IEEE P802.11 Wireless LANs

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| Proposed802.11ai Specification Text for Passive Scanning Enhancement Based on TGaiSFD |
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Abstract

The submission proposes 802.11ai specification text for the passive scanning enhancements, based on the accepted features and functionalities in the 802.11ai Specification Framework Document (SFD), i.e., Section 6.3.1, in 12/0151r12[Ref-1].

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

# Background

To facilitate a fast initial link setup, high-level descriptions about passive scanning enhancement related features/functionalities have been accepted in 802.11ai Specification Framework Document (SFD), 12/0151r12 .

The 802.11Task Group (TGai) has issued a new call for contributions for Specification Tex for the TGai detailed Draft Text, 12/0992r0 .

As a response to the TGai Call-for-Contributions, this document proposes detailed text for TGaiSpecifiction Document, for the passive scanning enhancement related features / functionalities, based on the TGai SFD.

It should be also pointed out that this contribution is intended to covert the TGai SFD contents about passive scanning enhancements into TGai specification text. As there are still some open issues and missing details in TGai SFD, this contribution is a partial proposal serving as a starting point, not a complete proposal, for passive scanning enhancements in TGai specification document. Follow-up contributions are expected upon further developments about solving the open issues and filling in the missing details.

# Conventions

In this contribution, the proposed 802.11ai Sepcification Document text will be presented as an amendment text based on the baseline 802.11 standard, 802.11-2012 [Ref-2]. The following format conventions are used:

1. The new added text is marked asblue 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.

# Proposed 802.11ai Specification Text

The proposed passive scanning enhancement related text is divided into multiple proposals, each for a specific required change to the baseline standard, 802.11-2012 [Ref-2]. Each proposal is written with the following basic components:

1. some background discussions that may refer back to the 802.11ai SFD;
2. proposed text for the 802.11ai specification document.

After describing the proposals of the required changes for the passive scanning enhancement related text, straw-polls and motions are presented to have further discussions and also request the acceptance of the proposals.

## Proposal 1

This proposal is to provide general descriptions for the FILS Discovery frame generation and usage.

### Discussions

Based on Subsection 6.3.1 in TGai SFD (12/0151r12 [Ref-1]), a smaller and more frequently transmitted MAC management frame (comparing to Beacon frame), called FILS Discovery (FD) frame, is used in 802.11ai to facilitate a fast initial link setup. The following is the relevant text in TGai SFD:

*The 802.11ai shall support improved passive scanning mechanisms to facilitate fast initial link setup, and/or to reduce the air time occupancy of MAC frames used for scanning.*

*The AP may transmit a MAC frame, to be defined as “FILS Discovery Frame”, between full Beacon instances to support a quick AP/Network Discovery for a fast initial link setup.*

*The FILS Discovery Frame may be transmitted periodically and/or non-periodically.*

*If transmitted periodically, the periodicity of the FILS Discovery Frame may be changed.*

*The interval between regular beacon and FILS Discovery Frame shall be no less than dot11aiFILSBeaconMinimumInterval.*

*FILS Discovery frames may be transmitted as non-HT duplicate PPDUs at 20MHz of the 20, 40, 80 and 160 MHz ( given the DFS ownership of the transmiter) at 5GHz band.*

A general description of the FILS Discovery framebased on the above TGai SFD text needs to be provided in the TGai Specification Docuemnt.

There are multiple possible places to provide a general description of the FILS Discovery frame, e.g., in the subsection 10.1.4.2 of Passiving Scanning, or in a newly added TGai FILS procecure section in Chapter 10, e.g., 10.25.

The proposal below chooses a new subsection under TGai procedure.

In addition, we suggest changing the parameter name “*dot11aiFILSBeaconMinimumInterval*” to “dot11FILSFDframeBeaconMinimumInterval”, for a consistent naming convention in TGai.

### Proposed TGai Specification Text

*Instructions to Editor: append a new section as shown belowat the end of Charpter 10 in 802.11-2012:*

**10.25 Fast Initial Link Setup (FILS) Procedures**

**10.25.1 General**

This subclause describes the Fast Initial Link Setup (FILS) procedures that are used for the STAs with dot11FILSActivated equal to true.

**10.25.2 FILS Discovery Frame Generation and Usage**

The FILS Discovery (FD) frame is a broadcast MAC management frame that contains the information to support a quick AP/Network Discovery for a fast initial link setup.The FD frame may be transmitted by a STA that transmits Beacon frames and has dot11FILSActivated equal to true.

The FILS Discovery frame may be transmitted as non-HT duplicate PPDUs at 20MHz of the 20, 40, 80 and 160 MHz (given the DFS ownership of the transmiter) at 5GHz band.

The FILS Discovery frame may be transmitted between Beacon frame instances periodically and/or non-periodically. If transmitted periodically, the periodicity of the FILS Discovery Frame may be changed; and the interval between Beacon frame and the FILS Discovery frame shall be no less than dot11FILSFDframeBeaconMinimumInterval.

If the FILS Discovery frame is transmitted non-periodically, the FD frame shall not be transmitted during dot11FILSFDframeBeaconMinimumInterval before or after the TBTT of the transmitter.

During scanning, when a STA with dot11FILSActivated equal to true receives and decodes a FILS Discovery frame, it uses the information in the FILS Discovery frame as follows:

1. If the SSID in the FD frame matches the SSID parameter or one of the SSIDs in the SSID List parameter in the MLME-SCAN.request primitive, then
	* If the FD frame provides enough information to issue an MLME-SCAN.confirm primitive with the BSSDescriptionFromFDSet, then:
		+ If the Reporting Option in the MLMS-SCAN.request is set to IMMEDIATE, then issue an MLME-SCAN.confirm primitive with the information obtained from the received FD frame;
		+ Otherwise, scan the next channel;
	* Otherwise, continue scanning the channel;
2. Otherwise, scan the next channel.

If all the channels in the ChannelList have been scanned, the MLME shall issue an MLME-SCAN.confirm primitive with the parameters properly set based on the information obtained during the scan.

## Proposal 2

This proposal is to provide the changes that are required in the MLME-SCAN.confirm primitive due to the introduction of FILS Discovrey frame.

### Discussions

The FILS Discovery frame provides an additional mechanism for STA to collect BSS information during scanning. From a received FILS Discovery frame, the MLME may obtain enough information about the BSS to issue an MLME-SCAN.confirm primitive containing the information specifically collected from the FILS Discovery frame. Therefore, supports in the MLME-SCAN.confirm primitive are needed to report the information collection from the FD frames.

The following text is about the FILS Discovery frame content items, in the TGai SFD (12/0151r12 [Ref-1]):

*The following information items shall be included in the FILS Discovery Frame body:*

* *SSID*

 *The FILS Discovery frame may include the information item of Access Network Options, encoded as 1-byte information as defined in Figure 8-352 in 802.11-2012 specification*

*The FILS Discovery frame may include the following information items:*

* *Capability*
* *Access network options*
* *Security*
* *AP Configuration change count*
* *AP’s next TBTT*
* *Neighbor AP’s next TBTT*

The BSS above information items and the MAC address of the STA transmitting FILS Discovery frame constitute the information contained in the MLML-SCAN.confirm primitive reporting the information collected from FD frame.

Also, please note that there are several rows that have an empty box for the “Valid Range” column in the proposed table below for BSS description information collected from the FILS Discovery frame, because the detailed design of those content items in FD frame is still in progress of discussions in TGai. Those empty boxes will be filled in once the accepted detailed design becomes available.

### Proposed TGai Specification Text

*Instructions to Editor:modifythe first three paragraphs in subclause 6.3.3.3.2 on page 109 in the 802.11-2012 standard as marked by the change tracking marks:*

**6.3.3.3.2 Semantics of the service primitive**

The primitive parameters are as follows:

MLME-SCAN.confirm(

BSSDescriptionSet,

BSSDescriptionFromMeasurementPilotSet,

BSSDescriptionFromFDSet,

ResultCode,

VendorSpecificInfo

)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| BSSDescriptionSet | Set ofBSSDescriptions | N/A | The BSSDescriptionSet is returned to indicate the results of the scan request. Itis a set containing zero or more instancesof a BSSDescription. |
| BSSDescriptionFromMeasurementPilotSet | Set of BSSDescriptionFromMeasurementPilots | N/A | TheBSSDescriptionFromMeasurementPilotSet is returned to indicate the results of thescan request derived from measurementpilots. It is a set containing zero or moreinstances of a BSSDescriptionFrom-MeasurementPilot. Present only if thevalue ofdot11RMMeasurementPilotActivated isnonzero. |
| BSSDescriptionFromFDSet | Set of BSS Description from FILS Discovery frames. | N/A | The BSSDescriptionFromFDSet is returned to indicate the results of the scan request derived from FILS Discovery frames. It is a set containing zero or more instances of a BSSDescriptionFromFD. Present only if dot11FILSActivated equal to true. |
| ResultCode | Enumeration | SUCCESS,NOT\_SUPPORTED | Indicates the result of the MLME- SCAN.confirm primitive. |
| VendorSpecificInfo | A set of elements | As defined in8.4.2.28 | Zero or more elements. |

*Instructions to Editor: append the follow text at the end of subclause 6.3.3.3.2 on page 109 in the 802.11-2012 standard:*

Each BSSDescriptionFromFD consists of the following information items:

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| BSSID | MAC Address | N/A | The BSSID of the found BSS. |
| SSID | Octet String | 0 – 32 octets | The SSID of the found BSS.  |
| FD Capability | Capability information field carried in FD frame |  | The advertised capabilities of the BSS in the FD frame.This parameter is optional.  |
| FD Security | Security information field carried in FD frame |  | The advertised security features supported by the BSS in the FD frame.This parameter is optional. |
| Access Network Options | Access Network Options information field | As defined in8.4.2.94 | The advertised access network options of the BSS.This parameter is optional. |
| AP Configuration Change Count | Integer |  | The value of the Configuration Change Count in the BSS.This parameter is optional. |
| AP’s Next TBTT | Integer |  | The information of next Target Beacon Transmission Time of the found BSS.This parameter is optional. |
| Neighbor AP Information | Neighbor AP Information field |  | The information of neighbor BSSs of the found BSS.This parameter is optional. |

## Proposal 3

This proposal is to provide the changes that are needed in Subsection 10.1.4.1 in the baseline standard, 802.11-2012, due to the introduction of the FILS Discovery frame.

### Discussions

The third paragraph in Subsection 10.1.4.1 of the baseline standard, 802.11-2012 [Ref-2], provides a general description of scanning, in which changes are needed to reflect the introduction of the FILS Discovery frame.

### Proposed TGai Specification Text

*Instructions to Editor: modify the third paragraph in Subection 10.1.4.1 of as shown by the change tracking marks.*

Upon receipt of the MLME-SCAN.request primitive, a STA shall perform scanning. The SSID parameter indicates the SSID for which to scan. The SSID List parameter indicates one or more SSIDs for which to scan. To become a member of a particular ESS using passive scanning, a STA shall scan for Beacon frames containing that ESS’s SSID, returning all Beacon frames matching the desired SSID in the BSSDescriptionSet parameter of the corresponding MLME-SCAN.confirm primitive with the appropriate bits in the Capabilities Information field indicating whether the Beacon frame came from an infrastructure BSS or IBSS. If the value of dot11RMMeasurementPilotActivated is greater than 1, the STA shall additionally scan for Measurement Pilot frames, returning in the BSSDescriptionFromMeasure-mentPilotSet parameter all Measurement Pilot frames that equal the requested BSSID of the corresponding MLME-SCAN.request primitive and are not already members of the BSSDescriptionSet. If the value of dot11FILSActivated is true, the STA shall additonally scan for FILS Discovery frames, returning in the BSSDescriptionFromFDSet parameter all FILS Discovery frames that equal the requested BSSID of the corresponding MLME-SCAN.request primitive and are not already members of the BSSDescriptionSet.To actively scan, the STA shall transmit Probe request frames containing the desired SSID or one or more SSID List elements. When the SSID List element is present in the Probe Request frame, one or more of the SSID elements may include a wildcard SSID (see 8.4.2.2). The exact procedure for determining the SSID or SSID List values in the MLME SCAN.request primitive is not specified in this standard. When a STA scans for a BSS whose AP does not support the SSID List element, or for a BSS for which AP support of the SSID List element is unknown, the SSID element with an SSID or wildcard SSID shall be included in the MLME-SCAN.request primitive. Upon completion of scanning, an MLME-SCAN.confirm primitive is issued by the MLME indicating all of the BSS information received.

## Proposal 4

This proposal is to provide the descriptions of the MIB parameters that are required by the passive scanning enhancement features and functionalities introduced by TGai.

### Discussions

The following is a list of the MIB parameters that are required by the passive scanning enhancement features and functionalities introduced by TGai:

1. dot11FILSActivated
2. dot11FILSFDframeBeaconMinimumInterval

The definitions of those MIB parameters are needed to be added to the 802.11 MIB definitions in Annex C of the baseline standard, 802.11-2012 [Ref-2].

### Proposed TGai Specification Text

*Instructions to Editor:Add new MIB parameters as shown below to Annex C.*

dot11FILSActivated OBJECT-TYPE

SYNTAX Boolean

MAX-ACCESS Read-Only

STATUS Current

Description

"This is a capability variable.Its value is determined by device capabilities.This attribute, when true, indicates that the station implementation is capable of supporting fast initial link setup. The capability is disabled, otherwise."

DEFVAL { false }

dot11FILSFDframeBeaconMinimumInterval OBJECT-TYPE

SYNTAX Unsigned8(0..255)

MAX-ACCESS Read-Only

STATUS Current

Description

"This is a control variable.It is written by an external management entity.Changes take effect as soon as practical in the implementation.This attribute indicates the duration in units of miliseconds. It indicates the minimum duration from the transmission of a FILS Discovery frame and the transmission of a Beacon frame. The FILS Discovery frame shall not be transmitted before or after a Beacon frame transmission within a duration defined by this value."

DEFVAL { 20 }

## Proposal 5

This proposal is to provide the descriptions of the FILS Discovery frame format and contents in TGai Specification document.

### Discussions

Based on the TGai SFD (12/0151r12 [Ref-1]), the FILS Discovery frame format design and detailed content design are still open forfurther discussions.

There are three options now for the FILS Discovery frame format design, including a modified Measurement Pilot frame, a modified 802.11ah short beacon frame, and a new public action frame.TGai really needs to narrow down the FILS Frame format design to one format, not three. We submit another contribution, 12/1029 [Ref-4], to facilitate further discussions on this issue, and hope one FILS Discovery frame formt will be accepted in 2012-September 802.11 meeting.

The content items of FILS Discovery frame have been identified and accepted in the TGai SFD (12/0151r12 [Ref-1]), including, mandatory item: SSID; and optional items: Capability, Security, Access Network Options, AP Configuration Change Count, AP’s next TBTT, and neigbhor APs’ TBTT. However, except for the content item of Access Network Options, the detailed content designs for all the other items are still open. We also submit another contribution, 12/1030 [Ref-5], to TGai to facilitate further discussions in the 2012-September 802.11 meeting.

Before further design decisions made in TGai about the FILS Discovery frame format and detailed contents, it is premature to propose any relevant TGai Specification text. Therefore, there is no specific proposed text in remaining of this subsection; instead, we mark them as place holders for the timebeing.

### Proposed TGai Specification Text

*Instructions to Editor:*

This is a place holder for the timebeing. It will be filled in upon further decisions made in TGai regarding the FILS Discovery frame format and detailed content design.

# Straw-Polls and Motions

In this contribution,

**Straw-Poll-1:** Do you support to include the text proposed in Subsection 3.1.2, Subsection 3.2.2, Subsection 3.3.2, and Subsection 3.4.2 of this contribution to the TGai Specification Document?

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

**Motion-4:** Include the text proposed in Subsection 3.1.2, Subsection 3.2.2, Subsection 3.3.2, and Subsection 3.4.2 of this contribution into the TGai Specification Document.

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

# References:

1. 11-12-151-12-00ai-Proposed-Specification-Framework-Document.docx
2. IEEE Std 802.11 – 2012
3. 11-12-0992-00-00ai-call-for-specification-text-contributions-for-the-tgai-detailed-draft-text
4. 11-12-1029-01-00ai-FILS-Discovery-Frame-Format-Discussions
5. 11-12-1030-00-00ai-FILS-Discovery-Frame-Content-Discussions