], Access Control Mechanism for FILS
		+ In 11ai management frames, e.g.: beacon, probe response , GAS, carry the network load information for STA’s AP/Network selection:
		+ the congestion information of the AP; The available bandwidth information etc.
	3. HTC contribution: 12/1051r2[Ref-8], Multi-channel information for AP discovery
		+ AP can attach the loading information of BSSs on other channels in the probe response and beacon, e.g., A condensed and aggregated loading information; Use a coarser unit to represent info such as BSS load, BSS Average access delay, BSS Available Admission Capacity

The purpose of providing AP availability information in Beacon/Probe Response is for the STA to have a fast AP/Network selection, by avoiding selecting a congested or near-congested AP/Network and also by avoiding the query overhead. Note that AP Availability info in Beacon / Probe Response is not about the physical link availability, as it assumes that the STA already can receive Beacon / probe response.

Based on the previous relevant TGai contributions, two more contributions, 12/1271 [Ref-9] and 12/1272 [Ref-10], were submitted to 2012-November TGai meeting, which propose to use the BSS Load IE as defined in Subsection 8.4.2.30 in 802.11-2012 standard[Ref-2], as the BSS/AP Status/load Indicator, and define a new IE, called Backhaul Link Status IE to carry the Backhaul Link Status/Load indicators.

According to the comments/suggestions received in 2012-November discussions, a revised proposal is presented in a new contribution, 13/0008[Ref-5], which:

1. Propose a combined BSS/Backhaul Link Status indication field;
2. Include the BSS/Backhaul link status indication field
	* As an IE in Beacon and Probe Response frames;
	* As a sub-element in Neighbor report;
	* As an optional field in FD frame
	* As an optional field in the Reduced Neighbor Report

This contribution provides corresponding text proposal to describe further details of the BSS/AP and network status information provisioning mechanism as proposed in 13/0008[Ref-5].

# Proposed 802.11ai Specification Text

*Instructions to Editor: insert the following new Subsection under Subsection 8.4.1 in the 802.11-2012 standard:*

**8.4.1.ai1 BSS/BHL (Backhaul Link) Status Field**

The BSS/BHL status field contains the status information of the BSS/AP and the backhaul link. The Backhaul Link (BHL) refers to the communication link that connects the BSS/AP to external networks. The format of the BSS/BHL status field is defined in Figure 8-ai-1.



**Figure 8-ai-1 BSS/BHL Status Field**

The 4-bit BSS status subfield contains the AP/BSS’s average access delay information, which results from scaling down the 8-bit code for average access delay as defined in Section 8.4.2.41 into a 4-bit code as follows:

0: Access Delay < 8us

1 ≤ n ≤ 12: 2 (n+2) us ≤ Access Delay < 2(n+3)us

13: 215us ≤ Access Delay

14: Service unable to access the channel

15: measurement not available

The 1-bit Backhaul Link Up/Down Indicator subfield indicates the operational status of the backhaul link. When the link is Up, it is set to 1; otherwise, it is set to 0.

The 1-bit Backhaul Link Relative Rate Indicator subfield indicates the data rate of the backhaul link relative to the data rate of the AP/BSS. When the data rate of the backhaul link is greater than or equal to the data rate of the AP/BSS, it is set to 1; otherwise it is set to 0.

The 2-bit Backhaul Link Load (BLL) Indicator subfield is a coded indicator, representing the current percentage loading of the backhaul connection. The algorithm to calculate backhaul link load and the measurement duration are implementation dependent. The Backhaul Link Load (BLL) Indicator is coded as follows:

0: BLL < 25%

1: 25% <= BLL < 50%

2: 50% <= BLL < 75%

3: 75% <= BLL

*Instructions to Editor: insert the following new subsection under Subsection 8.4.2 in the 802.11-2012 standard:*

**8.4.2.ai1 BSS/BHL (Backhaul Link) Status Element**

The BSS/BHL (Backhaul Link) Status Element provides the status information of the BSS and the Backhaul Link (BHL), where the Backhaul Link (BHL) refers to the communication link that connects the BSS/AP to external networks. The format of the BSS/BHL Status element is defined in Figure 8-ai-2.



**Figure 8-ai-2 BSS/BHL Status Element Format**

The Element ID field is set to the value given in Table 8-54 for this element.

The Length field is set to 1 octet.

The BSS/BHL Status field is defined in Section 8.4.1.ai1.

If the value of dot11FILSActivated is true, the BSS/BHL Status IE shall be included in Beacon and Probe Response frames.

*Instructions to Editor: insert a row of the BSS/BHL IE in Table 8-54 in the 802.11-2012 standard:*

**Table 8-54—Element IDs**

|  |  |  |  |
| --- | --- | --- | --- |
| **Element** | **Element ID** | **Length of indicated element (in octets)** | **Extensible** |
| ...... |  |  |  |
| BSS/BHL Status (see 8.4.2.ai1) | <ANA> | 1 |  |
| ...... |  |  |  |

*Instructions to Editor: insert a row of the BSS/BHL Status IE in Table 8-20 as a new element in the Beacon Frame Body in the 802.11-2012 standard:*

**Table 8-20 —Beacon frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| ...... |  |  |
| <ANA> | BSS/BHL Status | The BSS/BHL Status Element is present when dot11FILSActivated is true. |
| ...... |  |  |

*Instructions to Editor: insert a row of the BSS/BHL Status IE in Table 8-27 as a new element in the Probe Response Frame Body in the 802.11-2012 standard:*

**Table 8-27 —Probe Response frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| ...... |  |  |
| <ANA> | BSS/BHL Status | The BSS/BHL Status Element is present when dot11FILSActivated is true. |
| ...... |  |  |

*Instructions to Editor: insert a row of the BSS/BHL Status IE in Table 8-115 as a new subelement for the neigbhor report in the 802.11-2012 standard:*

**Table 8-115 —Optional subelement IDs for neighbor report**

|  |  |  |  |
| --- | --- | --- | --- |
| **Subelement ID** | **Name** | **Length field** **(octets)** | **Extensible** |
| ...... |  |  |  |
| <ANA> | BSS/BHL Status | 1 |  |
| ...... |  |  |  |

*Instructions to Editor: insert the following paragraph in Subsection 8.4.2.39, near the end, before the paragraph starting with “The Vendor Specific ...”, in the 802.11-2012 standard:*

The Backhaul Link Status subelement is the same as the Backhaul Link Status element as defined in 8.4.2.ai1.

*Instructions to Editor: in TGai draft specification D0.2, insert a row of the BSS/BHL Status Field in Table 8-221g in Section 8.5.8.34 as a new optional field in the FILS Discovery Frame:*

**Table 8-27 — FILS Discovery frame action field format**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| ...... |  |  |
| <ANA> | BSS/BHL Status | The 1-byte field of BSS/BHL Status is of the format as specified in Figure 8-11ai-1 in 8.4.1.ai1. It is an optional field in the FD frame, and its presence is indicated by an 1-bit BSS/BHL Status Presence indicator in the FD Frame Control. |
| ...... |  |  |

*Instructions to Editor: in TGai draft specification D0.2, replace Figure* ***8-460o*** *in Section 8.5.8.34 by the following figure for the FD Frame Control Format definition:*



**Figure 8-460o — FD Frame Control field format**

*Instructions to Editor: in TGai draft specification D0.2, insert the follow text in Section 8.5.8.34, in line 3 on page 34:*

The 1-bit BSS/BHL Status presence indicator is set to 1 if the BSS/BHL Status field is present in the FD frame body, otherwise it is set to 0.

*Instructions to Editor: in TGai draft specification D0.2, replace Figure* ***8.401cs*** *in line 17 on page 21 by the following figure:*



**Figure 8.401cs — TBTT Information Header subfield**

*Instructions to Editor: in TGai draft specification D0.2, insert the follow text in line 29 on page 21:*

The 1-bit BSS/BHL Status present indicator is set to 1 if the BSS/BHL Status field is present in the TBTT Information field, otherwise it is set to 0.

*Instructions to Editor: in TGai draft specification D0.2, replace Figure* ***8.401ct*** *in line 50 on page 21 by the following figure:*



**Figure 8.401ct - TBTT Information field**

*Instructions to Editor: in TGai draft specification D0.2, insert the follow text in line 4 on page 22:*

The 1-byte field of BSS/BHL Status is of the format as specified in Figure 8-11ai-1 in 8.4.1.ai1. It is an optional subfield in the TBTT information field, and its presence is indicated by an 1-bit BSS/BHL Status Present indicator in the TBTT Information Header subfield.

# Straw-Polls and Motions

The following lists the draft straw-polls and motions that are intended to present to the TGai Group in next Face-to-Face meeting.

**Motion-1:** Include the text proposed in Section 4 of this contribution (13/0011) into the TGai Draft Specification Document (D0.2).

Move:

Second:

Result: Yes: \_\_\_\_\_\_\_\_\_\_\_\_; No: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_; Abstain: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# References:

1. 11-12-0151-14-00ai-Proposed-Specification-Framework-Document.docx
2. IEEE Std 802.11 – 2012
3. IEEE Std 802.11ai/D0.2
4. 11-12-0992-02-00ai-call-for-specification-text-contributions-for-the-tgai-detailed-draft-text
5. 11-13-0008-00-00ai-AP-Network-status-info
6. 11-11-1565-00-00ai-ap-status-broadcast
7. 11-12-0545-01-00ai-access-control-mechanism-for-fils
8. 11-12-1051-02-00ai-multi-channel-information-for-ap-discovery
9. 11-12-1271-00-00ai-tgai-spec-text-proposal-for-ap-network-status-information
10. 11-12-1272-00-00ai-bss-network-status-information-for-a-fast-ap-network-selection