IEEE P802.11
Wireless LANs

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| --- |
| Selection of the AP for scanning |
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Abstract

This document proposes normative text for FILS Scanning – Selection of the AP for scanning.

Changes in the text refer to: Draft P802.11-REVmb/D12

This proposal provides normative text to make active scanning more efficiently by precise selection of the AP for scanning.

* Exclusion List is added to the Probe Request frames to precisely limit the scope of APs or STAs that should transmit Probe Response frame.
* Substrings can be used in the Exclusion List to indicate SSIDs or Mesh IDs. It helps to reduce the size of the Exclusion List, and it is not necessary to include individual SSIDs or Mesh IDs in the Exclusion List.
* Exclusion List with substring indication capability can provide precise selection of the AP to transmit Probe Response frame and it helps to reduce the unnecessary transmission of Probe Response frame.

**6.3.3 Scan**

**6.3.3.2.2 Semantics of the service primitive**

The primitive parameters are as follows:

MLME-SCAN.request(

BSSType,

BSSID,

SSID,

ScanType,

ProbeDelay,

ChannelList,

MinChannelTime,

MaxChannelTime,

RequestInformation,

SSID List,

ChannelUsage,

AccessNetworkType,

HESSID,

MeshID,

Exclusion List,

VendorSpecificInfo

)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| Exclusion List | Exclusion List element | As defined in 8.4.x. | Specifies the set of STAs that should not transmit a response to a Probe Request frame. If STAs are selected by BSSID, SSID, SSID List, HESSID, or Mesh ID and if some of the selected STAs are indicated by the lists in the Exclusion List, then they should not transmit a response to the Probe Request frame. This element is optionally present only if dot11FILSActivated is true and any of the fields in this element are nonzero. |

**8.3.3.9 Probe Request frame format**

**Table 8-26—Probe Request frame body**

|  |  |  |
| --- | --- | --- |
|  **Order** | **Information** | **Notes** |
| xx | Exclusion List | The Exclusion List element is optionally present only if dot11FILSActivated is true and any of the fields in this element are nonzero. |

**8.4.2.x BSSID element**

The format of the BSSID element is shown in Figure 8-x.

|  |  |  |
| --- | --- | --- |
| Element ID | Length | BSSID |

 Octets: 1 1 6

**Figure 8-x- BSSID element**

The Element ID field is equal to the BSSID value in Table 8-x.

The value of the Length field is the length of the BSSID in octets (6 octets).

The BSSID field contains a BSSID or a MAC address of a STA. A BSSID field of all 1s is used to indicate the wildcard BSSID.

**8.4.2.x HESSID element**

The format of the HESSID element is shown in Figure 8-x.

|  |  |  |
| --- | --- | --- |
| Element ID | Length | HESSID |

 Octets: 1 1 6

**Figure 8-x- HESSID element**

The Element ID field is equal to the HESSID value in Table 8-x.

The value of the Length field is the length of the HESSID in octets (6 octets).

The HESSID field contains a HESSID. A HESSID field of all 1s is used to indicate the wildcard HESSID.

**8.4.2.x BSSID List element**

The format of the BSSID List element is shown in Figure 8-x.

|  |  |  |
| --- | --- | --- |
| Element ID | Length | BSSID List |

 Octets: 1 1 variable

**Figure 8-x- BSSID List element**

The Element ID field is equal to the BSSID List value in Table 8-x.

The value of the Length field is the length of the BSSID List (variable) in octets.

The BSSID List field is a list of BSSID elements, each including the element ID, Length field and BSSID field (see 8.4.2.x) for which the STA is requesting information.

The BSSID List element is included in Exclusion List element, as described in 8.4.2.x~~.~~ The use of the BSSID List element and frames is described in 10.1.4.3.

**8.4.2.x HESSID List element**

The format of the HESSID List element is shown in Figure 8-x.

|  |  |  |
| --- | --- | --- |
| Element ID | Length | HESSID List |

 Octets: 1 1 variable

**Figure 8-x- HESSID List element**

The Element ID field is equal to the HESSID List value in Table 8-x.

The value of the Length field is the length of the HESSID list (variable) in octets.

The HESSID List field is a list of HESSID elements, each including the element ID, Length field and HESSID field (see 8.4.2.x) for which the STA is requesting information.

The HESSID List element is included in Exclusion List element, as described in 8.4.2.x. The use of the HESSID List element and frames is described in 10.1.4.3.

**8.4.2.x MESHID List element**

The format of the MESHID List element is shown in Figure 8-x.

|  |  |  |
| --- | --- | --- |
| Element ID | Length | MESHID List |

 Octets: 1 1 variable

**Figure 8-x—MESHID List element**

The Element ID field is equal to the MESHID List value in Table 8-x.

The value of the Length field is the length of the MESHID list (variable) in octets.

The MESHID List field is a list of Mesh ID elements, each including the element ID, Length field and Mesh ID field (see 8.4.2.101) for which the STA is requesting information.

The MESHID List element is included in Exclusion List element, as described in 8.4.2.x. The use of the MESHID List element and frames is described in 10.1.4.3.

**8.4.2.x Exclusion List element**

The format of the Exclusion List element is shown in Figure 8-x.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Element ID | Length  | SubstringInfo | SSID List | BSSID List | MESHID List | HESSID List |

 Octets: 1 1 1 variable

**Figure 8-x- Exclusion List element**

The Element ID field is equal to the Exclusion List value in Table 8-x.

The value of the Length field is the length of the Exclusion list (variable) in octets.

The SSID List element is a list of SSID elements of the STAs that should not transmit a response to a Probe Request frame. The format of the SSID List element is described in 8.4.2.75 SSID List element.

The BSSID List element is a list of BSSID elements of the STAs that should not transmit a response to a Probe Request frame. The format of the BSSID List element is described in 8.4.2.x BSSID List element.

The MESHID List element is a list of MSEHID elements of the Mesh STAs that should not transmit a response to a Probe Request frame. The format of the MESHID List element is described in 8.4.2.x MESHID List element.

The HESSID List element is a list of HESSID elements of the STAs that should not transmit a response to a Probe Request frame. The format of the HESSID List element is described in 8.4.2.x HESSID List element.

SubstringInfo field indicates whether the the strings contained in the SSID or Mesh ID elements included in the Exclusion List are substrings of the actual SSID or Mesh ID that indicate the STAs that should respond with the Probe Request frame.

The format of the Substring field is shown in Figure 8-x.

|  |  |  |
| --- | --- | --- |
| SubstringSupported | Substring Type | Reserved |

 Bits: 1 3 4

**Figure 8-x—SubstringInfo field format**

The Substring Supported subfield is set to 1 if the STA supports the indication of SSIDs or Mesh IDs as a substring. This subfield is set to 0 if the STA does not support the indication of SSIDs or Mesh IDs as a substring and if it is set to 0, then the value of Substring Type is reserved.

The Substring Type field indicates the type of substring used in the SSID or Mesh ID elements. Table 8-x lists the meaning of the SubstringInfo subfield.

**Table 8-x—Substring Type subfield value**

|  |  |
| --- | --- |
| **Value** | **Meaning** |
| 0 | Strings used in the SSID or Mesh ID elements in the Exclusion List are the actual SSIDs or Mesh IDs. (that is, the indicated strings are not the substrings of the SSIDs or Mesh IDs) |
| 1 | Strings used in the SSID or Mesh ID elements in the Exclusion List are the substrings of actual SSIDs or Mesh IDs. The actual SSIDs or Mesh IDs of the intended STAs are the SSIDs or Mesh IDs that start with, or end with, or contain the substrings specified in the SSID or Mesh ID elements in the Exclusion List.  |
| 2 | Strings used in the SSID or Mesh ID elements in the Exclusion List are the substrings of actual SSIDs or Mesh IDs. The actual SSIDs or Mesh IDs of the intended STAs are the SSIDs or Mesh IDs that start with the substrings specified in the SSID or Mesh ID elements in the Exclusion List.  |
| 3 | Strings used in the SSID or Mesh ID elements in the Exclusion List are the substrings of actual SSIDs or Mesh IDs. The actual SSIDs or Mesh IDs of the intended STAs are the SSIDs or Mesh IDs that end with the substrings specified in the SSID or Mesh ID elements in the Exclusion List.  |
| 4-7 | Reserved |

The Exclusion List element is included in Probe Request frames, as described in 8.3.3.9. The use of the Exclusion List element and frames is described in 10.1.4.3.

**Table 8-54—Element IDs**

|  |  |  |  |
| --- | --- | --- | --- |
| **Element** | **Element ID** | **Length of indicated element (in octets)** | Extensible |
| Exclusion List | xx | 2 to 257 |  |
| BSSID element | xx | 8 |  |
| HESSID element | xx | 8 |  |
| BSSID List element | xx | 2 to 257 |  |
| HESSID List element | xx | 2 to 257 |  |
| MESHID List element | xx | 2 to 257 |  |

**10.1.4.3 Active scanning**

**10.1.4.3.x Sending a probe request**

The transmitter can limit the scope of the STAs that should respond with the Probe Response frame by indicating BSSID, SSID, SSID List, HESSID, or Mesh ID in the Probe Request frame. It can be further limited by Exclusion List element in the Probe Request frame when the dot11FILSActivated is true.

**10.1.4.3.x Sending a probe response**

STAs, subject to the criteria below, receiving Probe Request frames shall respond with a probe response

only if:

1. The Address 1 field in the probe request is the broadcast address or the specific MAC address of the STA, and either item b) or item c) below.
2. The STA is a mesh STA and

1) The Exclusion List does not include the Mesh ID or substrings of the Mesh ID of the STA in the MESHID List element, or the specific MAC address of the STA in the BSSID List element, if the Exclusion List is present in the Probe Request and the dot11FILSActivated is true, and

2) The Mesh ID in the probe request is the wildcard Mesh ID, or the specific Mesh ID, of the STA.

1. The STA is not a mesh STA and
2. The Exclusion List does not include the SSID or the substrings of the SSID of the STA in the SSID List element, or the specific BSSID of the STA in the BSSID List element, if the Exclusion List is present in the Probe Request and the dot11FILSActivated is true, and
3. The SSID in the probe request is the wildcard SSID, the SSID in the probe request is the specific SSID of the STA, or the specific SSID of the STA is included in the SSID List element, and
4. The Address 3 field in the probe request is the wildcard BSSID or the BSSID of the STA.

Additionally, STAs with dot11InterworkingServiceActivated equal to true, receiving Probe Request frames containing an Interworking field in the Extended Capabilities element set to 1 shall examine the Interworking element in the received Probe Request frame and respond with a probe response only if

1. The Exclusion List does not include the HESSID of the STA in the HESSID List element if the Exclusion List is present in the Probe Request and the dot11FILSActivated is true, and the HESSID field, if present in the Interworking element, is the wildcard HESSID or the HESSID of the STA, and
2. The Access Network Type field in the Interworking element is the wildcard Access Network Type or the Access Network Type of the STA.

Note that if Mesh ID elements or SSID elements are included in the Exclusion List element in the Probe Request frame, and if the Substring Supported subfield of the SubstringInfo field in the Exclusion List is equal to 1 and the Substring Type subfield of the SubstringInfo field in the Exclusion List is equal to 1, 2, or 3, then the Mesh IDs or SSIDs used in the Exclusion List are the substrings of the actual Mesh IDs or BSSIDs that indicate the STAs that should respond with the Probe Request frame. In such cases, all the SSIDs or Mesh IDs whose substrings match with the substrings in the Mesh ID elements or SSID elements in the Exclusion List are regarded as if they are included in the Exclusion List. The detailed interpretation of the Substring Type subfield is described in Table 8-x.

Only APs and STAs in an IBSS or in an MBSS respond to probe requests. A result of the procedures defined in this subclause is that in each infrastructure BSS and IBSS there is at least one STA that is awake at any given time to receive and respond to probe requests. In an MBSS, STAs might not be awake at any given time to respond to probe requests. In an infrastructure BSS or in an IBSS, a STA that sent a Beacon frame shall remain in the Awake state and shall respond to probe requests, subject to criteria in the next paragraph, until a Beacon frame with the current BSSID is received. If the STA is contained within an AP, it shall remain in the Awake state and always respond to probe requests, subject to criteria in the next paragraph. There may be more than one STA in an IBSS that responds to any given probe request, particularly in cases where more than one STA transmitted a Beacon frame following the most recent TBTT, either due to not receiving successfully a previous Beacon frame or due to collisions between beacon transmissions.

In an infrastructure BSS or in an IBSS, STAs receiving Probe Request frames shall respond with a probe response when the SSID in the probe request is the wildcard SSID or matches the specific SSID of the STA, or the specific SSID of the STA is included in the SSID List element. Furthermore, a STA with dot11RadioMeasurementActivated true receiving a probe request with a DSSS Parameter Set element containing a Current Channel field value that is not the same as the value of dot11CurrentChannel shall not respond with a probe response. An AP shall respond to all probe requests meeting the above criteria. In an IBSS a STA that transmitted a Beacon frame since the last TBTT shall respond to group addressed Probe Request frames. A STA in an IBSS shall respond to Probe Request frames sent to the individual address of the STA.

An associated mesh STA that receives a Probe Request frame shall not respond with a Probe Response frame when dot11RadioMeasurementActivated is true and the Probe Request frame contains a DSSS Parameter Set element with its Current Channel field value different from the value of dot11CurrentChannelNumber.

Probe Response frames shall be sent as directed frames to the address of the STA that generated the probe request. The SSID List element shall not be included in a Probe Request frame in an IBSS.

STA supports it. In an improperly formed Request element, a STA may ignore the first element requested that is not ordered properly and all subsequent elements requested. In the probe response frame, the STA shall return the requested elements in the same order as requested in the Request element.

If dot11RadioMeasurementActivated is true and if the Request element of the Probe Request includes the RCPI element ID, the STA shall include in the Probe Response an RCPI element containing the measured RCPI value of the received Probe Request frame. If no measurement result is available, the RCPI value shall be set to indicate that a measurement is not available.