IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Proposed Text for MAAD | | | | |
| Date: 2022-09 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Graham SMITH | SR Technology | Sunrise, FL, USA. | 916 799 9563 | gsmith@srtrl.com |

Abstract

Proposed text for the MAAD MAC scheme as per 22/0737r2

Note: This proposed text uses text from “Network generated Device ID” 22/0187r1

In particular, the text concerning the Device ID that is provided to the non-AP STA in msg 3.

Rev 2 - Making reassociation clearer.

Rev 3 – Edits. FT reasssociation correction.

Rev 4 – ESS clarification. Edits

Rev 5 – Move description to Clause 12 so as to line up with Network Generated ID text.

Rev 6 – edits. Added words on pre-association

Rev 7 – written as changes to TGbh Draft 0.2

Made two MAAD MACs standard

Introduction:

The following provides the instructions for inserting the new text into Draft 0.2.

Instructions:

802.11 bh Draft 0.2 is base

*Add following Acronym to 3.4.*

MAAD MAC Address Designation

*At 4.5.4.10, edit last sentence to read*

Such a STA, when reconnecting to a network, can opt-in to exchange a device identifier that allows the network to recognize the device and/or use a MAC address that has been allocated by the network, but protects the information from third parties.

***Clause 6.3***

***We might need an “MLME-RCM” primitive so that the SME can instruct the MLME to set up which schemes (device ID, MAAD the STA will support. The primitive will consist of a single MLME-RCM.request. Discussions in TGbh to decide if MIB or MLME.***

*At 9.3.3.5 Association Request frame format*

*Insert new row in Table 9-62 Association Request frame body P23*

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <ANA> | Device ID | The Device ID element is optionally present when using FILS authentication; otherwise, it is not present. |
| <ANA> | MAAD | The MAAD element is optionally present when using FILS authentication; otherwise, it is not present |

*At 9.3.3.6 Assocaition Response frame format*

*Insert new row in Table 9-63 Association Response frame body P1031*

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <ANA> | Device ID | The Device ID element is optionally present when using FILS authentication; otherwise, it is not present. |
| <ANA> | MAAD | The MAAD element is optionally present when using FILS authentication; otherwise, it is not present |

*Insert new row in Table 9-64 Reassociation Request frame body*

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <ANA> | MAAD | The MAAD element is optionally present when using FILS authentication; otherwise, it is not present |

*Insert new row in Table 9-65 Reassociation Response frame body*

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <ANA> | MAAD | The MAAD element is optionally present when using FILS authentication; otherwise, it is not present |

*At 9.4.2.1 Insert new row in Table 9-128 Element IDs P23*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Element | Element ID | Element ID Extension | Extensible | Fragmentable |
| Device ID (see 9.4.2.x (Device ID element)) | 255 | <ANA> | No | No |
| MAAD (see 9.4.2.xx MAAD element) | 255 | <ANA> | No | No |

*At 9.4.2.241 Insert new row in Table 9-363 Extended Capabilities field, P24*

|  |  |  |
| --- | --- | --- |
| **Bit** | **Information** | **Notes** |
| <ANA> | Device ID support | The STA sets the Device ID Support field to 1 to indicate support for Device ID indication. Otherwise, the STA sets the Device ID field to 0. |
| <ANA> | MAAD Capability | A STA sets MAAD Capability subfield to 1 to indicate support for MAAD and sets to 0 if MAAD is not supported. |

*Insert following subclause after 9.4.2.296a “Device ID element” P 24*

9.4.2.x MAAD element

The MAAD element contains two MAAD MAC addresses. The format of the MAAD element is shown in Figure 9-y.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Element ID | Length | Element ID Extension | MAAD MAC  1 | MAAD MAC  2 |

Octets 1 1 1 6 6

**Figure 9-y MAAD element**

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

The MAAD MAC fields 1 and 2 are 48-bit MAC addresses.

**12. Security**

*Add the following new subclause after 12.2.10 (i.e., immediately before 12.3)*

**12.2.11 Changing MAC address**

To mitigate tracking and traffic analysis, a non-AP STA may randomly change its MAC address (see 4.5.4.10). For some services, however, it may be desirable to the user that the non-AP STA is identified by the AP and network services.

When using device ID indication, an AP may provide a device ID, contained in a device ID KDE in EAPOL Key-message 3 of the 4-way handshake, to a non-AP STA and the non-AP STA may provide that same device ID, in a device ID KDE in EAPOL Key-message 2 of the 4-way handshake, to any AP in the same ESS to allow the network to recognize the same non-AP STA when it returns to the ESS even if it changes its MAC address.

When using MAAD, an AP may provide a random MAC address (MAAD MAC 1 address) contained in a MAAD KDE in EAPOL Key-message 3 of the 4-way handshake, to a non-AP STA when it associates, and the non-AP STA may then use that MAAD MAC 1 address as its TA when associating the next time to that ESS or AP. An AP may provide a random MAC address (MAAD MAC 2 address) contained in a MAAD KDE in EAPOL Key-message 3 of the 4-way handshake, to a non-AP STA when it associates, and the non-AP STA may then use that MAAD MAC 2 address as its TA when sending probes. An AP or ESS can recognize the non-AP STA pre-association.

Device ID indication and MAAD may be used together.

***Renumber Device ID indication clause 12.2.11 as 12.2.11.1.***

***Delete the first paragraph and retain the rest (with changes as appropriate from the CID resolutions) as shown below:***

**12.2.11.1 Device ID indication**

~~An AP may provide an identifier to a non-AP STA and the non-AP STA may opt-in to providing that identifier to any AP in the same ESS to allow the network to recognize the same non-AP STA when it returns to the ESS even if it changes its MAC address. Exchanges of this identifier information are protected from third parties to limit the tracking capability to the APs in an ESS~~.

A non-AP STA indicates support for this capability in the Device ID Support subfield in the Extended RSN Capabilities field (see 9.4.2.241 (RSN Extension Element)). An AP shall not send an identifier to a non-AP STA that does not indicate support for this capability.

When using FILS authentication, the non-AP STA sends the identifier, if it has one and opts-in to using it, in the Association Request frame and the AP sends a new identifier in the Association Response frame. When using FT, the non-AP STA sends the identifier, if it has one and opts-in to using it, during the initial mobility domain association the EAPOL-Key message 2/4 and the AP sends a new identifier in the EAPOL-Key message 3/4; the identifier or a new identifier are not exchanged during the FT protocol reassociations within the same ESS. For other cases, the non-AP STA sends the identifier, if it has one and opts-in to using it, during the initial 4-way handshake in the EAPOL-Key message 2/4 and the AP sends a new identifier in the EAPOL-Key message 3/4. When the non-AP STA sends the opaque identifier, it shall send the most recently received value from an

AP in the ESS without modification.

***Insert following new sub clause***

**12.2.12.2 MAC Address Designation (MAAD) operation**

A STA advertises support for MAAD by setting the MAAD Capability subfield to 1 in the Extended Capabilites element in Probe Response, Association Response and Reassociation Response frames.

Each time the non-AP STA associates to the AP/ESS, it receives two new MAAD MAC addresses, MAAD MAC 1 and MAAD MAC 2, during the RSN association. The non-AP STA may then use that MAAD MAC 1 address as its TA the next time it requests association to that same AP/ESS. The non-AP STA may then use that MAAD MAC 2 address as its TA for any probes, directed or broadcast, that it may transmit when it intends to be identified.

When the associating non-AP STA advertises support for MAAD, the AP may allocate two new MAAD MAC addresses to the non-AP STA by including a MAAD KDE in message 3 of the 4-way handshake or, when using FILS authentication, including the MAAD element in the Association Response frame.

The non-AP STA should store the newly allocated MAAD MAC addresses as identifiers for that AP/ESS. The non-AP STA then may use that allocated MAAD MAC 1 address as its TA when it next associates to that same AP or another AP in the same ESS. In so doing, the AP/ESS will identify the non-AP STA. When reassocating to the same AP or another AP in the same ESS, the non-AP STA uses the MAAD MAC address that it used for the association.

Note 1: Allocating a new MAAD MAC during each association ensures that the non-AP STA will use a different TA for each association and hence that non-AP STA is unidentifiable to a third party.

A MAAD MAC address is a 48-bit address that is constructed from the locally administered address space (see 12.2.10). An AP should generate the MAAD MAC addresses on a random basis such that a returning non-AP STA cannot be identified by a third party from the TA it is using. A list of MAAD MACs and respective non-AP STAs shall be stored by the AP and used as an identifier for each non-AP STA. A non-AP STA should store the latest MAAD MAC received from a particular AP such that the next time the non-AP STA associates to that AP, the AP can identify the non-AP STA.

When a non-AP STA sends an Association Request using an allocated MAAD MAC 1 address as the TA, to the AP that allocated that address, then that AP can identify the non-AP STA before association is started or completed. A non-AP STA that has been allocated a MAAD MAC 2 address, may use that address when directly of broadcast probing for an AP or ESS that allocated that address, such that the AP may identify the non-AP STA and note that that particular non-AP STA is within range of the WM. A non-AP STA that has been allocated a MAAD MAC 1 address, may use that address in an ANQP packet such address such that the AP may identify the non-AP STA, if that non-AP STA had previously associated with that AP.

* EAPOL-Key frames

*Add a new row into Table 12-10 (KDE selectors) P26 as shown below:*

|  |  |  |  |
| --- | --- | --- | --- |
| * KDE selectors | | | |
| OUI | | Data type | Meaning |
| 00-0F-AC | | <ANA> | Device ID KDE |
| 00-0F-AC | | <ANA> | MAAD KDE |

*Make following additions for the new KDE at the end of 12.7.2 as shown below:*

The format of the MAAD KDE is shown in Figure 12-48b (MAAD KDE format).

|  |  |
| --- | --- |
| MAAD MAC  1 | MAAD MAC  2 |

Octets 6 6

Figure 12-48b—MAAD KDE format

The MAAD MAC 1 and 2 fields contains a MAAD MAC address.

* EAPOL-Key frame notation

*Insert following text after OCI KDE (shown for reference)*

OCI KDE is a KDE containing operating channel information

Device ID KDE is a KDE containing a device identifier

MAAD KDE is a KDE containing MAAD MACs

* 4-way handshake
* General

*Modify 12.7.6.1 P27 as shown below:*

RSNA defines a protocol using EAPOL-Key frames called the *4-way handshake*. The handshake completes the IEEE 802.1X authentication process. The information flow of the 4-way handshake is as follows:

Message 1: Authenticator  Supplicant: EAPOL-Key(0,0,1,0,P,0,0,ANonce,0,{} or {PMKID})

Message 2: Supplicant  Authenticator: EAPOL-Key(0,1,0,0,P,0,0,SNonce,MIC,{RSNE} or {RSNE, OCI KDE} or {RSNE, RSNXE} or {RSNE, OCI KDE, RSNXE} or {RSNE, OCI KDE, RSNXE} or {RSNE, Device ID KDE} or {RSNE, OCI KDE, Device ID KDE} or {RSNE, RSNXE, Device ID KDE} or {RSNE, OCI KDE, RSNXE,Device ID KDE})

Message 3: AuthenticatorSupplicant:   
EAPOL-Key(1,1,1,1,P,0,KeyRSC,ANonce,MIC,{RSNE,GTK[N]} or   
{RSNE, GTK[N], OCI KDE} or {RSNE, GTK[N], RSNXE} or   
{RSNE, GTK[N], OCI KDE, RSNXE} or   
{RSNE, GTK[N], Device ID KDE} or {RSNE, GTK[N], OCI KDE, Device ID KDE} or  
{RSNE, GTK[N], RSNXE, Device ID KDE} or {RSNE, GTK[N], OCI KDE, RSNXE, Device ID KDE} or   
{RSNE, GTK[N], MAAD KDE} or {RSNE, GTK[N], OCI KDE, MAAD KDE} or   
{RSNE, GTK[N], RSNXE, MAAD KDE} or {RSNE, GTK[N], OCI KDE, RSNXE, MAAD KDE})

Message 4: Supplicant  Authenticator: EAPOL-Key(1,1,0,0,P,0,0,0,MIC,{}).

* 4-way handshake message 3

*At P 28 Modify 12.7.6.4.4 as shown below:*

* Additionally, contains an OCI KDE when dot11RSNAOperatingChannelValidationActivated is true on the Authenticator.
* Additionally, may include a Device ID KDE
* Additionally, may include a MAAD KDE.
* The RSNXE that the Authenticator sent in its Beacon or Probe Response frame, if this element is present in the Beacon or Probe Response frame that the Authenticator sent.