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**Separation of Control and User Plane for Proxy Mobile IPv6
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Abstract

This document describes splitting of Control Plane (CP) and User Plane (UP) for a Proxy Mobile IPv6 based network infrastructure. Existing specifications allow a MAG to perform splitting of its control and user plane using Alternate Care of address mobility option for IPv6, or Alternate IPv4 Care of Address option for IPv4. However, the current specification does not have semantics for allowing the LMA to perform such functional split. To realize this requirement, this specification defines a mobility option that enables a local mobility anchor to provide an alternate LMA address to be used for the bi-directional tunnel between the MAG and LMA. With this extension, a local mobility anchor will be able to use an IP address for its user plane which is different than the IP address used for the control plane.

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1. Introduction

Widely deployed mobility management systems for wireless communications require isolation between the path for forwarding data packets (the user plane) and the control plane signaling for mobility management. To meet this requirement, Proxy Mobile IPv6 requires that the control plane functions of the local mobility anchor (LMA) to be addressable at a different IP address than the IP address assigned for the user plane. However, the current specification does not have semantics for allowing the LMA to perform such functional split. The LMA is required to associate the IP address of the tunnel source with the target IP address of the control messages received from the MAG.

A PMIPv6 infrastructure comprises two primary entities: LMA and MAG (Mobility Access Gateway). The interface between MAG and LMA consists of the control plane and user plane. The control plane is responsible for signaling messages between MAG and LMA such as the Proxy Binding Update and Proxy Binding Acknowledge messages to establish a mobility binding. In addition, the control plane components in the MAG and LMA are also responsible for setting up and tearing down of the bi-directional tunnel between the MAG and LMA. The user plane is responsible for forwarding the mobile node's IP packets between the MAG and the LMA over the bi-directional tunnel.

The control plane and user plane components (of the MAG and LMA) are typically co-located in the same physical entity. However, there are deployments where it is desirable to have the control and user plane of the MAG and LMA in separate physical entities. For example, in a WLAN (Wireless LAN) deployment, it may be desirable to have the control plane component of the MAG to be on Access Controller (also sometimes referred to as Wireless LAN Controller) while the user plane component of the MAG resides on the WLAN Access Point. This would enable all the signaling messages to the LMA to be centralized while the user plane would be distributed across the multiple Access Points. Similarly the control plane and user plane component of the LMA may be split according to different scaling requirements, or the need to centralize the control plane in one geo-location while distributing the user plane component across multiple geo-locations.

[RFC6463] and [[RFC6275](#)] enable splitting the control and user plane in the MAG. Specifically, [[RFC6463](#)] defines the Alternate IPv4 Proxy Care of Address Option while [[RFC6275](#)] defines an Alternate Care of Address for IPv6 address. The MAG can provide an Alternate Care of Address in the Proxy Binding Update (PBU) and if the LMA supports this option then a bidirectional tunnel is setup between the LMA address and the MAG's alternate Care of address. However, there is no corresponding option for the LMA to provide an alternate address

to the MAG.

CP: Control Plane

UP: User Plane

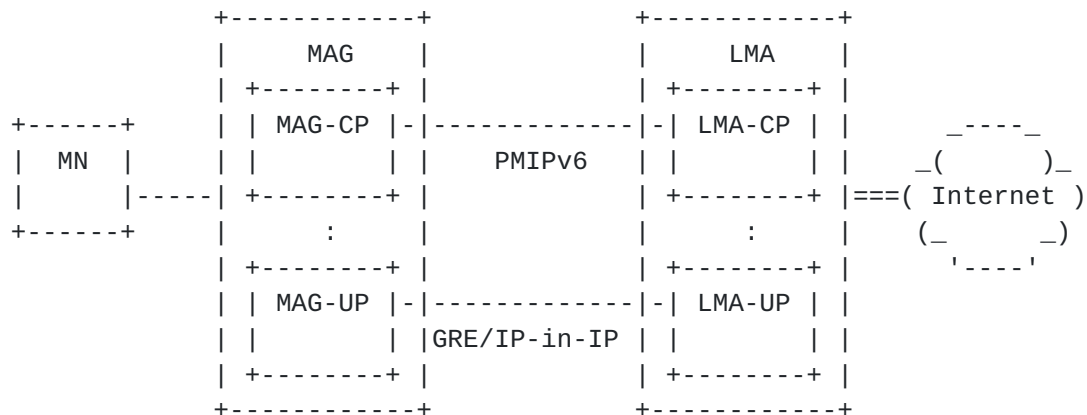


Figure 1: Functional Split of the Control and User Plane

This specification therefore defines a new mobility option that enables a local mobility anchor to provide an alternate LMA address to be used for the bi-directional tunnel between the MAG and 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 [RFC 2119](#) [[RFC2119](#)].

2.2. Terminology

3GPP terms can be found in [[RFC6459](#)]. Other mobility related terms used in this document are to be interpreted as defined in [[RFC5213](#)] and [[RFC5844](#)]. Additionally, this document uses the following terms:

IP-in-IP

IP-within-IP encapsulation [[RFC2473](#)]

GRE

Generic Record Encapsulation [[RFC1701](#)]

LMA Control Plane Address (LMA-CP)

The IP address on the LMA that is provided to the MAG for establishing control plane connections.

LMA User Plane Address (LMA-UP)

The IP address on the LMA that is used for establishing user plane tunnels with the mobile access gateway.

MAG Control Plane Address (MAG-CP)

The IP address on the MAG that is provided to the LMA for establishing control plane connections.

MAG User Plane Address (MAG-UP)

The IP address on the MAG that supports user plane tunnels with the LMA.

3. LMA User Plane Address Mobility Option

A new mobility header option, LMA User Plane Address mobility option is defined for use with Proxy Binding Update and Proxy Binding Acknowledgement messages exchanged between the LMA and the MAG. This option is used for notifying the LMA's user plane IPv6 or IPv4 address. There can be multiple instances of the LMA User Plane Address mobility option present in the message, one for IPv4 and the other for IPv6 transport.

The LMA User Plane Address mobility option has an alignment requirement of $8n+2$. Its format is as follows:

feature. Not including this option in the Proxy Binding Update will result in LMA disabling this feature for this MAG.

- o If the protocol configuration variable, Domain-wide-LMA-UPA-Support, is set to a value of (1), the MAG is not required to explicitly indicate to LMA on its support-capability for this feature. The MAG may choose not to include the LMA User Plane Address mobility option in the Proxy Binding Update.
- o The MAG when including the LMA User Plane Address mobility option in the Proxy Binding Update has to apply the following considerations:
 - * When using IPv4 transport for the user-plane, the IP address field in the option can be either a zero-length field, or it can be 4-octet field with ALL_ZERO value.
 - * When using IPv6 transport for the user-plane, the IP address field in the option can be either a zero-length field, or it can be 16-octet field with ALL_ZERO value.
- o When the LMA is configured to provide an alternate IP address to be used for the bi-directional tunnel between the MAG and LMA, it must apply the following considerations.
 - * If the protocol configuration variable, Domain-wide-LMA-UPA-Support, is set to a value of (0) and if the received Proxy Binding Update did not include the LMA User Plane Address mobility option, then the LMA MUST disable this feature for that MAG. The LMA MUST NOT include the LMA User Plane Address mobility Option in the Proxy Binding Acknowledgement.
 - * If the protocol configuration variable, Domain-wide-LMA-UPA-Support, is set to a value of (1), or if the LMA User Plane Address mobility option is present in the received Proxy Binding Update, then the LMA should include the LMA User Plane Address mobility Option in the Proxy Binding Acknowledgement. The IP address field in the option must be set to the IPv4 or IPv6 address used for the user-plane.
 - + When using IPv4 transport for the user-plane, the IP address field in the option must be the IPv4 address used for the user-plane.
 - + When using IPv6 transport for the user-plane, the IP address field in the option must be the IPv6 address used for the user-plane.

5. IANA Considerations

This document requires the following IANA actions.

- o Action-1: This specification defines a new mobility header option, LMA User Plane Address mobility option. The format of this option is described in [Section 3](#). The type value <IANA-1> for this mobility option needs to be allocated from the Mobility Options registry at <<http://www.iana.org/assignments/mobility-parameters>>. RFC Editor: Please replace <IANA-1> in [Section 3](#) with the assigned value and update this section accordingly.

6. Protocol Configuration Variables

This specification defines the following configuration variable. The mobility entities, LMA and MAG must allow this variable to be configured by the system management. The configured values for this protocol variable must survive server reboots and service restarts.

Domain-wide-LMA-UPA-Support

This variable indicates if all the mobility entities in the Proxy Mobile IPv6 domain have support for the feature specified in this document.

When this variable on the MAG is set to a value of (0), the MAG must explicitly indicate its support-capability for this feature by including the LMA User Plane Address mobility Option in the Proxy Binding Acknowledgement. If the option is not present in the Proxy Binding Update, the local mobility anchor will not enable this feature for that mobility session.

When this variable on the MAG is set to a value of (1), it is an indication that there is domain-wide support for this feature and the MAG is not required to explicitly indicate its support-capability for this feature by including the LMA User Plane Address mobility Option in the Proxy Binding Acknowledgement.

When this variable on the LMA is set to a value of (0), the LMA MUST NOT include the LMA User Plane Address mobility Option in the Proxy Binding Acknowledgement unless the MAG has explicitly indicated its support-capability for this feature by including the LMA User Plane Address mobility option in the Proxy Binding Update.

When this variable on the LMA is set to a value of (1), it is an indication that there is domain-wide support for this feature and the LMA MAY choose to include this LMA User Plane Address mobility Option in the Proxy Binding Acknowledgement even if the option is not present in the Proxy Binding Update message.

7. Security Considerations

The LMA User Plane Address mobility 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 [RFC5213]. Therefore, it inherits security guidelines from [RFC5213].

The LMA-UP provided as data within the LMA User Plane Address mobility Option MUST be a valid address under the administrative control associated with the LMA functional block.

If the LMA-UP and the LMA-CP functions are hosted in different entities, any signaling between these two entities MUST be protected by IPsec security association.

8. Acknowledgements

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