                   Civic Location ANI Suboption for PMIPv6
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   Abstract

      This specification defines extensions to Access Network Identifier
      mobility option for carrying the Civic Location information and MAG
      Group Identifer from the mobile access gateway to the local mobility
      anchor. This specificaton also defines a new ANI update timer sub-
      option that enables a MAG to communicate when the MAG will update the
      ANI information. This helps the LMA determine the freshness of the
      ANI options.

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1. Introduction

   In many deployments, the LMA needs to be aware of various identifiers
   of client's access network to ensure appropriate policies are
   implemented. For example, the LMA may provide access network
   identifiers to location based applications. [RFC6757] defined new
   mobility options to enable a MAG to provide Access Network
   Information (ANI). In Wi-Fi systems the ANI mobility option may
   carry the identifier of the Access Point (for instance the BSSID, AP-
   Name, or the geo-spatial coordinates of the Acess Point). When a
   client associates with an Access Point, the MAG (corresponding to the
   AP) may send the ANI (like SSID, BSSID, Geo-location) to the LMA.

   In many deployments (especially indoor AP deployments), it is
   difficult to provide Geo-spatial coordinates of APs. However, for
   many location based applications the civic location is sufficient.
   To provide civic location information, this document defines a new
   ANI sub-option within the ANI mobilty option defined in [RFC6757].
   [RFC4776] provides further motivations on usage of civic information
   in providing human-usable information, particularly within buildings.

   We also address an aspect related to ANI, frequency of ANI Update.
   In other words, how often does the MAG update the ANI. To understand
   this better, it is instructive to look at this closely in two Wi-Fi
   deployment scenarios:

   MAG is co-located with the Access Point: In this scenario, whenever
   the Wi-Fi client hands over from a source Access Point to a target
   Access Point there is new Proxy Binding Update (PBU) sent by the MAG
   on the target AP. If the PBU contains ANI information related to
   BSSID, or Geo-Lcation then those will correspondng to that of the
   target Access Point. As a result, the LMA has the latest ANI.

   MAG is not co-located with Access Point: An example of such a
   deployment is when the MAG may be co-located with a Wireless LAN
   Controller (WLC) also known as an Access Controller (as defined in
   [RFC5415] and [RFC5416]) or it may be co-located with an Access
   Router. Additionally in these deployments, the Mobile Node mobility
   between Access Points may be handled by acesss network (layer 2)
   specific methods and may not require any PMIPv6 signaling.
   Specifically, there may be no need for MAG to trigger a PBU when a
   client hands over from one AP another AP. As a result, in these
   cases it is possible (depending on which ANI sub options were sent by
   the MAG), the LMA may have "stale" acess network identifers. For
   example, the LMA may contain the BSSID or Geo-Location of a
   previously associated AP and not the currently associated AP.

   If the network deployment and applications that use ANI require the

LMA to have the current ANI, then one way of solving this problem is
to require the MAG to send a fresh PBU (with updated ANI) whenever it
is aware of an ANI change. This is an acceptable solution when the
MAG is aggregating a small number (say between 1 and 4) APs.
Consider a Wi-Fi deployment in stadium or in large exposition center
or a large enterprise. The number of APs in such venues could be
multiple hundred APs. This combined with a large number of mobility
events may create a large number of ANI updates (sent in PBUs). In
this specification, we propose a way to mechanism to specify the ANI
update interval based on the deployment needs as well as the
capability of the MAG and LMA.

This specification enables extensions to Access Network Identifier
mobility option for carrying Location information of the mobile node
from the mobile access gateway to the local mobility anchor. This
documents defines a new ANI sub-option that enables a MAG to
communicate how often the MAG will update the ANI information. This
helps the LMA determine whether the ANI informaiton is fresh or
stale.

2. Conventions and Terminology

2.1. Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
"SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
document are to be interpreted as described in RFC 2119 [RFC2119].

2.2. Terminology

All the mobility related terms used in this document are to be
interpreted as defined in [RFC5213] and [RFC5844].

3. Civic-Location Sub-Option

The Civic-Location is a mobility sub-option carried in the Access
Network Identifier option defined in [RFC6757]. This sub-option
carries the Civic Location information of the mobile node as known to
the MAG. The format of this option is defined below.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| ANI Type=IANA |  ANI Length   | Civic Location (PIDF Format)  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|       Civic Location (PIDF Format) continued               ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

                    Figure 1: Network-Identifier Sub-option

   ANI Type: <IANA-1>

   ANI Length: Total length of this sub option in octets, excluding the
      ANI Type and ANI length fields.

   Civic Location: This format is as specified in the Presence
      Information Data Format Location Object [RFC5139] with the
      additional constraint that the length shall not exceed 255 bytes.
      System architectures may choose to identify the exact PIDF XML
      elements to be carried in the PIDF object.

4. MAG Group-Id Sub-Option

   In many deployments, MAGs may be co-located with APs. In such cases,
   APs may be clustered in a "group". There is a common policy (for
   QoS, charging, etc) for all MNs connected to the same group.
   Further, in some cases there is a common policy (for QoS, DPI, etc)
   between MAGs and LMA in the same group. The group identifier may
   also serve a proxy for coarse location identification for MNs
   connected to the group of MAGs. These considerations motivate
   introduction of a group identifier to a MAG.

   The MAG Group Identifier is a mobility sub-option carried in the
   Access Network Identifier option defined in [RFC6757]. The MAG Group
   Identifier identifies the group affiliation of the mobile access
   gateway within that Proxy Mobile IPv6 domain.

   When the MAG is configured with a group identifier, the MAG may send
   its group-id in the PBU. The usage of the group identifier by the
   LMA is left to implementation. The format of this option is defined
   below.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| ANI Type=IANA | ANI Length    |           Reserved            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       Group Identifier                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

                  Figure 2: MAG Group-Identifier Sub-option

   ANI Type: <IANA-2>

   ANI Length: Total length of this sub option in octets, excluding the
      ANI Type and ANI length fields. The value is always 6.

   Reserved: MUST be set to zero when sending and ignored when
      received.

   Group Identifier:

5. ANI Update-Timer Sub-Option

   The ANI Update Timer is a mobility sub-option carried in the ANI
   option defined in [RFC6757]. The MAG sends a PBU with an updated
   value of ANI mobility options when the update-timer expires.
   Specifically, if the update-timer expires and the ANI values are
   identical to the last transmitted ANI values, then a PBU shall not be
   transmitted.

   When the Update-Timer Sub option is carried in a PBU, it is
   considered as a proposed value for the update-timer. When the
   Update-Timer sub option is carried in a PBA, then it is considered as
   an accepted value for the update-timer. If the MAG does not receive
   a update-timer sub option in PBA (in response to sending the sub-
   option in the PBU), then it the MAG behavior with respect to updating
   the ANI values is left to implementation choices.


```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| ANI Type=IANA | ANI Length    |           Reserved            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        Update-Timer                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
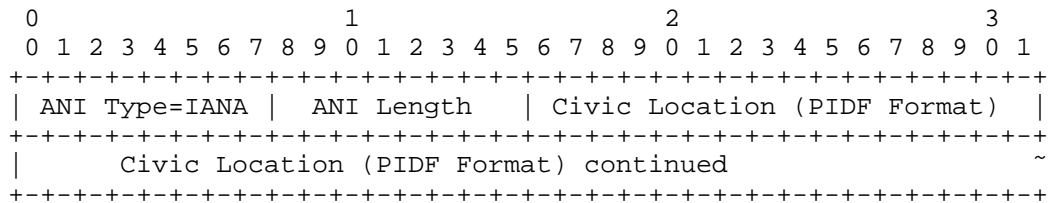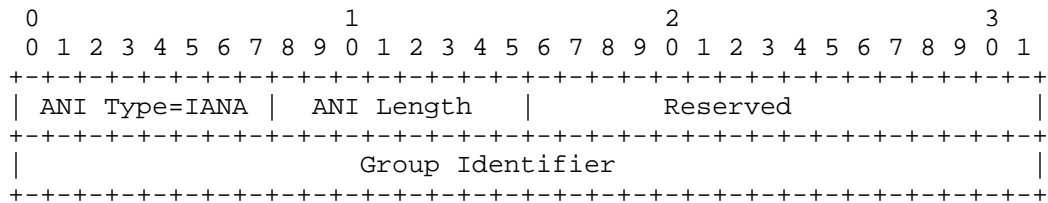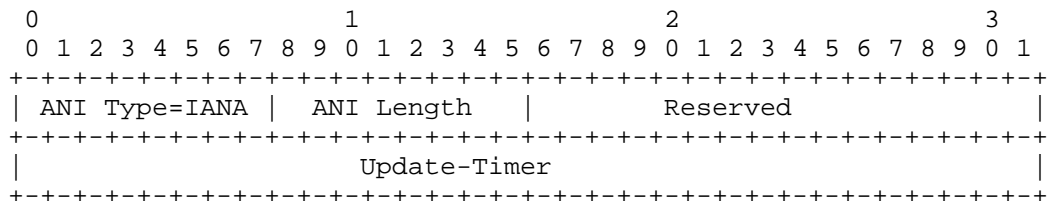
                Figure 3: Network-Identifier Sub-option

    ANI Type: <IANA-3>

    ANI Length: Total length of this sub option in octets, excluding the
       ANI Type and ANI length fields is always 6.

    Reserved: MUST be set to zero when sending and ignored when
       received.

    Update-Timer: Update-Timer is a 16 bit unsigned integer. It
       indicates the time in seconds before the MAG sends an update value
       of ANI mobility options. A value of 0 indicates that the MAG will
       send an updated ANI mobility option as soon as it discovers a
       change in ANI values.

6. Usage Example

    Consider a case where the MAG is not co-located with an AP.

    o MN Attaches to Wi-Fi Network

    o MAG registers with the LMA and provides an Update-Timer ANI sub
       option. The LMA responds with a value of Update-Timer in the PBA.

    o Application request LMA for ANI Information

    o if ANI information is current (for example, the MAG had sent the
       Update-Timer value of 0) then LMA provides ANI information

    o if ANI is not current, LMA sends Update Notification with ANI-
       Update-Requied Notiiication reason

    o MAG sends a re-registration with updated ANI sub options

```
        +--+      +--------+                   +------+     +------+
        |MN|      |AP/WLC  |                   | LMA  |     |App   |
        +--+      | MAG    |                   |      |     |Server|
         |        +--------+                   +------+     +------+
         |             |             |             |            |
         |             |             |             |            |
     (1) |-ATTACH--->  |             |             |            |
     (2) |             |PBU[Civic Loc, Update-Timer]--->        |
         |             |             |             |            |
     (3) |             |<-----PBA[Update-Timer]---------|       |
         |             |             |             |            |
     (4) |             |             |             |<-Get Loc----|
         |             |             |             |            |
         |             |             |         check ANI         |
         |             |             |           Timer           |
     (5) |             |<-Update Notification----------|         |
         |             |   (ANI-PARAMS-Requested)      |         |
         |             |             |             |            |
     (6) |             |---Update Notification Ack----->         |
     (7) |             |PBU[Civic Loc, Update-Timer]--->         |
     (8) |             |<-----PBA[Update-Timer]--------|         |
     (9) |             |             |             |---Location->|
```

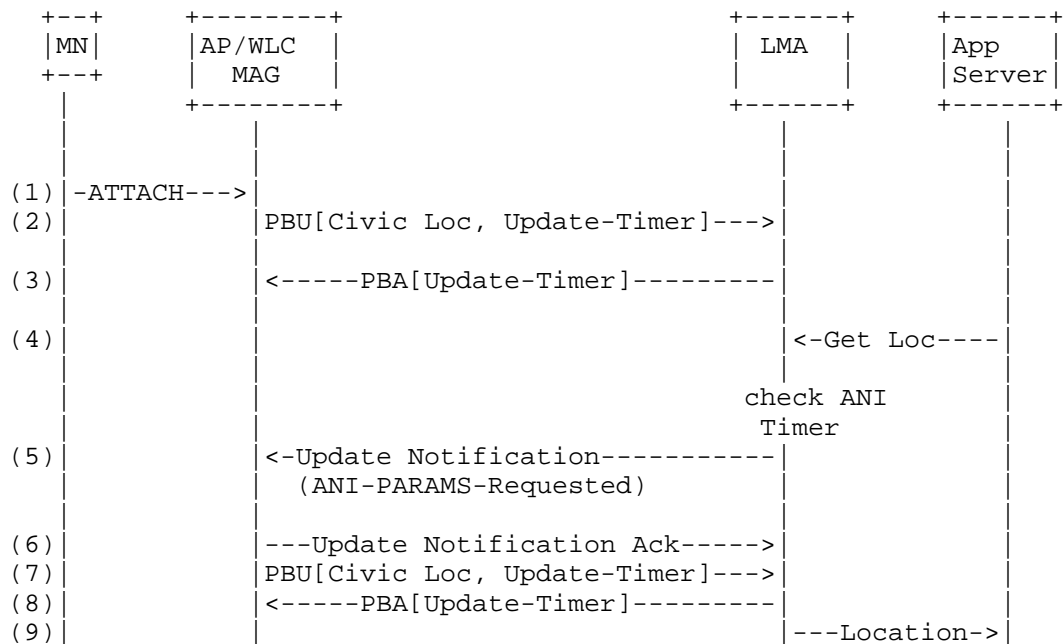   Figure 4: Usage Example

   Note the the protocol for retrieving location from the LMA is outside
   the scope of this document.

7. IANA Considerations

   This document requires the following IANA action.

   o Action-1: This specification defines a new Access Network
      Identifier sub-option called Civic Location Sub-option. This
      mobility sub-option is described in Section 3 and this sub-option
      can be carried in Access Network Identifier mobility option. The
      type value <IANA-1> for this sub-option needs to be allocated from
      the registry "Access Network Information (ANI) Sub-Option Type
      Values". RFC Editor: Please replace <IANA-1> in Section 3 with
      the assigned value, and update this section accordingly.

   o Action-2: This specification defines a new Access Network
      Identifier sub-option called MAG Group Identifier Sub-option.
      This mobility sub-option is described in Section 4 and this sub-
      option can be carried in Access Network Identifier mobility
      option. The type value <IANA-2> for this sub-option needs to be
      allocated from the registry "Access Network Information (ANI) Sub-

         Option Type Values". RFC Editor: Please replace <IANA-2> in
         Section 4 with the assigned value, and update this section
         accordingly.

    o Action-3: This specification defines a new Access Network
       Identifier sub-option called ANI-Update-Frequency Sub-option.
       This mobility sub-option is described in Section 5 and this sub-
       option can be carried in Access Network Identifier mobility
       option. The type value <IANA-3> for this sub-option needs to be
       allocated from the registry "Access Network Information (ANI) Sub-
       Option Type Values". RFC Editor: Please replace <IANA-3> in
       Section 5 with the assigned value, and update this section
       accordingly.

8. Security Considerations

    The Civic Location and the ANI-Update-Frequency sub-Options defined
    in this specification are to be carried in the Access Network
    Identifier option defined in [RFC6757]. This sub-option is carried
    in Proxy Binding Update and Proxy Binding Acknowledgement messages.
    This sub-option is carried like any other Access Network Identifier
    sub-option as defined in [RFC6757]. Therefore, it inherits from
    [RFC5213] and [RFC6757], its security guidelines and does not require
    any additional security considerations.

    The Civic Location sub-option carried in the Access Network
    Information option exposes the geo-location of the network to which
    the mobile node is attached. This information is considered to be
    very sensitive, so care must be taken to secure the Proxy Mobile IPv6
    signaling messages when carrying this sub-option. The base Proxy
    Mobile IPv6 specification [RFC5213] specifies the use of IPsec for
    securing the signaling messages, and those mechanisms can be enabled
    for protecting this information. Operators can potentially apply
    IPsec Encapsulating Security Payload (ESP) with confidentiality and
    integrity protection for protecting the location information.

    Access-network-specific information elements that the mobile access
    gateway sends may have been dynamically learned over DHCP or using
    other protocols. If proper security mechanisms are not in place, the
    exchanged information may be potentially compromised with the mobile
    access gateway sending incorrect access network parameters to the
    local mobility anchor. This situation may potentially result in
    incorrect service policy enforcement at the local mobility anchor and
    impact to other services that depend on this access network
    information. This threat can be mitigated by ensuring the
    communication path between the mobile access gateway and the access
    points is properly secured by the use of IPsec, Transport Layer

Security (TLS), or other security protocols.

9. Acknowledgements

TBD

10. References

10.1. Normative References

   [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119, March 1997.

   [RFC4776] Schulzrinne, H., "Dynamic Host Configuration Protocol
              (DHCPv4 and DHCPv6) Option for Civic Addresses
              Configuration Information", RFC 4776, November 2006.

   [RFC5139] Thomson, M. and J. Winterbottom, "Revised Civic Location
              Format for Presence Information Data Format Location
              Object (PIDF-LO)", RFC 5139, February 2008.

   [RFC5213] Gundavelli, S., Leung, K., Devarapalli, V., Chowdhury, K.,
              and B. Patil, "Proxy Mobile IPv6", RFC 5213, August 2008.

   [RFC5844] Wakikawa, R. and S. Gundavelli, "IPv4 Support for Proxy
              Mobile IPv6", RFC 5844, May 2010.

   [RFC6757] Gundavelli, S., Korhonen, J., Grayson, M., Leung, K., and
              R. Pazhyannur, "Access Network Identifier (ANI) Option for
              Proxy Mobile IPv6", RFC 6757, October 2012.

10.2. Informative References

   [RFC5415] Calhoun, P., Montemurro, M., and D. Stanley, "Control And
              Provisioning of Wireless Access Points (CAPWAP) Protocol
              Specification", RFC 5415, March 2009.

   [RFC5416] Calhoun, P., Montemurro, M., and D. Stanley, "Control and
              Provisioning of Wireless Access Points (CAPWAP) Protocol
              Binding for IEEE 802.11", RFC 5416, March 2009.

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