IEEE P802.11
Wireless LANs

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| Text for access delay reduction for FILS |
| Date: 1-9-2012 |
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Abstract

The submission provides normative text to make active scanning faster based on the ideas presented in 11/1523r3.

FILS can be hindered by excess traffic generated by multiple probe responses to a probe request especially in cases where several devices simultaneously attempt to probe for the available networks, i.e., active scan. Currently available passive scan is not a very suitable option since it requires a new STA to wait for the next beacon which could incur delays of up to 100ms or more.

In addition information about APs in other channels can also be included in the probe response, this would enable STAs to directly transit to an alternate channel to find a more suitable AP to associate.

The following ideas are covered in this document

* Include a network identifier in probe request to restrict the number of APs that respond to a broadcast probe request
* Modify STA behavior to pre-emptively stop probe request transmissions if it sees a probe response from an AP it is looking for
* Allow APs to send broadcast probe responses incase it receives multiple probe requests. The broadcast probe responses would carry information elements that combine the requests of the multiple probe requests

**=================Spec Framework Document Proposal===================**

# 5. Fast Network Discovery

5.1 Network ID

**Concept**

Add ‘Network ID’ to Probe-Request, Probe-Response and Beacon.

* Active scanning
	+ STA sends probe requests that includes a Network Identifier
	+ Only APs that match the requested Network Identifier will respond
* Passive scanning
	+ AP includes Network IDs supported by the AP

Properties of Network Identifier

* Network Identifier is associated with the service provider
	+ One option for the network identifier may be the roaming consortium organization identifier (11u)

**Motivation**

* Prevents multiple probe responses that could occur when wild card SSID is used

**Motion 1. Move to add the following text to the clause 5 of the specification framework document:**

802.11ai shall define a Network Identifier that may be included in Probe-Request, Probe-Response and Beacon

5.2 Bypass Probe Request procedure

**Concept**

* Modify STA behavior to pre-emptively stop probe request transmissions if it sees a probe response from an AP it is looking for
* The probe response may be broadcast or unicast probe response destined for another STA

**Motivation**

* Omission of Probe Request message – improves congestion, FILS-setup-time

**Motion 2. Move to add the following text to the clause 5 of the specification framework document:**

802.11ai shall include support for enabling an STA to pre-emptively stop probe request transmissions if it sees a probe response or beacon from an AP it is looking for.

5.3 Cancel Pending Probe Responses

**Concept**

* Modify AP behavior to pre-emptively stop probe response transmissions when it sees an association request, authentication request from the STA for which the probe response was destined

**Motivation**

* In domains with large number of APs, an STA can send an association request to an AP that it has found. The other APs that are in the process of sending their probe responses should terminate the sending process since those probe responses are not needed as the STA has made its choice.
* The cancellation of such probe responses will allow the AP to respond faster to other STAs thus improving set up time for FILS.

**Motion 3. Move to add the following text to the clause 5 of the specification framework document:**

802.11ai shall include support for enabling an AP to omit transmission of a probe response frame to a STA from which the AP has received (re)Association Request or authentication frame.

**=============================TEXT CHANGES========================**

**6.3.3 Scan**

**6.3.3.2 MLME-SCAN.request**

**6.3.3.2.2 Semantics of the service primitive**

*Instructions to Editor: Change the clause as shown underlined*

The primitive parameters are as follows:

MLME-SCAN.request(

 BSSType,

 BSSID,

 SSID,

 ScanType,

 ProbeDelay,

 ChannelList,

 MinChannelTime,

 MaxChannelTime,

 RequestInformation,

 SSID List,

 ChannelUsage,

 AccessNetworkType,

 HESSID,

 MeshID,

 Network ID(s)

 VendorSpecificInfo

)

*Instructions to Editor: Add the following row to the table in Clause 6.3.3.2.2*

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| Network ID | As defined in 8.4.2.ai3 |  | One or more identfiers that identfies one or more network domains\ |

**8. Frame formats**

**8.3 Format of individual frame types**

**8.3.3 Management frames**

**8.3.3.2 Beacon frame format**

*Instructions to Editor: Add two rows to Table 8-20 as follows*

**Table 8-20—Beacon frame body**

|  |  |  |
| --- | --- | --- |
| **Order**  | **Information**  | **Notes** |
| ANA | Network ID | Network ID element |
| ANA | Neighboring Network Information | Neighbor Network element |

**8.3.3.9 Probe Request frame format**

*Instructions to Editor: Add a row to Table 8-26 as follows*

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

|  |  |  |
| --- | --- | --- |
| **Order**  | **Information**  | **Notes** |
| ANA | Network ID | Network ID element |

**8.3.3.9 Probe Response frame format**

*Instructions to Editor: Add two rows to Table 8-27 as follows*

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

|  |  |  |
| --- | --- | --- |
| **Order**  | **Information**  | **Notes** |
| ANA | Network ID | Network ID element |
| ANA | Neighboring Network Information | Neighbor Network element |

**8.4 Management frame body components**

**8.4.2 Information elements**

**8.4.2.1 General**

*Instructions to Editor: Add two rows to Table 8-54 as follows*

|  |  |  |  |
| --- | --- | --- | --- |
| **Element** | **Element ID** | **Length of indicated element** | **Extensible** |
| Network ID | ANA | 3-257 |   |
| Neighbor Network  | ANA | 3-257 |   |

*Instructions to Editor: Add the following two subclasses to clause 8.4.2 as indicated below*

**8.4.2.ai1 Network ID Element**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Element ID | Length | Network ID |
| Octets | 1 | 1 | Var |

The Network ID element indicates the identity of the network domain. The length of the Network ID field is between 0 and TBD octets. A Network ID Element is used in a probe request frame to indicate the network domain from which a response is requested. A Network ID Element is used in a probe response or beacon frame to indicate the Network ID of the access point. If an AP belongs to multiple network domains, then the AP may include more than one Network ID elements in the beacon or probe response.

**8.4.2.ai2 Neighbor Network Element**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | BSSID | Channel | OperatingClass | Loading | SSID Length | SSID | Anonce |
| Octets | 1 | 1 | 6 | 1 | 1 | 1 | 1 | Var | 32 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **------** | Number of Network IDs | Network IDLength | Network ID | **\_ \_ \_ \_**  | Network IDLength | Network ID |
| Octets |  | 1 | Var |  | 1 | Var |

The Neigbhor Network element carries information about other networks in the vicinity of the AP. This element may be included in a beacon or probe response to enable STAs to determine if another AP should be considered. The fields in Neighbour Network Element are

 BSSID: Carries the BSSID of the Neighbouring Network

 Channel: Carries the operating channel of neighbouring network

 Operating Class: Specifies the operating class of the AP.a

 Loading: Carries the load factor which is the value of field divided by 255. The method for setting this field is described clause TBD.

 SSID: SSID of the neighbouring network

 Number of Network IDs : Number of Network IDs of the neighboring network

 Network ID: Network ID of the neighnboring network. More than one may be present.

**10. MLME**

**10.1 Synchronization**

**10.1.4 Acquiring synchronization, scanning**

**10.1.4.1 General**

*Instructions to Editor: Add the following to Clause for 10.1.4.1*

If dot11MgmtOptionFILSActivated is true in the scanning STA, it may include a Network ID element in the probe request frame containing the Network ID of the connectivity domain desired. An STA that starts a BSS that sets dot11MgmtOptionFILSActivated to true may include one or more Network ID elements in the beacon or the probe response sent. An STA that starts a BSS that sets dot11MgmtOptionFILSActivated to true may include one or Neighbour Network Elements in the beacon or a probe response.

**10.1.4.2 Passive scanning**

*Instructions to Editor: Add underlined sentence to the Clause 10.1.4.2*

If the ScanType parameter indicates a passive scan, the STA shall listen to each channel scanned for no

longer than a maximum duration defined by the MaxChannelTime parameter. An STA with dot11MgmtOptionFILSActivated set to true may listen for probe response messages with a RA sent to another STA and may begin association based on the information in such a probe response. An STA may also switch to a channel containing a suitable AP based on the Neighbor Network elements seen in a beacon.

**10.1.4.3 Active scanning**

*Instructions to Editor: Change the 6th parraph of 10.1.4.3 as shown by the underlined text*

In STAs where dot11MgmtOptionFILSActivated is false Probe Response frames shall be sent as directed frames to the address of the STA that generated the probe request. In STAs where dot11MgmtOptionFILSActivated is true Probe Response frames may be sent as a broadcast frame when several probe requests are received before sending out the probe response. The SSID List element shall not be included in a Probe Request frame in an IBSS. Requested Element IDs in the Request element shall be included in the Probe Response if the responding 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. In STAs where dot11MgmtOptionFILSActivated is true Probe Response frames that are sent as broadcast frames may include elements requested from several probe requests. An STA may also switch to a channel containing a suitable AP based on the Neighbor Network elements seen in the probe response.

**10.1.4.3.2 Sending a probe response**

*Instructions to Editor: Add the following subclause to 10.1.4.3*

**10.1.4.3.ai1 Canceling a Probe Response**

An AP with dot11MgmtOptionFILSActivated set to true may terminate the transmission of a pending probe response frame if it receives an Association Request from the STA that is the destination of the probe response.

**Annex C**

(normative)

*Instructions to Editor: Add new MIB variable as shown below*

dot11MgmtOptionFILSActivated 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 is capable of fast initial link setup (FILS).”

DEFVAL { false }