IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Proposed Text for IRM | | | | |
| Date: 2023 - Jan | | | | |
| 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 IRM scheme

Written such that IRM co-exists with Device ID

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.*

IRM Indentifiable MAC address

*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 it has previously provided to 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, IRM) the STA will support. The primitive would 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> | IRM | The IRM 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> | IRM | The IRM 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> | IRM | The IRM 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> | IRM | The IRM 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 |
| IRM (see 9.4.2.xx IRM 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> | IRM Capability | A STA sets IRM Capability subfield to 1 to indicate support for IRM and sets to 0 if IRM 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 a MAAD MAC address. The format of the MAAD element is shown in Figure 9-y.

|  |  |  |  |
| --- | --- | --- | --- |
| Element ID | Length | Element ID Extension | IRM |

Octets 1 1 1 6

**Figure 9-y IRM element**

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

The IRM field 1 is 48-bit MAC address.

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

Device ID indication and IRM 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 Identifiable MAC address (IRM) operation**

A STA advertises support for IRM by setting the IRM 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 provides a new IRM MAC address to the AP/ESS during the RSN association. The non-AP STA may then use that IRM MAC address as its TA the next time it requests association to that same AP/ESS. The non-AP STA may also use that IRM MAC address as its TA for any probes, directed or broadcast, that it may transmit when it intends to be identified.

When the associating, to an AP that advertises support for IRM, the non-AP STA may allocate a new IRM MAC address to the AP by including an IRM KDE in message 2 of the 4-way handshake or, when using FILS authentication, including the IRM element in the Association Response frame.

The non-AP STA should store the newly allocated IRM MAC address as identifier for that AP/ESS and the AP/ESS should store that IRM MAC address as an identifier for that non-AP STA. The non-AP STA then may use that allocated IRM MAC 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 IRM MAC address that it used for the association.

Note 1: Allocating a new IRM 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.

An IRM MAC address is a 48-bit address that is constructed from the locally administered address space (see 12.2.10). A non-AP STA should generate the IRM 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.

When a non-AP STA sends an Association Request using an IRM MAC address as the TA, to the AP that was allocated that address, then that AP can identify the non-AP STA before association is started or completed. A non-AP STA may use that address for direct or broadcast probing for an AP or ESS that was 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, but only if the non-AP STA wants be identifiable at that time. A non-AP STA that has allocated an IRM MAC address to an AP/ESS, may use that address in an ANQP packet 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> | IRM KDE |

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

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

|  |
| --- |
| IRM |

Octets 6

Figure 12-48b—MAAD KDE format

The IRM field contains an IRM 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

IRM KDE is a KDE containing IRM 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}) or   
{RSNE, GTK[N], IRM KDE} or {RSNE, GTK[N], OCI KDE, IRM KDE} or   
{RSNE, GTK[N], RSNXE, IRM KDE} or {RSNE, GTK[N], OCI KDE, RSNXE, IRM 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}

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

* + 1. 4-way handshake message 2

*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 an IRM 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.