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Mobile Access Gateway Configuration Parameters Controlled by the Local Mobility Anchor

Abstract

This specification defines a new extension, LMA-Controlled-MAG-Session-Params, to Proxy Mobile IPv6. This option can be used by the local mobility anchor (LMA) in a Proxy Mobile IPv6 domain for signaling a mobile access gateway (MAG) on enforcing specific values for various configuration parameters such as heartbeat and binding refresh parameters.

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 7841.

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/rfc8127.

Table of Contents

1. Introduction 3
2. Conventions and Terminology 3
2.1. Conventions 3
2.2. Terminology 3
3. Protocol Extension 4
3.1. Format of the LCMP Sub-Options 5
3.1.1. Binding Re-registration Control Sub-Option 6
3.1.2. Heartbeat Control Sub-Option 7
4. Protocol Configuration Variables 8
4.1. Local Mobility Anchor -- Configuration Variables 8
5. Protocol Considerations 9
5.1. Local Mobility Anchor Considerations 10
5.2. Mobile Access Gateway Considerations 10
6. IANA Considerations 11
7. Security Considerations 11
8. References 12
8.1. Normative References 12
8.2. Informative References 12
Acknowledgements 13
Authors' Addresses 14

1. Introduction

A large Proxy Mobile IPv6 (PMIPv6) [RFC5213] deployment, such as residential deployment, can have tens of thousands of mobile access gateways (MAGs) spread across geographical locations. While it can be operationally challenging to manage such a 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 aggressive values of parameters such as re-registration timeout and heartbeat interval can potentially create considerable signaling load on the local mobility anchor (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 enforced centrally from the LMA enables Service Providers to have better control on the behavior of the MAGs with deterministic signaling 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", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

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 (LCMPs) option is a mobility header option used to exchange information related to the parameters that an LMA enforces on a MAG. This option can be included only in the Proxy Binding Acknowledge (PBA) message, and there MUST NOT be more than a single instance of this mobility option in a given PBA message. This option MUST contain one or more LCMP sub-options. Each LCMP sub-option carries a specific configuration parameter. The sub-options are defined in Section 3.1. The LCMP option has an alignment requirement of 4n+2 [RFC8200].

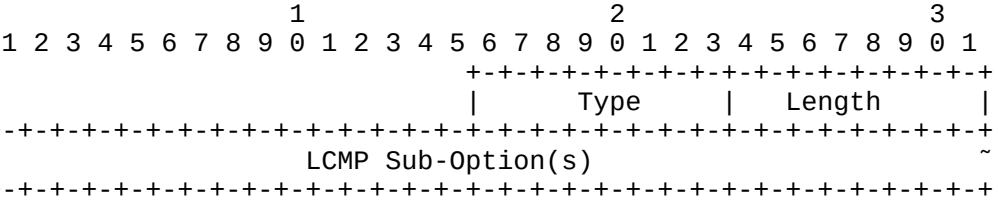

Figure 1: LMA-Controlled MAG Parameters Option

Type

MUST be set to the value of 62, indicating that it is an LMA-Controlled-MAG-Parameters option.

Length

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

LCMP Sub-Option(s)

LCMP sub-options are described in the sections below. The sub-options can be present in any order. Inclusion of any specific sub-option is optional, but at least one sub-option MUST be present.

3.1. Format of the LCMP Sub-Options

The LCMP 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 LCMP option defined in Section 3. The LCMP sub-options have an alignment requirement of 4n. The format of this sub-option is as follows.

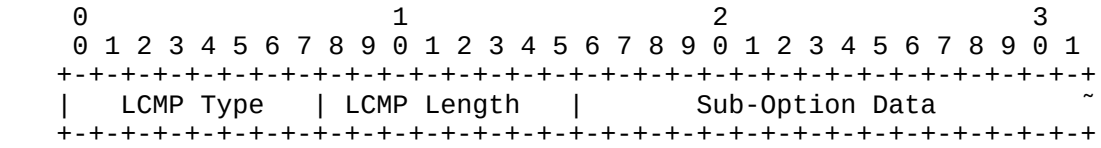

Figure 2: LMA-Controlled MAG Parameters Sub-Option

Type

8-bit unsigned integer indicating the type of the LCMP sub-option. This specification defines the following types:

0 - Reserved

1 - Binding Re-registration 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 LCMP mobility option defined in Section 3. This sub-option carries timer values related to re-registration. There MUST be no more than a single instance of this sub-option in the LCMP option. The format of this sub-option is defined below.

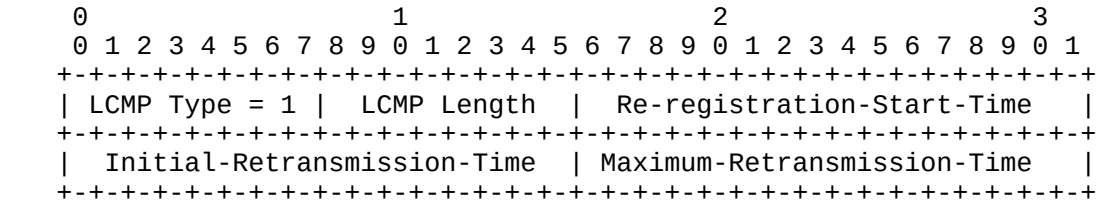

Figure 3: Binding Re-registration Control Sub-Option

LCMP Type

1 for the Binding Re-registration Control Sub-Option.

LCMP Length

6

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 Proxy Binding Update (PBU) retransmission of the exponential backoff process.

Maximum-Retransmission-Time

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

3.1.2. Heartbeat Control Sub-Option

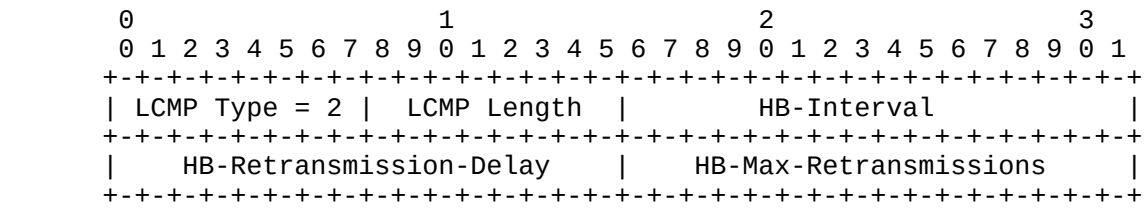

Figure 4: Heartbeat Control Sub-Option

LCMP Type

2 for the Heartbeat Control Sub-Option.

LCMP Length

6

HB-Interval

16-bit unsigned integer indicating the heartbeat interval, i.e., time delay in seconds after a successful heartbeat exchange (heartbeat 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

This specification defines 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 of this flag is (0), indicating that support for the Binding Re-registration Control Sub-Option is disabled.

EnableLCMPSubOptHeartbeatControl

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

The following variables MAY be defined at various granularities such as per binding, per cluster of bindings, per peering MAG, per cluster of peering MAGs, or any other custom grouping. Regardless of the granularity of this configuration, the LMA MUST be able to determine the value of these variables for every individual binding.

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. The default value of this variable is 10 units, where each unit is 4 seconds.

LCMPInitialRetransmissionTime

This variable is used to set the minimum delay in seconds before the first PBU retransmission of the exponential backoff process. This variable is the same as INITIAL_BINDACK_TIMEOUT mentioned in Section 6.9.4 of [RFC5213]. The default value of this variable is 1 second.

LCMPMaximumRetransmissionTime

This variable is used to set the maximum delay in seconds before the last PBU retransmission message of the exponential backoff process. This variable is the same as MAX_BINDACK_TIMEOUT mentioned in Section 6.9.4 of [RFC5213]. The default value of this variable is 32 seconds.

LCMPHeartbeatInterval

This variable is used to set the time delay in seconds after a successful heartbeat exchange (heartbeat request followed by response) when the next heartbeat exchange can be triggered. The default value of this variable is 60 seconds. The time delay SHOULD NOT be 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 configured on the LMA.

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 LCMPHeartbeatInterval. The default value of this variable is 5 seconds.

LCMPHeartbeatMaxRetransmissions

This variable is used to set the maximum number of heartbeat retransmissions. The default value of 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 configured on the LMA.

5. Protocol Considerations

The following considerations apply to the LMA and the MAG.

For supporting this extension, the conceptual Binding Cache Entry data structure maintained by the LMA, described in Section 5.1 of [RFC5213], and the conceptual Binding Update List entry data structure maintained by the MAG, described in Section 6.1 of [RFC5213], need to be extended to store the information elements related to the LCMP option that are defined below.

- LCMPReregistrationStartTime
- LCMPInitialRetransmissionTime

- LCMPMaximumRetransmissionTime
- LCMPHeartbeatInterval
- LCMPHeartbeatRetransmissionDelay
- LCMPHeartbeatMaxRetransmissions

5.1. Local Mobility Anchor Considerations

On receiving a PBU message [RFC5213] from a MAG, the LMA MUST check if the variable EnableLCMPSubOptReregControl is configured and set to (1). If yes, and if LCMPReregistrationStartTime, LCMPInitialRetransmissionTime, and LCMPMaximumRetransmissionTime are all set to NON_ZERO values, then it MUST include the Binding Re-registration Control Sub-Option in the LCMP mobility option, which is in turn included in the PBA message. If the variable EnableLCMPSubOptReregControl is configured and set to (1), and if any of LCMPReregistrationStartTime, LCMPInitialRetransmissionTime, and LCMPMaximumRetransmissionTime is set to ZERO value, then the LMA MUST report a configuration error and reject the binding request by sending a PBA message with status code '128 - Reason Unspecified' [RFC5213].

The LMA MUST also check if variable EnableLCMPSubOptHeartbeatControl is configured and set to (1). If yes, and if LCMPHeartbeatInterval, LCMPHeartbeatRetransmissionDelay, and LCMPHeartbeatMaxRetransmissions are all set to NON_ZERO values, then it MUST include the Heartbeat Control Sub-Option in the LCMP mobility option, which is in turn included in the PBA message. If the variable EnableLCMPSubOptHeartbeatControl is set to (1), and if any of LCMPHeartbeatInterval, LCMPHeartbeatRetransmissionDelay, and LCMPHeartbeatMaxRetransmissions is set to ZERO value, then the LMA MUST report a configuration error and reject the binding request by sending a PBA message with status code '128 - Reason Unspecified' [RFC5213].

5.2. Mobile Access Gateway Considerations

If the PBA message [RFC5213] received from the LMA contains the LCMP mobility option and the Binding Re-registration Control Sub-Option, then the MAG MUST overwrite the timer parameters related to binding re-registration that are configured locally on the MAG with the parameters received in the Binding Re-registration Control Sub-Option. If any of the parameters in the Binding Re-registration Control Sub-Option are ZERO, then the PBA message MUST be ignored and an error message SHOULD be logged.

Similarly, if the LCMP mobility option contains the Heartbeat Control Sub-Option, then the MAG MUST overwrite the heartbeat-related timer parameters configured locally on the MAG with the parameters received in the Heartbeat Control Sub-Option. If any of the parameters in the Heartbeat Control Sub-Option, except HB-Retransmission-Delay, are ZERO, then the PBA message MUST be ignored and an error message SHOULD be logged.

6. IANA Considerations

IANA has updated the "Mobile IPv6 parameters" registry as described here.

- Action 1: This specification defines a new mobility header option, "LMA-Controlled MAG Parameters". This mobility option is described in Section 3. The type value 62 has been assigned for this option in the "Mobility Options" registry, as defined in [RFC6275].

- Action 2: This specification defines a new mobility sub-option format, the LCMP sub-option. The format of this mobility sub-option is described in Section 3.1. This sub-option can be carried in the LCMP option. The type values for this sub-option are managed by IANA, under the "LMA-Controlled MAG Parameters Sub-Option Type Values" registry. Per this document, IANA has reserved the following type values. Approval of new LCMP sub-option type values are to be made through Expert Review [RFC8126].

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

7. Security Considerations

The LCMP option defined in this specification allows the configuration of re-registration and heartbeat frequencies. This option is defined for carrying it in Proxy Binding Update and Proxy Binding Acknowledgement messages. This option is carried like any other mobility header option as specified and does not require any special security considerations.

8. References

8.1. Normative References

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