IEEE P802.11
Wireless LANs

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| --- |
| Local MAC Address Policy ANQP |
| Date: 2019-08-12 |
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Abstract

This contribution proposes the basis of a resolution to LB236 Comment 2685, suggesting an ANQP 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.

Update in Revision 8

Local MAC Address Policy field Bits 1-4 have been revised, so that the value 0 no longer prohibits randomization.

Clarification has been added to cover the case of overlapping restricted prefixes, so that the longest match prevails.

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**

***Add the following to subclause 3.4 (Abbreviations and acronyms) in alphabetical order:***

AAI Administratively Assigned Identifier

ELI Extended Local Identifier

SAI Standard Assigned Identifier

SLAP Structured Local Address Plan (11u)

***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 |
| … | … | … |
| Local MAC Address Policy | <ANA> | 9.4.5.29 (Local 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** **Local MAC Address Policy ANQP-element**

The Local MAC Address Policy ANQP-element provides an indication of the local MAC address policy of the ESS.

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Info ID | Length | Local MAC Address Policy | Number Of Restricted Prefixes | Restricted Address Prefix  |
| Octets: | 2 | 2 | 1 | 1 | variable  |

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

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

The Local MAC Address Policy field is a bitmap advertising policies supported by the ESS regarding its support for local MAC address. The values of the bits are specified in Table 9-820a.

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

|  |  |
| --- | --- |
| **Bitmap value** | **Description** |
| Bit 0 (MSB) | Address server assignment supported |
| Bit 1 | Randomization subject to Restricted Address Prefixes supported in SLAP Quadrant 01  |
| Bit 2 | Randomization subject to Restricted Address Prefixes supported in SLAP Quadrant 11 |
| Bit 3 | Randomization subject to Restricted Address Prefixes supported in SLAP Quadrant 00 |
| Bit 4 | Randomization subject to Restricted Address Prefixes supported in SLAP Quadrant 10 |
| Bit 5  | Reserved |
| Bit 6 | Reserved |
| Bit 7 | Reserved |

The bitmap values provided in Table 9-820a indicate, to the receiving STA, aspects of the local MAC address policy of the ESS. The bits are independent and not mutally exclusive. They make reference to the Structured Local Address Plan (SLAP) introduced into IEEE Std 802 via the amendment IEEE Std 802c-2017. The bit value indications are as follows:

* Bit 0, when set to 1, indicates the availability of an address server, per IEEE Std 802.1CQ, enabled to provide local MAC address assignments. Bit 0, when set to 0, indicates that no such address server is available.
* Bit 1, when set to 1, represents the support of an address chosen by the STA randomly, within the Quadrant 01 (i.e. the SLAP ELI quadrant, with 0101 as the M, X, Y, and Z bits, respectively) but avoiding addresses beginning with any prefix specified in the Restricted Address Prefix field. Bit 1, when set to 0, indicates that the ESS provides no rules on MAC address use within SLAP Quadrant 01.
* Bit 2, when set to 1, represents the support of an address chosen by the STA randomly, in SLAP Quadrant 11 (i.e. the SLAP SAI quadrant, with 0111 as the M, X, Y, and Z bits, respectively) but avoiding addresses beginning with any prefix specified in the Restricted Address Prefix field. Bit 2, when set to 0, indicates that the ESS provides no rules on MAC address use within SLAP Quadrant 11.
* Bit 3, when set to 1, indicates the support of an address chosen by the STA randomly, in SLAP Quadrant 00 (i.e. the SLAP AAI quadrant, with 0100 as the M, X, Y, and Z bits, respectively) but avoiding addresses beginning with any prefix specified in the Restricted Address Prefix field. Bit 3, when set to 0, indicates that the ESS provides no rules on MAC address use within SLAP Quadrant 00.
* Bit 4, when set to 1, indicates the support of an address chosen by the STA randomly, in SLAP Quadrant 10 (i.e. the SLAP Reserved quadrant, with 0110 as the M, X, Y, and Z bits, respectively) but avoiding addresses beginning with any prefix specified in the Restricted Address Prefix field. Bit 4, when set to 0, indicates that the ESS provides no rules on MAC address use within SLAP Quadrant 10.

The Number Of Restricted Prefixes field specifies the number of Restricted Address Prefix subfields in the Restricted Address Prefix field.

Note – If Local MAC Address Policy field bits 1-4 are set to 1 and Number Of Restricted Prefixes to 0, the Local MAC Address Policy ANQP-element indicates that the ESS supports randomized address throughout local address range. In this case, the AP STA sets the Local MAC Address Policy field in the Extended Capabilities field to 0, indicating that local MAC addresses are not restricted, and consequently the Local MAC Address Policy ANQP-element is redundant.

The Restricted Address Prefix field contains zero or more Restricted Address Prefix subfields, each specifying the prefix of local MAC addresses supported in the ESS. Each such prefix indicates support for MAC addresses assigned as extensions of the indicated prefix, provided that the assignment is made according to the procedures specified for the use of that prefix, or, in the case that a MAC address is an extension of multiple indicated prefixes, the longest of those prefixes.

Note – The detailed specification of the use of local MAC addresses is provided in IEEE Std 802. IEEE Std 802.1CQ provides additional specification of the use of SAI addresses in the SLAP Quadrant 11. Within SLAP Quadrant 01, specification of the use of ELI addresses is provided by the assignee of a CID duly assigned by the IEEE Registration Authority.

The format of the Restricted Address Prefix subfield is described in Figure 9-820c.

|  |  |  |
| --- | --- | --- |
|  | Address Prefix Control | Address Prefix Octets |
| Octets: |  1 | variable |

**Figure 9-820c – Restricted Address Prefix subfield**

The format of the Address Prefix Control subfield is described in Figure 9-820d.

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

**Figure 9-820d –Address Prefix Control subfield**

The Length Of Address Prefix Octets subfield indicates the length (in octets) of the Address Prefix Octets field. Values 0 and 7 are reserved.

The Prefix Trim subfield indicates the number of bits to be truncated from the end of the value of the Address Prefix Octets subfield in order to obtain the MAC address prefix. In other words, the MAC address prefix is the value of the Address Prefix Octets subfield 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. If the Length Of Address Prefix Octets subfield is set to 1, then the value of the Prefix Trim subfield is not be set to 7; this provides that the length of the MAC address prefix is at least two bits. The bit and octet ordering of the MAC address prefix is per Figure 9-1 (Representation of a 48-bit MAC address).

***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 |
| Local MAC Address Policy | 9.4.5.29 (Local MAC Address Policy ANQP-element) | S | T | R | — |
| **Symbols**Q element is an ANQP queryS element is an ANQP responseT ANQP-element may be transmitted by MAC entityR 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** **Local MAC Address Policy procedure**

The Local MAC Address Policy ANQP-element is used by a non-AP STA to discover the MAC address policy for an ESS. The STA should use a MAC address consistent with the local MAC address policy, as determined from the Local MAC Address Policy ANQP-element and the Local MAC Address Policy field in the Extended Capabilities field. An AP may send a DENIED\_LOCAL\_MAC\_ADDRESS\_POLICY\_VIOLATION status code in an Association Response frame to a STA with a MAC address that is inconsistent with the MAC address policy.

***Add the following paragraphs to the end of 12.2.10:***

When dot11MACAddressPolicyActivated is true, an AP shall set the MAC Address Policy field in the Extended Capabilities field to 1, indicating the existence of a MAC address policy. When dot11MACAddressPolicyActivated is false, an AP STA shall set the MAC Address Policy field in the Extended Capabilities field to 0, indicating that local MAC addresses are not restricted.

A non-AP STA that receives from an AP an Extended Capabilities field with the Local MAC Address Policy subfield set to 1 should, unless it has previously stored the MAC address policy for the ESS, discover that policy, using the MAC Address Policy ANQP-element, before sending any Association Request frame to that AP using a local MAC address as the TA.

***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\_LOCAL\_MAC\_ADDRESS\_POLICY\_VIOLATION | Request denied because source address of request is inconsistent with local MAC address policy. |
| <ANA+1> – 65 535 | Reserved |  |

***Insert a new row of Table 9-153 and update the last (Reserved) row accordingly, resulting in the following two rows at the end of Table 9-153:***

**9.4.2 Elements**

**9.4.2.26** **Extended Capabilities element**

**Table 9-153—****Extended Capabilities field**

|  |  |  |
| --- | --- | --- |
| **Bit** | **Information** | **Notes** |
| <ANA> | Local MAC Address Policy | When dot11LocalMACAddressPolicyActivated is true, the Local MAC Address Policy subfield is set to 1.When dot11LocalMACAddressPolicyActivated is false, the Local MAC Address Policy subfield is set to 0. |
| <ANA+1>-*n* | Reserved |  |

**C.3 MIB detail**

***Insert a new row within “******Dot11StationConfigEntry ::= SEQUENCE” as follows:***

dot11LocalMACAddressPolicyActivated TruthValue,

***Insert a new section within “SA Query Procedure MIBs” as follows:***

dot11LocalMACAddressPolicyActivated OBJECT-TYPE

 SYNTAX TruthValue

 MAX-ACCESS read-write

 STATUS current

 DESCRIPTION

 "This is a control variable.

 It is written by an external management entity or the SME. Changes take

 effect as soon as practical in the implementation.

 This attribute, when true, indicates the presence of a local MAC address policy to be advertised. "

 DEFVAL {false}

 ::= { dot11StationConfigEntry <ANA> }