IEEE P802.11  
Wireless LANs

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| --- | --- | --- | --- | --- |
| MAC Address Policy ANQP and Beacon/Probe Response Element | | | | |
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Abstract

This contribution proposes the basis of a resolution to LB236 Comment 2685, suggesting an ANQP element and a beacon/probe response element providing information regarding the address types and address allocation mechanisms supported by the network. The contribution considers local address types specified in IEEE Std 802 (as amended by IEEE 802c) and the possibility of addresses assigned by an IEEE 802.1CQ Local Address Allocation Protocol (LAAP).

This contribution uses Draft P802.11REVmd/D2.0 as a baseline.

Relevant Comment

LB236 Comment 2685, from Stephen McCann regarding subclause 12.2.10 (IEEE P802.11-REVmd/D2.0 page 2518 line 24) says:

*Regarding MAC address privacy, a simple scheme to advertise the capability of a local administered LAN was discussed in 802.11 ARC (November 2018, see https://mentor.ieee.org/802.11/dcn/18/**11-18-2022-00-0arc-local-administrator-advertisements.ppt). It was suggested to create a submission to add such functionality to Draft P802.11REVmd\_D2.0.pdf.*

The comment goes on to say “Commenter will provide a submission.” The followup submission is IEEE 802.11-19/0134r4 [1], a revision of IEEE 802.11-19/0134r1, which was presented and discussed during TGmd meetings at the January 802.11 Interim Session.

Background

Comment 2685 references 802.11-18-2022-00 [2], which was discussed by 802.11 ARC at the November session. Other contributions relevant to local addresses were also discussed at the same meeting. In particular, IEEE 802.11-18/1934r1 [3] discusses applicability of the P802.1CQ project, which is developing a standard that “specifies protocols, procedures, and management objects for locally-unique assignment of 48-bit and 64-bit addresses in IEEE 802 networks.”

General Views

We agree with the intention, implied by the comment, regarding the need to provide support for advertisement by the network of its addressing policy. A number of comments to this effect were also submitting during the development of IEEE Std 802.11aq, in which random private addresses were introduced. IEEE 802.11aq introduced the statement that the non-AP STA (if establishing a pre-association transaction state with an AP) “shall configure its MAC address according to the rules of the local address space,” and we believe that it is important to specify how those rules can be learned. We base this on contribution on [1], listing several concerns with the content of [1]. Furthermore, we believe that any such changes should plan ahead for a future in which IEEE Std 802.1CQ provides local address assignment.

Specific Improvements with respect to IEEE 802.11-19/0134r4 [1]

This contribution includes improvements with respect to IEEE 802.11-19/0134r4 [1], addressing some issues therein:

* The policy alternatives are assigned by field value, without overlap. This is problematic because a typical policy would allow for more than one type. For example, a BSS that allows some form of local address would typically also allow EUI universal addresses. In order to accommodate expected combinations in the proposed format, a field value would need to be specified for each foreseeable combination. We believe that the policy options are more likely to be chosen independently from a menu. Therefore, we believe that bitmask format is more suitable.
* The text proposes that an ELI be created with a random extension to a CID. However, a CID is assigned by the IEEE Registration Authority to an assignee who is granted the authority to specify how ELIs are created from the CID. As stated in the source document (IEEE Std 802c), “An ELI-48 or ELI-64 created as an extension of the CID consists of two parts: the leading 24 bits are assigned as the CID, with the I/G bit assignable as described in 8.2.2, and the remaining bits are specified as an extension by the CID assignee or by a protocol designated by the CID assignee.” It would be inconsistent for an IEEE standard to specify creation of random addresses in the address space assigned to the CID assignee without finer controls to enable the assignee’s assignment policy details.
* The 3-byte CID field proposed for the ANQP-element could easily be extended to a variable number of bytes, allowing the self-assignment range to vary.
* Even with a single byte to enumerate the policy, we can allow for the advertisement of the availability of a Local Adddress Assignment Protocol (LAAP) server, currently being specified in IEEE P802.1CQ, for the automated assigned of addresses.
* It would be useful to extend the MAC Address Policy advertisement to allow its distribution in beacons and probe responses instead of only ANQP.

References

[1] Stephen McCann, “MAC Address Policy ANQP-element,” IEEE 802.11-19/0134r4, 2019-02-14

[2] Stephen McCann, “Local Administrator Advertisements,” IEEE 802.11-18/2022r0, 2018-11-13

[3] Antonio de la Oliva, Stephen McCann, and Michael Montemurro, “MAC Address Assignment in IEEE 802.11 through IEEE 802.11aq,” IEEE 802.11-18/1934r1, 2018-11-11

**Proposed changes to P802.11REVmd/D2.0**

***Modify the table in the following clause as shown:***

* + 1. Access Network Query Protocol (ANQP) elements(11u)

|  |  |  |
| --- | --- | --- |
| Table 9-330 ANQP-element definitions  (11u) | | |
| ANQP-element name | Info ID | ANQP- (Ed)element (subclause) |
| Reserved | 0 – 255 | n/a |
| … | … | … |
| MAC Address Policy | <ANA> | 9.4.5.29 (MAC Address Policy ANQP-element) |
| Reserved | <ANA+1> – 56796 | n/a |
| Vendor Specific | 56797 | 9.4.5.8 (Vendor Specific ANQP-element) |
| Reserved | 56798 – 65535 | n/a |

***Add the following subclause***

**9.4.5.29** **MAC Address Policy ANQP-element**

The MAC Address Policy ANQP-element provides an indication of the MAC Address Policy of the BSS.

The format of the MAC Address Policy ANQP-element is specified in Figure 9-820a.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Info ID | Length | MAC Address Policy | Policy Flags | MAC Address Prefix Octets |
| Octets: | 2 | 2 | 1 | 1 | 0–6 |

**Figure 9-820a – MAC Address Policy ANQP-element format**

The Info ID and Length fields are specified in 9.4.5.1 (General).

The MAC Address Policy field is a 1-octet bitmap field advertising specific MAC address policies supported by the BSS. The values of the bits are specified in Table 9-820a.

**Table 9-820a –** **MAC Address Policy field bits**

|  |  |
| --- | --- |
| **Bitmap value** | **Description** |
| Bit 0 (MSB) | EUI-48 supported |
| Bit 1 | ELI-48 supported |
| Bit 2 | SAI-48 supported |
| Bit 3 | LAAP Server assignment |
| Bit 4 | Self-Assignment using specified MAC Address Prefix |
| Bit 5 | Pre-configured administered address |
| Bit 6 | Reserved |
| Bit 7 | Reserved |

The bitmap values provided in the Table 9-820a enable the indication to the receiving STA of the MAC address policies supported by the BSS. The bits are independent and not mutally exclusive. Each represent an allowable option for MAC addresses or address assignments supported in the BSS. The bit value indications are specified as follows:

* Bit 0, when set to 1, represents the support of EUI-48 addresses, as specified in IEEE Std 802.
* Bit 1, when set to 1, represents the support of ELI-48 addresses, as specified in IEEE Std 802, incorporating IEEE Std 802c-2017.
* Bit 2, when set to 1, represents the support of SAI-48 addresses, as specified in IEEE Std 802, incorporating IEEE Std 802c-2017.
* Bit 3, when set to 1, indicates the availability of a Local Adddress Assignment Protocol (LAAP) server, per IEEE Std 802.1CQ. The LAAP protocol will provide the STA with a local MAC address assignment or a set of allowed local MAC address assignments.
* Bit 4, when set to 1, indicates support for self-assignment, using the MAC address prefix. This indicates support for local addresses formed by extending the MAC address prefix to 48 bits with random bits selected by the assignee.
* Bit 5 indicates that specific MAC addresses pre-configured by the administrator are supported.
* Bits 6-7 are reserved.

The Policy Flags field is a 1-octet field. When MAC Address Policy field Bit 4 is 0, the Policy Flags field is reserved. When MAC Address Policy field Bit 4 is 1, the Policy Flags field contains subfields as specified in Figure 9-820b.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 B2 | | B3 B5 | B6 B7 |
|  | Length of MAC Address Prefix Octets | | Prefix Trim | Reserved |
| Bits: | | 3 | 3 | 2 |

**Figure 9-820b –** **Policy Flags field format when** **MAC Address Policy field Bit 4 = 1**

The Length of MAC Address Prefix Octets subfield is 3 bits. When the Length of MAC Address Prefix Octets subfield is set to one of the values of 1–6, that value indicates the length (in octets) of the MAC Address Prefix Octets field. The Length of MAC Address Prefix Octets subfield is not set to 0 or 7; those values are reserved.

The Prefix Trim subfield is 3 bits and takes one of the values of 0–7, that value indicating number of bits to be truncated from the end of the MAC Address Prefix Octets field in order to obtain the MAC address prefix. In other words, the MAC address prefix is the value of the MAC Address Prefix Octets field after truncation of some of the most significant bits of the last octet, with the number of truncated bits equal to the value of the Prefix Trim subfield. The bit and octet ordering of the MAC address prefix is per Figure 9-1 (Representation of a 48-bit MAC address).

When MAC Address Policy field Bit 4 is 0, the MAC Address Prefix Octets field is absent. When MAC Address Policy field Bit 4 is 1, the MAC Address Prefix Octets field is a field of 1 to 6 octets (with the length signalled in the Length of MAC Address Prefix Octets subfield of the Policy Flags field) containing the full octets (prior to truncation per the Prefix Trim subfield) of the MAC address prefix relevant to address self-assignment.

***Modify the text and table in the following clause:***

11.23.3.3 ANQP procedures(11u)

11.23.3.3.1 General(Ed)

…

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Table 11-15 ANQP usage (11u) | | | | | |
|  | |  | BSS | | IBSS |
| ANQP-element Name | ANQP-element (subclause)(Ed) | ANQP-element Type | AP | Non-AP STA | STA |
| MAC Address Policy | 9.4.5.29 (MAC Address Policy ANQP-element) | S | T | R | — |
| **Symbols**  Q element is an ANQP query  S element is an ANQP response  T ANQP-element may be transmitted by MAC entity  R ANQP-element may be received by MAC entity  — ANQP-element is neither transmitted nor received by MAC entity | | | | | |

***Insert the following subclause***

**11.23.3.3.16** **MAC Address Policy procedure**

The MAC Address Policy ANQP-element is used to discover the MAC Address Policy for a BSS. A STA with a MAC address assigned in contradiction to the MAC address policy for the network, as identified in the values of the MAC Address Policy element, may receive a DENIED\_MAC\_ADDRESS\_POLICY\_VIOLATION status code in a (Re)Association Response.

***Insert a new penultimate row of Table 9-94 and update the last (Reserved) row accordingly, resulting in the following two rows at the end of Table 9-94:***

**9.4.2 Elements**

**9.4.2.1 General**

**Table 9-94 – Element IDs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Element ID** | **Element ID Extension** | **Extensible** | **Fragmentable** |
| MAC Address Policy | 255 | <ANA> | Yes | No |
| Reserved | 255 | <ANA+1>-255 |  |  |

***Insert the following subclause***

**9.4.2.241 MAC Address Policy element**

The MAC Address Policy element is used to discover the MAC Address Policy for a network. The format of the MAC Address Policy element is defined in Figure 9-772 (MAC Address Policy element format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | MAC Address Policy |
| Octets: | 1 | 1 | 1 | 1 |

**Figure 9-772 – MAC Address Policy element format**

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

The MAC Address Policy field is a 1-octet bitmap field and is defined in Table 9-320.

**Table 9-320 –** **MAC Address Policy field bits**

|  |  |
| --- | --- |
| **Bitmap value** | **Description** |
| Bit 0 (MSB) | EUI-48 supported |
| Bit 1 | ELI-48 supported |
| Bit 2 | SAI-48 supported |
| Bit 3 | LAAP Server assignment |
| Bit 4 | Self-Assignment using specified MAC address prefix |
| Bit 5 | Pre-configured administered address |
| Bit 6 | Reserved |
| Bit 7 | Reserved |

The bitmap values provided in the Table 9-320 enable the indication to the receiving STA of the MAC address policies supported by the BSS. The bits are independent and not mutally exclusive. Each represent an allowable option for MAC addresses or address assignments supported in the BSS.

* Bit 0, when set to 1, represents the support of EUI-48 addresses, as specified in IEEE Std 802.
* Bit 1, when set to 1, represents the support of ELI-48 addresses, as specified in IEEE Std 802, incorporating IEEE Std 802c-2017.
* Bit 2, when set to 1, represents the support of SAI-48 addresses, as specified in IEEE Std 802, incorporating IEEE Std 802c-2017.
* Bit 3, when set to 1, indicates the availability of a Local Adddress Assignment Protocol (LAAP) server, per IEEE Std 802.1CQ. The LAAP protocol will provide the STA with a local MAC address assignment or a set of allowed local MAC address assignments.
* Bit 4, when set to 1, indicates support for self-assignment, using the MAC address prefix specified in the MAC Address Policy ANQP-element. This indicates support for local addresses formed by extending the MAC address prefix to 48 bits with random bits selected by the assignee.
* Bit 5 indicates that specific MAC addresses pre-configured by the administrator are supported.
* Bits 6-7 are reserved.

When MAC Address Policy field Bit 4 is 1, the MAC address prefix can be obtained using the MAC Address Policy procedure.

A STA with a MAC address assigned in contradiction to the MAC address policy for the network, as identified in the values of the MAC Address Policy element, may receive a DENIED\_MAC\_ADDRESS\_POLICY\_VIOLATION status code in response to a (re)association request.

***Modify the table in the following clause as shown:***

**9.4.1 Fields that are not elements**

**9.4.1.9 Status Code field**

***Insert a new penultimate row of Table 9-52 and update the last row accordingly, resulting in the following two rows at the end of Table 9-52:***

**Table 9-52—****Status codes**

|  |  |  |
| --- | --- | --- |
| **Status code** | **Name** | **Meaning** |
| <ANA> | DENIED\_MAC\_ADDRESS\_POLICY\_VIOLATION | Request denied because source address of request is inconsistent with MAC address policy. |
| <ANA+1> – 65 535 | Reserved |  |