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LMA Controlled MAG Session Parameters
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Abstract

This specification defines a new extension, LMA-Controlled-MAG-Session-Params to Proxy Mobile IPv6. This option can be used by the LMA in PMIPv6 signaling for notifying the MAG to conform to various parameters contained in this extension.

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1. Introduction

A large PMIPv6 deployment, such as residential deployment, can have tens of thousands of MAGs spread across geographical locations. While it can be operationally challenging to manage such large number of MAGs, it can also be very difficult to ensure configuration consistency across all the MAGs if they are not centrally managed. Configuring aggresive values of parameters such as re-registration timeout and heartbeat interval can potentially create considerable signaling load on the LMA. This document provides a new option to enable the LMA to control various parameters on the MAG such as the re-registration frequency [RFC5213] and heartbeat frequency [RFC5847]. With this option, the configuration of these tunable parameters done centrally on the LMA enables Service Providers to have better control on the behavior of the MAGs with deterministic singaling load on the LMA.

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 [RFC2119].

2.2. Terminology

All the terms used in this document are to be interpreted as defined in [RFC5213], [RFC5847] and [RFC7563].

3. Protocol Extension

The LMA Controlled MAG Parameters (LCMP) option is a mobility header option used to exchange information related to the parameters that a local mobility anchor enforces on a mobile access gateway. The option can be included in Proxy Binding Acknowledgement (PBA) message only, and there MUST NOT be more than a single instance of this mobility option in a mobility message. This mobility option MUST contain one or more LMA Controlled MAG Parameters sub-options. The suboptions are defined in Section 3.1. The alignment requirement for this option is 4n [RFC2460].

```
 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            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                  ... LCMP Sub-option(s) ...                   ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 1: LMA Controlled MAG Parameters Option

Type

MUST be set to the value of IANA-1, indicating that it is a LMA-Controlled-MAG-Parameters option.

Length

8-bit unsigned integer indicating the length in octets of the option, excluding the Type and Length fields.

Reserved

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

3.1. Format of the LCMP Sub-Options

The LMA Controlled MAG Parameters sub-options are used for carrying information elements related to various parameters that need to be configured on the MAG. These sub-options can be included in the LMA Controlled MAG Parameters option defined in Section 3. The format of this sub-option is as follows. The alignment requirement for the sub-option is 4n. The sub-options are optional and can be present in any order.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   LCMP Type   | LCMP Length   |       Sub-Option Data         ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 2: LMA Controlled MAG Parameters Sub-Option

Type

8-bit unsigned integer indicating the type of the LMA Controlled MAG Parameters sub-option. This specification defines the following types:

0 - Reserved

1 - Binding Refresh Control Sub-Option

2 - Heartbeat Control Sub-Option

Length

8-bit unsigned integer indicating the number of octets needed to encode the Option Data, excluding the LCMP Type and LCMP Length fields of the sub-option.

3.1.1. Binding Re-registration Control Sub-Option

The Binding Re-registration Control Sub-Option is a mobility sub-option carried in the LMA Controlled MAG Parameters mobility option defined in Section 3.1. This sub-option carries re-registration related timer values. There MUST be no more than a single instance of this sub-option in LMA Controlled MAG Parameters option. The format of this sub-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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| LCMP Type = 1 |  LCMP Length  |  Re-registration-Start-Time   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Initial-Retransmission-Time  | Maximum-Retransmission-Time   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 3: Binding Re-registration Control Sub-Option

Re-registration-Start-Time

16-bit unsigned integer indicating the number of time units before the expiry of the PMIPv6 binding lifetime when the registration refresh process needs to be activated. One time unit is 4 seconds.

Initial-Retransmission-Time

16-bit unsigned integer indicating minimum delay in seconds before the first PBU retransmission of the exponential back-off process.

Maximum-Retransmission-Time

16-bit unsigned integer indicating maximum delay in seconds before the last PBU retransmission message of the exponential back-off process.

3.1.2. Heartbeat Control Sub-Option

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| LCMP Type = 2 |  LCMP Length  |        HB-Interval            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    HB-Retransmission-Delay    |    HB-Max-Retransmissions     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 4: Heartbeat Control Sub-Option

HB-Interval

16-bit unsigned integer indicating heartbeat interval, i.e. time delay in seconds after a successful heartbeat exchange (request followed by response) when the next heartbeat exchange can be triggered.

HB-Retransmission-Delay

16-bit unsigned integer indicating minimum time delay in seconds before a heartbeat message is retransmitted.

HB-Max-Retransmissions

16-bit unsigned integer indicating maximum number of heartbeat retransmissions.

4. Protocol Configuration Variables

4.1. Local Mobility Anchor - Configuration Variables

The local mobility anchor MUST allow the following variables to be configured by the system management. The configured values for these protocol variables MUST survive server reboots and service restarts.

EnableLCMPSubOptReregControl

This flag indicates the operational state of the Binding Re-registration Control sub-option support. The default value for this flag is set to (0), indicating that support for the Binding Re-registration Control sub-option is disabled.

When this flag on the mobile access gateway is set to a value of (1), the local mobility anchor SHOULD include this sub-option in the Proxy Binding Acknowledge messages that it sends to the mobile access gateway; otherwise, it SHOULD NOT include the sub-option. There can be situations where the local mobility anchor is unable to obtain the Binding Re-registration Control information and may not be able to construct this sub-option.

EnableLCMPSubOptHeartbeatControl

This flag indicates the operational state of the Heartbeat Control sub-option support. The default value for this flag is set to (0), indicating that support for the Heartbeat Control sub-option is disabled.

When this flag on the mobile access gateway is set to a value of (1), the local mobility anchor SHOULD include this sub-option in the Proxy Binding Acknowledge messages that it sends to the mobile access gateway; otherwise, it SHOULD NOT include the sub-option. There can be situations where the local mobility anchor is unable to obtain the Heartbeat Control information and may not be able to construct this sub-option.

The following variables MAY be defined at various granularity such as per binding, per peering MAG, per cluster of MAGs or any other custom grouping. Regardless of the granularity of this configuration, the local mobility anchor should be able to determine the value of these variables on an individual binding basis by way of configuration hierarchy.

LCMPReregistrationStartTime

This variable is used to set the minimum time interval in number of seconds before the expiry of the PMIPv6 binding lifetime when the registration refresh process SHOULD be activated.

LCMPInitialRetransmissionTime

This variable is used to set the minimum delay in seconds before the first PBU retransmission of the exponential back-off process. This variable is same as INITIAL_BINDACK_TIMEOUT mentioned in Section 6.9.4 of [RFC5213].

LCMPMaximumRetransmissionTime

This variable is used to set the maximum delay in seconds before the last PBU retransmission message of the exponential back-off process. This variable is same as MAX_BINDACK_TIMEOUT mentioned in Section 6.9.4 of [RFC5213].

LCMPHeartbeatInterval

This variable is used to set the time delay in seconds after a successful heartbeat exchange (request followed by response) when the next heartbeat exchange can be triggered. The default value is 60 seconds. It SHOULD NOT be set to less than 30 seconds or more than 3600 seconds. The value of this variable MAY be derived from the variable HEARTBEAT_INTERVAL defined in Section 5 of [RFC5847] if defined on the local mobility anchor.

LCMPHeartbeatRetransmissionDelay

This variable is used to set the minimum time delay in seconds before a heartbeat message is retransmitted.. The value of this variable SHOULD be less than LCMP_HEARTBEAT_INTERVAL. The default value is 5 seconds.

LCMPHeartbeatMaxRetransmissions

This variable is used to set the maximum number of heartbeat retransmissions. The default value for this variable is 3. The value of this variable MAY be derived from the variable MISSING_HEARTBEATS_ALLOWED defined in Section 5 of [RFC5847] if defined on the local mobility anchor.

5. Protocol Considerations

The following considerations apply to the local mobility anchor and the mobile access gateway.

The conceptual Binding Cache Entry data structure maintained by the local mobility anchor, described in Section 5.1 of [RFC5213] and the conceptual Binding Update List entry data structure maintained by the

mobile access gateway, described in Section 6.1 of [RFC5213], MUST be extended to store the LMA Controlled MAG Parameters option related information elements associated with the current session. Specifically the following parameters MUST be defined:

- o LCMPReregistrationStartTime
- o LCMPInitialRetransmissionTime
- o LCMPMaximumRetransmissionTime
- o LCMPHeartbeatInterval
- o LCMPHeartbeatRetransmissionDelay
- o LCMPHeartbeatMaxRetransmissions

5.1. Local Mobility Anchor Considerations

- o On receiving a Proxy Binding Update message [RFC5213] from a mobile access gateway, the local mobility anchor should check if EnableLCMPSubOptReregControl is set to (1). If yes, and if all of LCMPReregistrationStartTime, LCMPInitialRetransmissionTime and LCMPMaximumRetransmissionTime are set to NON_ZERO values, then in SHOULD include Binding Re-registration Control Sub-Option in the LMA Controlled MAG Parameters mobility option which is in turn included in the Proxy Binding Acknowledge message.

- o If EnableLCMPSubOptReregControl is set to (1) and if any of LCMPReregistrationStartTime, LCMPInitialRetransmissionTime and LCMPMaximumRetransmissionTime is set to ZERO value, then the local mobility anchor should report a configuration error.

- o The local mobility anchor should also check if EnableLCMPSubOptHeartbeatControl is set to (1). If yes, and if all of LCMPHeartbeatInterval, LCMPHeartbeatRetransmissionDelay and LCMPHeartbeatMaxRetransmissions are set to NON_ZERO values, then in SHOULD include Heartbeat Control Sub-Option in the LMA Controlled MAG Parameters mobility option which is in turn included in the Proxy Binding Acknowledge message.

- o If EnableLCMPSubOptHeartbeatControl is set to (1) and if any of LCMPHeartbeatInterval, LCMPHeartbeatRetransmissionDelay and LCMPHeartbeatMaxRetransmissions is set to ZERO value, then the local mobility anchor should report a configuration error.

5.2. Mobile Access Gateway Considerations

- On Receiving Proxy Binding Acknowledge message [RFC5213] from the local mobility anchor with LMA Controlled MAG Parameters mobility option, the mobile access gateway MUST overwrite the binding re-registration related timer parameters with the parameters received in Binding Re-registration Control Sub-Option, if present in the LMA Controlled MAG Parameters mobility option. Similarly, the mobile access gateway MUST overwrite the heartbeat related timer parameters with the parameters reveived in Heartbeat Control Sub-Option, if present in the LMA Controlled MAG Parameters mobility option.

- If any of the parameters in the Binding Re-registration Control Sub-Option is ZERO, then the sub-option MUST be ignored and an error message SHOULD be logged.

- If any of the parameters in the Heartbeat Control Sub-Option except HB-Retransmission-Delay is ZERO, then the sub-option MUST be ignored and error message SHOULD be logged.

6. IANA Considerations

This document requires the following IANA actions.

- Action 1: This specification defines a new mobility header option, the LMA Controlled MAG Parameters. This mobility option is described in Section 3. The type value (IANA-1) for this option needs to be assigned from the same numbering space as allocated for the other mobility options, as defined in [RFC6275].

- Action 2: This specification defines a new mobility sub-option format, the LMA Controlled MAG Parameters sub-option. The format of this mobility sub-option is described in Section 3.1. This sub-option can be carried in the LMA Controlled MAG Parameters option. The type value for this sub-option needs to be managed by IANA, under the registry "LMA Controlled MAG Parameters Sub-Option Type Values". This specification reserves the following type values. Approval of new LMA Controlled MAG Parameters sub-option type values are to be made through IANA Expert Review.

```
+---+-------------------------------------------------------+
| 0 | Reserved                                              |
+---+-------------------------------------------------------+
| 1 | Binding Re-registration Control Sub-Option            |
+---+-------------------------------------------------------+
| 2 | Heartbeat Control Sub-Option                          |
```

```
+---+-------------------------------------------------------+
```

7. Security Considerations

The LMA Controlled MAG Parameters option defined in this specification is for use in Proxy Binding Acknowledgement message. This option is carried like any other mobility header option as specified in [RFC6275] and does not require any special security considerations.

8. References

8.1. Normative References

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8.2. Informative References

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