                   RADIUS Support for Proxy Mobile IPv6

Abstract

   This document defines new attributes to facilitate Proxy Mobile IPv6
   operations using the RADIUS infrastructure. The protocol defined in
   this document uses RADIUS-based interfaces of the mobile access
   gateway and the local mobility anchor with the AAA server for
   authentication, authorization, and policy functions. The RADIUS
   interactions between the mobile access gateway and the RADIUS-based
   AAA server take place when the mobile node (MN) attaches,
   authenticates, and authorizes to a Proxy Mobile IPv6 domain.
   Furthermore, this document defines the RADIUS-based interface between
   the local mobility anchor and the AAA RADIUS server for authorizing
   received Proxy Binding Update messages for the mobile node's mobility
   session. In addition to the interactions related to mobility session
   setup, this document defines the baseline for the mobile access
   gateway and the local mobility anchor generated accounting.

Status of This Memo

   This is an Internet Standards Track document.

   This document is a product of the Internet Engineering Task Force
   (IETF). It represents the consensus of the IETF community. It has
   received public review and has been approved for publication by the
   Internet Engineering Steering Group (IESG). Further information on
   Internet Standards is available in Section 2 of RFC 5741.

   Information about the current status of this document, any errata,
   and how to provide feedback on it may be obtained at
   http://www.rfc-editor.org/info/rfc6572.

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1. Introduction

   Proxy Mobile IPv6 (PMIPv6) [RFC5213] is a network-based mobility
   management protocol that allows IP mobility support for a mobile node
   without requiring the mobile node's participation in any mobility-
   related signaling. The mobile management elements in the network,
   the mobile access gateway (MAG) and the local mobility anchor (LMA),
   are the two key functions in this network-based mobility system. The
   mobile access gateway is responsible for detecting the mobile node's
   movements in the network and for initiating the needed mobility
   management signaling with the local mobility anchor (LMA). Both the
   mobility management agents make use of the AAA infrastructure to
   retrieve the mobile node's policy profile and for performing service
   authorization.

   This document defines a RADIUS-based [RFC2865] profile and
   corresponding attributes to be used on the AAA interface between the
   MAG and the AAA RADIUS server. This interface is used to carry the
   per-MN policy profile from the remote policy store to the MAG.
   Furthermore, this document also defines a RADIUS-based interface
   between the LMA and the AAA RADIUS server for authorization of the
   received Proxy Mobile IPv6 signaling messages. The AAA procedures
   defined in this document cover the following two scenarios:

   o a mobile node connects to the Proxy Mobile IPv6 domain from the
      home network

   o a mobile node connects to the Proxy Mobile IPv6 domain from a
      visited network

2. Terminology

   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 [RFC2119].

   All the mobility-related terms used in this document are to be
   interpreted as defined in the Proxy Mobile IPv6 specifications
   [RFC5213] and [RFC5844]. Additionally, this document uses the
   following abbreviations:

   Network Access Server (NAS):

      A function that provides authorization services for a device/user
      access to the network as defined in [RFC2865]. This document
      makes an assumption that the NAS function is co-located with the

      MAG. In scenarios where the NAS function and MAG are decoupled,
      the messaging interface needed between them for the operation of
      PMIP6 is beyond the scope of this document.

   Home AAA (HAAA):

      An Authentication, Authorization, and Accounting (AAA) server
      located in the MN's home network. This sever has access to the
      mobile node's policy profiles.

   Visited AAA (VAAA):

      An Authentication, Authorization, and Accounting (AAA) server
      located in the MN's visited network. The VAAA server takes the
      role of a proxy-server, forwarding the received AAA service
      request to the HAAA server in the mobile node's home network and
      relaying the response to the requesting node, after applying any
      local access network policies.

   Local AAA (LAAA):

      An Authentication, Authorization, and Accounting proxy located in
      the local network. In a roaming case, the local AAAA has the
      visited AAA role.

3. Solution Overview

   This document defines the RADIUS-based AAA interactions with the two
   mobility management elements in the Proxy Mobile IPv6 domain.

   o Interactions between a MAG and a RADIUS-based AAA server

   o Interactions between a LMA and a RADIUS-based AAA server

   The mobile node's policy profile [RFC5213] is present in a policy
   store and is needed by the PMIPv6 mobility management elements for
   authorizing the mobile node for mobility management service and for
   obtaining various service-related parameters. This policy store
   could be locally co-located with the mobility management agents
   enabling direct local access or could be available from a AAA server
   through a RADIUS-based AAA interface.

   When a mobile node attaches to an access network, the NAS on that
   access network may activate the network access authentication
   procedure. The choice of the authentication mechanism is specific to
   the access network deployment; however, it is typically based on the
   Extensible Authentication Protocol (EAP) [RFC3748]. The NAS performs
   the network access authentication and queries the HAAA using AAA

protocol, such as RADIUS. If the network access authentication
succeeds, the MN's policy profile is obtained as part of the RADIUS
message exchange with the AAA server.

The mobile node may be an IPv4-only node, IPv6-only node, or a dual-
stack (IPv4/v6) node. Based on the policy specified in the policy
profile, the network access authentication procedure SHOULD provide
the unambiguous indication of the type of address(es) to be assigned
for the MN in the network and with all other service-related and
policy parameters relevant to the mobility service.

After the successful network access authentication and obtaining the
mobile node's policy profile, the MAG sends a Proxy Binding Update
(PBU) to the LMA. Upon receiving the PBU, the LMA interacts with the
HAAA to obtain the mobile node's policy profile, which is required
for authorizing and activating mobility service.

This document adds support for three distinct PMIPv6 mobility use
cases, taking into account the administrative domains to which the
MAG and the LMA belong. The following are the three relevant
deployment models.

1. the MAG and LMA are both in the home network,

2. the MAG and LMA are both in the visited network,

3. the MAG is in the visited network while the LMA is in the home
    network.

Figure 1 shows participating network entities for the PMIPv6 mobility
session, which is located in the home network. The MAG and LMA
interact only with the HAAA.

```
        +--------+
        | HAAA & |  RADIUS  +-----+
        | Policy |<-------->| LMA |
        | Profile|          +-----+
        +--------+            |  <--- LMA-Address
            ^                 |
            |               // \\
     +---|------------ //---\\--------------+
     (   |   IPv4/IPv6  //       \\              )
     (   |   Network  //         \\              )
      +---|-----------//---------\\------------+
            |        //           \\
         RADIUS     // <- Tunnel1  \\ <- Tunnel2
            |      //               \\
            |     |- MAG1-Address   |- MAG2-Address
            |  +----+               +----+
       +---->|MAG1|               |MAG2|
            |  +----+               +----+
            |    |                    |
            |    |                    |
               MN1                   MN2
```
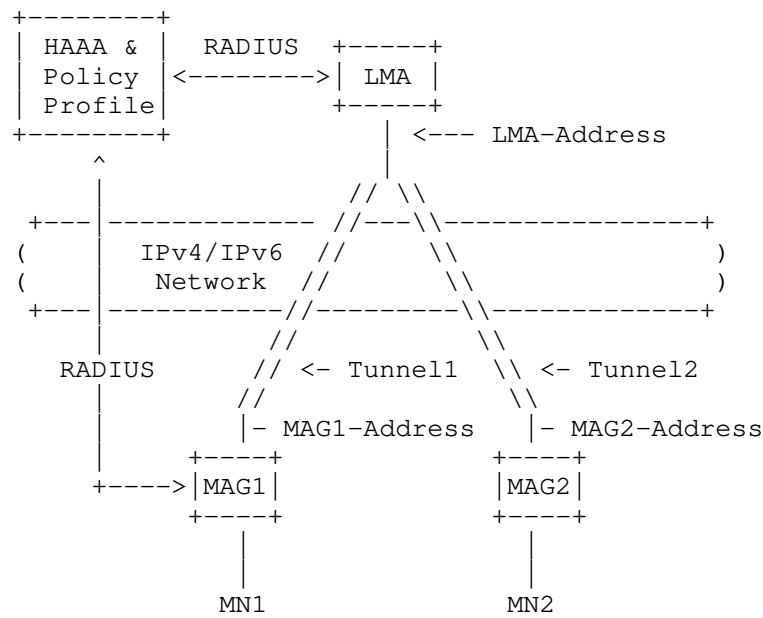
Figure 1: The MAG and LMA Are Both in the Home Network

Figure 2 shows both the LMA and MAG are in the visited network. The
MAG and LMA exchange signaling with the HAAA through the VAAA, which
acts as a Proxy. The visited network may append additional
information to the HAAA replies in order to reflect the local policy.

```
                         +--------------+
                         |    HAAA &     |
              +----------| Policy Profile|
              |          +--------------+
              |
      +---------+
      |[VL]AAA &| RADIUS  +-----+
      | Policy  |<------->| LMA |
      | Profile |         +-----+
      +---------+            |  <--- LMA-Address
          ^                 // \\
      +---|------------- //---\\--------------+
      (   |    IPv4/IPv6  //      \\            )
      (   |     Network  //        \\            )
      +---|-----------//---------\\------------+
          |          //            \\
       RADIUS       // <- Tunnel1   \\ <- Tunnel2
          |        //                \\
          |        |- MAG1-Address    |- MAG2-Address
          |     +----+              +----+
      +---->|MAG1|              |MAG2|
          |     +----+              +----+
                  |                    |
                 MN1                  MN2
```
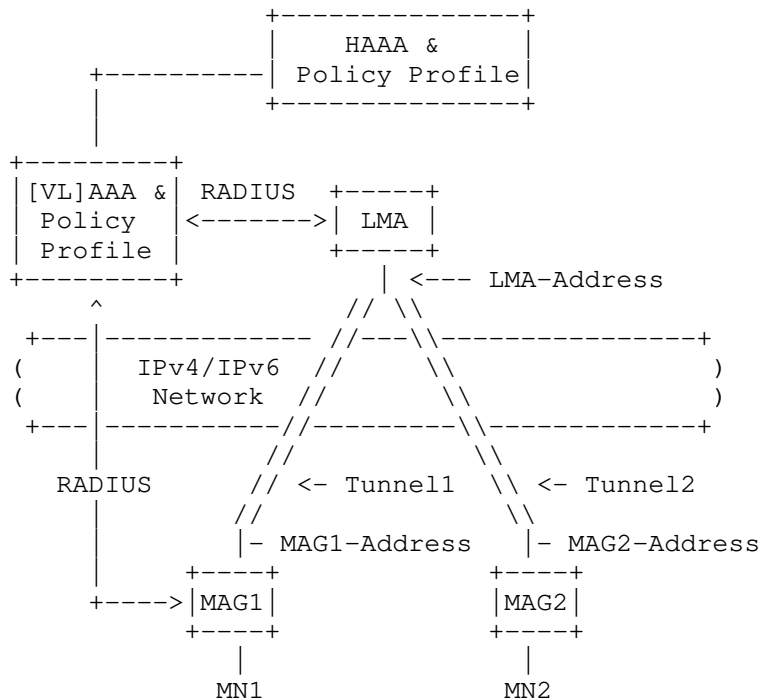
        Figure 2: The MAG and LMA Are Both in the Visited/Local Network

   Figure 3 illustrates a topology where the MAG resides in the visited
   network while the associated LMA is in MN's home network. Any
   message between the MAG and the HAAA passes through the VAAA, which
   acts as a Proxy. During the network authentication, the visited
   network's specific policy may also be propagated from the VAAA to the
   MAG. The LMA has a direct access to the HAAA.

```
                        +---------------+
                        |    HAAA &     |
            +---------- | Policy Profile|
            |           +---------------+
            |                   |
            |                 RADIUS
    +---------+                 |
    |[VL]AAA &|               +-----+
    | Policy  |               | LMA |
    | Profile |               +-----+
    +---------+                 | <--- LMA-Address
        ^                     // \\
    +---|------------- //---\\---------------+
    (   |  IPv4/IPv6  //       \\            )
    (   |   Network  //         \\           )
     +---|-----------//---------\\-----------+
         |          //           \\
      RADIUS       // <- Tunnel1  \\ <- Tunnel2
         |        //               \\
         |       |- MAG1-Address    |- MAG2-Address
         |    +----+            +----+
    +---->|MAG1|            |MAG2|
         |    +----+            +----+
              |                   |
             MN1                 MN2
```
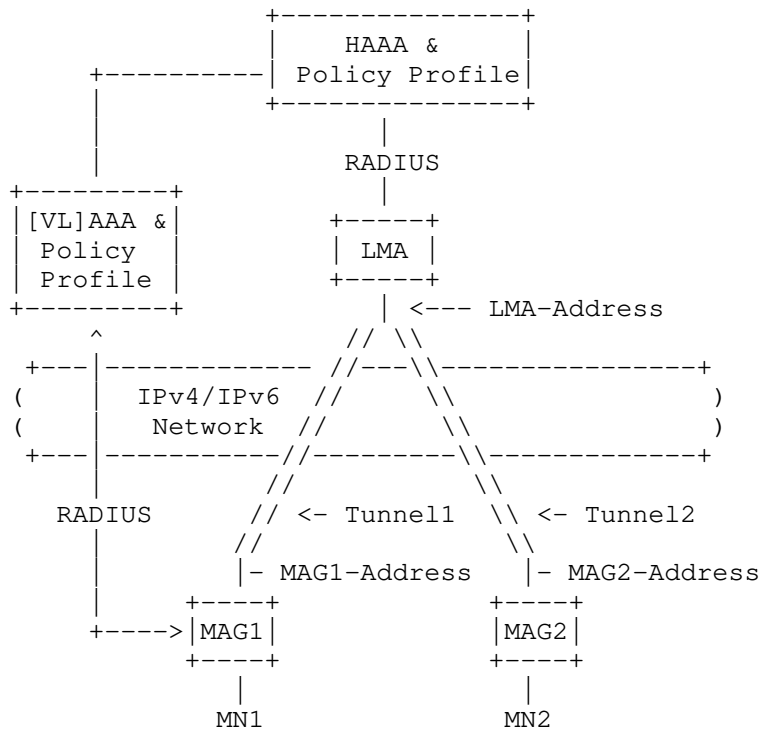
                Figure 3: Visited MAG and Home LMA Topology

4. Attribute Definitions

4.1. MIP6-Feature-Vector

   Diameter [RFC3588] reserves AVP Code space 1-255 as RADIUS attribute
   compatibility space. The MIP6-Feature-Vector attribute (Type value
   124) defined in [RFC5447] is of type OctetString and contains a
   64-bit flags field of supported mobility capabilities. This document
   reserves two new capability bits according to the rules in [RFC5447],
   and reuses the PMIPv6 capability bits defined by [RFC5779]. The
   following capability flag bits are used or defined in this document:

   PMIP6_SUPPORTED (0x0000010000000000)

      This capability bit is used as defined in [RFC5779].

   IP4_HOA_SUPPORTED (0x0000020000000000)

      This capability bit is used as defined in [RFC5779]. Assignment
      of the IPv4-HoA (Home Address) is defined by [RFC5844].

   LOCAL_MAG_ROUTING_SUPPORTED (0x0000040000000000)

      This capability bit is used as defined in [RFC5779].

   IP4_TRANSPORT_SUPPORTED (0x0000800000000000)

      This capability bit is used for negotiation of the IPv4 transport
      support between the MAG and AAA. When the MAG sets this flag bit
      in the MIP6-Feature-Vector, it indicates the ability of the MAG to
      provide IPv4 transport (i.e., IPv4-based encapsulation) for
      carrying IP traffic between the MAG and the LMA. If this flag bit
      is unset in the returned MIP6-Feature-Vector attribute, the AAA
      does not authorize the use of IPv4 transport on the MAG-to-LMA
      tunnel.

   IP4_HOA_ONLY_SUPPORTED (0x0001000000000000)

      This capability bit is used for determination of the authorized
      PMIPv6 mobility mode. When this bit is set by the AAA, it
      indicates PMIPv6 mobility with IPv4 support has only been
      authorized for the MN. As a result, the RADIUS Access-Accept
      SHOULD NOT carry the IPv6 Home Network Prefix (IPv6 HNP). When
      this bit is set, the PMIP6_SUPPORTED flag MUST also be set and the
      IP4_HOA_SUPPORTED flag MUST NOT be set.

   To summarize the use of the MIP6-Feature-Vector the following
   capability bit combination settings mean:

      PMIP6-SUPPORTED bit set - only IPv6 mobility is supported and
      authorized.

      PMIP6-SUPPORTED and IP4-ONLY-HOA-SUPPORTED bits set - only IPv4
      mobility is supported and authorized.

      PMIP6-SUPPORTED and IP4-HOA-SUPPORTED bits set - both IPv6 and
      IPv4 mobility are supported and authorized.

   The MIP6-Feature-Vector attribute is also used on the LMA to the
   RADIUS AAA interface. This capability announcement attribute enables
   direct capability negotiation between the LMA and the AAA. The
   capabilities that are announced by both parties in the MIP6-Feature-
   Vector are known to be mutually supported. The LMA may use this
   mechanism during authorization of the received PBU against the AAA to
   check individual PMIPv6 feature permissions for a particular MN.

   If the RADIUS Access-Accept contains a contradicting combination of
   the capability flag bits such as both the IP4_HOA_ONLY_SUPPORTED and
   the IP4_HOA_SUPPORTED flags being set, then the RADIUS client MUST

   treat the Access-Accept as an Access-Reject and SHOULD log the event.
   Similarly, if the RADIUS Access-Request contains a contradicting
   combination of the capability flag bits, then the RADIUS server MUST
   reply with an Access-Reject message and SHOULD log the event.

4.2. Mobile-Node-Identifier

   The Mobile-Node-Identifier attribute (Type value 145) is of type
   String and contains the mobile node identifier (MN-Identifier), see
   [RFC5213], in a form of a Network Access Identifier (NAI) [RFC4282].
   This identifier and the identifier used for access authentication may
   be different; however, there needs to be a mapping between the two
   identities as specified in Section 6.6 of [RFC5213]. This attribute
   is used on the interface between the MAG and the AAA server. The
   Mobile-Node-Identifier attribute is designed for deployments where
   the identity used during network access authentication and the
   identity used for mobility management is decoupled. It may also be
   the case where the MAG does not have means to find out the MN
   identity that could be used in subsequent PBU and Proxy Binding
   Acknowledgement (PBA) exchanges (e.g., due to identity hiding during
   the network access authentication) or when the HAAA wants to assign
   periodically changing identities to the MN.

   The Mobile-Node-Identifier attribute MAY be returned by the HAAA in
   the RADIUS Access-Accept message that completes a successful
   authentication and authorization exchange between the MAG and the
   HAAA. The MAG MUST use the received MN-Identifier.

```
     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
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |     Type      |    Length     |    Mobile Node Identifier...   ~
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   Type:
     Mobile-Node-Identifier 145.

   Length:
      In octets, including Type and Length fields (>= 3).

   Mobile Node Identifier:
      This field is of type String and contains the MN-Identifier
      of the MN to be used in the PBU/PBA exchange.

4.3. Service-Selection

   The Service-Selection attribute (Type value 146) is of type UTF-8
   text and contains the name of the service or the external network
   with which the mobility service for the particular MN SHOULD be
   associated [RFC5149]. The identifier MUST be unique within the
   PMIPv6 Domain when normalized using the selected normalization form
   [UNF] for the particular PMIPv6 Domain deployment. For instance,
   [RFC5149] uses the Normalization Form KC (NFKC).

   The MAG MUST include the Service-Selection attribute in the Access-
   Request sent to the AAA if the information was acquired, e.g., by
   operator-specific configuration. The AAA MAY include the Service-
   Selection attribute in the Access-Accept response message to the MAG
   even if it was not included in the Access-Request as a means of
   indicating the MN's default service.

   The Service Selection mobility option defined in [RFC5149] can be
   used in PBU/PBA messages between the MAG and LMA. On the LMA-to-AAA
   interface, the LMA MAY populate the Service-Selection attribute in
   the Access-Request message using the service information found in the
   received PBU, if such a mobility option were included. The Service-
   Selection identifier should be used to assist the PBU authorization,
   the assignment of the MN-HNP, and the IPv4-MN-HoA as described in
   [RFC5149] and [RFC5779].

```
    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
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |      Type     |     Length    |     Service Identifier...    ~
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   Type:
      Service-Selection 146.

   Length:
   In octets, including Type and Length fields (>= 3).

   Text:
      This field is of type UTF-8 text and contains the Service
      Identifier with which the MN is associated.

4.4. PMIP6-Home-LMA-IPv6-Address

   The PMIP6-Home-LMA-IPv6-Address attribute (Type value 147) is of type
   IPv6 address and is used to deliver the IPv6 address of the LMA
   located in the home network.

   Before the MAG can initiate Proxy Mobile IPv6 signaling, it must be
   aware of the LMA's IP address.

   When the LMA is assigned to the MN from the home network, this
   attribute MAY be sent by the HAAA to the MAG in the RADIUS Access-
   Accept message.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      Type      |    Length     |      Home LMA IPv6 address
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                     Home LMA IPv6 address
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                     Home LMA IPv6 address
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                     Home LMA IPv6 address
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
      Home LMA IPv6 address      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
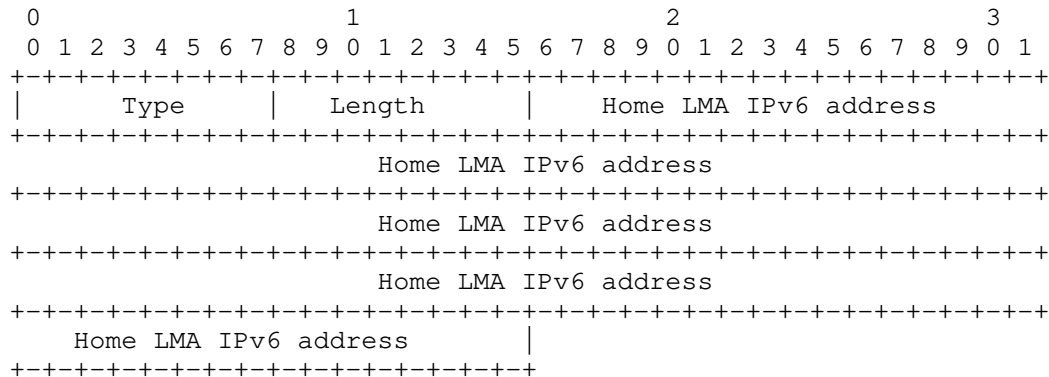
   Type:
     PMIP6-Home-LMA-IPv6-Address 147.

   Length:
      = 18 octets

   Home LMA IPv6 address:
      128-bit IPv6 address of the assigned home LMA IPv6 address.

4.5. PMIP6-Visited-LMA-IPv6-Address

   The PMIP6-Visited-LMA-IPv6-Address attribute (Type value 148) is of
   type IPv6 address and is used to propose a particular LMA in the
   visited network and to authorize the use of the LMA in the visited/
   local network.

   PMIP6-Visited-LMA-IPv6-Address attribute MAY be included by the MAG
   in the RADIUS Access-Request message. The LMA in the visited/local
   network may be assigned by the [VL]AAA as the result of retrieved
   policy profile. If included by the [VL]AAA in the RADIUS Access-
   Accept sent to the MAG, the use of the LMA in the visited/local
   network is authorized and the attribute SHALL carry the IPv6 address
   of the LMA assigned for the particular MN. See Section 4.2.5 of
   [RFC5447] how the MIP6-Feature-Vector attribute and
   LOCAL_HOME_AGENT_ASSIGNMENT capability flag is used with the LMA
   (Home Agent) assignment.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     Type      |    Length     |    Visited LMA IPv6 address
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
               Visited LMA IPv6 address
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
               Visited LMA IPv6 address
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
               Visited LMA IPv6 address
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     Visited LMA IPv6 address     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   Type:
     PMIP6-Visited-LMA-IPv6-Address 148.

   Length:
     = 18 octets

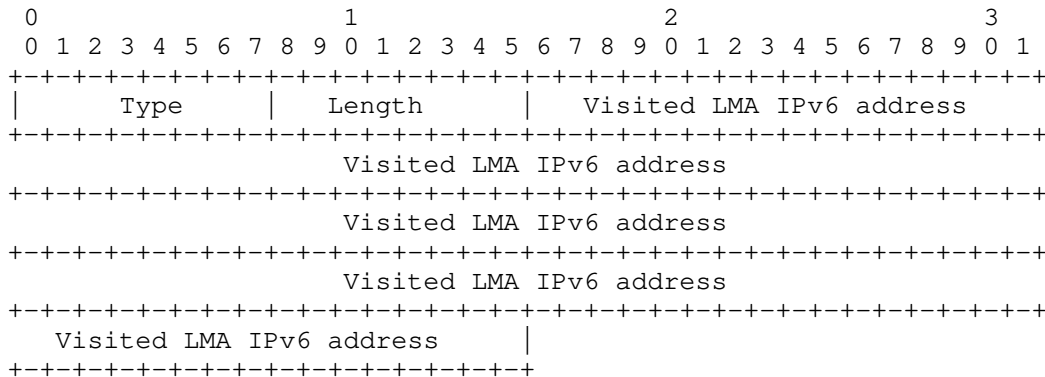   Visited LMA IPv6 address:
     128-bit IPv6 address of the assigned visited LMA IPv6 address.

4.6. PMIP6-Home-LMA-IPv4-Address

   The PMIP6-Home-LMA-IPv4-Address attribute (Type value 149) is of type
   IPv4 address and contains the IPv4 address of the LMA assigned by the
   HAAA. The [RFC5844] supports Proxy Mobile IPv6 signaling exchange
   between MAG and LMA using the IPv4 transport.

   When the LMA is located in the home network, this attribute MAY be
   sent by the HAAA to the MAG in the RADIUS Access-Accept message.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     Type      |    Length     |     Home LMA IPv4 address
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     Home LMA IPv4 address       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
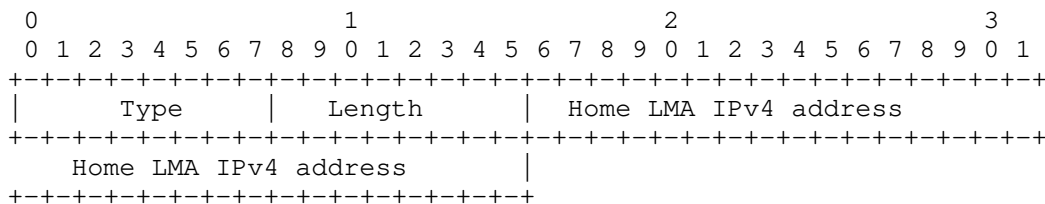
   Type:
     PMIP6-Home-LMA-IPv4-Address 149.

   Length:
     = 6 octets

     Home LMA IPv4 address:
        32-bit IPv4 address of the assigned LMA.

4.7. PMIP6-Visited-LMA-IPv4-Address

   The PMIP6-Visited-LMA-IPv4-Address attribute (Type value 150) is of
   type IPv4 address and is used to propose a particular LMA in the
   visited network and to authorize the use of the LMA in the visited
   network.

   PMIP6-Visited-LMA-IPv4-Address attribute MAY be included by the MAG
   in the RADIUS Access-Request message. The LMA in the visited/local
   network may be assigned by the [VL]AAA as the result of retrieved
   policy profile. If included by the [VL]AAA in the RADIUS Access-
   Accept sent to the MAG, the use of the LMA in the visited/local
   network is authorized and the attribute SHALL carry the IPv4 address
   of the LMA assigned for the particular MN. See Section 4.2.5 of
   [RFC5447] how the MIP6-Feature-Vector attribute and
   LOCAL_HOME_AGENT_ASSIGNMENT capability flag is used with the LMA
   (Home Agent) assignment.

    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
   +-+
   | Type | Length | Visited LMA IPv4 address
   +-+
      Visited LMA IPv4 address |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

   Type:
     PMIP6-Visited-LMA-IPv4-Address 150.

   Length:
      = 6 octets

   IPv4 LMA address:
      32-bit IPv4 address of the assigned LMA.

4.8. PMIP6-Home-HN-Prefix

   The PMIP6-Home-HN-Prefix attribute (Type value 151) is of type IPv6
   prefix. It contains the Mobile Node - Home Network Prefix (MN-HNP),
   which is the IPv6 prefix assigned to the link between the MN and the
   MAG. The MN configures its IP interface from its home network
   prefix(es). When the LMA is located in the home network, the PMIP6-
   Home-HN-Prefix attribute is used to deliver the MN-HNP from the HAAA
   to the MAG.

The PMIP6-Home-HN-Prefix attribute is also used on the LMA-to-HAAA
interface containing the prefix assigned to the MN. If the LMA
delegates the MN-HNP assignment to the HAAA, the attribute MUST
contain all zeroes in the address of (i.e., '::') the Access-Request
message. The attribute MUST be present in the RADIUS Access-Accept
message if the prior request already included one and SHOULD carry
the MN-HNP the HAAA assigned to the MN.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     Type      |    Length     |    Reserved   | Prefix-Length |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                         Home MN-HNP                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                         Home MN-HNP                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                         Home MN-HNP                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                         Home MN-HNP                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
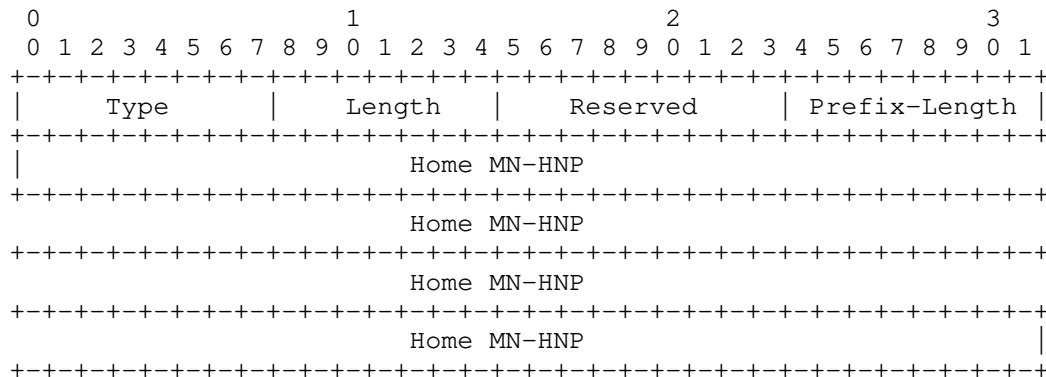
Type:
   PMIP6-Home-HN-Prefix 151.

Length:
   = at least 4 and no larger than 20.

Reserved:
   Reserved for future use. The bits MUST be set to zero by the
   sender and MUST be ignored by the receiver.

Prefix-Length:
   The 8-bit unsigned integer indicating the prefix length of
   the home network prefix (at least 0 and no larger than 128).
   If the home network prefix contains an address of all zeroes
   (i.e., '::'), then the Prefix-Length MUST be set to 128.

Home Network Prefix:
   The home network prefix for the MN's IPv6 address configuration.
   The Prefix field is up to 16 octets in length. Bits outside of
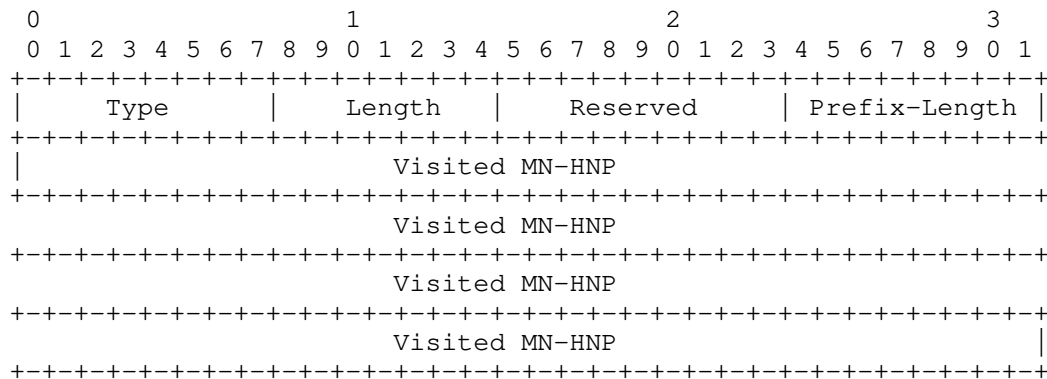   the Prefix-Length, if included, must be zero.

4.9. PMIP6-Visited-HN-Prefix

   The PMIP6-Visited-HN-Prefix attribute (Type value 152) is of type
   IPv6 prefix. It contains the Mobile Node - Home Network Prefix (MN-
   HNP), which is the IPv6 prefix assigned to the link between the MN

and the MAG. The MN configures its IP interface from its home
network prefix(es). When the LMA is located in the visited network,
the PMIP6-Visited-HN-Prefix attribute is used to deliver the MN-HNP
from the VAAA to the MAG.

The PMIP6-Visited-HN-Prefix attribute is also used on the LMA-to-VAAA
interface containing the IPv6 prefix assigned to the MN. If the LMA
delegates the assignment of the MN-HNP to the VAAA, the attribute
MUST contain an address of all zeroes (i.e., '::') in the RADIUS
Access-Request message. The attribute MUST be present in Access-
Accept message if the prior request already included one and SHOULD
carry the MN-HNP the VAAA assigned to the MN.

The attribute SHOULD NOT be included if the use of LMA in the home
network is authorized (the PMIP6-Home-HN-Prefix and/or PMIP6-Home-
LMA-IPv6-Address attributes are already present). However, if the
VAAA local policy allows both home and visited LMA addresses to be
delivered to the MAG, then this attribute MAY also be included.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     Type      |    Length     |    Reserved    | Prefix-Length |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        Visited MN-HNP                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                         Visited MN-HNP
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                         Visited MN-HNP
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                         Visited MN-HNP                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Type:
   PMIP6-Visited-HN-Prefix 152.

Length:
   = at least 4 and no larger than 20.

Reserved:
   Reserved for future use. The bits MUST be set to zero by the
   sender and MUST be ignored by the receiver.

Prefix-Length:
   The 8-bit unsigned integer indicating the prefix length of
   the Visited MN-HNP (at least 0 and no larger than 128). If
   the visited home network prefix contains an address of all zeroes
   (i.e., '::'), then the Prefix-Length MUST be set to 128.

      Visited Home Network Prefix:
         The home network prefix for the MN's IPv6 address configuration.
         The Prefix field is up to 16 octets in length. Bits outside of
         the Prefix-Length, if included, must be zero.

4.10. PMIP6-Home-Interface-ID

   The PMIP6-Home-Interface-ID attribute (Type value 153) is of type
   String and contains the MN's interface identifier. The selection of
   the interface identifier SHOULD NOT allow the tracking of individual
   MNs or users between PMIPv6 mobility sessions for privacy reasons.
   This attribute is applicable in network systems and link
   technologies, where the network explicitly delivers an interface
   identifier to the MN during the link setup. Third Generation
   Partnership Project (3GPP) and PPP link technologies are examples of
   such.

   This attribute MAY be sent by the LMA or the MAG to the HAAA in the
   RADIUS Access-Request packet as a proposal. This attribute MAY be
   sent by the HAAA to the LMA or to the MAG in an Access-Accept packet;
   however, it MUST be present if the prior request already included
   one.

```
    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
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |      Type     |    Length     |   Home Interface Identifier
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                      Home Interface Identifier
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
      Home Interface Identifier     |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
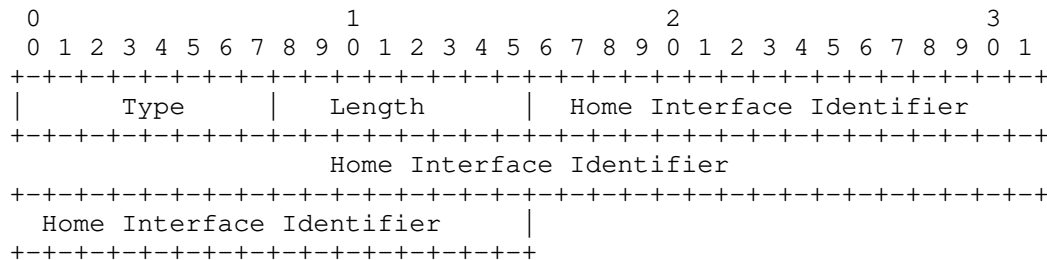
   Type:
      PMIP6-Home-Interface-ID 153.

   Length:
      = 10 octets.

   Home Interface Identifier:
      The 64-bit long interface identifier (8 octets).

4.11. PMIP6-Visited-Interface-ID

   The PMIP6-Visited-Interface-ID attribute (Type value 154) is of type
   String and contains the MN's interface identifier. The selection of
   the interface identifier SHOULD NOT allow the tracking of individual
   MNs or users between PMIPv6 mobility session for privacy reasons.

   This attribute is applicable in network systems and link
   technologies, where the network explicitly delivers an interface
   identifier to the MN during the link setup. 3GPP and PPP link
   technologies are examples of such.

   This attribute MAY be sent by the LMA or the MAG to the VAAA in the
   RADIUS Access-Request packet as a proposal. This attribute MAY be
   sent by the VAAA to the LMA or to the MAG in an Access-Accept packet;
   however, it MUST be present if the prior request already included
   one.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     Type      |    Length     |  Visited Interface Identifier
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                  Visited Interface Identifier
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   Visited Interface Identifier  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   Type:
      PMIP6-Visited-Interface-ID 154.
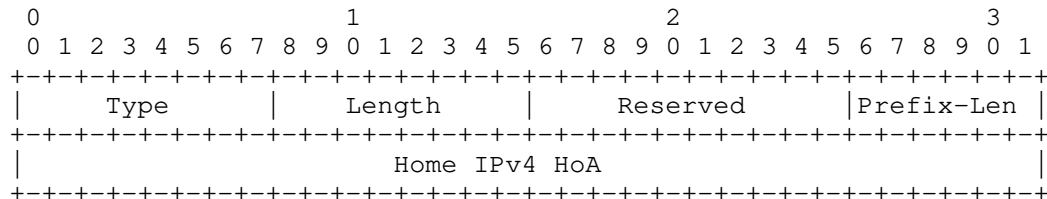
   Length:
      = 10 octets.

   Visited Interface Identifier:
      The 64-bit long interface identifier (8 octets).

4.12. PMIP6-Home-IPv4-HoA

   [RFC5844] specifies extensions to Proxy Mobile IPv6 protocol that
   enable IPv4 home address mobility support to the MN. The PMIP6-Home-
   IPv4-HoA attribute (Type value 155) is of type Address and contains
   the IPv4 Home Address of the MN. The primary use of this attribute
   is to deliver the assigned IPv4-HoA from HAAA to the MAG.

   The PMIP6-Home-IPv4-HoA is also used on the LMA-to-HAAA interface.
   If the LMA in the home network delegates the assignment of the
   IPv4-HoA to the HAAA, the attribute MUST contain an address of all
   zeroes (i.e., 0.0.0.0) in the Access-Request message. The attribute
   MUST be included in by HAAA in the Access-Accept message if the
   previous request included it, and it contains the IPv4-HoA assigned
   to the MN.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     Type      |     Length    |      Reserved       |Prefix-Len |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       Home IPv4 HoA                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Type:
   PMIP6-Home-IPv4-HoA 155.

Length:
   = 8 octets

Reserved
   The 10-bit field reserved for future use. The value MUST be
   initialized to zero by sender and MUST be ignored by the
   receiver.

Prefix-Len
   The 6-bit unsigned integer indicating the prefix length of the
   IPv4 HoA. If the Home IPv4 HoA contains an address of all zeroes
   (i.e., '0.0.0.0'), then the Prefix-Len MUST be set to 32.
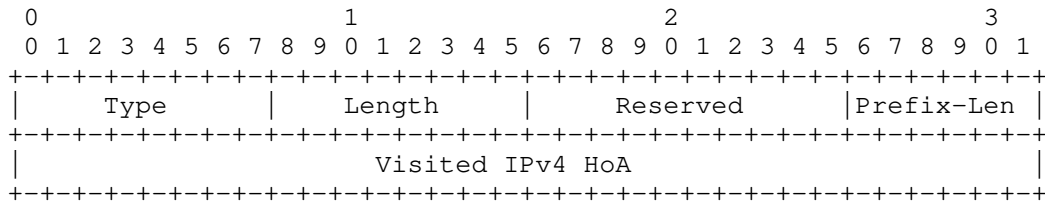
Home IPv4 HoA:
   This field is of type Address and contains the IPv4 home
   address of the MN in the home network.

4.13. PMIP6-Visited-IPv4-HoA

   When both the MAG and the LMA are in the visited network, the PMIP6-
   Visited-IPv4-HoA attribute (Type value 156) is of type Address and is
   used to exchange information between the VAAA and the MAG on the
   assignment of the IPv4 Home Address to the MN being present in the
   visited network.

   The PMIP6-Visited-IPv4-HoA is also used on the LMA-to-VAAA interface.
   If the LMA delegates the assignment of the IPv4-HoA to the VAAA, the
   attribute MUST contain an address of all zeroes (i.e., 0.0.0.0) in
   the RADIUS Access-Request message. The Access-Accept message MUST
   have the attribute present if the prior request to the VAAA already
   included one.

   The attribute SHOULD NOT be included if the use of the LMA in the
   home network is authorized (the PMIP6-Home-IPv4-HoA and/or PMIP6-
   Home-LMA-IPv4-Address attributes are already present). However, if
   the VAAA local policy allows both home and visited LMA addresses to
   be delivered to the MAG, then this attribute MAY also be included.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     Type      |     Length    |      Reserved      |Prefix-Len |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       Visited IPv4 HoA                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Type:
   PMIP6-Visited-IPv4-HoA 156.

Length:
   = 8 octets

Reserved:
   The 10-bit field reserved for future use. The value MUST be
   initialized to zero by the sender and MUST be ignored by the
   receiver.

Prefix-Len:
   6-bit unsigned integer indicating the prefix length of the IPv4
   HoA. If the Visited IPv4 HoA contains an address of all zeroes
   (i.e., '0.0.0.0'), then the Prefix-Len MUST be set to 32.

Visited IPv4 HoA:
   This field is of type Address and contains the IPv4 home address
   of the MN in the visited network.

4.14. PMIP6-Home-DHCP4-Server-Address

   The PMIP6-Home-DHCP4-Server-Address (Type value 157) is of type
   Address and contains the IPv4 address of the DHCPv4 server in the
   home network. The particular DHCP server address is indicated to the
   MAG that serves the concerning MN. The HAAA MAY assign a DHCP server
   to the MAG in deployments where the MAG acts as a DHCP Relay, as
   defined in [RFC5844].

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      Type     |     Length    |    Home DHCPv4 server address
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    Home DHCPv4 server address   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
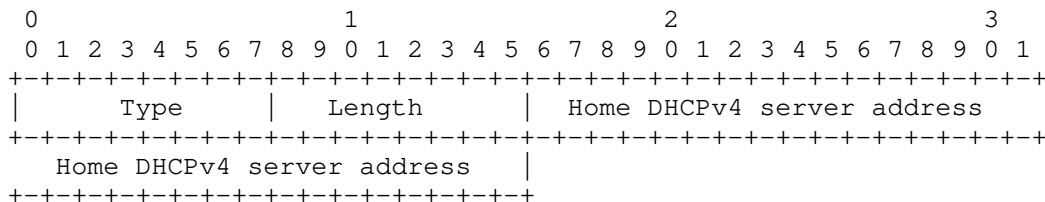
Type:
   PMIP6-Home-DHCP4-Server-Address 157.

   Length:
      = 6 octets.

   Home DHCPv4 server address:
      This field is of type Address and contains a 4-octet IPv4 address
      of the DHCP server.

4.15. PMIP6-Visited-DHCP4-Server-Address

   The PMIP6-Visited-DHCP4-Server-Address attribute (Type value 158) is
   of type Address and delivers the IPv4 address of the DHCPv4 server
   from the visited network to the MAG. When both the MAG and the LMA
   are in the visited network, the VAAA MAY assign a DHCPv4 server to
   the MAG in deployments where the MAG acts as a DHCP Relay, as defined
   in [RFC5844].

```
    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
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |      Type     |    Length     | Visited DHCPv4 server address
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     Visited DHCPv4 server address |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   Type:
      PMIP6-Visited-DHCP4-Server-Address 158.

   Length:
      = 6 octets

   Visited DHCPv4 server address:
      This field is of type Address and contains a 4-octet IPv4 address
      of the DHCPv4 server.

4.16. PMIP6-Home-DHCP6-Server-Address

   The PMIP6-Home-DHCP6-Server-Address (Type value 159) is of type IPv6
   address and contains the IPv6 address of the DHCPv6 server in the
   home network indicated by the HAAA to the MAG that serves the MN.
   The HAAA MAY assign a DHCPv6 server to the MAG in deployments where
   the MAG acts as a DHCP Relay, as defined in [RFC5213].

```
    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
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |      Type       |     Length      |  Home DHCPv6 server address
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                      Home DHCPv6 server address
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                      Home DHCPv6 server address
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                      Home DHCPv6 server address
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
      Home DHCPv6 server address    |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   Type:
     PMIP6-Home-DHCP6-Server-Address 159.
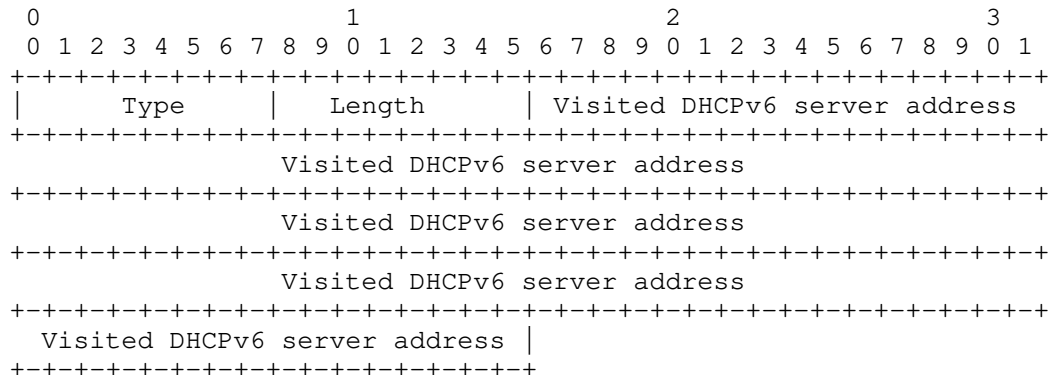
   Length:
     = 18 octets

   Home DHCPv6 server address:
     This field is of type Address and contains 16-octet IPv6 address
     of the DHCPv6 server.

4.17. PMIP6-Visited-DHCP6-Server-Address

   The PMIP6-Visited-DHCP6-Server-Address attribute (Type value 160) is
   of type IPv6 address and contains the IPv6 address of the DHCPv6
   server in the visited network indicated by the VAAA to the MAG that
   serves the MN. When both MAG and the LMA are located in the visited
   network, the VAAA MAY assign a DHCPv6 server to the MAG in
   deployments where the MAG acts as a DHCP Relay, as defined in
   [RFC5213].

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      Type     |     Length    |  Visited DHCPv6 server address
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
              Visited DHCPv6 server address
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
              Visited DHCPv6 server address
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
              Visited DHCPv6 server address
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   Visited DHCPv6 server address |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   Type:
     PMIP6-Visited-DHCP6-Server-Address 160.

   Length:
      = 18 octets

   Visited DHCPv6 server address:
      This field is of type Address and contains the 16-octet IPv6
      address of the DHCPv6 server.

4.18. Calling-Station-Id

   The Calling-Station-Id attribute (Type value 31) is of type String.
   When used within PMIPv6 deployments, the attribute contains the MN
   Link-Layer Identifier option of the MN as defined in [RFC5213],
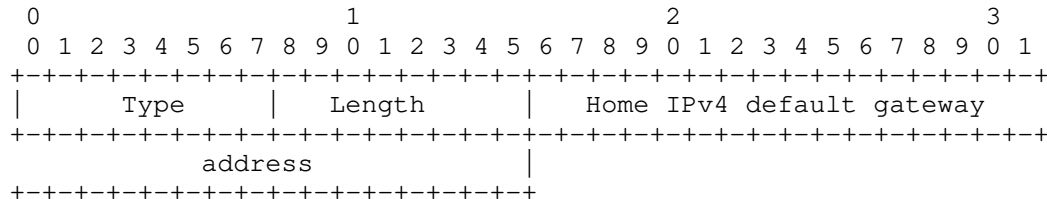   Sections 2.2 and 8.6.

4.19. Chargeable-User-Identity

   The Chargeable-User-Identity attribute, or CUI, (Type value 89) is a
   unique, temporary handle used as means to, for example, correlate
   authentication, accounting, and bill post-processing for a particular
   chargeable subscriber. The CUI format and use follows guidelines
   defined by [RFC4372].

   In the scope of this document, the CUI attribute MAY be present in
   the Access-Request. The CUI MAY also be present in the Access-
   Accept. The CUI MUST be present in the Access-Accept if it was
   present in the Access-Request. If the use of the Chargeable-User-
   Identity attribute is supported, then the MAG and/or the LMA commits
   to include the Chargeable-User-Identity attribute in all subsequent
   RADIUS Accounting packets they send for the given user.

4.20. PMIP6-Home-IPv4-Gateway

   [RFC5844] specifies extensions to Proxy Mobile IPv6 protocol that
   enable IPv4 home address mobility support to the MN. The PMIP6-Home-
   IPv4-Gateway attribute (Type value 161) is of type Address and
   contains the default gateway IPv4 address for the MN. This address
   is populated into the PMIPv6 IPv4 Default-Router Address Option
   [RFC5844]. The address MUST belong to the subnet defined in the
   PMIP6-Home-IPv4-HoA attribute.

```
     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
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |     Type      |    Length     |    Home IPv4 default gateway
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
             address           |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   Type:
      PMIP6-Home-IPv4-Gateway 161.

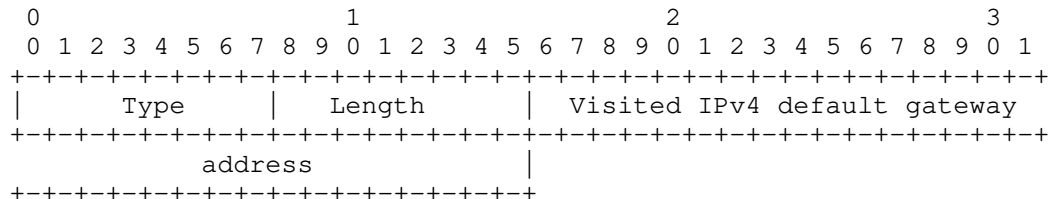   Length:
      = 6 octets

   Home IPv4 default gateway address:
      This field is of type Address and contains a 4-octet IPv4 default
      gateway address.

4.21. PMIP6-Visited-IPv4-Gateway

   [RFC5844] specifies extensions to Proxy Mobile IPv6 protocol that
   enable IPv4 home address mobility support to the MN. The PMIP6-
   Visited-IPv4-Gateway attribute (Type value 162) is of type Address
   and contains the default gateway IPv4 address for the MN. This
   address is populated into the PMIPv6 IPv4 Default-Router Address
   Option [RFC5844]. The address MUST belong to the subnet defined in
   the PMIP6-Visited-IPv4-HoA attribute.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      Type       |     Length      |    Visited IPv4 default gateway
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
            address               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Type:
   PMIP6-Visited-IPv4-Gateway 162.

Length:
   = 6 octets

Visited IPv4 default gateway address:
   This field is of type Address and contains a 4-octet IPv4 default
   gateway address.

5. MAG to RADIUS AAA Interface

5.1. Interface Operations

   The MAG to the AAA RADIUS server interface is used for retrieval of
   the policy profile when an MN tries to attach, authenticate, and
   authorize to a PMIPv6 domain. Depending on the policies and network
   capabilities, the MAG may retrieve different sets of PMIPv6-session-
   related parameters:

   o Configuration attributes for home or visited network access
      scenario, depending on the location and attachment point of the
      MN,

   o The IPv6 or IPv4 address of the designated LMA, depending on the
      access network's actual IP topology,

   o The IPv6 or IPv4 configuration parameters for the MN, depending on
      the utilized IP configuration method and individual MN's service
      Policy,

   o The DHCP Relay support attributes (IPv4 or IPv6) in case such
      functionality is supported in the network.

   In addition to PMIPv6-specific attributes, other RADIUS attributes
   are to be used on the MAG-to-AAA interface.

The User-Name attribute MUST be present in the Access-Request. It
MUST carry a correctly formed identifier that SHOULD correspond to an
MN identity unless the identity is being suppressed for policy
reasons, for example, when identity hiding is in effect. The MN
identity, if available, MUST be in Network Access Identifier (NAI)
[RFC4282] format. At minimum, the home realm of the MN MUST be
available at the MAG when the network access authentication takes
place. Otherwise, the MAG is not able to route RADIUS request
messages towards the correct HAAA. The MN identity used on the MAG-
to-HAAA interface and in the User-Name attribute MAY entirely be
related to the network access authentication and, therefore, not be
suitable to be used as the MN-Identifier mobility option value in the
subsequent PBU/PBA messages. In this case, the HAAA MUST provide the
MN-Identifier for PBU/PBA messages using the Mobile-Node-Identifier
attribute (see Section 4.2).

At least one of the NAS-IP-Address, NAS-IPv6-Address, or
NAS-Identifier attributes MUST be present in the Access-Request. The
Service-Type attribute SHOULD be set to value 1 (Login) and the NAS-
Port-Type attribute SHOULD be present in the Access-Request.

5.2. Table of Attributes

The following table provides a guide to attributes that may be found
in authentication and authorization RADIUS messages between the MAG
and the AAA server.

   Request Accept Reject Challenge #   Attribute

   1   0-1   0   0   1   User-Name
   0-1   0   0   0   4   NAS-IP-Address
   0-1   0-1   0   0   5   NAS-Port
   0-1   0-1   0   0   6   Service-Type
   0-1   0-1   0   0-1   24   State
   0   0-1   0   0   25   Class
   0   0-1   0   0-1   27   Session-Timeout
   0-1   0   0   0   31   Calling-Station-Id
   0-1   0   0   0   32   NAS-Identifier
   0+   0+   0+   0+   33   Proxy-State
   0-1   0   0   0   69   NAS-Port-Type
   0+   0+   0+   0+   79   EAP-Message
   1   1   1   1   80   Message-Authenticator
   0-1   0-1   0   0   89   Chargeable-User-Identity
   0-1   0   0   0   95   NAS-IPv6-Address
   0-1   0-1   0   0   124   MIP6-Feature-Vector
   0   1   0   0   145   Mobile-Node-Identifier
   0-1   0-1   0   0   146   Service-Selection
   0   0-1   0   0   147   PMIP6-Home-LMA-IPv6-Address
   0-1   0-1   0   0   148   PMIP6-Visited-LMA-IPv6-Address
   0   0-1   0   0   149   PMIP6-Home-LMA-IPv4-Address
   0-1   0-1   0   0   150   PMIP6-Visited-LMA-IPv4-Address
   0   0+   0   0   151   PMIP6-Home-HN-Prefix
   0   0+   0   0   152   PMIP6-Visited-HN-Prefix
   0   0-1   0   0   153   PMIP6-Home-Interface-ID
   0   0-1   0   0   154   PMIP6-Visited-Interface-ID
   0   0-1   0   0   155   PMIP6-Home-IPv4-HoA
   0   0-1   0   0   156   PMIP6-Visited-IPv4-HoA
   0   0-1   0   0   157   PMIP6-Home-DHCP4-Server-Address
   0   0-1   0   0   158   PMIP6-Visited-DHCP4-Server-Address
   0   0-1   0   0   159   PMIP6-Home-DHCP6-Server-Address
   0   0-1   0   0   160   PMIP6-Visited-DHCP6-Server-Address
   0   0-1   0   0   161   PMIP6-Home-IPv4-Gateway
   0   0-1   0   0   162   PMIP6-Visited-IPv4-Gateway

6. LMA to RADIUS AAA Interface

6.1. Interface Operations

   The LMA-to-HAAA interface may be used for multiple purposes. These
   include the authorization of the incoming PBU, updating the LMA
   address to the HAAA, delegating the assignment of the MN-HNP or the
   IPv4-HoA to the HAAA, and accounting and PMIPv6 session management.
   The primary purpose of this interface is to update the HAAA with the

LMA address information in case of dynamically assigned LMA and to
exchange the MN address assignment information between the LMA and
the HAAA.

Whenever the LMA sends an Access-Request message to the HAAA, the
User-Name attribute SHOULD contain the MN's identity. The LMA-
provided identity in the User-Name attribute is strongly RECOMMENDED
to be the same as the MN's identity information in the PBU MN-
Identifier mobility option. The identity SHOULD also be the same as
used on the MAG-to-HAAA interface; however, in case those identities
differ, the HAAA MUST have a mechanism of mapping the MN identity
used on the MAG-to-HAAA interface to the identity used on the LMA-to-
HAAA interface.

If the PBU contains the MN Link-Layer Identifier option, the Calling-
Station-Id attribute SHOULD be included in the request message
containing the received MN Link-Layer Identifier option.
Furthermore, if the PBU contains the Service Selection mobility
option [RFC5149], the Service-Selection attribute SHOULD be included
in the request message containing the received service identifier.
Both the MN Link-Layer Identifier option and the service selection
can be used to provide more information for the PBU authorization
step in the HAAA.

The Service-Type attribute MUST be set to the value 17 (Authorize
Only). If the HAAA is not able to authorize the subscriber's
mobility service session, then the Access-Reject message to the LMA
MAY contain the Reply-Message attribute describing the reason for
rejecting the authorization. A failed authorization obviously
results in a rejection of the PBU, and a PBA with an appropriate
error Status Value MUST be sent back to the MAG.

The authorization step MUST be performed at least for the initial PBU
session up to a mobility session, when the LMA-to-HAAA interface is
deployed. For the subsequent re-registration and handover of PBUs,
the authorization step MAY be repeated (in this case, the LMA-to-HAAA
interface should also maintain an authorization session state).

In case of a dynamic LMA discovery and assignment [RFC6097], the HAAA
and the remote policy store may need to be updated with the selected
LMA address information. The update can be done during the PBU
authorization step using the LMA-to-HAAA interface. This
specification uses the PMIP6-*-LMA-*-Address attribute for carrying
the LMA's address information from the LMA to the HAAA. The LMA
address information in the request message MUST contain the IP
address of the LMA, the Fully Qualified Domain Name (FQDN) uniquely

identifying the LMA, or both. The LMA address information refers to
the PMIPv6 part of the LMA, not necessarily the LMA part interfacing
with the AAA infrastructure.

The LMA and the HAAA use the PMIP6-Home-HN-Prefix/
PMIP6-Visited-HN-Prefix attributes to exchange the MN-HNP when
appropriate. Similarly, the LMA and the HAAA use the PMIP6-Home-
IPv4-HoA/PMIP6-Visited-IPv4-HoA attributes to exchange the IPv4-MN-
HoA when appropriate. The MN address information exchange is again
done during the PBU authorization step. The HAAA MAY also use the
LMA-provided MN address information as a part of the information used
to authorize the PBU.

Which entity is actually responsible for the address management is
deployment specific within the PMIPv6 Domain and MUST be pre-agreed
on per deployment basis. When the LMA is responsible for the address
management, the PMIP6-*-HN-Prefix/PMIP6-*-IPv4-HoA attributes are
used to inform the HAAA and the remote policy store of the MN-HNP/
IPv4-MN-HoA assigned to the MN. It is also possible that the LMA
delegates the address management to the HAAA. In this case, the
MN-HNP/IPv4-MN-HoA are set to undefined addresses in the Access-
Request message sent from the LMA to the HAAA. The LMA expects to
receive the HAAA assigned HNP/IPv4-MN-HoA in the corresponding
Access-Accept message.

6.2. Table of Attributes

The following table provides a guide to which attributes may be found
in authorization process between LMA and the AAA.

Request	Accept	Reject	Challenge	#	Attribute
1	0-1	0	0	1	User-Name
0-1	0-1	0	0	4	NAS-IP-Address
0-1	0-1	0	0	5	NAS-Port
1	0-1	0	0	6	Service-Type
0	0-1	0	0	25	Class
0	0-1	0	0-1	27	Session-Timeout
0-1	0	0	0	31	Calling-Station-Id
1	0	0	0	32	NAS-Identifier
0+	0+	0+	0+	33	Proxy-State
1	0	0	0	69	NAS-Port-Type
1	1	1	1	80	Message-Authenticator
0-1	0-1	0	0	89	Chargeable-User-Identity
0-1	0-1	0	0	95	NAS-IPv6-Address
0-1	0-1	0	0	124	MIP6-Feature-Vector
1	0	0	0	145	Mobile-Node-Identifier
0-1	0-1	0	0	146	Service-Selection
0-1	0	0	0	147	PMIP6-Home-LMA-IPv6-Address
0-1	0	0	0	148	PMIP6-Visited-LMA-IPv6-Address
0-1	0	0	0	149	PMIP6-Home-LMA-IPv4-Address
0-1	0	0	0	150	PMIP6-Visited-LMA-IPv4-Address
0+	0+	0	0	151	PMIP6-Home-HN-Prefix
0+	0+	0	0	152	PMIP6-Visited-HN-Prefix
0-1	0-1	0	0	153	PMIP6-Home-Interface-ID
0-1	0-1	0	0	154	PMIP6-Visited-Interface-ID
0-1	0-1	0	0	155	PMIP6-Home-IPv4-HoA
0-1	0-1	0	0	156	PMIP6-Visited-IPv4-HoA
0-1	0-1	0	0	161	PMIP6-Home-IPv4-Gateway
0-1	0-1	0	0	162	PMIP6-Visited-IPv4-Gateway

7. Accounting

   Radius-based interfaces at the MAG and LMA with the AAA server
   enables the metering of traffic associated with the MN, commonly
   called "accounting". If accounting is turned on in the mobile node's
   policy profile, the local routing SHOULD NOT be enabled [RFC5213].

7.1. Accounting at LMA

   The accounting at the LMA to AAA server interface is based on
   [RFC2865] and [RFC2866]. This interface MUST support the transfer of
   accounting records needed for service control and charging. These
   records should include (but may not be limited to) the following:
   time of binding cache entry creation and deletion, number of the
   octets sent and received by the MN over the bi-directional tunnel,
   etc.

7.2. Accounting at MAG

   The accounting at the MAG to AAA server interface is based on
   [RFC2865] and [RFC2866]. The interface MUST also support the
   transfer of accounting records that should include the following:
   time of binding cache entry creation and deletion, number of the
   octets sent and received by the MN over the bi-directional tunnel,
   etc.

   If there is data traffic between a visiting MN and a correspondent
   node that is locally attached to an access link connected to the same
   MAG, the mobile access gateway MAY optimize on the delivery efforts
   by locally routing the packets instead of using reverse tunneling to
   the mobile node's LMA. In this case, the local data traffic too MUST
   be reported to AAA Accounting servers by means of RADIUS protocol.

7.3. Table of Attributes

   The following table provides a list of attributes that may be
   included in the RADIUS Accounting messages. These attributes are to
   complement the set of accounting attributes already required by
   [RFC2866] and [RFC2869].

   Accounting
   Request   # Attribute

   0-1   145 Mobile-Node-Identifier
   0-1   146 Service-Selection
   0-1   147 PMIP6-Home-LMA-IPv6-Address
   0-1   148 PMIP6-Visited-LMA-IPv6-Address
   0-1   149 PMIP6-Home-LMA-IPv4-Address
   0-1   150 PMIP6-Visited-LMA-IPv4-Address
   0+   151 PMIP6-Home-HN-Prefix
   0+   152 PMIP6-Visited-HN-Prefix
   0-1   155 PMIP6-Home-IPv4-HoA
   0-1   156 PMIP6-Visited-IPv4-HoA
   0-1   31 Calling-Station-Id
   0-1   80 Message-Authenticator
   0-1   89 Chargeable-User-Identity
   0-1   124 MIP6-Feature-Vector

8. Security Considerations

   The RADIUS messages may be transported between the MAG and/or the LMA
   to the RADIUS server via one or more AAA brokers or RADIUS proxies.
   In this case, the communication between the LMA and the RADIUS AAA
   server relies on the security properties of the intermediate AAA
   brokers and RADIUS proxies.

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   Regarding the privacy threats associated with sending MN-specific
   information between the MAG and AAA server and between the LMA and
   AAA server, considerations of the RADIUS Base protocol [RFC2865],
   RADIUS Accounting [RFC2866], and the RADIUS EAP application [RFC3579]
   are applicable to this document. The MAG, LMA, and AAA server SHOULD
   avoid including attributes containing personally identifying
   information such as a MN's Interface ID, link-layer address, or NAI,
   except as needed and SHOULD pay special attention if identity hiding
   is desired.

9. IANA Consideration

9.1. Attribute Type Codes

   This specification defines the following new RADIUS attribute type
   values:

          Mobile-Node-Identifier   145
          Service-Selection   146
          PMIP6-Home-LMA-IPv6-Address   147
          PMIP6-Visited-LMA-IPv6-Address   148
          PMIP6-Home-LMA-IPv4-Address   149
          PMIP6-Visited-LMA-IPv4-Address   150
          PMIP6-Home-HN-Prefix   151
          PMIP6-Visited-HN-Prefix   152
          PMIP6-Home-Interface-ID   153
          PMIP6-Visited-Interface-ID   154
          PMIP6-Home-IPv4-HoA   155
          PMIP6-Visited-IPv4-HoA   156
          PMIP6-Home-DHCP4-Server-Address   157
          PMIP6-Visited-DHCP4-Server-Address 158
          PMIP6-Home-DHCP6-Server-Address   159
          PMIP6-Visited-DHCP6-Server-Address 160
          PMIP6-Home-IPv4-Gateway   161
          PMIP6-Visited-IPv4-Gateway   162

9.2. Namespaces

   This specification defines new values to the Mobility Capability
   registry (see [RFC5447]) for use with the MIP6-Feature-Vector AVP:

     Token | Value
     ---------------------------------+--------------------
     IP4_TRANSPORT_SUPPORTED | 0x0000800000000000
     IP4_HOA_ONLY_SUPPORTED | 0x0001000000000000

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